12th Edition

The Blue Book

OCULAR DISORDERS PRESUMED TO BE INHERITED IN PUREBRED DOGS

GENETICS COMMITTEE OF THE AMERICAN COLLEGE OF VETERINARY OPHTHALMOLOGISTS

2019-2020

Foreword

Ocular disorders, proven or presumed to be inherited in purebred dogs, have been a topic of intense dialogue by Diplomates of the American College of Veterinary Ophthalmologists (ACVO) for many years. Discussions commenced in the latter half of the 20th century during the early days of this College's inception, have continued into the 21st century, and will no doubt continue for years to come. Our knowledge of the existence, nature, progression, and inheritance of ocular disorders continues to expand as this field of veterinary science evolves. The Genetics Committee of the ACVO was originally formed in response to requests by registries, breed groups, and veterinarians, with the intent to provide a scientific advisory panel and guidelines regarding ocular disorders in purebred dogs. The Genetics Committee of today remains engaged in an ongoing effort to update information on ocular disorders for this purpose.

The content of this production has originated from several sources as the ACVO recently created a Companion Animal Eye Registry (CAER), which is a joint effort between the Orthopedic Foundation for Animals (OFA) and the ACVO. The addition of eye examination results to the OFA database makes the OFA the most complete source of canine health screening results in the world, allowing responsible breeders to make more informed breeding decisions in an effort to reduce the incidence of inherited disease.

The generation of statistical information is made possible by the efforts of dedicated breeders of purebred dogs who present their dogs to Diplomates of the ACVO for an OFA Companion Animal Eye Registry examination. The research copies of these examinations are then conscientiously submitted to OFA by the examining Veterinary Ophthalmologists. These data generate annual statistics. The statistics for each breed are then reviewed by the Genetics Committee for the most recent year and from the previous 5 years. Recommendations regarding the ocular disorders listed for each breed and the breeding advice are compiled following guidelines detailed elsewhere in this publication. A comprehensive review of the scientific literature since the last published edition was undertaken by all committee members. The scientific articles and breed disorders from the statistical and literature review have been added to the information on each breed in the production of this document. The collective educated clinical experience of the committee members is utilized to reach a consensus of opinion in areas where there remains a paucity of hard scientific proof regarding certain identified breed problems.

The current Genetics Committee has instituted an annual scientific literature search, in addition to the previously established yearly statistical data review. This information is compiled and submitted in an effort to maintain a bank of current information for future editions and versions of this document. The content of all editions past, present, and future will remain dynamic and ever changing as more precise technologies advance the study of the canine genome, as continued scientific research expands our knowledge, and as the database grows.

It is an honor and a privilege to serve the ACVO, our fellow Diplomates, reputable dog breeders, and our most trusted canine companions in this endeavor.

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12th Edition
2019 - 2020 Version Acknowledgements

The following groups and individuals deserve credit for the production of this edition of Ocular Disorders Presumed to be Inherited in Purebred Dogs ("The Blue Book"):

The ACVO Board of Regents

Genetics Committee Chairs Dr. Andras Komaromy 2006-2008, Dr. Katie Diehl (2009-2011), Dr. Jacqueline Pearce (2011-2012), Dr. Carrie Breaux (2011-2013), Dr. Kenneth Pierce (2014), Dr. Wendy Townsend (2015), Ellen Belknap (2016), Jessica Meekins (2017), Renee Carter (2018), Adam King (2019), Jane Ashley Huey (2020) and all previous Genetics Committee members

Eddie Dziuk, Chief Operating Officer, and Erika Werne, CAER Program Manager, for the OFA

Introduction

What is the purpose of this book?

The Orthopedic Foundation for Animals (OFA), Canine Eye Registration Foundation (CERF), other breed registry groups, breed clubs, and practicing veterinarians have requested that the American College of Veterinary Ophthalmologists (ACVO) provide a scientific advisory panel to furnish guidelines regarding ocular disorders of major concern to purebred dogs. The Genetics Committee of the ACVO was formed in response to these requests and is engaged in an ongoing effort to update information on ocular disorders proven or suspected to be hereditary in purebred dogs. The compendium of ocular disorders and breeding recommendations which follow are interim guidelines. They are reviewed regularly and revised whenever additional information becomes available.

How can this information be used?

National and international breed clubs are encouraged to submit their input regarding breeding decisions for ocular disorders found in their breeds. **Local breed clubs** can participate by encouraging and organizing ocular examination clinics and forwarding their requests and concerns to their national organization. **Practicing veterinarians** are encouraged to contribute by informing all owners of potential breeding animals of the value and availability of ocular examinations, prior to breeding. Information regarding ocular disorders found in litters or individuals can be forwarded to the Genetics Committee via any ACVO diplomate. **Individual breeders** wishing to uphold high ethical standards for the improvement of their breed are urged to contribute by annual examination of their breeding animals and by encouraging the same from other breeders. Further information can be obtained from the Orthopedic Foundation for Animals (OFA): 2300 E Nifong Boulevard, Columbia, MO, 65201-3806, 573-442-0418. Only through increased awareness of the problems and a sustained cooperative effort to disseminate accurate information, will we be able to control and/or eliminate hereditary eye diseases in purebred dogs.

How do we identify an inherited eye disease?

Although there are noteworthy exceptions, most of the ocular diseases of dogs which are presumed to be hereditary have not been adequately documented. Genetic studies require examination of large numbers of related animals in order to characterize the disorder (age of onset, characteristic appearance, rate of progression) and to define the mode of inheritance (recessive, dominant). In a clinical situation, related animals are frequently not available for examination once a disorder suspected to be inherited is identified in an individual dog. Maintaining a number of dogs for controlled breeding trials through several generations is a long and costly process. Both of these obstacles are compounded by the fact that many ocular conditions do not develop until later in life. Due to the potential for disease to arise from inherited genetic defects at any age, the Genetics Committee recommends annual eye exams.

Until the genetic basis of an ocular disorder is defined in a published report, we rely on what statistical information is available from registry organizations, informed opinions and consensus from ACVO diplomates, and must satisfy ourselves with terms like "presumed inherited" and "suspected to be inherited." Several companies provide information on genetic testing which greatly assists in providing more information and data to aid in defining the canine genetics of ocular diseases.

When do we suspect that a disorder is inherited in a given breed?

- When the frequency is greater than in other breeds
- When the frequency increases in a given breed as a whole
- When the frequency is greater in related dogs within a breed
- When it has a characteristic appearance and location
- When it has a characteristic age of onset and course of progression (predictable stages of development and time for each stage to develop)
- When it looks identical to an entity which has been proven to be inherited in another breed

Special thank you to the "Father of Veterinary Medical Genetics," Donald F. Patterson, DVM, DSc. Dr. Patterson, who died in 2013, was Emeritus Professor of Medicine and Medical Genetics, University of Pennsylvania School of Veterinary Medicine and Emeritus Professor of Human Genetics, University of Pennsylvania School of Medicine. These guidelines on the heritability of disorders in dogs are based on his lectures and publications.

Guidelines Used by the ACVO Genetics Committee in Making Breeding Recommendations

In this book, we chose the term "**BREEDING ADVICE**" and intentionally avoided the words "certifiable" and "registerable." The ACVO does not serve as a registry organization. Registry organizations operate independently of the ACVO and set their own standards for registration. However, the OFA does follow the guidelines set forth by the ACVO Genetics Committee in this publication. Any registry organization may use the information in this compendium and results of examinations performed by ACVO Diplomates in the registering of animals with regard to breeding suitability as they see fit.

It is important to recognize that the sensitivity of genetic disorder detection is greater when large numbers of dogs are examined. The extensive number of disorders listed in this book for some breeds may reflect the popularity of the breed and the numbers of animals evaluated. Conversely, the lack of disorders listed for other breeds often reflects only the paucity of examinations reported for each breed. For these reasons, the ACVO Genetics Committee strongly recommends annual evaluations of dogs of all breeds as the imperative first step in the control of hereditary ocular disorders. We would like to acknowledge the contribution of the Orthopedic Foundation for Animals (OFA) and Canine Eye Registration Foundation (CERF) for providing statistical summaries of ophthalmic examinations from their files.

For each breed, specific ocular disorders have been listed which are known or suspected to be inherited based on one or more of the following criteria:

1) There are published reports in the scientific literature regarding a condition in a particular breed with evidence of inheritance.

2) The incidence of affected animals (from OFA and CERF reports) is greater than or equal to 1% of the examined population with a minimum of five affected animals per five year period. Regardless of the population of dogs examined, if 50 or more affected individuals are identified in a five year period, the entity will be listed for that breed.

3) A specific request from a breed club that a condition be included for their breed may be considered at the ACVO annual meeting of the Genetics Committee if information is received by August 1. Such requests are reviewed critically and must include specific documentation as to the disorder in question and the numbers seen. Further information from the breed club may be requested. The request must receive agreement by a majority of the committee.

4) There is overwhelming opinion by a majority of the Genetics Committee members that clinical experience by ACVO Diplomates would indicate a particular condition should be listed for a breed, in spite of the absence of direct evidence of affected animals on OFA or CERF reports.

5) Results of genetic laboratory research and genetic testing.

The "Breeding Advice" given is determined by the significance of the condition to vision and/or very strong evidence of heritability:

Two categories of advice regarding breeding have been established:

> **NO**: Substantial evidence exists to support the heritability of this entity AND/OR the entity represents a potential compromise of vision or other ocular function.
>
> **BREEDER OPTION**: Entity is suspected to be inherited but does not represent potential compromise of vision or other ocular function.

When the breeding advice is "**NO,**" even a minor clinical form of the entity would make this animal unsuitable for breeding. When the advice is "**BREEDER OPTION,**" caution is advised. In time, it may be appropriate to modify this stand to "**NO**" based on accumulated evidence. If, in time, it becomes apparent that there is insufficient evidence that an entity is inherited, it may be deleted from the list.

There are currently eleven disorders for which there is an unequivocal recommendation <u>against</u> breeding in all breeds:

These are conditions which frequently result in blindness and for which there is definite evidence of heritability in one or more breeds. However, these disorders will not be listed on the individual breed page for a given breed, unless they also meet the criteria described above.

- **Keratoconjunctivitis sicca (KCS)** – Breeding is not recommended for any animal demonstrating keratitis consistent with KCS. The prudent approach is to assume KCS to be hereditary except in cases suspected to be non-genetic in origin. See *note.
- **Glaucoma** – See *note.
- **Persistent Pupillary Membranes**
    - **Iris to Lens**
    - **Iris to Cornea**
    - **Iris Sheets**
    - **Endothelial Opacity/No Strands**
- **Cataract** – Breeding is not recommended for any animal demonstrating partial or complete opacity of the lens or its capsule *unless the examiner has also checked the box for "suspect not inherited" or unless specified otherwise for the particular breed*. See *note.
- **Lens luxation or subluxation** – See *note.
- **Persistent hyperplastic primary vitreous (PHPV)/persistent hyperplastic tunica vasculosa lentis (PHTVL)** – See *note.
- **Retinal detachment** – See *note.
- **Retinal atrophy – generalized (PRA)** - Breeding is not advised for any animal demonstrating bilaterally symmetric retinal degeneration (considered to be PRA unless proven otherwise).
- **Retinal dysplasia, geographic or detached forms** – See *note.
- **Optic nerve coloboma**
- **Optic nerve hypoplasia**

*Note: The prudent approach of these disorders is to assume they are hereditary except in cases specifically known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

In breeds recognized with Persistent Pupillary Membrane (PPM) as an inherited problem there is an unequivocal recommendation against breeding when there is PPM iris to lens, or PPM iris to cornea, or iris sheets. Breeding advice is **"NO."**

The following breeds are recommended to have a preliminary examination prior to initial pharmacological dilation to best facilitate identification of these disorders:

Dalmatian – iris hypoplasia/sphincter dysplasia
Australian Shepherd – iris coloboma
Miniature American Shepherd/Miniature Australian Shepherd – iris coloboma
Toy Australian Shepherd – iris coloboma

What can be detected during an Eye Certification Examination?

A routine eye screening examination includes indirect ophthalmoscopy and slit lamp biomicroscopy following pharmacological dilation of the pupils. Gonioscopy, tonometry, Schirmer tear test, electroretinography, and ultrasonography are not routinely performed; thus, dogs with goniodysgenesis, glaucoma, keratoconjunctivitis sicca, or some early cases of progressive retinal atrophy might not be detected without further testing.

The diagnoses obtained during an ophthalmic eye certification examination refer only to the **phenotype** (clinical appearance) of an animal. Thus, it is possible for a clinically normal animal to be a carrier (abnormal **genotype**) of genetic abnormalities.

An individual ACVO Diplomate may disagree with the breeding advice contained in this compendium. It is appropriate for this examiner to contact the ACVO Genetics Committee to voice disagreement, initiate change, or suggest additions. The members of the Genetics Committee represent the ACVO but acknowledge that the information generated for a breed may not agree with the knowledge and clinical experience of every individual ACVO Diplomate.

What is the role of the responsible dog breeder?

The final beneficiary of the information in this book is the dog breeder. It is up to the conscientious breeder to use this information along with other criteria in selecting which animals to breed. To assist this determination, current certification is recommended. Animals currently free of heritable eye disease will be issued a certificate on receipt of the examination/application by OFA. To avoid confusion between a normal animal (no evidence of heritable eye disorders) and one that may have a minor fault coming under the advice of Breeder Option, the Breeder Option category will be printed on the certificate. This is intended to stimulate conversation as to the specific nature of the Breeder Option condition found in that particular animal, allowing breeders using a dog in a breeding program to make an informed decision.

There are many ocular conditions which are a direct result of selection for a facial conformation considered desirable by breeders.

These include:

- Entropion
- Ectropion
- Macroblepharon
- Exposure keratopathy syndrome

Facial conformation with excessively prominent eyes, heavy facial folds, or eyelids which are either inverted or everted predispose animals to corneal irritation, discomfort, and if left untreated, can lead to loss of vision. A responsible breeding program should recognize and select away from these exaggerated facial features.

THE ROLE OF GENETIC TESTING IN THE DETECTION OF OCULAR DISEASE

Genetic testing plays a very important role in the diagnosis of disease. However, it is important to be aware of the limitations of genetic testing and understand its role in the detection and control of genetically inherited diseases.

Genetically inherited diseases are caused by a deleterious sequence change (mutation) in the DNA that results in an abnormal protein (protein can be absent, have insufficient function, or have an abnormal function) that results in disease.

Genetic tests are developed by comparing the DNA sequence of a normal animal to that of an animal with disease. This allows the identification of a particular DNA sequence that can be causally associated with the disease. This is an extremely powerful tool that, in some cases, allows for identification of disease even before it is evident clinically.

However, a particular test is only capable of detecting the DNA sequence it was designed to detect. That is, the DNA test only tests for a specific change in the DNA that can cause disease. For example, a DNA test specific for the *PDE6B* gene mutation (responsible for the rcd1 form of PRA in the Irish Setter) will not detect any abnormalities in other breeds or mixed breeds that have other mutations in the same gene. Thus the specificity of a DNA test is also its limitation, and in the case of PRA in Irish Setters it is specific for the Irish Setter defect and not for any other defects.

In polygenic disorders, a genetic test cannot evaluate the integrity of all the proteins that make up a particular cellular process. Thus, it is possible for a DNA test that has been associated with a disease to be normal and yet the disease can still be present. The disease could be caused by an abnormality in one of the other genes that are involved with that particular cellular process. The defect in the other protein still results in an abnormal cellular process, which still results in disease. A perfect example of this is observed in oculo-skeletal dysplasia in Labrador Retrievers and Samoyed dogs. In both breeds the diseases are clinically identical, yet caused by mutations in different genes involved in fibril formation of a specific kind of collagen molecule.

Thus, obtaining a DNA test that is normal does not guarantee absence of disease. It only guarantees that the particular change the DNA test was designed to detect is not present, and that disease from that particular change will not occur. This is why genetic testing should be combined with ophthalmic examination for maximum efficacy. An ophthalmic exam evaluates the sum total or “result” of all the cellular processes required to maintain ocular health and result in vision, and is an essential part of the ocular wellness exam to ensure that other important clinically recognizable diseases are not present.

Breeder Option Codes

A – Eyelids

A1	Entropion
A2	Ectropion
A3	Distichiasis
A4	Ectopic Cilia
A6	Imperforate Lacrimal Punctum

B – Nicitans

B1	Cartilage Anomaly/Eversion
B2	Gland Prolapse

C – Cornea

C1	Corneal Dystrophy – Epithelial/Stromal
C2	Corneal Dystrophy – Endothelial
C4	Pigmentary Keratitis/Keratopathy

D – Uvea

D1a	Uveal Cyst – Free Floating
D1b	Uveal Cyst – Single
D1c	Uveal Cyst – Multiple
D2	Iris Coloboma
D3	Persistent Pupillary Membranes – Iris to Iris
D4	Iris Hypoplasia

E – Lens

E1	Cataract – Suspect Not Inherited
E2	Posterior Y Tip Suture Opacities

F – Vitreous

F1	Persistent Hyaloid Artery
F2a	Vitreous Degeneration – Syneresis
F2b	Vitreous Degeneration – Anterior Chamber

G – Fundus

G1	Retinal Dysplasia – Folds
G5	Micropapilla
G6	Retinopathy

Breeds Not Listed for Insufficient Data

Attempts have been made to confirm information on the following list of breeds/rare breeds. This list is not an endorsement of the breed status and may change from time to time as additional information is available.

To date there are no published reports of inherited ocular conditions in these breeds and/or the numbers of individuals for which examinations are recorded are too low to identify the presence of significant ocular disorders. Examinations are encouraged to accumulate information and reduce the likelihood of undetected conditions becoming problematic.

Aatu Tamaskan
Alano
Alapaha Blue-Blood Bulldog
Akbash
American Alsatian
American Bandogge Mastiff
American Bully
American English Coonhound
American Foxhound
American Husky
American Leopard Hound
Anatolian Shepherd
Armenian Gampr
Australian Koolie
Azawakh
Bavarian Mountain Scent Hound
Bergamasco
Berger des Pyrenees
Biewer Terrier
Blue Lacy
Blue Mountain Shepherd
Bluetick Coonhound
Boz Shepherd
Braque d'Auvergne
Braque du Bourbonnais
Braque Francais Pyrenees
Bull Terrier
Ca De Bou
Cao De Castro Laboreiro
Carolina Dog
Catalan Sheepdog
Caucasian Shepherd
Central Asian Shepherd
Cesky Terrier
Chart Polski
Chinook Hybrid
Cirneco Dell'Etna
Czechoslovakian Vlcak
Danish Broholmer
Danish Swedish Farmhound
Dogo d'Argentino
Drentsch Partrijshond
Drever
ECT Landseer
English Coonhound
English Foxhound
English Jack Russell Terrier
Epagneul Breton
Estrela Mountain Dog
Fila Brasileiro
Finnish Spitz
French Pointer
French Spaniel
German Longhaired Pointer
German Spaniel
Grand Basset Griffon Vendeen
Greenland Dog
Hanoverian Hound
Harrier
Hovawart
Jindo
Kishu Ken
Korean Poongsan
Kromforhlander
Large Munsterlander
Llewellin Setter
Magyar Agar
McNab
Munsterlander
Native American Indian Dog
Native American Village Dog
Nederlandse Kooikerhondje
New Zealand Huntaway
North American Shepherd
Norwegian Lundehund
Old English Bulldogge
Otterhound
Picardy Spaniel
Polish Tatra Sheepdog
Porcelaine Hound
Portuguese Podengo
Portuguese Pointer
Pudelpointer
Pumi
Pyrenean Mastiff
Redbone Coonhound
Saluki
Scottish Deerhound
Seppala Siberian Sled Dog
Shorty Bull
Skye Terrier
Slovakian Wirehaired Pointer
Small Munsterlander
Spanish Greyhound
Spanish Mastiff
Stabyhoun
Treeing Walker
Wachtelhund
Welsh Sheepdog
White Swiss Shepherd
Windsprite
Working Kelpie
Yakutian Laika

Glossary of Terms

(For more detailed definitions, the reader is referred to medical and genetic scientific texts.)

Achromatopsia: see **Day blindness**

Canine multifocal retinopathy: characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). The condition includes numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina with accumulation of material that produces gray-tan-pink colored lesions (multifocal bullous retinal detachments). These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs and might not progress or progress slowly, or may appear to heal with discrete areas of tapetal hyper-reflectivity or hyperpigmentation. Most dogs exhibit no noticeable problem with vision despite their abnormal appearing retinas.

Cataract: any opacity of the lens and/or its capsule, regardless of size or location within the lens. Cataracts are assumed to be hereditary unless associated with known trauma, ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

Ceroid lipofuscinosis: an inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

Choroidal hypoplasia: a congenital, inherited, non-progressive defect primarily affecting the choroid resulting in some or all of the following: decreased or lack of pigment in the retinal pigment epithelium or choroid, tapetal thinning, and reduced or abnormal choroidal blood vessels.

Chronic superficial keratitis (CSK): see **Pannus**

Collie eye anomaly: a congenital syndrome of ocular anomalies characterized by bilateral and often symmetrical defects including any combination of **choroidal hypoplasia**, **coloboma**, and **retinal detachment(s)**.

Coloboma: a congenital abnormality in ocular development usually characterized by focal absence of tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure.

Cone degeneration: the loss of photopic vision caused by selective degeneration of the cone photoreceptors. Also known as day blindness, hemeralopia, or achromatopsia.

Corneal degeneration: opacification of one or more of the corneal layers frequently resulting from deposition of lipid or mineral and occurring secondary to chronic inflammation.

Corneal dystrophy: non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers (**epithelium, stroma, endothelium**). The term dystrophy implies an inherited condition. It is usually bilateral although not necessarily symmetrical and the onset in one eye may precede the other.

> **Corneal dystrophy - endothelial:** breed-related loss or dysfunction of corneal endothelial cells resulting in bilateral, progressive corneal edema.

Corneal dystrophy - epithelial, stromal: breed-related, non-inflammatory, white to silver-colored opacification of the corneal epithelium and/or stroma frequently resulting from deposition of lipid.

Day blindness: see **Cone degeneration**

Dermoid: a congenital, non-cancerous growth occurring on the cornea, conjunctiva, or eyelid typified by the presence of skin-like structures.

Distichiasis: the presence of abnormally oriented eyelashes, frequently protruding from Meibomian gland ductal openings.

Dry eye: see **Keratoconjunctivitis sicca**

Dysplasia: abnormality of development.

Dystrophy: non-inflammatory, developmental, nutritional, or metabolic abnormality; dystrophy implies a possible hereditary basis and is usually bilateral.

Ectopic cilia: aberrant hairs emerging through the palpebral conjunctiva which often causes ocular discomfort and corneal disease.

Ectropion: a conformational defect resulting in eversion of the eyelid margin, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

Entropion: a conformational defect resulting in inversion of the eyelid margin which may cause ocular irritation. It is likely that entropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

Euryblepharon: an exceptionally long eyelid marginal length, which may lead to Ectropion or Entropion. Euryblepharon is synonymous with the term macropalpebral fissure.

Exposure/pigmentary keratitis: a condition characterized by variable degrees of superficial vascularization, fibrosis, and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos, and macropalpebral fissure.

Glaucoma: characterized by an elevation of intraocular pressure (IOP) which causes optic nerve and retinal degeneration and results in blindness. Diagnosis and classification of glaucoma requires tonometry and gonioscopy, which are not part of a routine eye certification examination.

Glaucoma, pigmentary: see O**cular melanosis**

Goniodysgenesis: congenital anomaly characterized by the persistence of a variably fenestrated sheet of uveal tissue spanning the iridocorneal angle, extending from the iris base to the peripheral cornea. Diagnosis is by gonioscopy, which is not part of a routine eye certification examination.

Hemeralopia: see **Cone degeneration**

Imperforate lacrimal punctum: developmental anomaly resulting in an imperforate opening of the lacrimal puncta. An imperforate lower punctum may result in epiphora, an overflow of tears onto the face.

Iridocorneal angle: the junction between the iris and the cornea; the drainage angle. Aqueous humor leaves the anterior chamber via the trabecular meshwork within the iridocorneal angle into the venous circulation.

Iris coloboma: a congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the eye certification form.

Iris cyst: see **Uveal cyst**

Iris hypoplasia: a congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the eye certification form.

Iris melanoma: see **Uveal melanoma**

Iris sphincter dysplasia: a congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue at the level of the iris sphincter, causing pupillary dilation. This abnormality has been noted in the Dalmatian breed.

Keratitis: inflammation of the cornea.

Keratitis, punctate: inflammation of the cornea accompanied by multifocal, coalescing areas of stromal corneal ulceration of variable depth.

Keratoconjunctivitis sicca (KCS): an abnormality of the tear film attributed to deficiency of the aqueous portion of the tears. Progressive KCS may result in ocular surface irritation and/or vision impairment via corneal opacification. Also called dry eye. The test for this condition is the Schirmer Tear Test, which is not part of a routine eye certification examination.

Lens subluxation/luxation: partial (subluxation) or complete displacement of the lens from the normal anatomic site. Lens luxation may result in elevated intraocular pressure (secondary glaucoma), causing vision impairment, pain, and/or retinal detachment.

Lenticonus: an anomaly of the lens in which the anterior or posterior surface protrudes in a conical form; usually congenital.

Macroblepharon: an exceptionally large palpebral fissure. Macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

Merle: an incompletely dominant phenotype in which heterozygous (M/m) dogs exhibit a coat color phenotype of various dilute color patches, while homozygous (M/M) dogs exhibit marked hypopigmentation and ocular defects, including microphthalmia, blindness and colobomas, and deafness. Deafness and ocular defects are sometimes seen in heterozygous individuals.

Micropapilla: a congenital anomaly which results in a small optic disk diameter without vision loss. Contrast with optic nerve hypoplasia, which may have a similar ophthalmoscopic appearance with vision loss.

Microphakia: a congenital anomaly in which there is an abnormally small lens.

Microphthalmos: a congenital anomaly in which the globe is abnormally small. Commonly associated with multiple ocular malformations and when severe, may affect vision.

Nictitans cartilage anomaly/eversion: a congenital anomaly in the nictitating membrane in which the T-shaped cartilage is malformed and/or folded.

Nictitans gland prolapse: protrusion of the tear-producing gland of the nictitating membrane from its normal position posterior to the nictitating membrane, to a position superior to the free margin of this structure.

Nodular granulomatous episclerokeratitis (NGE): an inflammatory disorder of the sclera and episclera, with occasional corneal involvement, characterized by granulomatous infiltrates. Previously known as **Proliferative keratoconjunctivitis**. This condition is most commonly seen in the Collie.

Nyctalopia: loss of scotopic (night) vision. Causes include genetic defects in photoreceptors and in retinal pigment epithelium, either dystrophy or degeneration of affected cells.

Ocular melanosis: progressive bilateral and sometimes asymetrical increase in pigmentation with melanocytic accumulation the uveal tract and adjacent tissues. Ultimately progresses to glaucoma and loss of vision in most cases (melanocytic glaucoma). Not associated with systemic disease or metastases. Most often recognized in Cairn Terriers.

Optic nerve coloboma: a congenital abnormality of the optic nerve commonly associated with failure of closure of the optic fissure, resulting in a defect in the optic nerve in the anterior-posterior plane. May result in partial or total vision loss.

Optic nerve hypoplasia: a congenital anomaly, which results in a small optic disk diameter and vision loss. Contrast with micropapilla, which may have a similar ophthalmoscopic appearance but without loss of vision.

Pannus: a bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the inferior or inferiotemporal cornea, followed by the formation of a vascularized subepithelial opacity that begins to spread toward the central cornea; pigmentation may follow the vascularization. If severe, vision impairment occurs. Plasma cell infiltration of the nictitans may occur in conjunction with CSK, or on its own. (Also called “CSK”.)

Persistent hyaloid artery (PHA): congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

Persistent hyperplastic primary vitreous (PHPV): congenital defect resulting from abnormalities in the regression of the hyaloid artery (the primary vitreous) and the interaction of the blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with congenital cataracts and frequently seen with PHTVL.

Persistent hyperplastic tunica vasculosa lentis (PHTVL): congenital defect resulting from failure of regression of the embryonic vascular network which surrounds the developing lens. Often associated with PHPV and a patent hyaloid artery.

Persistent pupillary membranes (PPM): persistent blood vessel remnants in the anterior chamber which fail to regress normally by 3 months of age. These strands arise from the iris collaret and may bridge from iris to iris, iris to lens, iris to cornea, or form sheets of tissue in the anterior chamber.

Persistent tunica vasculosa lentis (PTVL): clinically insignificant posterior epicapsular lenticular opacities resulting from incomplete regression of the embryonic vascular network which surrounds the developing lens.

Pigmentary glaucoma: see **Ocular melanosis**

Pigmentary uveitis: see **Uveitis, pigmentary**

Pigmentary keratopathy: a condition reported in Pugs in which the cornea becomes pigmented, often resulting in vision impairment. Development of pigmentary keratopathy is associated with congenital uveal pathology – iris hypoplasia and the presence of persistent pupillary membranes – but not with other factors such as Schirmer tear test values or medial canthal entropion.

Plasmoma: see **Pannus**. Also called Atypical Pannus. Bilateral thickening and depigmentation of the nictitans due to invasion of lymphocytes and plasma cells. It may or may not be associated with corneal involvement (Pannus).

Progressive rod-cone degeneration (PRCD) (see also **PRA**): Typically refers to recessively inherited generalized loss of rod photoreceptors followed by cone degeneration. Many different genetic mutations result in a similar phenotypic presentation.

Progressive retinal atrophy (PRA): an umbrella term used to describe a group of inherited dysplastic, dystrophic, or degenerative diseases of the retinal visual cells (photoreceptors, retinal pigment epithelium, or both).

Proliferative keratoconjunctivitis: see **Nodular granulomatous episclerokeratitis**

Retinal atrophy: a non-specific term used to describe a decrease in the number and deterioration of the cells of the retina, regardless of cause.

Retinal degeneration: see **Retinal atrophy**

Retinal detachment: a separation of the neurosensory retina from the retinal pigment epithelium.

Retinal dysplasia: abnormal development of the retina present at birth. This condition is non-progressive and recognized in 3 forms: **folds**, **geographic**, **detached**.

> **Retinal dysplasia – folds:** seen ophthalmoscopically as linear, triangular, curved or curvilinear foci of retinal folding. May be single or multiple. In puppies, retinal folds can be seen as a transient phenomenon, resolving as the eye retains maturity.
>
> **Retinal dysplasia – geographic:** an irregularly shaped area of retinal development containing both areas of thinning and areas of elevation. This form may be associated with visual impairment.
>
> **Retinal dysplasia – detached:** severe retinal disorganization associated with separation of the neurosensory retina from the retinal pigmented epithelium. This form results in visual impairment.

Retinopathy: any non-inflammatory condition of the retina. These conditions can usually be detected by ophthalmoscopic examination, but an electroretinogram (ERG) may be required in some instances (e.g. canine multifocal retinopathy).

Rod-cone dysplasia: an inherited retinal disease characterized by abortive or abnormal development of rods and cones. Affected animals become blind early in life, usually within the first 6 months, with the exception of *rcd4* in the Gordon and Irish Setter dogs. See specific breed pages for rod-cone dysplasia type descriptions.

Rod dysplasia: abnormal development of the visual cells resulting in vision impairment in dim light by 6 months and total blindness at 3-5 years.

Uveal cyst: a pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions in various breeds.

> **Uveal cyst, anterior chamber:** a pigmented, fluid-filled, epithelial-lined structure arising from the posterior iris or ciliary body epithelium which has detached from its site of origin and is free-floating in the anterior chamber.
>
> **Uveal cyst, ciliary body:** a pigmented, fluid-filled, epithelial-lined structure arising from the ciliary body epithelium and attached to the ciliary body.
>
> **Uveal cyst, iris:** a pigmented, fluid-filled, epithelial-lined structure arising from the posterior iris epithelium and attached to the iris.

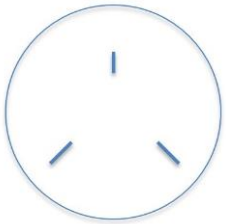
Uveal melanoma: a locally invasive melanocytic neoplasm arising within the uveal tract, may be benign (melanocytoma) or malignant (malignant melanoma). Uveal melanomas are reported in higher frequency in German Shepherd Dogs and Labrador Retrievers. Inherited iris melanoma has been reported in Labrador Retrievers.

Uveitis, pigmentary: a specific form of uveitis most commonly seen in middle-aged to older Golden Retrievers. Clinically manifests early as pigment deposition in a radial fashion on the anterior lens capsule with iridociliary cysts. Later stages are associated with posterior synechia, fibrinous anterior uveitis, cataract, and ultimately glaucoma. Not associated with systemic disease; may be asymmetric in presentation.

Uveodermatologic syndrome: an immune-mediated syndrome of anterior uveitis, chorioretinitis, dermal depigmentation (vitiligo), and hair depigmentation (poliosis). A similar syndrome in humans, called Vogt-Koyanagi-Harada syndrome (VKH), is an autoimmune disease directed against melanocytes. Secondary glaucoma and/or retinal detachment are frequent complications of this disease. Seen most commonly in the Akita, Samoyed, and Siberian Husky breeds.

Vitreous degeneration: Liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

Y-suture tip opacity: These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



AFFENPINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Affenpinscher breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
AFFENPINSCHER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 362 #	 %	2016-2020 146 #	 %
GLOBE					
0.110	microphthalmia	1	0.3%	0	
EYELIDS					
20.140	ectopic cilia	1	0.3%	2	1.4%
25.110	distichiasis	21	5.8%	3	2.1%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	0		1	0.7%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.3%	0	
CORNEA					
70.220	pigmentary keratitis	0		2	1.4%
70.700	corneal dystrophy	6	1.7%	5	3.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	26	7.2%	18	12.3%
93.730	persistent pupillary membranes, iris to cornea	1	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	1.1%	2	1.4%
LENS					
100.200	cataract, unspecified	3	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown	8	2.2%	1	0.7%
100.302	punctate cataract, posterior cortex	1	0.3%	0	
100.311	incipient cataract, anterior cortex	1	0.3%	0	
100.312	incipient cataract, posterior cortex	3	0.8%	1	0.7%
100.316	incipient cataract, nucleus	0		1	0.7%
100.328	y-suture tip opacities	0		1	0.7%
100.330	generalized/complete cataract	3	0.8%	0	
100.345	*significant cataracts (summary)*	*11*	*3.0%*	*3*	*2.1%*
VITREOUS					
110.200	vitreous degeneration-anterior chamber	0		1	0.7%
110.320	vitreal degeneration	4	1.1%	0	
RETINA					
120.170	retinal dysplasia, folds	2	0.6%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	0		1	0.7%
OTHER					
900.000	other, unspecified	3	0.8%	0	
900.100	other, not inherited	8	2.2%	1	0.7%
900.110	other. suspect not inherited/significance unknown	1	0.3%	3	2.1%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	306 84.5%	109 74.7%

AFGHAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1, 2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	1, 3-6	NO
E.	Y-suture tip opacity	Not defined	1	Breeder Option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

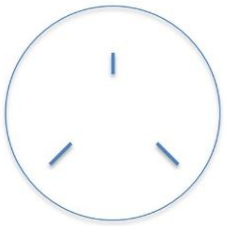
D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The characteristic cataract in the Afghan Hound begins as equatorial lens vacuoles in dogs from 4 months to 2 years of age. The opacities then extend into the anterior and posterior cortices. Rapid progression can occur with visual impairment in young adults. Test breedings have been done which support a hereditary basis; however, the exact mode of inheritance is unknown.

E. Y-suture tip opacity

These are prominent (or "highlighted" or "more dense") distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a "peace sign" as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the "Lens" section of the CAER form. The newest version of the form (3/16/21) has boxes that say, "posterior Y-suture tip opacities" which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures" AND ALSO MARK "suspect not inherited/significance unknown" (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: "E2" or "posterior suture tip opacities." This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Vainisi SJ, Goldberg MF. *Animal models of inherited disease. In: Genetic and Metabolic Eye Disease* Little Brown and Company, Boston, 1974.

3. Roberts SR, Helper LC. Cataracts in Afghan hounds. *J Am Vet Med Assoc*. 1972; 160: 427.

4. Roberts SR. Hereditary cataracts. *Vet Clin North Am*. 1973; 3: 433.

5. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985; 26: 305.

6. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978; 19: 109-120.

OCULAR DISORDERS REPORT
AFGHAN HOUND

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	2,160		400	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	0		1	0.2%
10.000	glaucoma	2	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.1%	0	
25.110	distichiasis	26	1.2%	3	0.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
CORNEA					
70.210	corneal pannus	3	0.1%	0	
70.700	corneal dystrophy	232	10.7%	49	12.2%
70.730	corneal endothelial degeneration	3	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	57	2.6%	14	3.5%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.810	uveal melanoma	0		1	0.2%
93.999	uveal cysts	4	0.2%	0	
LENS					
100.200	cataract, unspecified	9	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	126	5.8%	32	8.0%
100.301	punctate cataract, anterior cortex	1	0.0%	2	0.5%
100.302	punctate cataract, posterior cortex	2	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.0%	1	0.2%
100.305	punctate cataract, posterior sutures	7	0.3%	4	1.0%
100.306	punctate cataract, nucleus	1	0.0%	0	
100.307	punctate cataract, capsular	3	0.1%	0	
100.311	incipient cataract, anterior cortex	4	0.2%	3	0.8%
100.312	incipient cataract, posterior cortex	2	0.1%	2	0.5%
100.313	incipient cataract, equatorial cortex	2	0.1%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures	10	0.5%	2	0.5%
100.316	incipient cataract, nucleus	3	0.1%	1	0.2%
100.317	incipient cataract, capsular	2	0.1%	1	0.2%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.5%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.5%
100.323	incomplete cataract, equatorial cortex	0		2	0.5%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.326	incomplete cataract, nucleus	1	0.0%	3	0.8%
100.328	y-suture tip opacities	3	0.1%	13	3.2%
100.330	generalized/complete cataract	2	0.1%	0	
100.345	*significant cataracts (summary)*	*59*	*2.7%*	*39*	*9.8%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	1	0.2%
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	3	0.8%
110.320	vitreal degeneration	8	0.4%	3	0.8%
FUNDUS					
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	5	0.2%	1	0.2%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	9	0.4%	0	
120.960	retinopathy	2	0.1%	1	0.2%
OPTIC NERVE					
130.110	micropapilla	0		1	0.2%
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	20	0.9%	0	
900.100	other, not inherited	34	1.6%	0	
900.110	other. suspect not inherited/significance unknown	23	1.1%	12	3.0%
NORMAL					
0.000	normal globe	1,720	79.6%	269	67.2%

AIREDALE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- iris to cornea	Not defined	1	NO
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Airedale Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
AIREDALE TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 773 #	%	2016-2020 153 #	%
GLOBE						
0.110	microphthalmia		3	0.4%	0	
EYELIDS						
20.140	ectopic cilia		2	0.3%	0	
21.000	entropion, unspecified		4	0.5%	0	
25.110	distichiasis		54	7.0%	12	7.8%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.700	corneal dystrophy		9	1.2%	0	
70.730	corneal endothelial degeneration		3	0.4%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		25	3.2%	7	4.6%
93.720	persistent pupillary membranes, iris to lens		7	0.9%	1	0.7%
93.730	persistent pupillary membranes, iris to cornea		21	2.7%	1	0.7%
93.740	persistent pupillary membranes, iris sheets		2	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		4	0.5%	5	3.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.4%	7	4.6%
93.999	uveal cysts		1	0.1%	0	
97.150	chorioretinal coloboma, congenital		0		1	0.7%
LENS						
100.200	cataract, unspecified		7	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown		50	6.5%	9	5.9%
100.301	punctate cataract, anterior cortex		7	0.9%	2	1.3%
100.302	punctate cataract, posterior cortex		6	0.8%	0	
100.303	punctate cataract, equatorial cortex		2	0.3%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		4	0.5%	1	0.7%
100.306	punctate cataract, nucleus		1	0.1%	0	
100.307	punctate cataract, capsular		1	0.1%	0	
100.311	incipient cataract, anterior cortex		9	1.2%	0	
100.312	incipient cataract, posterior cortex		9	1.2%	0	
100.313	incipient cataract, equatorial cortex		6	0.8%	1	0.7%
100.315	incipient cataract, posterior sutures		4	0.5%	0	
100.316	incipient cataract, nucleus		2	0.3%	0	
100.317	incipient cataract, capsular		3	0.4%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.7%
100.322	incomplete cataract, posterior cortex		0		1	0.7%
100.328	y-suture tip opacities		0		1	0.7%
100.330	generalized/complete cataract		4	0.5%	0	
100.345	*significant cataracts (summary)*		*66*	*8.5%*	*7*	*4.6%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		3	0.4%	2	1.3%
110.135	PHPV/PTVL		1	0.1%	0	
110.320	vitreal degeneration		7	0.9%	0	

	1991-2015		2016-2020	
FUNDUS				
97.120 coloboma	1	0.1%	0	
RETINA				
120.170 retinal dysplasia, folds	20	2.6%	2	1.3%
120.180 retinal dysplasia, geographic	9	1.2%	0	
120.310 generalized progressive retinal atrophy (PRA)	12	1.6%	0	
120.910 retinal detachment without dialysis	1	0.1%	0	
OPTIC NERVE				
130.110 micropapilla	0		1	0.7%
130.120 optic nerve hypoplasia	0		1	0.7%
OTHER				
900.000 other, unspecified	8	1.0%	0	
900.100 other, not inherited	35	4.5%	0	
900.110 other. suspect not inherited/significance unknown	11	1.4%	17	11.1%
NORMAL				
0.000 normal globe	569	73.6%	97	63.4%

OCULAR DISORDERS REPORT
AKBASH DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AKBASH DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AKBASH DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 39 #	 %	2016-2020 0 #	 %
GLOBE					
0.110	microphthalmia	1	2.6%	0	
EYELIDS					
21.000	entropion, unspecified	3	7.7%	0	
22.000	ectropion, unspecified	1	2.6%	0	
UVEA					
93.999	uveal cysts	2	5.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	5.1%	0	
100.303	punctate cataract, equatorial cortex	1	2.6%	0	
100.316	incipient cataract, nucleus	1	2.6%	0	
100.330	generalized/complete cataract	1	2.6%	0	
100.345	*significant cataracts (summary)*	*3*	*7.7%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	2.6%	0	
NORMAL					
0.000	normal globe	32	82.1%	0	

AKITA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Entropion	Not defined	1, 3	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Y-suture tip opacity	Not defined	1	Breeder option
G.	Retinal dysplasia - folds	Not defined	1	Breeder option
H.	Uveodermatologic syndrome	Not defined	1, 4-10	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Multiple ocular defects consisting of small eye (microphthalmia), opacity of the lens (cataract), conical shape of the posterior lens (posterior lenticonus), and folding of the retina into rosettes (retinal dysplasia) have been reported in related Akita pups. Cataracts affected primarily the nuclear and cortical lens. Retinal dysplasia affected the superior retina overlying the tapetal fundus. Affected dogs may have severe visual dysfunction. An autosomal recessive mode of inheritance is suspected but not proven.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. OFA/CERF data indicates that entropion in the Akita usually occurs by 2 years of age.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

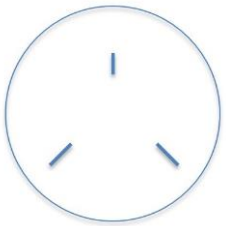
In the Akita, many of these strands bridge between the iris and lens, thus resulting in focal cataract and possible vision impairment.

E. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

F. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which

should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

G. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

H. Uveodermatologic syndrome

Uveodermatologic syndrome in the Akita bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Akitas compared with other dog breeds. Affected dogs are generally young, ranging in age between 1 ½ to 4 years.

References

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OCULAR DISORDERS REPORT
AKITA

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	10,752		888	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	33	0.3%	5	0.6%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	103	1.0%	10	1.1%
22.000	ectropion, unspecified	15	0.1%	0	
25.110	distichiasis	67	0.6%	11	1.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.1%	4	0.5%
NICTITANS					
51.100	third eyelid cartilage anomaly	7	0.1%	0	
CORNEA					
70.700	corneal dystrophy	54	0.5%	7	0.8%
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	268	2.5%	24	2.7%
93.720	persistent pupillary membranes, iris to lens	37	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	23	0.2%	5	0.6%
93.740	persistent pupillary membranes, iris sheets	3	0.0%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.1%	12	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	2	0.2%
93.999	uveal cysts	1	0.0%	0	
LENS					
100.200	cataract, unspecified	28	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	243	2.3%	22	2.5%
100.301	punctate cataract, anterior cortex	6	0.1%	1	0.1%
100.302	punctate cataract, posterior cortex	7	0.1%	1	0.1%
100.303	punctate cataract, equatorial cortex	4	0.0%	0	
100.304	punctate cataract, anterior sutures	3	0.0%	0	
100.305	punctate cataract, posterior sutures	33	0.3%	7	0.8%
100.306	punctate cataract, nucleus	2	0.0%	0	
100.307	punctate cataract, capsular	5	0.0%	4	0.5%
100.311	incipient cataract, anterior cortex	10	0.1%	2	0.2%
100.312	incipient cataract, posterior cortex	38	0.4%	0	
100.313	incipient cataract, equatorial cortex	8	0.1%	0	
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	16	0.1%	2	0.2%
100.316	incipient cataract, nucleus	6	0.1%	1	0.1%
100.317	incipient cataract, capsular	9	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.322	incomplete cataract, posterior cortex	1	0.0%	0	
100.324	incomplete cataract, anterior sutures	0		1	0.1%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	y-suture tip opacities	3	0.0%	8	0.9%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	26	0.2%	2	0.2%
100.345	*significant cataracts (summary)*	*207*	*1.9%*	*32*	*3.6%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	16	0.1%	4	0.5%
110.135	PHPV/PTVL	5	0.0%	1	0.1%
110.320	vitreal degeneration	10	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	200	1.9%	17	1.9%
120.180	retinal dysplasia, geographic	21	0.2%	5	0.6%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	89	0.8%	1	0.1%
120.910	retinal detachment without dialysis	6	0.1%	0	
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.120	optic nerve hypoplasia	8	0.1%	1	0.1%
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	52	0.5%	0	
900.100	other, not inherited	179	1.7%	2	0.2%
900.110	other. suspect not inherited/significance unknown	93	0.9%	29	3.3%
NORMAL					
0.000	normal globe	9,600	89.3%	716	80.6%

ALASKAN KLEE KAI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Alaskan Klee Kai breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
ALASKAN KLEE KAI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 607 #	%	2016-2020 228 #	%
EYELIDS						
25.110	distichiasis		48	7.9%	9	3.9%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.2%	3	1.3%
CORNEA						
70.220	pigmentary keratitis		1	0.2%	0	
70.700	corneal dystrophy		11	1.8%	1	0.4%
70.730	corneal endothelial degeneration		2	0.3%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		6	1.0%	5	2.2%
93.730	persistent pupillary membranes, iris to cornea		1	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		5	0.8%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		11	1.8%	10	4.4%
100.301	punctate cataract, anterior cortex		0		1	0.4%
100.304	punctate cataract, anterior sutures		0		1	0.4%
100.307	punctate cataract, capsular		1	0.2%	0	
100.311	incipient cataract, anterior cortex		7	1.2%	1	0.4%
100.312	incipient cataract, posterior cortex		1	0.2%	0	
100.345	*significant cataracts (summary)*		*9*	*1.5%*	*3*	*1.3%*
VITREOUS						
110.320	vitreal degeneration		9	1.5%	0	
RETINA						
120.170	retinal dysplasia, folds		5	0.8%	0	
OTHER						
900.000	other, unspecified		6	1.0%	0	
900.100	other, not inherited		4	0.7%	1	0.4%
900.110	other. suspect not inherited/significance unknown		8	1.3%	6	2.6%
NORMAL						
0.000	normal globe		527	86.8%	194	85.1%

ALASKAN MALAMUTE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Cone degeneration - day blindness	Autosomal recessive	1, 2-8	NO	Mutation in the *CNGB3* gene

Descriptions and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a deletion in the *CNGB3* gene. A DNA test is available.

References

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OCULAR DISORDERS REPORT
ALASKAN MALAMUTE

		TOTAL DOGS EXAMINED	1991-2015 8,712		2016-2020 1,067	
Diagnostic Name			#	%	#	%
GLOBE						
0.110	microphthalmia		2	0.0%	0	
10.000	glaucoma		2	0.0%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
21.000	entropion, unspecified		5	0.1%	0	
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		198	2.3%	14	1.3%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		2	0.0%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.220	pigmentary keratitis		0		1	0.1%
70.700	corneal dystrophy		72	0.8%	13	1.2%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		3	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		559	6.4%	83	7.8%
93.720	persistent pupillary membranes, iris to lens		35	0.4%	7	0.7%
93.730	persistent pupillary membranes, iris to cornea		12	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		4	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		8	0.1%	7	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.0%	0	
93.810	uveal melanoma		2	0.0%	0	
93.999	uveal cysts		6	0.1%	2	0.2%
LENS						
100.200	cataract, unspecified		125	1.4%	0	
100.210	cataract. suspect not inherited/significance unknown		347	4.0%	54	5.1%
100.301	punctate cataract, anterior cortex		21	0.2%	5	0.5%
100.302	punctate cataract, posterior cortex		137	1.6%	12	1.1%
100.303	punctate cataract, equatorial cortex		14	0.2%	3	0.3%
100.304	punctate cataract, anterior sutures		16	0.2%	1	0.1%
100.305	punctate cataract, posterior sutures		64	0.7%	3	0.3%
100.306	punctate cataract, nucleus		8	0.1%	5	0.5%
100.307	punctate cataract, capsular		28	0.3%	4	0.4%
100.311	incipient cataract, anterior cortex		27	0.3%	6	0.6%
100.312	incipient cataract, posterior cortex		349	4.0%	30	2.8%
100.313	incipient cataract, equatorial cortex		40	0.5%	4	0.4%
100.314	incipient cataract, anterior sutures		8	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures		78	0.9%	6	0.6%
100.316	incipient cataract, nucleus		19	0.2%	3	0.3%
100.317	incipient cataract, capsular		39	0.4%	1	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	2	0.0%	3	0.3%
100.322	incomplete cataract, posterior cortex	13	0.1%	15	1.4%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	2	0.0%	1	0.1%
100.326	incomplete cataract, nucleus	2	0.0%	1	0.1%
100.327	incomplete cataract, capsular	0		5	0.5%
100.328	y-suture tip opacities	3	0.0%	1	0.1%
100.330	generalized/complete cataract	80	0.9%	1	0.1%
100.345	*significant cataracts (summary)*	*1,077*	*12.4%*	*111*	*10.4%*
100.375	*subluxation/luxation, unspecified*	*7*	*0.1%*	*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	3	0.3%
110.135	PHPV/PTVL	6	0.1%	0	
110.200	vitreous degeneration-anterior chamber	0		1	0.1%
110.320	vitreal degeneration	13	0.1%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	60	0.7%	0	
120.180	retinal dysplasia, geographic	19	0.2%	2	0.2%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	17	0.2%	1	0.1%
120.400	retinal hemorrhage	2	0.0%	0	
120.910	retinal detachment without dialysis	10	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.1%
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	2	0.0%	1	0.1%
130.120	optic nerve hypoplasia	9	0.1%	0	
130.150	optic disc coloboma	2	0.0%	2	0.2%
OTHER					
900.000	other, unspecified	75	0.9%	0	
900.100	other, not inherited	257	2.9%	3	0.3%
900.110	other. suspect not inherited/significance unknown	108	1.2%	46	4.3%
NORMAL					
0.000	normal globe	6,864	78.8%	767	71.9%

ALASKAN NOBLE COMPANION DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Alaskan Noble Companion Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
ALASKAN NOBLE COMPANION DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 53 #	 %	2016-2020 33 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	4	7.5%	1	3.0%
93.999	uveal cysts	0		1	3.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		1	3.0%
RETINA					
120.170	retinal dysplasia, folds	1	1.9%	0	
OTHER					
900.110	other. suspect not inherited/significance unknown	0		1	3.0%
NORMAL					
0.000	normal globe	50	94.3%	30	90.9%

AMERICAN BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	2	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Multifocal retinopathy - *cmr1*	Autosomal recessive	3	Breeder Option	Mutation in the *BEST1* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

American Bulldogs with glaucoma were reported to have uveal cysts (evident on ophthalmic exam, ultrasound biomicroscopy and/or histopathology), goniodysgenesis, and anterior segment inflammation. Consistent clinical findings among reported individuals included an absent menace response, diminished to absent light perception, mydriasis, and elevated intraocular pressures.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is

minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas. A DNA test is available.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Pumphrey SA, Pizzirani S, Pirie CG, et al. Glaucoma associated with uveal cysts and goniodysgenesis in American Bulldogs: a case series. *Vet Ophthalmol*. 2012:1-9.

3. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci.* 2007 May;48:1959-1967.

OCULAR DISORDERS REPORT
AMERICAN BULLDOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 120 #	 %	2016-2020 28 #	 %
EYELIDS					
20.160	macropalpebral fissure	3	2.5%	0	
21.000	entropion, unspecified	9	7.5%	0	
22.000	ectropion, unspecified	2	1.7%	0	
25.110	distichiasis	30	25.0%	1	3.6%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	4	3.3%	0	
CORNEA					
70.220	pigmentary keratitis	1	0.8%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	0.8%	4	14.3%
93.720	persistent pupillary membranes, iris to lens	0		1	3.6%
93.730	persistent pupillary membranes, iris to cornea	1	0.8%	0	
93.999	uveal cysts	1	0.8%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	0.8%	2	7.1%
RETINA					
120.170	retinal dysplasia, folds	3	2.5%	0	
OTHER					
900.000	other, unspecified	16	13.3%	0	
900.110	other. suspect not inherited/significance unknown	1	0.8%	0	
NORMAL					
0.000	normal globe	84	70.0%	21	75.0%

AMERICAN ESKIMO DOG

(all varieties)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Lens luxation	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene
C.	Retinal atrophy (*prcd*)	Autosomal recessive	3	NO	Mutation in the *prcd* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

C. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Eskimo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease

begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
AMERICAN ESKIMO DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,423 #	 %	2016-2020 222 #	 %
EYELIDS						
21.000	entropion, unspecified		4	0.2%	0	
25.110	distichiasis		18	0.7%	1	0.5%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	0	
CORNEA						
70.700	corneal dystrophy		9	0.4%	3	1.4%
70.730	corneal endothelial degeneration		4	0.2%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		21	0.9%	0	
93.720	persistent pupillary membranes, iris to lens		1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea		4	0.2%	1	0.5%
93.740	persistent pupillary membranes, iris sheets		4	0.2%	0	
93.999	uveal cysts		4	0.2%	0	
LENS						
100.200	cataract, unspecified		3	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		136	5.6%	16	7.2%
100.301	punctate cataract, anterior cortex		24	1.0%	2	0.9%
100.302	punctate cataract, posterior cortex		9	0.4%	1	0.5%
100.303	punctate cataract, equatorial cortex		6	0.2%	0	
100.304	punctate cataract, anterior sutures		3	0.1%	0	
100.305	punctate cataract, posterior sutures		4	0.2%	0	
100.306	punctate cataract, nucleus		3	0.1%	0	
100.307	punctate cataract, capsular		3	0.1%	1	0.5%
100.311	incipient cataract, anterior cortex		21	0.9%	5	2.3%
100.312	incipient cataract, posterior cortex		23	0.9%	1	0.5%
100.313	incipient cataract, equatorial cortex		13	0.5%	0	
100.314	incipient cataract, anterior sutures		5	0.2%	0	
100.315	incipient cataract, posterior sutures		3	0.1%	0	
100.316	incipient cataract, nucleus		6	0.2%	1	0.5%
100.317	incipient cataract, capsular		6	0.2%	0	
100.323	incomplete cataract, equatorial cortex		1	0.0%	0	
100.326	incomplete cataract, nucleus		0		1	0.5%
100.327	incomplete cataract, capsular		1	0.0%	1	0.5%
100.330	generalized/complete cataract		10	0.4%	1	0.5%
100.340	resorbing/hypermature cataract		1	0.0%	0	
100.345	*significant cataracts (summary)*		*145*	*6.0%*	*14*	*6.3%*
100.375	*subluxation/luxation, unspecified*		*3*	*0.1%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		6	0.2%	2	0.9%
110.135	PHPV/PTVL		3	0.1%	0	
110.200	vitreous degeneration-anterior chamber		1	0.0%	0	
110.320	vitreal degeneration		18	0.7%	0	

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	8	0.3%	1	0.5%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	182	7.5%	3	1.4%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	2	0.1%	0	
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	8	0.3%	0	
900.100	other, not inherited	86	3.5%	0	
900.110	other. suspect not inherited/significance unknown	25	1.0%	9	4.1%
NORMAL					
0.000	normal globe	1,938	80.0%	180	81.1%

AMERICAN HAIRLESS TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17* gene
B.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

B. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Hairless Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sc*i. 2010 Sep;51:4716-4721.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol.* 2011 Nov;14:378-384.

OCULAR DISORDERS REPORT
AMERICAN HAIRLESS TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 26 #	 %	2016-2020 66 #	 %
EYELIDS						
25.110	distichiasis		0		1	1.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	3.8%	1	1.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	3.8%	0	
100.305	punctate cataract, posterior sutures		0		1	1.5%
100.345	*significant cataracts (summary)*		*0*		*1*	*1.5%*
RETINA						
120.170	retinal dysplasia, folds		0		1	1.5%
120.910	retinal detachment without dialysis		1	3.8%	0	
OTHER						
900.000	other, unspecified		1	3.8%	0	
NORMAL						
0.000	normal globe		23	88.5%	62	93.9%

AMERICAN PIT BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - cone-rod dystrophy 2 (*crd2*)	Autosomal recessive	2-4	NO	Mutation in the *IQCB1* gene
B.	Retinal atrophy - cone-rod dystrophy 1 (*CRD1/rcd1b)*	Autosomal recessive	1	NO	Mutation in the *PDE6B* gene

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Description and Comments

A. Retinal atrophy - cone-rod dystrophy 2 (*crd2*)

A cone rod dystrophy characterized by initial loss of cones (day vision) followed by degeneration of the rods (night vision). Evidence of vision loss is evident at an early age with severe retinal degeneration and complete blindness by a year of age. The disease is a severe early onset retinal blindness more appropriately considered a form of Leber congenital amaurosis (LCA). The condition is inherited as an autosomal recessive trait and caused by a mutation in *IQCB1.* A DNA test is available.

B. Retinal Atrophy - Rod-cone dysplasia 1b [previously considered cone-rod dystrophy 1(*crd1*)]

The disease was previously considered a cone-rod dystrophy (crd1) based on incorrect phenotype ascertainment using ERG. The term crd1 should no longer be used to refer to the disease in this breed. The disease is more appropriately classified as rod-cone dysplasia 1b (rcd1b). In affected dogs there is evidence of vision loss at an early age with severe retinal degeneration and complete blindness by early adulthood, and ophthalmoscopic evidence of advanced retinal degeneration by 1 year of age. The disease is caused by a mutation in the *PDE6B* gene, with clinical abnormalities similar to what is found in rcd1-affected Irish Setters, and rcd1a affected Sloughis and Spanish Water Dogs. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Miyadera K, Acland GM, Aguirre GD. Genetic and phenotypic variations of inherited retinal diseases in dogs: the power of within- and across-breed studies. *Mamm Genome*. 2012;23:40-61.

3. Goldstein O, Mezey JG, Schweitzer P, et al. IQCB1 and PDE6B mutations cause similar early onset retinal degenerations in two closely related terrier dog breeds. *Invest Ophthalmol*. 2013;54:7005-7019.

4. Kijas JW, Zanger B, Miller B, et al. Cloning of the canine ABCA4 gene and evaluation in canine cone-rod dystrophies and progressive retinal atrophies. *Mol Vis*. 2004;10:223-232.

OCULAR DISORDERS REPORT
AMERICAN PIT BULL TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**189**		**45**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	5	2.6%	3	6.7%
CORNEA					
70.700	corneal dystrophy	1	0.5%	0	
70.730	corneal endothelial degeneration	1	0.5%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	4	2.1%	2	4.4%
93.720	persistent pupillary membranes, iris to lens	2	1.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	1.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.5%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	7	3.7%	0	
100.301	punctate cataract, anterior cortex	1	0.5%	0	
100.302	punctate cataract, posterior cortex	2	1.1%	0	
100.305	punctate cataract, posterior sutures	1	0.5%	0	
100.326	incomplete cataract, nucleus	1	0.5%	0	
100.328	y-suture tip opacities	0		1	2.2%
100.345	*significant cataracts (summary)*	*5*	*2.6%*	*1*	*2.2%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.5%*	*0*	
RETINA					
120.170	retinal dysplasia, folds	2	1.1%	0	
120.180	retinal dysplasia, geographic	1	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	1.1%	0	
OTHER					
900.000	other, unspecified	1	0.5%	0	
900.100	other, not inherited	10	5.3%	1	2.2%
900.110	other. suspect not inherited/significance unknown	0		2	4.4%
NORMAL					
0.000	normal globe	162	85.7%	36	80.0%

AMERICAN STAFFORDSHIRE TERRIER*

*Please note that since 1972 the AKC considers the Staffordshire Bull Terrier a different breed from the American Staffordshire Terrier. Since the latter breed evolved from the former, it is possible that the same genetic diseases exist in both.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1, 2, 3	NO	
D.	Retinal atrophy - cone-rod dystrophy 2 (*crd2*)	Autosomal recessive	1	NO	Mutation in the *IQCB1* gene
E.	Retinal atrophy - cone-rod dystrophy 1 (*CRD1/rcd1b)*	Autosomal recessive	4-6	NO	Mutation in the *PDE6B* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes

of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In this breed, cataracts usually develop by one year of age. There is initial opacification of the suture lines progressing to nuclear and cortical cataract formation; complete cataracts and blindness develop by three years of age. A simple autosomal recessive mode of inheritance has been proposed; however, the genetics have not been defined and additional studies will be required.

D. Retinal Atrophy - Cone-rod dystrophy 2 (*crd2*)

A cone rod dystrophy characterized by initial loss of cones (day vision) followed by degeneration of the rods (night vision). Evidence of vision loss is evident at an early age with severe retinal degeneration and complete blindness by a year of age. The disease is a severe early onset retinal blindness more appropriately considered a form of Leber congenital amaurosis (LCA). The condition is inherited as an autosomal recessive trait and caused by a mutation in *IQCB1.* A DNA test is available.

E. Retinal Atrophy - Rod-cone dysplasia 1b [previously considered cone-rod dystrophy 1 (*crd1*)]

The disease was previously considered a cone-rod dystrophy (crd1) based on incorrect phenotype ascertainment using ERG (Aguirre, personal communication, 2016). The term crd1 should no longer be used to refer to the disease in this breed. The disease is more appropriately classified as rod-cone dysplasia 1b (rcd1b). In affected dogs there is evidence of vision loss at an early age with severe retinal degeneration and complete blindness by early adulthood, and ophthalmoscopic evidence of advanced retinal degeneration by 1 year of age. The disease is caused by a mutation in the *PDE6B* gene, with clinical abnormalities similar to what is found in rcd1-affected Irish Setters, and rcd1a affected Sloughis and Spanish Water Dogs. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978;19:109-120.

3. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305-316.

4. Kijas JW, Zanger B, Miller B, et al. Cloning of the canine ABCA4 gene and evaluation in canine cone-rod dystrophies and progressive retinal atrophies. *Mol Vis*. 2004;10:223-232.

5. Miyadera K, Acland GM, Aguirre GD. Genetic and phenotypic variations of inherited retinal diseases in dogs: the power of within- and across-breed studies. *Mamm Genome*. 2012;23:40-61.

6. Goldstein O, Mezey JG, Schweitzer P, et al. IQCB1 and PDE6B mutations cause similar early onset retinal degenerations in two closely related terrier dog breeds. *Invest Ophthalmol*. 2013;54:7005-7019.

OCULAR DISORDERS REPORT
AMERICAN STAFFORDSHIRE TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**726**		**98**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
21.000	entropion, unspecified	2	0.3%	0	
25.110	distichiasis	34	4.7%	2	2.0%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	1	0.1%	1	1.0%
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.110	iris hypoplasia	0		1	1.0%
93.710	persistent pupillary membranes, iris to iris	30	4.1%	3	3.1%
93.720	persistent pupillary membranes, iris to lens	2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	2	0.3%	1	1.0%
LENS					
100.200	cataract, unspecified	1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	28	3.9%	5	5.1%
100.301	punctate cataract, anterior cortex	1	0.1%	0	
100.302	punctate cataract, posterior cortex	2	0.3%	0	
100.303	punctate cataract, equatorial cortex	2	0.3%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.311	incipient cataract, anterior cortex	4	0.6%	0	
100.312	incipient cataract, posterior cortex	3	0.4%	0	
100.313	incipient cataract, equatorial cortex	4	0.6%	0	
100.323	incomplete cataract, equatorial cortex	0		1	1.0%
100.328	y-suture tip opacities	0		1	1.0%
100.330	generalized/complete cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*20*	*2.8%*	*2*	*2.0%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.3%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.3%	0	
110.320	vitreal degeneration	3	0.4%	0	
RETINA					
120.170	retinal dysplasia, folds	8	1.1%	0	
120.180	retinal dysplasia, geographic	2	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.4%	0	
OTHER					
900.000	other, unspecified	8	1.1%	0	
900.100	other, not inherited	30	4.1%	0	
900.110	other. suspect not inherited/significance unknown	8	1.1%	5	5.1%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	620 85.4%	80 81.6%

AMERICAN WATER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Y-suture tip opacity	Not defined	1	Breeder Option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

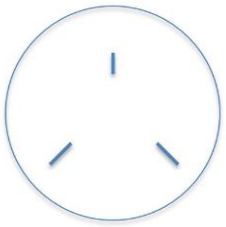
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the American Water Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
AMERICAN WATER SPANIEL

	TOTAL DOGS EXAMINED	1991-2015 1,050		2016-2020 125	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	2	0.2%	0	
10.000	glaucoma	3	0.3%	0	
EYELIDS					
20.160	macropalpebral fissure	2	0.2%	0	
21.000	entropion, unspecified	7	0.7%	1	0.8%
22.000	ectropion, unspecified	2	0.2%	0	
25.110	distichiasis	336	32.0%	54	43.2%
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	5	0.5%	2	1.6%
UVEA					
93.150	iris coloboma	2	0.2%	0	
93.710	persistent pupillary membranes, iris to iris	11	1.0%	1	0.8%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	6	0.6%	4	3.2%
93.999	uveal cysts	1	0.1%	0	
LENS					
100.200	cataract, unspecified	5	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown	38	3.6%	8	6.4%
100.301	punctate cataract, anterior cortex	5	0.5%	0	
100.302	punctate cataract, posterior cortex	7	0.7%	0	
100.303	punctate cataract, equatorial cortex	2	0.2%	0	
100.305	punctate cataract, posterior sutures	5	0.5%	3	2.4%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	2	0.2%	0	
100.311	incipient cataract, anterior cortex	7	0.7%	0	
100.312	incipient cataract, posterior cortex	11	1.0%	4	3.2%
100.315	incipient cataract, posterior sutures	5	0.5%	1	0.8%
100.317	incipient cataract, capsular	1	0.1%	1	0.8%
100.322	incomplete cataract, posterior cortex	0		1	0.8%
100.327	incomplete cataract, capsular	0		1	0.8%
100.328	y-suture tip opacities	1	0.1%	2	1.6%
100.330	generalized/complete cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*53*	*5.0%*	*13*	*10.4%*
100.375	*subluxation/luxation, unspecified*	*0*		*1*	*0.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	0	
110.135	PHPV/PTVL	0		1	0.8%
110.320	vitreal degeneration	0		2	1.6%
RETINA					
120.170	retinal dysplasia, folds	8	0.8%	0	
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.5%	0	

RETINA CONTINUED	1991-2015		2016-2020	
120.960 retinopathy	1	0.1%	0	
OPTIC NERVE				
130.110 micropapilla	0		2	1.6%
OTHER				
900.000 other, unspecified	5	0.5%	0	
900.100 other, not inherited	18	1.7%	0	
900.110 other. suspect not inherited/significance unknown	2	0.2%	7	5.6%
NORMAL				
0.000 normal globe	659	62.8%	50	40.0%

OCULAR DISORDERS REPORT
ARGENTINE DOGO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ARGENTINE DOGO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ARGENTINE DOGO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 129 #	%	2016-2020 21 #	%
EYELIDS						
25.110	distichiasis		1	0.8%	0	
CORNEA						
70.700	corneal dystrophy		1	0.8%	2	9.5%
70.730	corneal endothelial degeneration		1	0.8%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		14	10.9%	0	
93.720	persistent pupillary membranes, iris to lens		1	0.8%	0	
LENS						
100.200	cataract, unspecified		1	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		1	0.8%	0	
100.302	punctate cataract, posterior cortex		1	0.8%	0	
100.312	incipient cataract, posterior cortex		2	1.6%	1	4.8%
100.316	incipient cataract, nucleus		2	1.6%	0	
100.330	generalized/complete cataract		1	0.8%	0	
100.345	*significant cataracts (summary)*		*7*	*5.4%*	*1*	*4.8%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.8%	0	
OTHER						
900.100	other, not inherited		1	0.8%	0	
900.110	other. suspect not inherited/significance unknown		1	0.8%	0	
NORMAL						
0.000	normal globe		109	84.5%	18	85.7%

AUSTRALIAN CATTLE DOG

(Queensland Heeler or Blue Heeler)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	2	NO	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Y-suture tip opacity	Not defined	1	Breeder option	
E.	Lens luxation	Autosomal recessive	3, 4	NO	Mutation in the *ADAMTS17* gene
F.	Retinal atrophy (*prcd*)	Autosomal recessive	5, 6	NO	Mutation in the *prcd* gene
G.	Retinal atrophy - rod-cone dysplasia type 4	Autosomal recessive	7	NO	Mutation in the *C2orf71* gene

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy).

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

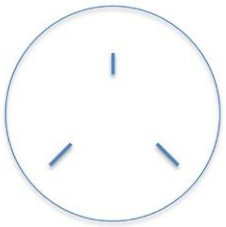
C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane,

persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Australian Cattle Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the Australian Cattle Dog the

phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

G. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified also in the Australian Cattle Dog breed. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available. The test is accurate only for this mutation and is of no value in identifying other forms of PRA.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

4. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

5. Dekomien G, Epplen JT. Exclusion of the PDE6A gene for generalised progressive retinal atrophy in 11 breeds of dog. *Anim Genet*. 2000;31:135-139.

6. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

7. Downs LM, Bell JS, Freeman J, et al. Late-onset progressive retinal atrophy in the Gordon and Irish Setter breeds is associated with a frameshift mutation in C2orf71. *Anim Genet*. 2012;44:169-177.

OCULAR DISORDERS REPORT
AUSTRALIAN CATTLE DOG

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	4,627		549	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	0		1	0.2%
EYELIDS					
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	15	0.3%	2	0.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.2%
NICTITANS					
50.210	pannus of third eyelid	2	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.0%	0	
70.700	corneal dystrophy	23	0.5%	5	0.9%
70.730	corneal endothelial degeneration	4	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	42	0.9%	6	1.1%
93.720	persistent pupillary membranes, iris to lens	2	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	6	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	0	
93.999	uveal cysts	11	0.2%	4	0.7%
LENS					
100.200	cataract, unspecified	35	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown	283	6.1%	30	5.5%
100.301	punctate cataract, anterior cortex	38	0.8%	6	1.1%
100.302	punctate cataract, posterior cortex	35	0.8%	5	0.9%
100.303	punctate cataract, equatorial cortex	19	0.4%	1	0.2%
100.304	punctate cataract, anterior sutures	3	0.1%	0	
100.305	punctate cataract, posterior sutures	14	0.3%	4	0.7%
100.306	punctate cataract, nucleus	4	0.1%	0	
100.307	punctate cataract, capsular	4	0.1%	0	
100.311	incipient cataract, anterior cortex	45	1.0%	10	1.8%
100.312	incipient cataract, posterior cortex	70	1.5%	2	0.4%
100.313	incipient cataract, equatorial cortex	51	1.1%	5	0.9%
100.314	incipient cataract, anterior sutures	2	0.0%	4	0.7%
100.315	incipient cataract, posterior sutures	18	0.4%	2	0.4%
100.316	incipient cataract, nucleus	4	0.1%	3	0.5%
100.317	incipient cataract, capsular	4	0.1%	3	0.5%
100.321	incomplete cataract, anterior cortex	0		3	0.5%
100.322	incomplete cataract, posterior cortex	0		3	0.5%
100.323	incomplete cataract, equatorial cortex	0		2	0.4%
100.326	incomplete cataract, nucleus	1	0.0%	3	0.5%
100.327	incomplete cataract, capsular	0		2	0.4%
100.328	y-suture tip opacities	1	0.0%	5	0.9%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	22	0.5%	2	0.4%
100.340	resorbing/hypermature cataract	0		1	0.2%
100.345	*significant cataracts (summary)*	*370*	*8.0%*	*66*	*12.0%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.1%*	*1*	*0.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.2%	0	
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	13	0.3%	2	0.4%
FUNDUS					
97.110	choroidal hypoplasia	3	0.1%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	37	0.8%	1	0.2%
120.180	retinal dysplasia, geographic	12	0.3%	3	0.5%
120.190	retinal dysplasia, detached	1	0.0%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	251	5.4%	6	1.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	3	0.1%	0	
120.920	retinal detachment with dialysis	0		2	0.4%
120.960	retinopathy	1	0.0%	7	1.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	20	0.4%	0	
900.100	other, not inherited	126	2.7%	1	0.2%
900.110	other. suspect not inherited/significance unknown	32	0.7%	45	8.2%
NORMAL					
0.000	normal globe	3,811	82.4%	415	75.6%

AUSTRALIAN KELPIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/ coloboma	Autosomal recessive	2	NO	Mutation in the NHEJ1 gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Kucharczyk, N., et al. (2019). "Collie Eye Anomaly in Australian Kelpie dogs in Poland." BMC Vet Res 15(1): 392. PMID: 31684941.

OCULAR DISORDERS REPORT
AUSTRALIAN KELPIE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 225 #	 %	2016-2020 20 #	 %
CORNEA						
70.700	corneal dystrophy		1	0.4%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	5.0%
93.810	uveal melanoma		3	1.3%	0	
LENS						
100.200	cataract, unspecified		5	2.2%	0	
100.210	cataract. suspect not inherited/significance unknown		28	12.4%	5	25.0%
100.301	punctate cataract, anterior cortex		7	3.1%	0	
100.302	punctate cataract, posterior cortex		8	3.6%	0	
100.306	punctate cataract, nucleus		1	0.4%	0	
100.311	incipient cataract, anterior cortex		9	4.0%	0	
100.312	incipient cataract, posterior cortex		7	3.1%	0	
100.313	incipient cataract, equatorial cortex		2	0.9%	0	
100.315	incipient cataract, posterior sutures		1	0.4%	0	
100.330	generalized/complete cataract		1	0.4%	0	
100.345	*significant cataracts (summary)*		*41*	*18.2%*	*0*	
VITREOUS						
110.320	vitreal degeneration		3	1.3%	0	
FUNDUS						
97.110	choroidal hypoplasia		1	0.4%	0	
RETINA						
120.170	retinal dysplasia, folds		5	2.2%	0	
120.310	generalized progressive retinal atrophy (PRA)		11	4.9%	0	
OTHER						
900.000	other, unspecified		7	3.1%	0	
900.100	other, not inherited		8	3.6%	0	
900.110	other. suspect not inherited/significance unknown		1	0.4%	1	5.0%
NORMAL						
0.000	normal globe		171	76.0%	13	65.0%

AUSTRALIAN LABRADOODLE

(Labradoodle, Australian Cobber Dog)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1-3	Breeder option	
B.	Ectropion	Not defined	1	Breeder option	
C.	Distichiasis	Not defined	1	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	1, 4	Breeder option	
E.	Uveal cysts	Not defined	5	Breeder option	
F.	Persistent pupillary membranes - iris to iris - lens pigment foci no strands	 Not defined Not defined	 1 1	 Breeder option Passes with no notation	
G.	Cataract	Not defined	1	NO	
H.	Y-suture tip opacity	Not defined	1	Breeder option	
I.	Persistent hyaloid artery	Not defined	1	Breeder option	
J.	Vitreous degeneration	Not defined	1	Breeder option	
K.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 5-9	NO	Mutation of the *prcd* gene
L.	Achromatopsia Type 1 (ACHM – Type 1)	Autosomal recessive	10	NO	Deletion in the *CNGA3* gene
M.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 11-20	NO (Breeder option with Normal DNA test)	Mutation of the *COL9A3* gene
N.	Retinal dysplasia - geographic/ detached (without skeletal defects)	Presumed autosomal recessive	1, 11-21	NO	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
O.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive with incomplete dominance for the eyes	1, 11-21	NO	Mutation of the *COL9A3* gene
P.	Limbal melanoma	Not defined	22	NO	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In Labrador Retrievers in Europe, one form of corneal dystrophy has been shown to be caused by accumulations of glycosaminoglycans in the corneal stroma. This form of corneal dystrophy is caused by a mutation in the CHST6 gene.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

G. Cataract

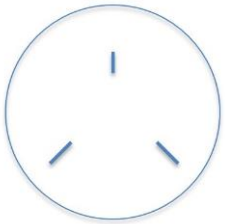
A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most frequently reported cataracts in the Labradoodle (Australian) are bilateral or unilateral, focal, posterior polar (posterior cortical)/subcapsular cataracts, which usually present between 1-3 years of age. These are generally stationary or very slowly progressive and generally do not interfere with vision. It has been suggested that these cataracts are inherited as dominant with incomplete penetrance, but definitive breeding studies are still required to verify this hypothesis.

A second type of cataract is a progressive cortical cataract which may involve the entire lens. It is not clear whether this is a distinct entity, or an aberrant form of the posterior polar cataract.

H. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-



diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.

These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

I. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

K. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Labradoodle is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

L. Achromatopsia Type 2 (ACHM – Type 2)

A congenital form of day blindness. Visual deficits become apparent between 8-10 weeks of age. Normal vision is present in low light conditions. Clinical examination is normal. Cone responses are absent on an electroretinogram. The causative genetic mutation of the *CNGA3* gene (3nt deletion in exon 7). A DNA test is available.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its

significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Labrador Retriever, the presence of retinal folds may be seen in the heterozygous state described in “R” below, thus the recommendation against breeding.

The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog, showing that it is not a carrier of the *COL9A3* mutation.

N. Retinal dysplasia - geographic, detached without skeletal defects

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd Dog it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship between the three forms of retinal dysplasia is not known for all breeds

In Europe, this condition has been documented as an autosomal recessive condition and results in early retinal detachment and blindness. Lens and corneal opacities can also be present, but skeletal abnormalities (see below) are not present. The condition of generalized retinal dysplasia with retinal detachment but without skeletal abnormalities has been reported primarily in Europe, and is rarely if ever seen in the United States.

In the United States, the milder forms of retinal dysplasia (folds/geographic) are seen in Labradors. These may represent the heterozygous form of the condition in which the homozygote also displays skeletal malformations (see “R” below) or it may represent a genetically distinct entity with an undetermined mode of inheritance. It is not possible clinically to make this distinction. Thus, Labradors with any form of retinal dysplasia should not be used for breeding.

O. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1) in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs (“downhill” conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal

degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

P. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition has been noted in the German Shepherd, Labrador and Golden Retriever.

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OCULAR DISORDERS REPORT
AUSTRALIAN LABRADOODLE

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	4,250		7,487	
Diagnostic Name		#	%	#	%
EYELIDS					
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	41	1.0%	165	2.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	15	0.2%
40.910	keratoconjunctivitis sicca	0		2	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	3	0.0%
CORNEA					
70.210	corneal pannus	1	0.0%	1	0.0%
70.700	corneal dystrophy	40	0.9%	130	1.7%
UVEA					
93.110	iris hypoplasia	0		1	0.0%
93.150	iris coloboma	0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	163	3.8%	521	7.0%
93.720	persistent pupillary membranes, iris to lens	4	0.1%	5	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	71	1.7%	263	3.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		3	0.0%
93.810	uveal melanoma	1	0.0%	0	
97.150	chorioretinal coloboma, congenital	1	0.0%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	102	2.4%	209	2.8%
100.301	punctate cataract, anterior cortex	10	0.2%	23	0.3%
100.302	punctate cataract, posterior cortex	1	0.0%	11	0.1%
100.303	punctate cataract, equatorial cortex	1	0.0%	4	0.1%
100.304	punctate cataract, anterior sutures	1	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures	13	0.3%	30	0.4%
100.306	punctate cataract, nucleus	4	0.1%	6	0.1%
100.307	punctate cataract, capsular	1	0.0%	24	0.3%
100.311	incipient cataract, anterior cortex	6	0.1%	13	0.2%
100.312	incipient cataract, posterior cortex	1	0.0%	14	0.2%
100.313	incipient cataract, equatorial cortex	2	0.0%	5	0.1%
100.314	incipient cataract, anterior sutures	0		2	0.0%
100.315	incipient cataract, posterior sutures	0		4	0.1%
100.316	incipient cataract, nucleus	1	0.0%	6	0.1%
100.317	incipient cataract, capsular	1	0.0%	6	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	5	0.1%
100.322	incomplete cataract, posterior cortex	0		6	0.1%
100.323	incomplete cataract, equatorial cortex	2	0.0%	4	0.1%
100.325	incomplete cataract, posterior sutures	2	0.0%	1	0.0%
100.326	incomplete cataract, nucleus	1	0.0%	5	0.1%
100.327	incomplete cataract, capsular	0		3	0.0%
100.328	y-suture tip opacities	17	0.4%	61	0.8%
100.330	generalized/complete cataract	0		2	0.0%

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*65*	*1.5%*	*236*	*3.2%*
100.375	*subluxation/luxation, unspecified*	*0*		*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	20	0.3%
110.135	PHPV/PTVL	2	0.0%	1	0.0%
110.200	vitreous degeneration-anterior chamber	0		4	0.1%
110.320	vitreal degeneration	3	0.1%	9	0.1%
RETINA					
120.170	retinal dysplasia, folds	31	0.7%	49	0.7%
120.180	retinal dysplasia, geographic	0		2	0.0%
120.960	retinopathy	4	0.1%	1	0.0%
OPTIC NERVE					
130.110	micropapilla	10	0.2%	8	0.1%
130.120	optic nerve hypoplasia	0		2	0.0%
130.150	optic disc coloboma	0		3	0.0%
OTHER					
900.100	other, not inherited	1	0.0%	9	0.1%
900.110	other. suspect not inherited/significance unknown	85	2.0%	319	4.3%
NORMAL					
0.000	normal globe	1,826	43.0%	5,835	77.9%

AUSTRALIAN SHEPHERD

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Iris coloboma	Not defined	1	NO	
E.	Iris hypoplasia	Not defined	1	Breeder option	
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
G.	Cataract	Autosomal co-dominant	1, 7,8	NO	Mutation in the *HSF4* gene
H.	Y-suture tip opacity	Not defined	1	Breeder option	
I.	Vitreous degeneration	Not defined	1	Breeder option	
J.	Persistent hyaloid artery	Not defined	1	Breeder option	
K.	Retinal atrophy (*prcd)*	Autosomal recessive	1, 9, 10	NO	Mutation in the *prcd* gene
L.	Cone degeneration - day blindness	Autosomal recessive	16	NO	Mutation in the *CNGB3* gene
M.	Multifocal retinopathy - *cmr1*	Autosomal recessive	17	Breeder option	Mutation in the *BEST1* gene
N.	Retinal dysplasia - folds	Not defined	1	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
O.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/ coloboma	Autosomal recessive	1, 12-15	NO	Mutation in the *NHEJ1* gene
P.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO	
Q.	Micropapilla	Not defined	1	Breeder option	

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merle coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

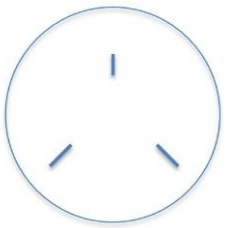
G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Y-suture tip opacity

These are prominent (or "highlighted" or "more dense") distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a "peace sign" as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress



(unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.

These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

I. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

J. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

K. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

L. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

M. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

O. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

P. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a

congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

Q. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment.

Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
AUSTRALIAN SHEPHERD

	TOTAL DOGS EXAMINED	1991-2015 96,323		2016-2020 22,420	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	92	0.1%	15	0.1%
10.000	glaucoma	8	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	5	0.0%	0	
20.160	macropalpebral fissure	4	0.0%	0	
21.000	entropion, unspecified	15	0.0%	1	0.0%
22.000	ectropion, unspecified	6	0.0%	0	
25.110	distichiasis	1,578	1.6%	310	1.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	5	0.0%	7	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
50.210	pannus of third eyelid	0		1	0.0%
51.100	third eyelid cartilage anomaly	4	0.0%	0	
52.110	prolapsed gland of the third eyelid	2	0.0%	1	0.0%
CORNEA					
70.210	corneal pannus	8	0.0%	1	0.0%
70.220	pigmentary keratitis	1	0.0%	1	0.0%
70.700	corneal dystrophy	432	0.4%	163	0.7%
70.730	corneal endothelial degeneration	14	0.0%	2	0.0%
UVEA					
93.110	iris hypoplasia	208	0.2%	144	0.6%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	1,430	1.5%	215	1.0%
93.180	liris sphincter dysplasia	8	0.0%	21	0.1%
93.710	persistent pupillary membranes, iris to iris	4,597	4.8%	1,561	7.0%
93.720	persistent pupillary membranes, iris to lens	87	0.1%	16	0.1%
93.730	persistent pupillary membranes, iris to cornea	43	0.0%	7	0.0%
93.740	persistent pupillary membranes, iris sheets	92	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	25	0.0%	23	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	22	0.0%	6	0.0%
93.810	uveal melanoma	8	0.0%	1	0.0%
93.999	uveal cysts	39	0.0%	7	0.0%
97.150	chorioretinal coloboma, congenital	16	0.0%	11	0.0%
LENS					
100.200	cataract, unspecified	169	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	2,311	2.4%	442	2.0%
100.301	punctate cataract, anterior cortex	221	0.2%	37	0.2%
100.302	punctate cataract, posterior cortex	318	0.3%	41	0.2%
100.303	punctate cataract, equatorial cortex	83	0.1%	12	0.1%
100.304	punctate cataract, anterior sutures	30	0.0%	4	0.0%
100.305	punctate cataract, posterior sutures	200	0.2%	68	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.306	punctate cataract, nucleus	149	0.2%	36	0.2%
100.307	punctate cataract, capsular	81	0.1%	35	0.2%
100.311	incipient cataract, anterior cortex	302	0.3%	46	0.2%
100.312	incipient cataract, posterior cortex	742	0.8%	72	0.3%
100.313	incipient cataract, equatorial cortex	189	0.2%	21	0.1%
100.314	incipient cataract, anterior sutures	24	0.0%	2	0.0%
100.315	incipient cataract, posterior sutures	151	0.2%	17	0.1%
100.316	incipient cataract, nucleus	197	0.2%	23	0.1%
100.317	incipient cataract, capsular	109	0.1%	23	0.1%
100.321	incomplete cataract, anterior cortex	5	0.0%	15	0.1%
100.322	incomplete cataract, posterior cortex	16	0.0%	27	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	7	0.0%
100.324	incomplete cataract, anterior sutures	0		1	0.0%
100.325	incomplete cataract, posterior sutures	1	0.0%	4	0.0%
100.326	incomplete cataract, nucleus	6	0.0%	5	0.0%
100.327	incomplete cataract, capsular	1	0.0%	3	0.0%
100.328	y-suture tip opacities	31	0.0%	67	0.3%
100.330	generalized/complete cataract	230	0.2%	10	0.0%
100.345	*significant cataracts (summary)*	*3,256*	*3.4%*	*576*	*2.6%*
100.375	*subluxation/luxation, unspecified*	*18*	*0.0%*	*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	507	0.5%	121	0.5%
110.135	PHPV/PTVL	108	0.1%	14	0.1%
110.200	vitreous degeneration-anterior chamber	4	0.0%	11	0.0%
110.320	vitreal degeneration	255	0.3%	47	0.2%
FUNDUS					
97.110	choroidal hypoplasia	152	0.2%	34	0.2%
97.120	coloboma	96	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	924	1.0%	200	0.9%
120.180	retinal dysplasia, geographic	45	0.0%	4	0.0%
120.190	retinal dysplasia, detached	9	0.0%	3	0.0%
120.310	generalized progressive retinal atrophy (PRA)	133	0.1%	4	0.0%
120.400	retinal hemorrhage	13	0.0%	0	
120.910	retinal detachment without dialysis	61	0.1%	0	
120.920	retinal detachment with dialysis	10	0.0%	8	0.0%
120.960	retinopathy	8	0.0%	10	0.0%
OPTIC NERVE					
130.110	micropapilla	200	0.2%	95	0.4%
130.120	optic nerve hypoplasia	114	0.1%	19	0.1%
130.150	optic disc coloboma	154	0.2%	23	0.1%
OTHER					
900.000	other, unspecified	545	0.6%	0	
900.100	other, not inherited	1,262	1.3%	29	0.1%
900.110	other. suspect not inherited/significance unknown	558	0.6%	445	2.0%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	84,363 87.6%	18,511 82.6%

AUSTRALIAN STUMPY TAIL CATTLE DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Stumpy Tail Cattle Dog is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Australian Stumpy Tail Cattle Dog. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
AUSTRALIAN STUMPY TAIL CATTLE DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 44 #	 %	2016-2020 1 #	 %
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	4.5%	0	
100.301	punctate cataract, anterior cortex	1	2.3%	0	
100.305	punctate cataract, posterior sutures	1	2.3%	0	
100.311	incipient cataract, anterior cortex	1	2.3%	0	
100.312	incipient cataract, posterior cortex	2	4.5%	0	
100.313	incipient cataract, equatorial cortex	2	4.5%	0	
100.316	incipient cataract, nucleus	1	2.3%	0	
100.345	*significant cataracts (summary)*	*8*	*18.2%*	*0*	
RETINA					
120.170	retinal dysplasia, folds	1	2.3%	0	
120.180	retinal dysplasia, geographic	1	2.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	6.8%	0	
OTHER					
900.100	other, not inherited	1	2.3%	0	
900.110	other. suspect not inherited/significance unknown	1	2.3%	0	
NORMAL					
0.000	normal globe	38	86.4%	1	100.0%

AUSTRALIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Australian Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
AUSTRALIAN TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 842 #	1991-2015 842 %	2016-2020 205 #	2016-2020 205 %
GLOBE					
10.000	glaucoma	1	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.2%	0	
25.110	distichiasis	3	0.4%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.5%
70.700	corneal dystrophy	4	0.5%	1	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	38	4.5%	18	8.8%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.6%	10	4.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	1	0.5%
LENS					
100.200	cataract, unspecified	2	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	28	3.3%	10	4.9%
100.301	punctate cataract, anterior cortex	3	0.4%	0	
100.302	punctate cataract, posterior cortex	2	0.2%	0	
100.303	punctate cataract, equatorial cortex	2	0.2%	1	0.5%
100.305	punctate cataract, posterior sutures	2	0.2%	0	
100.306	punctate cataract, nucleus	2	0.2%	0	
100.311	incipient cataract, anterior cortex	5	0.6%	2	1.0%
100.312	incipient cataract, posterior cortex	4	0.5%	0	
100.313	incipient cataract, equatorial cortex	5	0.6%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	1	0.1%	0	
100.317	incipient cataract, capsular	0		1	0.5%
100.323	incomplete cataract, equatorial cortex	1	0.1%	0	
100.326	incomplete cataract, nucleus	1	0.1%	0	
100.330	generalized/complete cataract	8	1.0%	0	
100.345	*significant cataracts (summary)*	*39*	*4.6%*	*4*	*2.0%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	
VITREOUS					
110.320	vitreal degeneration	3	0.4%	0	
RETINA					
120.170	retinal dysplasia, folds	3	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.4%	0	
120.400	retinal hemorrhage	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	

	1991-2015		2016-2020	
OTHER				
900.000 other, unspecified	4	0.5%	0	
900.100 other, not inherited	8	1.0%	2	1.0%
900.110 other. suspect not inherited/significance unknown	3	0.4%	8	3.9%
NORMAL				
0.000 normal globe	737	87.5%	162	79.0%

BARBET

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent Pupillary Membranes - lens pigment foci no strands	Not defined	1	Passes with no notation	
C.	Cataract	Not defined	1	NO	
D.	Y suture tip opacity	Not defined	1	Breeder option	
E.	Retinal atrophy (*prcd*)	Autosomal recessive	2	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

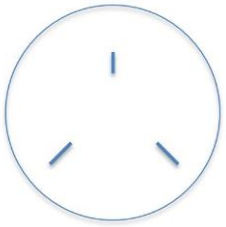
C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Barbet is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
BARBET

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 155 #	1991-2015 155 %	2016-2020 183 #	2016-2020 183 %
EYELIDS					
25.110	distichiasis	10	6.5%	6	3.3%
CORNEA					
70.700	corneal dystrophy	0		1	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	4	2.6%	4	2.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	2.6%	5	2.7%
93.999	uveal cysts	0		2	1.1%
LENS					
100.210	cataract. suspect not inherited/significance unknown	20	12.9%	18	9.8%
100.301	punctate cataract, anterior cortex	1	0.6%	0	
100.303	punctate cataract, equatorial cortex	1	0.6%	1	0.5%
100.305	punctate cataract, posterior sutures	0		1	0.5%
100.307	punctate cataract, capsular	0		1	0.5%
100.311	incipient cataract, anterior cortex	0		2	1.1%
100.312	incipient cataract, posterior cortex	0		2	1.1%
100.313	incipient cataract, equatorial cortex	0		1	0.5%
100.315	incipient cataract, posterior sutures	0		1	0.5%
100.317	incipient cataract, capsular	0		1	0.5%
100.328	y-suture tip opacities	2	1.3%	5	2.7%
100.330	generalized/complete cataract	0		1	0.5%
100.345	*significant cataracts (summary)*	*4*	*2.6%*	*16*	*8.7%*
VITREOUS					
110.320	vitreal degeneration	0		1	0.5%
FUNDUS					
97.110	choroidal hypoplasia	1	0.6%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		2	1.1%
120.920	retinal detachment with dialysis	0		1	0.5%
120.960	retinopathy	0		3	1.6%
OPTIC NERVE					
130.110	micropapilla	0		2	1.1%
OTHER					
900.000	other, unspecified	2	1.3%	0	
900.100	other, not inherited	0		2	1.1%
900.110	other. suspect not inherited/significance unknown	5	3.2%	7	3.8%
NORMAL					
0.000	normal globe	126	81.3%	135	73.8%

BASENJI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Corneal dystrophy - endothelial	Not defined	1	NO	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 2-9	Breeder option	
	- iris to cornea	Not defined	1	NO	
	- iris to lens	Not defined	1	NO	
	- endothelial opacity/no strands	Not defined	1	NO	
D.	Cataract	Not defined	1	NO	
E.	Y suture tip opacity	Not defined	1	Breeder option	
F.	Retinal atrophy - generalized	Not defined	1, 6, 7	NO	
	- Bas_PRA1	Autosomal recessive	1, 6, 7	NO	Mutation in the S-antigen (*SAG)*
G.	Optic nerve coloboma	Not defined	1, 2	NO	

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older. In the Basenji, this condition is less common than corneal endothelial disease caused by attachment of persistent pupillary membranes.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

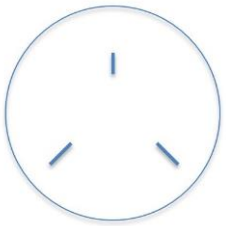
In the Basenji, this is a particularly significant problem with many cases reported where the strands bridge between the iris and the cornea resulting in localized corneal opacities which may cause vision impairment. This has also been associated with optic nerve coloboma (see "F" below).

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or "highlighted" or "more dense") distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a "peace sign" as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the "Lens" section of the CAER form. The newest version of the form (3/16/21) has boxes that say, "posterior Y-suture tip opacities" which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures" AND ALSO MARK "suspect not inherited/significance unknown" (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: "E2" or "posterior suture tip opacities." This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

Bas_PRA1

A specific mutation has been located in the S-antigen (*SAG)* gene that causes a late onset form of retinal degeneration in the Basenji. The condition is inherited in an autosomal recessive fashion. Initial thinning of the retina evidenced by irregular hypo and hyper-reflectivity of the tapetal fundus is typically noted at 5 years of age with retinal vascular attenuation noted by 6-7 years of age. Clinically the disease closely resembles *prcd*-PRA. The retinal degeneration progresses gradually and ultimately results in complete vision loss. This mutation is responsible for the majority, but not all cases of PRA within the Basenji breed.

G. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

In the Basenji, this condition has been associated with persistent pupillary membranes (see “C” above).

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Barnett KC and Knight CG. Persistent pupillary membrane and associated defects in the Basenji. *Vet Rec*. 1969 Aug 30;85:242-248.

3. Roberts SR and Bistner SI. Persistent pupillary membrane in Basenji dogs. *J Am Vet Med Assoc*. 1968 Sep 1;153:533-542.

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5. Bistner SI, Rubin LF and Roberts SR. A review of persistent pupillary membranes in the Basenji dog. *J Am Anim Hosp Assoc*. 1971;7:143.

6. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *American Journal of Veterinary Research*. 1974;35:571-574.

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OCULAR DISORDERS REPORT
BASENJI

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 10,454 #	 %	2016-2020 1,573 #	 %
GLOBE					
0.110	microphthalmia	8	0.1%	0	
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	6	0.1%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	61	0.6%	13	0.8%
CORNEA					
70.210	corneal pannus	2	0.0%	0	
70.220	pigmentary keratitis	2	0.0%	0	
70.700	corneal dystrophy	314	3.0%	41	2.6%
70.730	corneal endothelial degeneration	242	2.3%	12	0.8%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	0		1	0.1%
93.140	corneal endothelial pigment without PPM	18	0.2%	0	
93.150	iris coloboma	9	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	5,263	50.3%	1,041	66.2%
93.720	persistent pupillary membranes, iris to lens	449	4.3%	33	2.1%
93.730	persistent pupillary membranes, iris to cornea	1,100	10.5%	117	7.4%
93.740	persistent pupillary membranes, iris sheets	40	0.4%	7	0.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	14	0.1%	23	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	175	1.7%	133	8.5%
93.810	uveal melanoma	0		1	0.1%
93.999	uveal cysts	2	0.0%	6	0.4%
97.150	chorioretinal coloboma, congenital	1	0.0%	0	
LENS					
100.200	cataract, unspecified	47	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	461	4.4%	50	3.2%
100.301	punctate cataract, anterior cortex	42	0.4%	4	0.3%
100.302	punctate cataract, posterior cortex	16	0.2%	2	0.1%
100.303	punctate cataract, equatorial cortex	9	0.1%	0	
100.304	punctate cataract, anterior sutures	5	0.0%	0	
100.305	punctate cataract, posterior sutures	63	0.6%	19	1.2%
100.306	punctate cataract, nucleus	15	0.1%	4	0.3%
100.307	punctate cataract, capsular	58	0.6%	22	1.4%
100.310	incipient cataract, unspecified	0		1	0.1%
100.311	incipient cataract, anterior cortex	29	0.3%	3	0.2%
100.312	incipient cataract, posterior cortex	26	0.2%	8	0.5%
100.313	incipient cataract, equatorial cortex	17	0.2%	4	0.3%
100.314	incipient cataract, anterior sutures	3	0.0%	0	
100.315	incipient cataract, posterior sutures	30	0.3%	7	0.4%
100.316	incipient cataract, nucleus	21	0.2%	1	0.1%
100.317	incipient cataract, capsular	23	0.2%	3	0.2%
100.328	y-suture tip opacities	6	0.1%	20	1.3%
100.330	generalized/complete cataract	22	0.2%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*432*	*4.1%*	*98*	*6.2%*
100.375	*subluxation/luxation, unspecified*	*9*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	5	0.3%
110.135	PHPV/PTVL	8	0.1%	1	0.1%
110.200	vitreous degeneration-anterior chamber	1	0.0%	2	0.1%
110.320	vitreal degeneration	29	0.3%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	13	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	20	0.2%	3	0.2%
120.180	retinal dysplasia, geographic	19	0.2%	1	0.1%
120.190	retinal dysplasia, detached	4	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	379	3.6%	2	0.1%
120.400	retinal hemorrhage	5	0.0%	0	
120.910	retinal detachment without dialysis	7	0.1%	0	
120.960	retinopathy	9	0.1%	4	0.3%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	99	0.9%	9	0.6%
OTHER					
900.000	other, unspecified	78	0.7%	0	
900.100	other, not inherited	223	2.1%	6	0.4%
900.110	other. suspect not inherited/significance unknown	259	2.5%	45	2.9%
NORMAL					
0.000	normal globe	4,130	39.5%	361	22.9%

BASSET FAUVE DE BRETAGNE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma - POAG	Autosomal recessive	2-8	NO	Mutation in the *ADAMTS17* gene
B.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Basset Fauve de Bretagne, both closed angle (PCAG) and open angle (POAG) forms of glaucoma are present. Some Basset Fauve de Bretagnes have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmologic examination using an indirect ophthalmoscope or a slit-lamp microscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. It is suspected that mild to severe anterior uveitis impairs outflow of aqueous through the small perforations that are present in the sheet of tissue in the iridocorneal angle; this results in a secondary and often irreversible rise in intraocular pressure that causes blindness.

The inheritance of PCAG and goniodysgenesis in the Basset Fauve de Bretagne are not known. Until the inheritance is determined, control should be directed to removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny affected with glaucoma. Three genetic loci, *COL1A2, RAB22A,* and *NEB,* have been implicated as possible contributors to the development of PCAG in the Basset Fauve de Bretagne. One is an autosomal recessive missense mutation of a nebulin (NEB) residue on chromosome 19. Because 33% of unaffected animals were homozygous for the risk allele, it was hypothesized that modifying factors may be present. A genetic test is not yet available for PCAG.

POAG in the Basset Fauve de Bretagne is caused by a 19 base pair deletion in exon 2 of

ADAMTS17. This deletion alters the reading frame and is suspected to cause a truncated protein. The trait shows an autosomal recessive mode of inheritance. A DNA test is available.

B. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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3. Bedford PG. The aetiology of primary glaucoma in the dog. *J Small Anim Pract*. 1975;16:217-239.

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8. Ahram DF, Grozdanic SD, Kecova H, et al. Variants in Nebulin (NEB) Are Linked to the Development of Familial Primary Angle Closure Glaucoma in Basset Hounds. *PloS one*. 2015;10:e0126660.

OCULAR DISORDERS REPORT
BASSET FAUVE DE BRETAGNE

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 43 #	 %	2016-2020 77 #	 %
GLOBE					
10.000	glaucoma	2	4.7%	0	
EYELIDS					
25.110	distichiasis	0		1	1.3%
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	4.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	13	30.2%	9	11.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	5	11.6%	4	5.2%
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	1.3%
OTHER					
900.110	other. suspect not inherited/significance unknown	3	7.0%	3	3.9%
NORMAL					
0.000	normal globe	23	53.5%	60	77.9%

BASSET HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma - POAG	Autosomal recessive	1-9	NO	Mutation in the *ADAMTS17* gene
B.	Entropion	Not defined	1	Breeder option	
C.	Ectropion	Not defined	1, 10	Breeder option	
D.	Distichiasis	Not defined	11	Breeder option	
E.	Nictitans cartilage anomaly/eversion	Not defined	2	Breeder option	
F.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to cornea	Not defined	1	NO	
G.	Cataract	Not defined	1	NO	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Basset Hound, both closed angle (PCAG) and open angle (POAG) forms of glaucoma are present. Some Basset Hounds have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmologic examination using an indirect ophthalmoscope or a slit-lamp microscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. It is suspected that mild to severe anterior uveitis impairs outflow of aqueous through the small perforations that are present in the sheet of tissue in the iridocorneal angle; this results in a secondary and often irreversible rise in intraocular pressure that causes blindness.

The inheritance of PCAG and goniodysgenesis in the Basset Hound are not known. Until the inheritance is determined, control should be directed to removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny

affected with glaucoma. Three genetic loci, *COL1A2, RAB22A,* and *NEB,* have been implicated as possible contributors to the development of PCAG in the Basset Hound. One is an autosomal recessive missense mutation of a nebulin (NEB) residue on chromosome 19. Because 33% of unaffected animals were homozygous for the risk allele, it was hypothesized that modifying factors may be present. A genetic test is not yet available for PCAG.

POAG in the Basset Hound is caused by a 19 base pair deletion in exon 2 of *ADAMTS17.* This deletion alters the reading frame and is suspected to cause a truncated protein. The trait shows an autosomal recessive mode of inheritance. A DNA test is available.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Basset Hound, ectropion is associated with an exceptionally large palpebral fissure (macroblepharon) and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid segment. This causes severe ocular irritation.

It is acknowledged that factors other than genetics may play a role or be the cause of entropion and/or ectropion. However, when non-genetic factors can be ruled out, selection should be directed to a more normal head conformation that minimizes or eliminates the likelihood of the defects.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Ahram DF, Cook AC, Kecova H, et al. Identification of genetic loci associated with primary angle-closure glaucoma in the basset hound. *Mol Vis*. 2014;20:497-510.

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4. Bedford PGC. A gonioscopic study of the iridocorneal angle in the English and America breeds of Cocker Spaniel and the Bassest Hound. *J Small Anim Pract*. 1977;18:631-642.

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6. Martin CL, Wyman M. Glaucoma in the Basset Hound. *J Am Vet Med Assoc*. 1968;153:1320-1327.

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OCULAR DISORDERS REPORT
BASSET HOUND

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	1,798		167	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
20.160	macropalpebral fissure	17	0.9%	0	
21.000	entropion, unspecified	20	1.1%	7	4.2%
22.000	ectropion, unspecified	126	7.0%	20	12.0%
25.110	distichiasis	25	1.4%	1	0.6%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	6	0.3%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	20	1.1%	2	1.2%
52.110	prolapsed gland of the third eyelid	9	0.5%	3	1.8%
CORNEA					
70.210	corneal pannus	3	0.2%	0	
70.220	pigmentary keratitis	3	0.2%	0	
70.700	corneal dystrophy	4	0.2%	0	
70.730	corneal endothelial degeneration	5	0.3%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	49	2.7%	6	3.6%
93.720	persistent pupillary membranes, iris to lens	11	0.6%	1	0.6%
93.730	persistent pupillary membranes, iris to cornea	28	1.6%	1	0.6%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.2%	0	
93.999	uveal cysts	4	0.2%	1	0.6%
LENS					
100.200	cataract, unspecified	6	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	52	2.9%	10	6.0%
100.301	punctate cataract, anterior cortex	17	0.9%	0	
100.302	punctate cataract, posterior cortex	9	0.5%	1	0.6%
100.303	punctate cataract, equatorial cortex	5	0.3%	0	
100.304	punctate cataract, anterior sutures	3	0.2%	0	
100.305	punctate cataract, posterior sutures	7	0.4%	1	0.6%
100.306	punctate cataract, nucleus	3	0.2%	2	1.2%
100.307	punctate cataract, capsular	6	0.3%	1	0.6%
100.311	incipient cataract, anterior cortex	7	0.4%	1	0.6%
100.312	incipient cataract, posterior cortex	13	0.7%	1	0.6%
100.313	incipient cataract, equatorial cortex	2	0.1%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	3	0.2%	0	
100.316	incipient cataract, nucleus	4	0.2%	0	
100.317	incipient cataract, capsular	3	0.2%	2	1.2%

LENS CONTINUED		1991-2015		2016-2020	
100.326	incomplete cataract, nucleus	2	0.1%	0	
100.327	incomplete cataract, capsular	1	0.1%	0	
100.328	y-suture tip opacities	0		1	0.6%
100.330	generalized/complete cataract	5	0.3%	0	
100.345	*significant cataracts (summary)*	*97*	*5.4%*	*10*	*6.0%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	7	0.4%	0	
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	5	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	11	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.1%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.1%	1	0.6%
OTHER					
900.000	other, unspecified	19	1.1%	0	
900.100	other, not inherited	43	2.4%	7	4.2%
900.110	other. suspect not inherited/significance unknown	98	5.5%	8	4.8%
NORMAL					
0.000	normal globe	1,384	77.0%	106	63.5%

BEAGLE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	See below	1, 2	NO	
B.	Glaucoma – POAG	Presumed autosomal recessive	5	NO	Mutation in the *ADAMTS10* gene
C.	Distichiasis	Not defined	1	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	16-21	Breeder option	
E.	Cataract	Not defined	22, 23	NO	
F.	Tapetal degeneration	Presumed autosomal recessive	24-27	Breeder option	
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	
H.	Congenital stationary night blindness	Autosomal recessive	28	NO	Mutation in the *LRIT3* gene

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

A developmental anomaly in which the eyeball is abnormally small. This is often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens, and/or retina.

In the Beagle, the condition may be present unilaterally or bilaterally and is characterized by a small globe and associated ocular defects which are variable. Several forms of the condition, all apparently different, are recognized:

1) In one study, complete lens opacities were noted by 5-6 months of age; the severity of the cataract correlated closely with the extent of microphthalmia. Severely microphthalmic eyes also had multiple retinal folds. The disorder appeared to be inherited; the exact mode was not fully defined, although an X-linked disorder could not be ruled out.

2) A different form of microphthalmia is recognized in association with microphakia and

persistent pupillary membrane (PPM). Based on a limited pedigree of one cross, a dominant inheritance was proposed; heterozygotes have PPM and microphakia/cataract and homozygous affected show microphthalmia and multiple congenital ocular anomalies.

3) A third form of microphthalmia is recognized in the breed. This condition is usually unilateral and the fellow eye is normal. The mode of inheritance has not been defined, but autosomal recessive inheritance is suspected.

B. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

Primary open angle glaucoma is present in the breed, and extensive breeding studies have demonstrated its inheritance as autosomal recessive. By one year of age, the intraocular pressure (IOP) is elevated, but the filtration angle is open (early glaucoma). Animals with moderate glaucoma show sustained elevations of IOP, focal disinsertions of the lens zonules and focal closures of the iridocorneal angle. Later the globe enlarges, the lens luxates and the eyes become blind and show the effects of chronic glaucoma. The causative mutation in *ADAMTS10* causes an arginine for glycine substitution at position 661. A DNA test is available.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In the Beagle, corneal dystrophy has been described as an oval opacity located at the junction at the middle and inferior thirds of the cornea. The opacities are caused by accumulation of cholesterol and other lipids within the cornea. Progression was noted with possible vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

Several different types of cataract (anterior capsular, posterior cortical, other) have been reported in the Beagle, but the mode of inheritance of the defects is unknown. When one considers that this breed, particularly the laboratory-bred Beagle, has been the subject of extensive ophthalmological examination, the relatively low incidence of cataracts is surprising.

F. Tapetal degeneration

The tapetum lucidum is a modified choroidal structure present in the eyes of many animals that have good night vision. In Beagles there is a recessively inherited defect of the tapetal layer. Absence of this layer is determined by ophthalmoscopy which shows that the fundus has a uniform reddish coloration. The degeneration of the tapetum occurs as a result of abnormal postnatal development of this structure. The degeneration of the tapetum does not affect vision and does not result in functional or structural damage to the retina. As such, the condition probably represents an insignificant inherited variation of no functional significance.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Congenital stationary night blindness (CSNB)

A non-progressive retinal disease characterized by night blindness; day vision is normal. This condition is very rare and has only been found to date in a research colony in Japan. The condition is inherited in an autosomal recessive manner. Affected dogs had normal retinas on clinical examination, but no detectable rod photoreceptor responses with an electroretinogram (ERG). A DNA test is available.

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OCULAR DISORDERS REPORT
BEAGLE

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,620**		**443**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	4	0.2%	0	
EYELIDS					
21.000	entropion, unspecified	3	0.2%	3	0.7%
22.000	ectropion, unspecified	1	0.1%	0	
25.110	distichiasis	293	18.1%	80	18.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	4	0.2%	8	1.8%
40.910	keratoconjunctivitis sicca	3	0.2%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.1%	0	
52.110	prolapsed gland of the third eyelid	10	0.6%	1	0.2%
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	6	0.4%	1	0.2%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.150	iris coloboma	0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	20	1.2%	4	0.9%
93.730	persistent pupillary membranes, iris to cornea	3	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	1	0.2%
93.999	uveal cysts	2	0.1%	3	0.7%
LENS					
100.200	cataract, unspecified	9	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	46	2.8%	13	2.9%
100.301	punctate cataract, anterior cortex	8	0.5%	1	0.2%
100.302	punctate cataract, posterior cortex	6	0.4%	0	
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.305	punctate cataract, posterior sutures	3	0.2%	0	
100.306	punctate cataract, nucleus	0		1	0.2%
100.307	punctate cataract, capsular	3	0.2%	0	
100.311	incipient cataract, anterior cortex	3	0.2%	0	
100.312	incipient cataract, posterior cortex	14	0.9%	0	
100.313	incipient cataract, equatorial cortex	6	0.4%	2	0.5%
100.315	incipient cataract, posterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	4	0.2%	1	0.2%
100.317	incipient cataract, capsular	2	0.1%	0	
100.322	incomplete cataract, posterior cortex	1	0.1%	0	
100.323	incomplete cataract, equatorial cortex	1	0.1%	0	
100.328	y-suture tip opacities	1	0.1%	0	
100.330	generalized/complete cataract	19	1.2%	0	
100.345	*significant cataracts (summary)*	*83*	*5.1%*	*5*	*1.1%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.135	PHPV/PTVL	1	0.1%	1	0.2%
110.320	vitreal degeneration	6	0.4%	2	0.5%
RETINA					
120.170	retinal dysplasia, folds	33	2.0%	3	0.7%
120.180	retinal dysplasia, geographic	6	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	8	0.5%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	4	0.2%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	18	1.1%	0	
900.100	other, not inherited	44	2.7%	1	0.2%
900.110	other. suspect not inherited/significance unknown	24	1.5%	17	3.8%
NORMAL					
0.000	normal globe	1,196	73.8%	314	70.9%

BEARDED COLLIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Y suture tip opacity	Not defined	1		
F.	Retinal dysplasia - folds	Not defined	1	Breeder option	
G.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1-3	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

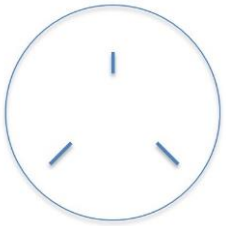
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached), which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

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OCULAR DISORDERS REPORT
BEARDED COLLIE

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**3,775**		**454**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
25.110	distichiasis	25	0.7%	7	1.5%
CORNEA					
70.700	corneal dystrophy	49	1.3%	3	0.7%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	154	4.1%	17	3.7%
93.720	persistent pupillary membranes, iris to lens	9	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.7%
93.999	uveal cysts	9	0.2%	2	0.4%
LENS					
100.200	cataract, unspecified	12	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	374	9.9%	56	12.3%
100.301	punctate cataract, anterior cortex	38	1.0%	6	1.3%
100.302	punctate cataract, posterior cortex	15	0.4%	1	0.2%
100.303	punctate cataract, equatorial cortex	28	0.7%	4	0.9%
100.304	punctate cataract, anterior sutures	5	0.1%	0	
100.305	punctate cataract, posterior sutures	21	0.6%	6	1.3%
100.306	punctate cataract, nucleus	6	0.2%	1	0.2%
100.307	punctate cataract, capsular	7	0.2%	3	0.7%
100.311	incipient cataract, anterior cortex	37	1.0%	2	0.4%
100.312	incipient cataract, posterior cortex	33	0.9%	1	0.2%
100.313	incipient cataract, equatorial cortex	23	0.6%	3	0.7%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	10	0.3%	1	0.2%
100.316	incipient cataract, nucleus	12	0.3%	4	0.9%
100.317	incipient cataract, capsular	9	0.2%	3	0.7%
100.321	incomplete cataract, anterior cortex	2	0.1%	1	0.2%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.327	incomplete cataract, capsular	0		1	0.2%
100.328	y-suture tip opacities	3	0.1%	8	1.8%
100.330	generalized/complete cataract	5	0.1%	0	
100.345	*significant cataracts (summary)*	*269*	*7.1%*	*46*	*10.1%*
100.375	*subluxation/luxation, unspecified*	*6*	*0.2%*	*1*	*0.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.2%	0	
110.320	vitreal degeneration	7	0.2%	1	0.2%
FUNDUS					
97.110	choroidal hypoplasia	22	0.6%	0	
97.120	coloboma	4	0.1%	0	

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	52	1.4%	0	
120.180	retinal dysplasia, geographic	1	0.0%	2	0.4%
120.310	generalized progressive retinal atrophy (PRA)	8	0.2%	0	
120.960	retinopathy	2	0.1%	0	
OPTIC NERVE					
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	37	1.0%	0	
900.100	other, not inherited	73	1.9%	1	0.2%
900.110	other. suspect not inherited/significance unknown	26	0.7%	30	6.6%
NORMAL					
0.000	normal globe	3,047	80.7%	315	69.4%

BEAUCERON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Beauceron breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BEAUCERON

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 128 #	 %	2016-2020 397 #	 %
GLOBE						
0.110	microphthalmia		1	0.8%	0	
EYELIDS						
25.110	distichiasis		1	0.8%	5	1.3%
NICTITANS						
51.100	third eyelid cartilage anomaly		0		1	0.3%
CORNEA						
70.210	corneal pannus		1	0.8%	0	
70.700	corneal dystrophy		0		2	0.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	1.6%	12	3.0%
93.720	persistent pupillary membranes, iris to lens		0		1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	4.7%	27	6.8%
LENS						
100.210	cataract. suspect not inherited/significance unknown		3	2.3%	14	3.5%
100.302	punctate cataract, posterior cortex		1	0.8%	1	0.3%
100.305	punctate cataract, posterior sutures		2	1.6%	0	
100.307	punctate cataract, capsular		1	0.8%	1	0.3%
100.311	incipient cataract, anterior cortex		0		2	0.5%
100.315	incipient cataract, posterior sutures		2	1.6%	0	
100.316	incipient cataract, nucleus		1	0.8%	1	0.3%
100.317	incipient cataract, capsular		0		1	0.3%
100.328	y-suture tip opacities		1	0.8%	1	0.3%
100.345	*significant cataracts (summary)*		*8*	*6.2%*	*7*	*1.8%*
100.375	*subluxation/luxation, unspecified*		*0*		*2*	*0.5%*
VITREOUS						
110.200	vitreous degeneration-anterior chamber		0		1	0.3%
110.320	vitreal degeneration		6	4.7%	0	
RETINA						
120.170	retinal dysplasia, folds		0		4	1.0%
120.180	retinal dysplasia, geographic		1	0.8%	0	
OTHER						
900.000	other, unspecified		3	2.3%	0	
900.110	other. suspect not inherited/significance unknown		4	3.1%	16	4.0%
NORMAL						
0.000	normal globe		104	81.2%	317	79.8%

BEDLINGTON TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Imperforate lacrimal punctum	Not defined	1, 2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	1	NO
E.	Y suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

B. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

C. Persistent pupillary membranes (PPMs)

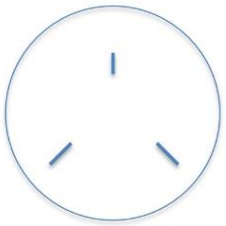
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Barnett KC. Imperforate and micro-lachrymal puncta in the dog. *J Small Anim Pract*. 1979 Aug;20:481-490.

OCULAR DISORDERS REPORT
BEDLINGTON TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,592**		**261**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	4	0.3%	1	0.4%
EYELIDS					
20.140	ectopic cilia	2	0.1%	0	
21.000	entropion, unspecified	2	0.1%	0	
25.110	distichiasis	127	8.0%	12	4.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	11	0.7%	4	1.5%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	0	
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	7	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	122	7.7%	39	14.9%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	3	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
LENS					
100.200	cataract, unspecified	13	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown	114	7.2%	20	7.7%
100.301	punctate cataract, anterior cortex	7	0.4%	3	1.1%
100.302	punctate cataract, posterior cortex	3	0.2%	1	0.4%
100.303	punctate cataract, equatorial cortex	8	0.5%	2	0.8%
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	14	0.9%	4	1.5%
100.307	punctate cataract, capsular	3	0.2%	2	0.8%
100.311	incipient cataract, anterior cortex	38	2.4%	1	0.4%
100.312	incipient cataract, posterior cortex	18	1.1%	0	
100.313	incipient cataract, equatorial cortex	31	1.9%	0	
100.314	incipient cataract, anterior sutures	4	0.3%	0	
100.315	incipient cataract, posterior sutures	9	0.6%	0	
100.316	incipient cataract, nucleus	3	0.2%	0	
100.317	incipient cataract, capsular	1	0.1%	0	
100.321	incomplete cataract, anterior cortex	1	0.1%	0	
100.322	incomplete cataract, posterior cortex	1	0.1%	0	
100.328	y-suture tip opacities	4	0.3%	2	0.8%
100.330	generalized/complete cataract	14	0.9%	2	0.8%
100.345	*significant cataracts (summary)*	*174*	*10.9%*	*17*	*6.5%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.320	vitreal degeneration	7	0.4%	1	0.4%
RETINA					
120.170	retinal dysplasia, folds	8	0.5%	2	0.8%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.2%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	0		2	0.8%
130.120	optic nerve hypoplasia	1	0.1%	0	
130.150	optic disc coloboma	5	0.3%	0	
OTHER					
900.000	other, unspecified	13	0.8%	0	
900.100	other, not inherited	34	2.1%	0	
900.110	other. suspect not inherited/significance unknown	16	1.0%	9	3.4%
NORMAL					
0.000	normal globe	1,188	74.6%	176	67.4%

OCULAR DISORDERS REPORT
BELGIAN LAEKENOIS

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BELGIAN LAEKENOIS breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BELGIAN LAEKENOIS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 153 #	 %	2016-2020 54 #	 %
EYELIDS						
25.110	distichiasis		5	3.3%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		0		2	3.7%
CORNEA						
70.700	corneal dystrophy		1	0.7%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	0.7%	2	3.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	1.9%
LENS						
100.210	cataract. suspect not inherited/significance unknown		16	10.5%	2	3.7%
100.302	punctate cataract, posterior cortex		0		1	1.9%
100.311	incipient cataract, anterior cortex		0		2	3.7%
100.312	incipient cataract, posterior cortex		0		1	1.9%
100.322	incomplete cataract, posterior cortex		0		1	1.9%
100.345	*significant cataracts (summary)*		*0*		*5*	*9.3%*
VITREOUS						
110.320	vitreal degeneration		5	3.3%	0	
RETINA						
120.170	retinal dysplasia, folds		6	3.9%	0	
120.310	generalized progressive retinal atrophy (PRA)		0		1	1.9%
OTHER						
900.000	other, unspecified		4	2.6%	0	
900.100	other, not inherited		4	2.6%	0	
900.110	other. suspect not inherited/significance unknown		2	1.3%	0	
NORMAL						
0.000	normal globe		125	81.7%	45	83.3%

BELGIAN MALINOIS

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Y-suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

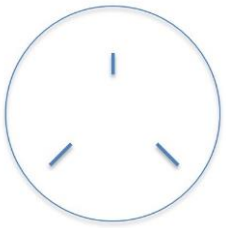
B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Malinois, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

C. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Belgian Malinois breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BELGIAN MALINOIS

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**2,577**		**846**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	0		1	0.1%
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	2	0.1%	1	0.1%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.1%
51.100	third eyelid cartilage anomaly	0		3	0.4%
CORNEA					
70.210	corneal pannus	10	0.4%	1	0.1%
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	16	0.6%	2	0.2%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	30	1.2%	20	2.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	10	0.4%	0	
LENS					
100.200	cataract, unspecified	3	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	112	4.3%	46	5.4%
100.301	punctate cataract, anterior cortex	12	0.5%	3	0.4%
100.302	punctate cataract, posterior cortex	8	0.3%	1	0.1%
100.303	punctate cataract, equatorial cortex	1	0.0%	0	
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	12	0.5%	5	0.6%
100.306	punctate cataract, nucleus	2	0.1%	0	
100.307	punctate cataract, capsular	1	0.0%	2	0.2%
100.311	incipient cataract, anterior cortex	12	0.5%	6	0.7%
100.312	incipient cataract, posterior cortex	21	0.8%	7	0.8%
100.313	incipient cataract, equatorial cortex	6	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures	7	0.3%	0	
100.315	incipient cataract, posterior sutures	8	0.3%	1	0.1%
100.316	incipient cataract, nucleus	15	0.6%	2	0.2%
100.317	incipient cataract, capsular	2	0.1%	2	0.2%
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.328	y-suture tip opacities	2	0.1%	6	0.7%
100.330	generalized/complete cataract	6	0.2%	0	
100.345	*significant cataracts (summary)*	*121*	*4.7%*	*38*	*4.5%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	2	0.2%
110.135	PHPV/PTVL	2	0.1%	0	
110.320	vitreal degeneration	18	0.7%	6	0.7%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	22	0.9%	4	0.5%
120.180	retinal dysplasia, geographic	6	0.2%	1	0.1%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	13	0.5%	1	0.1%
120.910	retinal detachment without dialysis	4	0.2%	0	
120.920	retinal detachment with dialysis	1	0.0%	3	0.4%
120.960	retinopathy	1	0.0%	3	0.4%
OPTIC NERVE					
130.150	optic disc coloboma	1	0.0%	1	0.1%
OTHER					
900.000	other, unspecified	21	0.8%	0	
900.100	other, not inherited	78	3.0%	1	0.1%
900.110	other. suspect not inherited/significance unknown	24	0.9%	45	5.3%
NORMAL					
0.000	normal globe	2,286	88.7%	702	83.0%

BELGIAN SHEEPDOG

(BELGIAN SHEPHERD-GROENENDAEL)

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Chronic superficial keratitis/pannus	Not defined	1	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Achiasmic optic nerves with nystagmus	Autosomal recessive	2	NO

Description and Comments

A. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Sheepdog, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

D. Achiasmatic optic nerves with nystagmus

Achiasmatic optic nerves with nystagmus have been described in a small family of black Belgian Sheepdogs. Congenital nystagmus is the clinical sign most commonly noted. All retinal ganglion cell axons extend directly into the ipsilateral optic disc with no chiasmal decussation. No optic nerve hypoplasia/micropapilla was noted in the animals studied and reported.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Hogan D and Williams RW. Analysis of the retinas and optic nerves of achiasmatic Belgian sheepdogs. *The Journal of comparative neurology.* 1995 Feb 13;352:367-380.

OCULAR DISORDERS REPORT
BELGIAN SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 5,646 #	%	2016-2020 932 #	%
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	11	0.2%	3	0.3%
NICTITANS					
50.210	pannus of third eyelid	2	0.0%	7	0.8%
51.100	third eyelid cartilage anomaly	3	0.1%	1	0.1%
CORNEA					
70.210	corneal pannus	49	0.9%	18	1.9%
70.220	pigmentary keratitis	3	0.1%	4	0.4%
70.700	corneal dystrophy	32	0.6%	5	0.5%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	408	7.2%	81	8.7%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	4	0.1%	2	0.2%
93.740	persistent pupillary membranes, iris sheets	5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	9	0.2%	7	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.1%	0	
93.999	uveal cysts	3	0.1%	3	0.3%
97.150	chorioretinal coloboma, congenital	0		1	0.1%
LENS					
100.200	cataract, unspecified	13	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	199	3.5%	40	4.3%
100.301	punctate cataract, anterior cortex	17	0.3%	3	0.3%
100.302	punctate cataract, posterior cortex	39	0.7%	3	0.3%
100.303	punctate cataract, equatorial cortex	5	0.1%	0	
100.304	punctate cataract, anterior sutures	3	0.1%	0	
100.305	punctate cataract, posterior sutures	15	0.3%	2	0.2%
100.306	punctate cataract, nucleus	4	0.1%	1	0.1%
100.307	punctate cataract, capsular	6	0.1%	5	0.5%
100.311	incipient cataract, anterior cortex	25	0.4%	2	0.2%
100.312	incipient cataract, posterior cortex	59	1.0%	6	0.6%
100.313	incipient cataract, equatorial cortex	12	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures	4	0.1%	0	
100.315	incipient cataract, posterior sutures	14	0.2%	0	
100.316	incipient cataract, nucleus	11	0.2%	0	
100.317	incipient cataract, capsular	6	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		2	0.2%
100.322	incomplete cataract, posterior cortex	0		2	0.2%
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.328	y-suture tip opacities	4	0.1%	2	0.2%
100.330	generalized/complete cataract	7	0.1%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*245*	*4.3%*	*30*	*3.2%*
100.375	*subluxation/luxation, unspecified*	*0*		*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	0	
110.320	vitreal degeneration	3	0.1%	2	0.2%
FUNDUS					
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	37	0.7%	2	0.2%
120.180	retinal dysplasia, geographic	6	0.1%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	4	0.1%	0	
120.910	retinal detachment without dialysis	2	0.0%	0	
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.110	micropapilla	28	0.5%	6	0.6%
130.120	optic nerve hypoplasia	12	0.2%	2	0.2%
130.150	optic disc coloboma	5	0.1%	0	
OTHER					
900.000	other, unspecified	54	1.0%	0	
900.100	other, not inherited	112	2.0%	1	0.1%
900.110	other. suspect not inherited/significance unknown	44	0.8%	50	5.4%
NORMAL					
0.000	normal globe	4,846	85.8%	691	74.1%

BELGIAN TERVUREN

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Chronic superficial keratitis/pannus	Not defined	1, 2	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Micropapilla	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Tervuren, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

E. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Chavkin MJ, Roberts SM, Salman MD, et al. Risk factors for development of chronic superficial keratitis in dogs. *J Am Vet Med Assoc*. 1994 May 15;204:1630-1634.

OCULAR DISORDERS REPORT
BELGIAN TERVUREN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 12,526 #	%	2016-2020 1,798 #	%
GLOBE						
0.110	microphthalmia		4	0.0%	0	
10.000	glaucoma		1	0.0%	0	
EYELIDS						
21.000	entropion, unspecified		3	0.0%	0	
25.110	distichiasis		115	0.9%	8	0.4%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		2	0.0%	0	
NICTITANS						
50.210	pannus of third eyelid		5	0.0%	6	0.3%
51.100	third eyelid cartilage anomaly		18	0.1%	3	0.2%
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		87	0.7%	25	1.4%
70.220	pigmentary keratitis		6	0.0%	3	0.2%
70.700	corneal dystrophy		69	0.6%	8	0.4%
70.730	corneal endothelial degeneration		7	0.1%	0	
UVEA						
93.150	iris coloboma		2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		933	7.4%	207	11.5%
93.720	persistent pupillary membranes, iris to lens		12	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		5	0.0%	0	
93.740	persistent pupillary membranes, iris sheets		14	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		28	0.2%	32	1.8%
93.810	uveal melanoma		0		2	0.1%
93.999	uveal cysts		17	0.1%	1	0.1%
LENS						
100.200	cataract, unspecified		66	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown		650	5.2%	132	7.3%
100.301	punctate cataract, anterior cortex		59	0.5%	12	0.7%
100.302	punctate cataract, posterior cortex		89	0.7%	12	0.7%
100.303	punctate cataract, equatorial cortex		17	0.1%	0	
100.304	punctate cataract, anterior sutures		3	0.0%	5	0.3%
100.305	punctate cataract, posterior sutures		31	0.2%	4	0.2%
100.306	punctate cataract, nucleus		3	0.0%	2	0.1%
100.307	punctate cataract, capsular		17	0.1%	10	0.6%
100.311	incipient cataract, anterior cortex		59	0.5%	9	0.5%
100.312	incipient cataract, posterior cortex		129	1.0%	31	1.7%
100.313	incipient cataract, equatorial cortex		18	0.1%	6	0.3%
100.314	incipient cataract, anterior sutures		6	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures		26	0.2%	5	0.3%
100.316	incipient cataract, nucleus		3	0.0%	2	0.1%
100.317	incipient cataract, capsular		15	0.1%	5	0.3%
100.321	incomplete cataract, anterior cortex		0		1	0.1%
100.322	incomplete cataract, posterior cortex		0		5	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	y-suture tip opacities	4	0.0%	9	0.5%
100.330	generalized/complete cataract	12	0.1%	0	
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*558*	*4.5%*	*120*	*6.7%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	5	0.3%
110.135	PHPV/PTVL	3	0.0%	0	
110.320	vitreal degeneration	29	0.2%	16	0.9%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	41	0.3%	2	0.1%
120.180	retinal dysplasia, geographic	11	0.1%	2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	23	0.2%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	2	0.0%	4	0.2%
OPTIC NERVE					
130.110	micropapilla	120	1.0%	21	1.2%
130.120	optic nerve hypoplasia	91	0.7%	5	0.3%
130.150	optic disc coloboma	4	0.0%	0	
OTHER					
900.000	other, unspecified	107	0.9%	0	
900.100	other, not inherited	250	2.0%	2	0.1%
900.110	other. suspect not inherited/significance unknown	143	1.1%	115	6.4%
NORMAL					
0.000	normal globe	10,438	83.3%	1,238	68.9%

BERGER PICARD
(PICARDY SHEPHERD, PICARDIE)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Y suture tip opacity	Not defined	1	Breeder option
G.	Retinal atrophy - generalized	Not defined	1	NO
H.	Retinal dysplasia - folds	Not defined	1	Breeder option
I.	Retinopathy	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

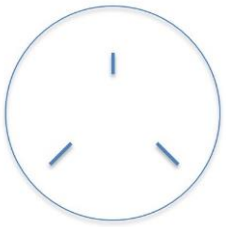
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality is also known as progressive retinal atrophy or PRA, and may be detected by electroretinogram (not part of a routine eye screening examination) before there are detectable funduscopic changes seen by ophthalmoscopy. There are multiple genetic types of PRA including the rod cone dysplasias described elsewhere.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Retinopathy

A lesion similar to canine multifocal retinopathy has been noted in the Berger Picard. The lesions initially appear as multifocal sub-retinal fluid elevations that over time may become hyper-reflective lesions.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BERGER PICARD

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**789**		**762**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	0		1	0.1%
EYELIDS					
25.110	distichiasis	64	8.1%	46	6.0%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	2	0.3%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	14	1.8%	17	2.2%
52.110	prolapsed gland of the third eyelid	0		2	0.3%
CORNEA					
70.700	corneal dystrophy	11	1.4%	18	2.4%
UVEA					
90.250	pigmentary uveitis	1	0.1%	0	
93.150	iris coloboma	0		1	0.1%
93.180	Iiris sphincter dysplasia	0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	199	25.2%	94	12.3%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.810	uveal melanoma	1	0.1%	0	
93.999	uveal cysts	2	0.3%	5	0.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	93	11.8%	82	10.8%
100.301	punctate cataract, anterior cortex	0		5	0.7%
100.302	punctate cataract, posterior cortex	1	0.1%	4	0.5%
100.304	punctate cataract, anterior sutures	0		2	0.3%
100.305	punctate cataract, posterior sutures	18	2.3%	20	2.6%
100.307	punctate cataract, capsular	3	0.4%	5	0.7%
100.311	incipient cataract, anterior cortex	1	0.1%	4	0.5%
100.312	incipient cataract, posterior cortex	5	0.6%	8	1.0%
100.313	incipient cataract, equatorial cortex	0		1	0.1%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	7	0.9%	9	1.2%
100.316	incipient cataract, nucleus	0		2	0.3%
100.317	incipient cataract, capsular	0		1	0.1%
100.321	incomplete cataract, anterior cortex	0		3	0.4%
100.322	incomplete cataract, posterior cortex	3	0.4%	3	0.4%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.326	incomplete cataract, nucleus	1	0.1%	0	
100.328	y-suture tip opacities	12	1.5%	28	3.7%
100.330	generalized/complete cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*52*	*6.6%*	*97*	*12.7%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.6%	4	0.5%
110.320	vitreal degeneration	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	159	20.2%	80	10.5%
120.180	retinal dysplasia, geographic	7	0.9%	4	0.5%
120.190	retinal dysplasia, detached	0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	14	1.8%	16	2.1%
120.960	retinopathy	34	4.3%	35	4.6%
OPTIC NERVE					
130.110	micropapilla	0		2	0.3%
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	25	3.2%	0	
900.100	other, not inherited	13	1.6%	10	1.3%
900.110	other. suspect not inherited/significance unknown	35	4.4%	46	6.0%
NORMAL					
0.000	normal globe	343	43.5%	393	51.6%

BERNESE MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	1	NO
E.	Retinal atrophy - generalized	Not defined	1, 2	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Bernese Mountain Dog, one French report found the early onset retinopathy to be functionally and electroretinographically similar to the congenital stationary night blindness (retinal dystrophy) seen in the Briard.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Chaudieu G and Molon-Noblot S. Early retinopathy in the Bernese Mountain Dog in France: preliminary observations. *Vet Ophthalmol*. 2004 May-Jun;7:175-184.

OCULAR DISORDERS REPORT
BERNESE MOUNTAIN DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 15,937 #	 %	2016-2020 3,328 #	 %
GLOBE					
0.110	microphthalmia	6	0.0%	1	0.0%
EYELIDS					
20.160	macropalpebral fissure	25	0.2%	0	
21.000	entropion, unspecified	239	1.5%	39	1.2%
22.000	ectropion, unspecified	103	0.6%	16	0.5%
25.110	distichiasis	141	0.9%	45	1.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	40	0.3%	5	0.2%
52.110	prolapsed gland of the third eyelid	1	0.0%	2	0.1%
CORNEA					
70.210	corneal pannus	2	0.0%	1	0.0%
70.700	corneal dystrophy	63	0.4%	13	0.4%
70.730	corneal endothelial degeneration	4	0.0%	0	
UVEA					
93.110	iris hypoplasia	1	0.0%	0	
93.150	iris coloboma	8	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	591	3.7%	156	4.7%
93.720	persistent pupillary membranes, iris to lens	14	0.1%	5	0.2%
93.730	persistent pupillary membranes, iris to cornea	6	0.0%	5	0.2%
93.740	persistent pupillary membranes, iris sheets	5	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	16	0.1%	30	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	9	0.1%	3	0.1%
93.999	uveal cysts	52	0.3%	8	0.2%
LENS					
100.200	cataract, unspecified	6	0.0%	0	
100.210	cataract. suspect not inherited/significance unknown	957	6.0%	155	4.7%
100.301	punctate cataract, anterior cortex	77	0.5%	20	0.6%
100.302	punctate cataract, posterior cortex	80	0.5%	15	0.5%
100.303	punctate cataract, equatorial cortex	41	0.3%	10	0.3%
100.304	punctate cataract, anterior sutures	12	0.1%	5	0.2%
100.305	punctate cataract, posterior sutures	29	0.2%	7	0.2%
100.306	punctate cataract, nucleus	21	0.1%	6	0.2%
100.307	punctate cataract, capsular	14	0.1%	12	0.4%
100.311	incipient cataract, anterior cortex	53	0.3%	14	0.4%
100.312	incipient cataract, posterior cortex	173	1.1%	16	0.5%
100.313	incipient cataract, equatorial cortex	99	0.6%	10	0.3%
100.314	incipient cataract, anterior sutures	8	0.1%	2	0.1%
100.315	incipient cataract, posterior sutures	30	0.2%	2	0.1%
100.316	incipient cataract, nucleus	29	0.2%	9	0.3%
100.317	incipient cataract, capsular	45	0.3%	9	0.3%
100.321	incomplete cataract, anterior cortex	0		3	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.322	incomplete cataract, posterior cortex	3	0.0%	1	0.0%
100.323	incomplete cataract, equatorial cortex	1	0.0%	1	0.0%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	1	0.0%	8	0.2%
100.327	incomplete cataract, capsular	0		3	0.1%
100.328	y-suture tip opacities	2	0.0%	4	0.1%
100.330	generalized/complete cataract	28	0.2%	1	0.0%
100.340	resorbing/hypermature cataract	0		2	0.1%
100.345	*significant cataracts (summary)*	*752*	*4.7%*	*161*	*4.8%*
100.375	*subluxation/luxation, unspecified*	*9*	*0.1%*	*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	26	0.2%	8	0.2%
110.135	PHPV/PTVL	9	0.1%	3	0.1%
110.320	vitreal degeneration	29	0.2%	1	0.0%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	34	0.2%	10	0.3%
120.180	retinal dysplasia, geographic	8	0.1%	1	0.0%
120.190	retinal dysplasia, detached	3	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	51	0.3%	0	
120.400	retinal hemorrhage	2	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	3	0.0%	8	0.2%
OPTIC NERVE					
130.110	micropapilla	19	0.1%	9	0.3%
130.120	optic nerve hypoplasia	30	0.2%	6	0.2%
130.150	optic disc coloboma	21	0.1%	1	0.0%
OTHER					
900.000	other, unspecified	193	1.2%	0	
900.100	other, not inherited	454	2.8%	5	0.2%
900.110	other. suspect not inherited/significance unknown	148	0.9%	137	4.1%
NORMAL					
0.000	normal globe	13,685	85.9%	2,627	78.9%

BICHON FRISE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1-3	NO
F.	Y suture tip opacity	Not defined	1	Breeder option
G.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Bichon Frise, many of these strands bridge between the iris and cornea where they may be associated with corneal opacities and vision impairment.

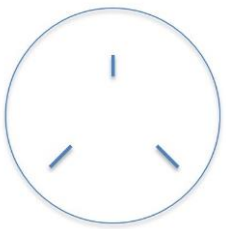
E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The range in age of animals affected with cataracts in one study was 1-2 years to 9-10 years old, with the peak age of 3 years old. The cataracts involved all regions of the lens, but in age groups of 2-4 years old, the predominant regions affected were the posterior cortex, and the anterior and posterior cortices combined. The earliest abnormalities usually consisted of small punctate opacities in the paracentral posterior cortex, independent of the posterior lens sutures.

F. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts -

which would either be breeder option or failing.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gelatt KN, Wallace MR, Andrew SE, et al. Cataracts in the Bichon Frise. *Vet Ophthalmol*. 2003 Mar;6:3-9.

3. Schmidt GM and Vainisi SJ. Retrospective study of prophylactic random transscleral retinopexy in the Bichon Frise with cataract. *Vet Ophthalmol*. 2004 Sep-Oct;7:307-310.

OCULAR DISORDERS REPORT
BICHON FRISE

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**9,835**		**1,663**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	2	0.0%	0	
21.000	entropion, unspecified	7	0.1%	19	1.1%
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	347	3.5%	79	4.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.1%
40.910	keratoconjunctivitis sicca	2	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	0		3	0.2%
CORNEA					
70.210	corneal pannus	2	0.0%	0	
70.220	pigmentary keratitis	2	0.0%	2	0.1%
70.700	corneal dystrophy	339	3.4%	63	3.8%
70.730	corneal endothelial degeneration	5	0.1%	2	0.1%
UVEA					
93.110	iris hypoplasia	2	0.0%	0	
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	4	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	223	2.3%	60	3.6%
93.720	persistent pupillary membranes, iris to lens	13	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	31	0.3%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	6	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	8	0.1%	2	0.1%
LENS					
100.200	cataract, unspecified	23	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	534	5.4%	79	4.8%
100.301	punctate cataract, anterior cortex	93	0.9%	12	0.7%
100.302	punctate cataract, posterior cortex	85	0.9%	6	0.4%
100.303	punctate cataract, equatorial cortex	11	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures	8	0.1%	0	
100.305	punctate cataract, posterior sutures	37	0.4%	8	0.5%
100.306	punctate cataract, nucleus	9	0.1%	1	0.1%
100.307	punctate cataract, capsular	8	0.1%	11	0.7%
100.311	incipient cataract, anterior cortex	84	0.9%	12	0.7%
100.312	incipient cataract, posterior cortex	214	2.2%	16	1.0%
100.313	incipient cataract, equatorial cortex	32	0.3%	6	0.4%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	46	0.5%	3	0.2%
100.316	incipient cataract, nucleus	9	0.1%	2	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.317	incipient cataract, capsular	12	0.1%	3	0.2%
100.321	incomplete cataract, anterior cortex	0		4	0.2%
100.322	incomplete cataract, posterior cortex	3	0.0%	3	0.2%
100.328	y-suture tip opacities	4	0.0%	22	1.3%
100.330	generalized/complete cataract	147	1.5%	2	0.1%
100.345	*significant cataracts (summary)*	*827*	*8.4%*	*113*	*6.8%*
100.375	*subluxation/luxation, unspecified*	*4*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	20	0.2%	18	1.1%
110.135	PHPV/PTVL	3	0.0%	0	
110.200	vitreous degeneration-anterior chamber	2	0.0%	8	0.5%
110.320	vitreal degeneration	97	1.0%	34	2.0%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	67	0.7%	6	0.4%
120.180	retinal dysplasia, geographic	3	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	58	0.6%	2	0.1%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	2	0.0%	3	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	1	0.1%
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	10	0.1%	0	
OTHER					
900.000	other, unspecified	39	0.4%	0	
900.100	other, not inherited	145	1.5%	0	
900.110	other. suspect not inherited/significance unknown	64	0.7%	90	5.4%
NORMAL					
0.000	normal globe	8,104	82.4%	1,191	71.6%

OCULAR DISORDERS REPORT
BIEWER TERRIER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BIEWER TERRIER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BIEWER TERRIER

Diagnostic Name		1991-2015 59 #	1991-2015 59 %	2016-2020 105 #	2016-2020 105 %
EYELIDS					
25.110	distichiasis	1	1.7%	3	2.9%
CORNEA					
70.700	corneal dystrophy	0		1	1.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	7	11.9%	3	2.9%
93.720	persistent pupillary membranes, iris to lens	0		1	1.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	3.4%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	1.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	4	6.8%	0	
100.302	punctate cataract, posterior cortex	0		1	1.0%
100.330	generalized/complete cataract	0		1	1.0%
100.340	resorbing/hypermature cataract	0		1	1.0%
100.345	*significant cataracts (summary)*	*0*		*3*	*2.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	1.7%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	1.7%	0	
RETINA					
120.170	retinal dysplasia, folds	0		2	1.9%
OPTIC NERVE					
130.150	optic disc coloboma	1	1.7%	0	
OTHER					
900.000	other, unspecified	1	1.7%	0	
NORMAL					
0.000	normal globe	49	83.1%	93	88.6%

BLACK AND TAN COONHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BLACK AND TAN COONHOUND

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**543**		**173**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
21.000	entropion, unspecified	3	0.6%	1	0.6%
22.000	ectropion, unspecified	6	1.1%	1	0.6%
25.110	distichiasis	6	1.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.4%	0	
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
CORNEA					
70.210	corneal pannus	2	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	5	0.9%	0	
93.720	persistent pupillary membranes, iris to lens	3	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea	0		2	1.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	1.3%	2	1.2%
93.999	uveal cysts	0		1	0.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	42	7.7%	8	4.6%
100.301	punctate cataract, anterior cortex	4	0.7%	1	0.6%
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.304	punctate cataract, anterior sutures	0		3	1.7%
100.305	punctate cataract, posterior sutures	1	0.2%	0	
100.306	punctate cataract, nucleus	6	1.1%	0	
100.307	punctate cataract, capsular	1	0.2%	2	1.2%
100.311	incipient cataract, anterior cortex	1	0.2%	0	
100.312	incipient cataract, posterior cortex	5	0.9%	1	0.6%
100.314	incipient cataract, anterior sutures	1	0.2%	1	0.6%
100.316	incipient cataract, nucleus	3	0.6%	0	
100.323	incomplete cataract, equatorial cortex	1	0.2%	0	
100.330	generalized/complete cataract	3	0.6%	0	
100.345	*significant cataracts (summary)*	*27*	*5.0%*	*8*	*4.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.6%
110.135	PHPV/PTVL	1	0.2%	0	
110.320	vitreal degeneration	1	0.2%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	25	4.6%	47	27.2%
120.180	retinal dysplasia, geographic	0		1	0.6%

	1991-2015		2016-2020	
OTHER				
900.000 other, unspecified	2	0.4%	0	
900.100 other, not inherited	11	2.0%	0	
900.110 other. suspect not inherited/significance unknown	3	0.6%	7	4.0%
NORMAL				
0.000 normal globe	430	79.2%	105	60.7%

BLACK RUSSIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	POANV (polyneuropathy, ocular abnormalities neuronal vacuolation) - Microphthalmia - Cataracts -PPM (iris to iris)	Autosomal recessive	2	NO	Mutation in the *RAB3GAP1: c.743delC* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. POANV- Polyneuropathy with ocular abnormalities and neuronal vacuolation

An autosomal recessive condition resulting in juvenile polyneuropathy that presents as laryngeal paralysis and weakness. Patients have concurrent ophthalmic abnormalities including microphthalmia, incomplete cataracts (primarily nuclear) and iris-to-iris PPMs. Neuronal vacuolation was identified on histopathology. Affected dogs were found to be homozygous for the RAB3GAP1: c.743delC mutation. Patients with this variant are not reported to survive past 6 months.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Mhlanga-Mutangadura T, Johnson GJ, Schnabel RD, et al. A mutation in the Warburg syndrome gene, RAB3GAP1, causes a similar syndrome with polyneuropathy and neuronal vacuolation in Black Russian Terrier dogs. Neurobiology of Disease. 2016;86:75-85.

OCULAR DISORDERS REPORT
BLACK RUSSIAN TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 562 #	 %	2016-2020 305 #	 %
EYELIDS						
21.000	entropion, unspecified		5	0.9%	3	1.0%
22.000	ectropion, unspecified		4	0.7%	0	
25.110	distichiasis		5	0.9%	6	2.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.2%	0	
52.110	prolapsed gland of the third eyelid		1	0.2%	0	
CORNEA						
70.700	corneal dystrophy		2	0.4%	3	1.0%
UVEA						
93.110	iris hypoplasia		1	0.2%	0	
93.150	iris coloboma		1	0.2%	0	
93.710	persistent pupillary membranes, iris to iris		10	1.8%	10	3.3%
93.720	persistent pupillary membranes, iris to lens		1	0.2%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.2%	3	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.2%	0	
93.810	uveal melanoma		0		1	0.3%
93.999	uveal cysts		3	0.5%	1	0.3%
LENS						
100.210	cataract. suspect not inherited/significance unknown		27	4.8%	24	7.9%
100.301	punctate cataract, anterior cortex		3	0.5%	5	1.6%
100.302	punctate cataract, posterior cortex		7	1.2%	2	0.7%
100.304	punctate cataract, anterior sutures		1	0.2%	0	
100.305	punctate cataract, posterior sutures		2	0.4%	0	
100.307	punctate cataract, capsular		1	0.2%	0	
100.311	incipient cataract, anterior cortex		0		5	1.6%
100.312	incipient cataract, posterior cortex		9	1.6%	5	1.6%
100.315	incipient cataract, posterior sutures		1	0.2%	0	
100.316	incipient cataract, nucleus		1	0.2%	0	
100.317	incipient cataract, capsular		0		1	0.3%
100.326	incomplete cataract, nucleus		0		2	0.7%
100.328	y-suture tip opacities		0		1	0.3%
100.345	*significant cataracts (summary)*		*25*	*4.4%*	*21*	*6.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	0.3%
110.320	vitreal degeneration		2	0.4%	0	
RETINA						
120.170	retinal dysplasia, folds		1	0.2%	2	0.7%
120.920	retinal detachment with dialysis		0		1	0.3%
OPTIC NERVE						
130.110	micropapilla		1	0.2%	0	

	1991-2015		2016-2020	
OTHER				
900.000 other, unspecified	12	2.1%	0	
900.100 other, not inherited	8	1.4%	0	
900.110 other. suspect not inherited/significance unknown	7	1.2%	6	2.0%
NORMAL				
0.000 normal globe	491	87.4%	234	76.7%

BLOODHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Entropion	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to cornea	Not defined	1	NO
D.	Cataract	Not defined	1	NO
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comment

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BLOODHOUND

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**573**		**55**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
20.160	macropalpebral fissure	75	13.1%	0	
21.000	entropion, unspecified	128	22.3%	4	7.3%
22.000	ectropion, unspecified	149	26.0%	9	16.4%
25.110	distichiasis	9	1.6%	2	3.6%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	3	0.5%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.2%	0	
52.110	prolapsed gland of the third eyelid	6	1.0%	0	
CORNEA					
70.210	corneal pannus	5	0.9%	0	
70.220	pigmentary keratitis	3	0.5%	0	
70.730	corneal endothelial degeneration	2	0.3%	1	1.8%
UVEA					
93.710	persistent pupillary membranes, iris to iris	17	3.0%	1	1.8%
93.720	persistent pupillary membranes, iris to lens	5	0.9%	0	
93.730	persistent pupillary membranes, iris to cornea	38	6.6%	1	1.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.5%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
93.999	uveal cysts	1	0.2%	0	
LENS					
100.200	cataract, unspecified	1	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	14	2.4%	2	3.6%
100.301	punctate cataract, anterior cortex	10	1.7%	0	
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.306	punctate cataract, nucleus	1	0.2%	0	
100.307	punctate cataract, capsular	2	0.3%	0	
100.311	incipient cataract, anterior cortex	15	2.6%	0	
100.312	incipient cataract, posterior cortex	6	1.0%	0	
100.314	incipient cataract, anterior sutures	3	0.5%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	4	0.7%	0	
100.317	incipient cataract, capsular	4	0.7%	1	1.8%
100.321	incomplete cataract, anterior cortex	1	0.2%	0	
100.322	incomplete cataract, posterior cortex	2	0.3%	0	
100.330	generalized/complete cataract	1	0.2%	0	
100.340	resorbing/hypermature cataract	1	0.2%	0	
100.345	*significant cataracts (summary)*	*53*	*9.2%*	*1*	*1.8%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	0	
110.135	PHPV/PTVL	1	0.2%	0	
110.320	vitreal degeneration	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	33	5.8%	1	1.8%
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	0	
120.910	retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE					
130.150	optic disc coloboma	1	0.2%	0	
OTHER					
900.000	other, unspecified	5	0.9%	0	
900.100	other, not inherited	12	2.1%	0	
900.110	other. suspect not inherited/significance unknown	11	1.9%	3	5.5%
NORMAL					
0.000	normal globe	258	45.0%	35	63.6%

BOERBOEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST
A.	Multifocal retinopathy	Autosomal recessive	2	Breeder option	Mutation in *BEST1 gene*
B.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

B. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis.* 2010;16:2791-2804.

OCULAR DISORDERS REPORT
BOERBOEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 22 #	%	2016-2020 66 #	%
EYELIDS						
20.160	macropalpebral fissure		1	4.5%	0	
21.000	entropion, unspecified		0		3	4.5%
22.000	ectropion, unspecified		1	4.5%	0	
25.110	distichiasis		3	13.6%	1	1.5%
CORNEA						
70.220	pigmentary keratitis		0		1	1.5%
70.700	corneal dystrophy		0		1	1.5%
70.730	corneal endothelial degeneration		0		1	1.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	4.5%	0	
93.720	persistent pupillary membranes, iris to lens		0		1	1.5%
93.730	persistent pupillary membranes, iris to cornea		0		2	3.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	4.5%	1	1.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		2	9.1%	2	3.0%
100.301	punctate cataract, anterior cortex		0		1	1.5%
100.302	punctate cataract, posterior cortex		0		1	1.5%
100.312	incipient cataract, posterior cortex		0		1	1.5%
100.315	incipient cataract, posterior sutures		0		1	1.5%
100.345	*significant cataracts (summary)*		*0*		*4*	*6.1%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		2	3.0%
RETINA						
120.170	retinal dysplasia, folds		0		5	7.6%
120.180	retinal dysplasia, geographic		1	4.5%	0	
120.960	retinopathy		0		1	1.5%
OTHER						
900.110	other. suspect not inherited/significance unknown		0		5	7.6%
NORMAL						
0.000	normal globe		15	68.2%	46	69.7%

BOLOGNESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Bolognese breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BOLOGNESE

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 708 #	 %	2016-2020 111 #	 %
EYELIDS					
21.000	entropion, unspecified	3	0.4%	0	
25.110	distichiasis	106	15.0%	4	3.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.3%	0	
40.910	keratoconjunctivitis sicca	2	0.3%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.3%	0	
CORNEA					
70.700	corneal dystrophy	14	2.0%	2	1.8%
UVEA					
93.710	persistent pupillary membranes, iris to iris	99	14.0%	24	21.6%
93.730	persistent pupillary membranes, iris to cornea	6	0.8%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.6%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	18	2.5%	2	1.8%
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.311	incipient cataract, anterior cortex	2	0.3%	0	
100.312	incipient cataract, posterior cortex	2	0.3%	0	
100.313	incipient cataract, equatorial cortex	3	0.4%	0	
100.314	incipient cataract, anterior sutures	0		1	0.9%
100.315	incipient cataract, posterior sutures	7	1.0%	0	
100.317	incipient cataract, capsular	1	0.1%	0	
100.330	generalized/complete cataract	4	0.6%	0	
100.345	*significant cataracts (summary)*	*20*	*2.8%*	*1*	*0.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.9%
110.135	PHPV/PTVL	0		1	0.9%
110.200	vitreous degeneration-anterior chamber	2	0.3%	0	
110.320	vitreal degeneration	12	1.7%	0	
RETINA					
120.170	retinal dysplasia, folds	6	0.8%	0	
120.180	retinal dysplasia, geographic	0		1	0.9%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
OTHER					
900.000	other, unspecified	19	2.7%	0	
900.100	other, not inherited	20	2.8%	0	

OTHER CONTINUED	1991-2015	2016-2020
900.110 other. suspect not inherited/significance unknown	7 1.0%	1 0.9%
NORMAL		
0.000 normal globe	515 72.7%	75 67.6%

BORDER COLLIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma – POAG	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17* gene
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Y suture tip opacity	Not defined	1	Breeder option	
F.	Lens luxation	Autosomal recessive	1, 3	NO	Mutation in the *ADAMTS17* gene
G.	Vitreous degeneration	Not defined	1	Breeder option	
H.	Retinal atrophy - generalized	Suggested X-linked	1, 4	NO	
I.	Choroidal hypoplasia (Collie Eye Anomaly) - optic Nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	5-7	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

POAG in the Basset Hound is caused by a 19 base pair deletion in exon 2 of *ADAMTS17.* This deletion alters the reading frame and is suspected to cause a truncated protein. The

trait shows an autosomal recessive mode of inheritance. A DNA test is available.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

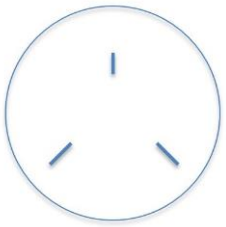
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

I. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Foster SJ, Curtis R, Barnett KC. Primary lens luxation in the Border Collie. J Small Anim Pract. 1986;27:1-6.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Veterinary Ophthalmology 2011;14:378-384.

4. Vilboux T, Chaudieu G, Jeannin P, et al. Progressive retinal atrophy in the Border Collie: a new XLPRA. *BMC Vet Res*. 2008;4:10.

5. Bedford PG. Collie eye anomaly in the Border Collie. *Vet Rec*. 1982;111:34-35.

6. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

7. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for collie eye anomaly. *Genomics*. 2003;82:86-95.

OCULAR DISORDERS REPORT
BORDER COLLIE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 25,576 #	%	2016-2020 2,893 #	%
GLOBE						
0.110	microphthalmia		13	0.1%	1	0.0%
10.000	glaucoma		1	0.0%	0	
EYELIDS						
21.000	entropion, unspecified		2	0.0%	0	
25.110	distichiasis		122	0.5%	17	0.6%
NICTITANS						
50.210	pannus of third eyelid		0		1	0.0%
51.100	third eyelid cartilage anomaly		5	0.0%	2	0.1%
CORNEA						
70.210	corneal pannus		17	0.1%	5	0.2%
70.220	pigmentary keratitis		1	0.0%	0	
70.700	corneal dystrophy		197	0.8%	48	1.7%
70.730	corneal endothelial degeneration		4	0.0%	1	0.0%
UVEA						
90.250	pigmentary uveitis		1	0.0%	0	
93.110	iris hypoplasia		1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM		2	0.0%	0	
93.150	iris coloboma		8	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		1,591	6.2%	215	7.4%
93.720	persistent pupillary membranes, iris to lens		31	0.1%	8	0.3%
93.730	persistent pupillary membranes, iris to cornea		34	0.1%	1	0.0%
93.740	persistent pupillary membranes, iris sheets		15	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		8	0.0%	12	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.0%	2	0.1%
93.810	uveal melanoma		0		1	0.0%
93.999	uveal cysts		10	0.0%	2	0.1%
97.150	chorioretinal coloboma, congenital		2	0.0%	1	0.0%
LENS						
100.200	cataract, unspecified		57	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		1,198	4.7%	162	5.6%
100.301	punctate cataract, anterior cortex		108	0.4%	17	0.6%
100.302	punctate cataract, posterior cortex		63	0.2%	3	0.1%
100.303	punctate cataract, equatorial cortex		46	0.2%	6	0.2%
100.304	punctate cataract, anterior sutures		5	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures		109	0.4%	49	1.7%
100.306	punctate cataract, nucleus		25	0.1%	7	0.2%
100.307	punctate cataract, capsular		27	0.1%	13	0.4%
100.311	incipient cataract, anterior cortex		138	0.5%	12	0.4%
100.312	incipient cataract, posterior cortex		101	0.4%	13	0.4%
100.313	incipient cataract, equatorial cortex		115	0.4%	19	0.7%
100.314	incipient cataract, anterior sutures		12	0.0%	0	
100.315	incipient cataract, posterior sutures		52	0.2%	17	0.6%
100.316	incipient cataract, nucleus		25	0.1%	12	0.4%
100.317	incipient cataract, capsular		25	0.1%	3	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	4	0.0%	7	0.2%
100.322	incomplete cataract, posterior cortex	1	0.0%	5	0.2%
100.323	incomplete cataract, equatorial cortex	2	0.0%	2	0.1%
100.326	incomplete cataract, nucleus	0		2	0.1%
100.327	incomplete cataract, capsular	1	0.0%	0	
100.328	y-suture tip opacities	19	0.1%	65	2.2%
100.330	generalized/complete cataract	29	0.1%	1	0.0%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.345	*significant cataracts (summary)*	*964*	*3.8%*	*256*	*8.8%*
100.375	*subluxation/luxation, unspecified*	*14*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	66	0.3%	3	0.1%
110.135	PHPV/PTVL	19	0.1%	1	0.0%
110.200	vitreous degeneration-anterior chamber	3	0.0%	6	0.2%
110.320	vitreal degeneration	162	0.6%	21	0.7%
FUNDUS					
97.110	choroidal hypoplasia	431	1.7%	40	1.4%
97.120	coloboma	48	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	196	0.8%	16	0.6%
120.180	retinal dysplasia, geographic	16	0.1%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	226	0.9%	17	0.6%
120.400	retinal hemorrhage	6	0.0%	0	
120.910	retinal detachment without dialysis	18	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	15	0.1%	8	0.3%
OPTIC NERVE					
130.110	micropapilla	19	0.1%	4	0.1%
130.120	optic nerve hypoplasia	18	0.1%	1	0.0%
130.150	optic disc coloboma	91	0.4%	6	0.2%
OTHER					
900.000	other, unspecified	214	0.8%	0	
900.100	other, not inherited	607	2.4%	1	0.0%
900.110	other. suspect not inherited/significance unknown	212	0.8%	140	4.8%
NORMAL					
0.000	normal globe	21,384	83.6%	2,078	71.8%

BORDER TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Y suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

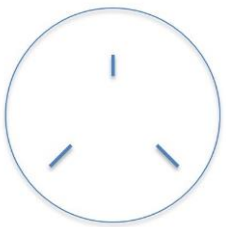
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Border Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BORDER TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 5,864 #	%	2016-2020 1,618 #	%
EYELIDS						
21.000	entropion, unspecified		3	0.1%	0	
25.110	distichiasis		44	0.8%	11	0.7%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		2	0.1%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.700	corneal dystrophy		12	0.2%	4	0.2%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		154	2.6%	69	4.3%
93.720	persistent pupillary membranes, iris to lens		1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.0%	1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	0	
93.999	uveal cysts		1	0.0%	0	
LENS						
100.200	cataract, unspecified		9	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		359	6.1%	150	9.3%
100.301	punctate cataract, anterior cortex		31	0.5%	11	0.7%
100.302	punctate cataract, posterior cortex		19	0.3%	5	0.3%
100.303	punctate cataract, equatorial cortex		17	0.3%	4	0.2%
100.304	punctate cataract, anterior sutures		2	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures		12	0.2%	16	1.0%
100.306	punctate cataract, nucleus		5	0.1%	0	
100.307	punctate cataract, capsular		5	0.1%	9	0.6%
100.311	incipient cataract, anterior cortex		55	0.9%	16	1.0%
100.312	incipient cataract, posterior cortex		46	0.8%	15	0.9%
100.313	incipient cataract, equatorial cortex		63	1.1%	22	1.4%
100.314	incipient cataract, anterior sutures		2	0.0%	2	0.1%
100.315	incipient cataract, posterior sutures		12	0.2%	8	0.5%
100.316	incipient cataract, nucleus		13	0.2%	0	
100.317	incipient cataract, capsular		8	0.1%	3	0.2%
100.321	incomplete cataract, anterior cortex		3	0.1%	6	0.4%
100.322	incomplete cataract, posterior cortex		4	0.1%	7	0.4%
100.323	incomplete cataract, equatorial cortex		2	0.0%	3	0.2%
100.326	incomplete cataract, nucleus		1	0.0%	0	
100.327	incomplete cataract, capsular		1	0.0%	0	
100.328	y-suture tip opacities		10	0.2%	45	2.8%
100.330	generalized/complete cataract		19	0.3%	3	0.2%
100.340	resorbing/hypermature cataract		1	0.0%	2	0.1%
100.345	*significant cataracts (summary)*		*340*	*5.8%*	*178*	*11.0%*
100.375	*subluxation/luxation, unspecified*		*1*	*0.0%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.1%	5	0.3%
110.200	vitreous degeneration-anterior chamber	5	0.1%	5	0.3%
110.320	vitreal degeneration	56	1.0%	14	0.9%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	12	0.2%	5	0.3%
120.180	retinal dysplasia, geographic	8	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	0.2%	2	0.1%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		5	0.3%
OPTIC NERVE					
130.110	micropapilla	0		1	0.1%
130.120	optic nerve hypoplasia	1	0.0%	0	
OTHER					
900.000	other, unspecified	56	1.0%	0	
900.100	other, not inherited	125	2.1%	5	0.3%
900.110	other. suspect not inherited/significance unknown	52	0.9%	76	4.7%
NORMAL					
0.000	normal globe	5,207	88.8%	1,208	74.7%

BORZOI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Retinopathy	Not defined	2	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Storey ES, Grahn BH and Alcorn J. Multifocal chorioretinal lesions in Borzoi dogs. *Vet Ophthalmol*. 2005 Sep-Oct;8:337-347.

OCULAR DISORDERS REPORT
BORZOI

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**3,277**		**962**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	7	0.2%	0	
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
25.110	distichiasis	9	0.3%	2	0.2%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.1%
51.100	third eyelid cartilage anomaly	1	0.0%	2	0.2%
CORNEA					
70.210	corneal pannus	17	0.5%	2	0.2%
70.220	pigmentary keratitis	0		2	0.2%
70.700	corneal dystrophy	16	0.5%	0	
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	71	2.2%	10	1.0%
93.720	persistent pupillary membranes, iris to lens	6	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	11	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	1	0.1%
93.810	uveal melanoma	0		5	0.5%
93.999	uveal cysts	6	0.2%	4	0.4%
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	102	3.1%	24	2.5%
100.301	punctate cataract, anterior cortex	5	0.2%	3	0.3%
100.302	punctate cataract, posterior cortex	9	0.3%	3	0.3%
100.303	punctate cataract, equatorial cortex	0		1	0.1%
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	8	0.2%	2	0.2%
100.306	punctate cataract, nucleus	1	0.0%	0	
100.307	punctate cataract, capsular	4	0.1%	1	0.1%
100.311	incipient cataract, anterior cortex	11	0.3%	2	0.2%
100.312	incipient cataract, posterior cortex	18	0.5%	1	0.1%
100.313	incipient cataract, equatorial cortex	2	0.1%	2	0.2%
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	0	
100.316	incipient cataract, nucleus	1	0.0%	0	
100.317	incipient cataract, capsular	4	0.1%	3	0.3%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.328	y-suture tip opacities	3	0.1%	2	0.2%
100.330	generalized/complete cataract	7	0.2%	1	0.1%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*81*	*2.5%*	*22*	*2.3%*
100.375	*subluxation/luxation, unspecified*	*4*	*0.1%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	12	0.4%	2	0.2%
110.135	PHPV/PTVL	11	0.3%	0	
110.200	vitreous degeneration-anterior chamber	0		4	0.4%
110.320	vitreal degeneration	9	0.3%	3	0.3%
RETINA					
120.170	retinal dysplasia, folds	8	0.2%	2	0.2%
120.180	retinal dysplasia, geographic	8	0.2%	2	0.2%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	25	0.8%	3	0.3%
120.400	retinal hemorrhage	2	0.1%	0	
120.910	retinal detachment without dialysis	5	0.2%	0	
120.920	retinal detachment with dialysis	2	0.1%	0	
120.960	retinopathy	18	0.5%	24	2.5%
OPTIC NERVE					
130.110	micropapilla	10	0.3%	8	0.8%
130.120	optic nerve hypoplasia	14	0.4%	2	0.2%
130.150	optic disc coloboma	3	0.1%	1	0.1%
OTHER					
900.000	other, unspecified	44	1.3%	0	
900.100	other, not inherited	109	3.3%	1	0.1%
900.110	other. suspect not inherited/significance unknown	68	2.1%	74	7.7%
NORMAL					
0.000	normal globe	2,849	86.9%	787	81.8%

BOSTON TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-3	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Imperforate lacrimal punctum	Not defined	1	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
E.	Corneal dystrophy - endothelial	Not defined	1, 4	NO	
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
G.	Cataract	Autosomal recessive	1, 5-9	NO	Mutation in the *HSF4* gene (*HSF4-1*)
H.	Vitreous degeneration	Not defined	1	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral

E. Corneal dystrophy – endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

In the Boston Terrier, this is a primary degenerative endothelial disease leading to progressive and permanent corneal edema. It is not known if this disease is an inherited disorder. There is no sex predilection. The condition is observed in older dogs, 6 to 13 years of age with a mean of 9.5 years. The corneal edema starts asymptomatically in the dorsal temporal corneal quadrant of one eye and slowly progresses medially, eventually involving the entire cornea. Typically, it becomes bilateral. In the later stages, discomfort, intracorneal bullae with subsequent ulceration and keratoconus may develop.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally during the first three months of life. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The Boston Terrier has at least two distinct forms of inherited cataract. One type has an onset before 6 months of age with rapid progression to complete opacity prior to 2 years old. The early onset cataract is inherited as an autosomal recessive mutation in the *HSF4* gene (*HSF4-1*). A DNA test is available. A second type of cataract occurs after 4-5 years of age with variable progression. The genetic mutation responsible for this cataract is not yet known.

H. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Slater MR, Erb HN. Effects of risk factors and prophylactic treatment on primary glaucoma in the dog. *J Am Vet Med Assoc*. 1986;188:1028-1030.

3. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111.

4. Martin CL, Dice PF. Corneal Endothelial Dystrophy in the Dog. *J Am Anim Hosp Assoc*. 1982;18:327-336.

5. Curtis R. Late-onset cataract in the Boston terrier. *Vet Rec*. 1984;115:577-578.

6. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305-316.

7. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978;19:109-120.

8. Mellersh CS, Graves KT, McLaughlin B, et al. Mutation in HSF4 associated with early but not late-onset hereditary cataract in the Boston Terrier. *J Hered*. 2007;98:531-533.

9. Mellersh CS, Pettitt L, Forman OP, et al. Identification of mutations in HSF4 in dogs of three different breeds with hereditary cataracts. *Vet Ophthalmol*. 2006;9:369-378.

OCULAR DISORDERS REPORT
BOSTON TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 13,491 #	%	2016-2020 3,575 #	%
GLOBE						
0.110	microphthalmia		2	0.0%	3	0.1%
10.000	glaucoma		1	0.0%	0	
EYELIDS						
20.140	ectopic cilia		5	0.0%	0	
20.160	macropalpebral fissure		12	0.1%	0	
21.000	entropion, unspecified		41	0.3%	16	0.4%
22.000	ectropion, unspecified		2	0.0%	0	
25.110	distichiasis		462	3.4%	108	3.0%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		29	0.2%	65	1.8%
40.910	keratoconjunctivitis sicca		9	0.1%	5	0.1%
NICTITANS						
50.210	pannus of third eyelid		0		3	0.1%
51.100	third eyelid cartilage anomaly		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		9	0.1%	4	0.1%
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.220	pigmentary keratitis		18	0.1%	8	0.2%
70.700	corneal dystrophy		322	2.4%	66	1.8%
70.730	corneal endothelial degeneration		26	0.2%	3	0.1%
UVEA						
93.110	iris hypoplasia		5	0.0%	3	0.1%
93.150	iris coloboma		7	0.1%	1	0.0%
93.710	persistent pupillary membranes, iris to iris		498	3.7%	153	4.3%
93.720	persistent pupillary membranes, iris to lens		12	0.1%	4	0.1%
93.730	persistent pupillary membranes, iris to cornea		6	0.0%	1	0.0%
93.740	persistent pupillary membranes, iris sheets		8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.0%	0	
93.810	uveal melanoma		1	0.0%	0	
93.999	uveal cysts		27	0.2%	18	0.5%
LENS						
100.200	cataract, unspecified		81	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		310	2.3%	72	2.0%
100.301	punctate cataract, anterior cortex		160	1.2%	44	1.2%
100.302	punctate cataract, posterior cortex		46	0.3%	14	0.4%
100.303	punctate cataract, equatorial cortex		70	0.5%	16	0.4%
100.304	punctate cataract, anterior sutures		33	0.2%	13	0.4%
100.305	punctate cataract, posterior sutures		24	0.2%	5	0.1%
100.306	punctate cataract, nucleus		9	0.1%	1	0.0%
100.307	punctate cataract, capsular		20	0.1%	20	0.6%
100.311	incipient cataract, anterior cortex		631	4.7%	114	3.2%
100.312	incipient cataract, posterior cortex		156	1.2%	26	0.7%
100.313	incipient cataract, equatorial cortex		292	2.2%	35	1.0%
100.314	incipient cataract, anterior sutures		83	0.6%	13	0.4%

LENS CONTINUED		1991-2015		2016-2020	
100.315	incipient cataract, posterior sutures	34	0.3%	5	0.1%
100.316	incipient cataract, nucleus	18	0.1%	5	0.1%
100.317	incipient cataract, capsular	17	0.1%	1	0.0%
100.321	incomplete cataract, anterior cortex	25	0.2%	51	1.4%
100.322	incomplete cataract, posterior cortex	11	0.1%	18	0.5%
100.323	incomplete cataract, equatorial cortex	15	0.1%	9	0.3%
100.324	incomplete cataract, anterior sutures	2	0.0%	1	0.0%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	0		2	0.1%
100.328	y-suture tip opacities	7	0.1%	7	0.2%
100.330	generalized/complete cataract	92	0.7%	8	0.2%
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*1,827*	*13.5%*	*409*	*11.4%*
100.375	*subluxation/luxation, unspecified*	*13*	*0.1%*	*5*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	44	0.3%	20	0.6%
110.135	PHPV/PTVL	9	0.1%	4	0.1%
110.200	vitreous degeneration-anterior chamber	6	0.0%	7	0.2%
110.320	vitreal degeneration	176	1.3%	25	0.7%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	2	0.1%
RETINA					
120.170	retinal dysplasia, folds	34	0.3%	5	0.1%
120.180	retinal dysplasia, geographic	12	0.1%	5	0.1%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	0.1%	0	
120.400	retinal hemorrhage	3	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	3	0.0%	2	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	1	0.0%
130.150	optic disc coloboma	0		1	0.0%
OTHER					
900.000	other, unspecified	165	1.2%	0	
900.100	other, not inherited	380	2.8%	3	0.1%
900.110	other. suspect not inherited/significance unknown	174	1.3%	199	5.6%
NORMAL					
0.000	normal globe	10,916	80.9%	2,667	74.6%

BOUVIER DES FLANDRES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Y-suture tip opacity	Not defined	1	Breeder option
E.	Persistent hyperplastic primary vitreous/Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	1, 4	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

In this breed, primary glaucoma is associated with narrowed iridocorneal angles and various degrees of congenital angle malformations varying from mild to severe. Dysplastic pectinate ligaments and subsequent narrowed angles are similar to those described in the Basset Hound and American and English Cocker Spaniels. The occurrence of glaucoma is related to the most severe abnormalities of the pectinate ligaments. The relationship between glaucoma development and the anomaly of the pectinate ligament is not clear.

A recent study evaluated risk factors for development of glaucoma in the Bouvier des Flandres. A narrow angle with dysplastic pectinate ligaments on gonioscopy and/or presence of a narrow or closed ciliary cleft on high resolution ultrasound were associated with development of primary glaucoma in the breed.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

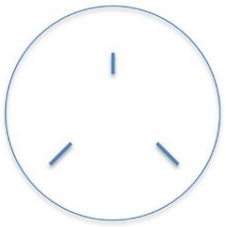
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the

interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

In the Bouvier des Flandres, the condition is associated with retinal dysplasia and detachment, optic nerve hypoplasia, lenticonus, cataract and congenital blindness.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. van der Linde-Sipman JS. Dysplasia of the pectinate ligament and primary glaucoma in the Bouvier des Flandres dog. *Vet Pathol*. 1987;24:201-206.

3. Dubin AJ, Bentley E, Buhr KA, et al. Evaluation of potential risk factors for primary angle-closure glaucoma in Bouvier des Flandres. *J Am Vet Med Assoc.* 2017;250: 60-67.

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OCULAR DISORDERS REPORT
BOUVIER DES FLANDRES

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**5,020**		**834**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	1	0.0%	1	0.1%
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	28	0.6%	4	0.5%
22.000	ectropion, unspecified	6	0.1%	0	
25.110	distichiasis	42	0.8%	6	0.7%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.220	pigmentary keratitis	1	0.0%	1	0.1%
70.700	corneal dystrophy	31	0.6%	2	0.2%
70.730	corneal endothelial degeneration	4	0.1%	0	
UVEA					
93.180	liris sphincter dysplasia	0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	417	8.3%	80	9.6%
93.720	persistent pupillary membranes, iris to lens	11	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	7	0.1%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	16	0.3%	13	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	0	
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	13	0.3%	8	1.0%
LENS					
100.200	cataract, unspecified	5	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	414	8.2%	96	11.5%
100.301	punctate cataract, anterior cortex	30	0.6%	9	1.1%
100.302	punctate cataract, posterior cortex	38	0.8%	5	0.6%
100.303	punctate cataract, equatorial cortex	4	0.1%	2	0.2%
100.304	punctate cataract, anterior sutures	5	0.1%	3	0.4%
100.305	punctate cataract, posterior sutures	31	0.6%	8	1.0%
100.306	punctate cataract, nucleus	9	0.2%	2	0.2%
100.307	punctate cataract, capsular	19	0.4%	5	0.6%
100.311	incipient cataract, anterior cortex	18	0.4%	5	0.6%
100.312	incipient cataract, posterior cortex	97	1.9%	10	1.2%
100.313	incipient cataract, equatorial cortex	20	0.4%	3	0.4%
100.314	incipient cataract, anterior sutures	0		1	0.1%
100.315	incipient cataract, posterior sutures	23	0.5%	4	0.5%
100.316	incipient cataract, nucleus	32	0.6%	5	0.6%
100.317	incipient cataract, capsular	10	0.2%	4	0.5%
100.321	incomplete cataract, anterior cortex	1	0.0%	3	0.4%
100.322	incomplete cataract, posterior cortex	2	0.0%	2	0.2%
100.326	incomplete cataract, nucleus	1	0.0%	1	0.1%
100.328	y-suture tip opacities	9	0.2%	27	3.2%
100.330	generalized/complete cataract	31	0.6%	0	
100.345	*significant cataracts (summary)*	*385*	*7.7%*	*99*	*11.9%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.0%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.2%	7	0.8%
110.135	PHPV/PTVL	6	0.1%	0	
110.200	vitreous degeneration-anterior chamber	0		1	0.1%
110.320	vitreal degeneration	11	0.2%	2	0.2%
RETINA					
120.170	retinal dysplasia, folds	35	0.7%	1	0.1%
120.180	retinal dysplasia, geographic	3	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	0.3%	0	
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.110	micropapilla	2	0.0%	1	0.1%
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	64	1.3%	0	
900.100	other, not inherited	136	2.7%	2	0.2%
900.110	other. suspect not inherited/significance unknown	145	2.9%	44	5.3%
NORMAL					
0.000	normal globe	3,909	77.9%	545	65.3%

BOXER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not Defined	1	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
E.	Corneal dystrophy - epithelial erosion	Not defined	1-4	Breeder option
F.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

In the Boxer, because there is significant clinical disease associated with the abnormal hairs, breeding affected animals should be discouraged.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Corneal dystrophy - epithelial erosion

A general group of corneal ulcerative conditions (e.g. erosions, indolent or persistent ulcers, epithelial bonding defects) is recognized as a common problem in older Boxers (as well as other older animals). It has been commonly referred to as Boxer corneal ulceration. Animals that are affected are usually 7-8 years of age or older. The ulceration can be a very difficult lesion to heal, and it is often recurrent. The chronic form stimulates eventual scarring, with vascularization, fibrosis and pigmentation of the lesion site. The lesion can cause vision impairment.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Roberts SR. Superficial indolent ulcer in the cornea of Boxer dogs. *J Small Anim Pract.* 1965;6:111.

3. Gelatt KN and Samuelson DA. Recurrent corneal erosions and epithelial dystrophy in the Boxer dog. *J Am Anim Hosp Assoc*. 1982;18:453.

4. Kirschner SE, Niyo Y and Betts DM. Idiopathic persistent corneal erosions: clinical and pathological findings in 18 dogs. *J Am Anim Hosp Assoc*. 1989;25:84.

OCULAR DISORDERS REPORT
BOXER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,664**		**238**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	5	0.3%	0	
EYELIDS					
20.140	ectopic cilia	3	0.2%	0	
20.160	macropalpebral fissure	9	0.5%	0	
21.000	entropion, unspecified	4	0.2%	3	1.3%
22.000	ectropion, unspecified	61	3.7%	9	3.8%
25.110	distichiasis	198	11.9%	32	13.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0	
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	141	8.5%	14	5.9%
70.730	corneal endothelial degeneration	2	0.1%	1	0.4%
UVEA					
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	4	0.2%	0	
93.720	persistent pupillary membranes, iris to lens	3	0.2%	1	0.4%
93.730	persistent pupillary membranes, iris to cornea	8	0.5%	4	1.7%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	4	1.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.2%	1	0.4%
93.999	uveal cysts	1	0.1%	1	0.4%
LENS					
100.200	cataract, unspecified	4	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	40	2.4%	12	5.0%
100.301	punctate cataract, anterior cortex	2	0.1%	1	0.4%
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.304	punctate cataract, anterior sutures	3	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.4%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	2	0.1%	0	
100.311	incipient cataract, anterior cortex	15	0.9%	4	1.7%
100.312	incipient cataract, posterior cortex	2	0.1%	1	0.4%
100.313	incipient cataract, equatorial cortex	7	0.4%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	2	0.1%	0	
100.316	incipient cataract, nucleus	2	0.1%	2	0.8%
100.317	incipient cataract, capsular	1	0.1%	1	0.4%
100.321	incomplete cataract, anterior cortex	1	0.1%	1	0.4%
100.326	incomplete cataract, nucleus	1	0.1%	0	
100.328	y-suture tip opacities	1	0.1%	1	0.4%
100.330	generalized/complete cataract	7	0.4%	0	
100.345	*significant cataracts (summary)*	*56*	*3.4%*	*12*	*5.0%*

LENS CONTINUED		1991-2015		2016-2020	
100.375	subluxation/luxation, unspecified	2	0.1%	0	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	1	0.4%
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	11	0.7%	1	0.4%
RETINA					
120.170	retinal dysplasia, folds	5	0.3%	0	
120.180	retinal dysplasia, geographic	0		2	0.8%
120.310	generalized progressive retinal atrophy (PRA)	3	0.2%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	1	0.1%	0	
130.150	optic disc coloboma	3	0.2%	0	
OTHER					
900.000	other, unspecified	13	0.8%	0	
900.100	other, not inherited	44	2.6%	0	
900.110	other. suspect not inherited/significance unknown	18	1.1%	13	5.5%
NORMAL					
0.000	normal globe	1,217	73.1%	161	67.6%

BOYKIN SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 1	 Breeder option Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Persistent hyaloid artery	Not defined	1	Breeder option	
G.	Retinal atrophy - generalized	Not defined	1	NO	
H.	Retinal dysplasia - folds	Not defined	1	Breeder option	
I.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1, 2	NO	Mutation in the *NHEJ1 gene*

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

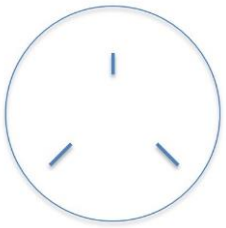
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram before it is apparent clinically. In most breeds studied to date, retinal atrophy is recessively inherited.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee, 1999 and/or Data from OFA All-Breeds Report, 1991-1998.

2. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Genome Res*. 2007 Nov;17:1562-1571.

OCULAR DISORDERS REPORT
BOYKIN SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 3,413 #	%	2016-2020 1,640 #	%
GLOBE					
0.110	microphthalmia	1	0.0%	1	0.1%
EYELIDS					
20.160	macropalpebral fissure	2	0.1%	0	
21.000	entropion, unspecified	1	0.0%	2	0.1%
25.110	distichiasis	436	12.8%	247	15.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		3	0.2%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	1	0.1%
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.220	pigmentary keratitis	4	0.1%	0	
70.700	corneal dystrophy	53	1.6%	17	1.0%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	2	0.1%	4	0.2%
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	85	2.5%	48	2.9%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	10	0.3%	28	1.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%
93.999	uveal cysts	1	0.0%	0	
97.150	chorioretinal coloboma, congenital	1	0.0%	1	0.1%
LENS					
100.200	cataract, unspecified	7	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	185	5.4%	151	9.2%
100.301	punctate cataract, anterior cortex	15	0.4%	16	1.0%
100.302	punctate cataract, posterior cortex	43	1.3%	10	0.6%
100.303	punctate cataract, equatorial cortex	7	0.2%	0	
100.304	punctate cataract, anterior sutures	4	0.1%	3	0.2%
100.305	punctate cataract, posterior sutures	17	0.5%	7	0.4%
100.306	punctate cataract, nucleus	9	0.3%	9	0.5%
100.307	punctate cataract, capsular	6	0.2%	13	0.8%
100.311	incipient cataract, anterior cortex	17	0.5%	9	0.5%
100.312	incipient cataract, posterior cortex	39	1.1%	35	2.1%
100.313	incipient cataract, equatorial cortex	6	0.2%	4	0.2%
100.314	incipient cataract, anterior sutures	1	0.0%	0	
100.315	incipient cataract, posterior sutures	5	0.1%	5	0.3%
100.316	incipient cataract, nucleus	10	0.3%	5	0.3%
100.317	incipient cataract, capsular	7	0.2%	16	1.0%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	0		3	0.2%
100.322	incomplete cataract, posterior cortex	0		3	0.2%
100.323	incomplete cataract, equatorial cortex	1	0.0%	3	0.2%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	y-suture tip opacities	4	0.1%	7	0.4%
100.330	generalized/complete cataract	10	0.3%	1	0.1%
100.345	*significant cataracts (summary)*	*208*	*6.1%*	*150*	*9.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	26	0.8%	36	2.2%
110.135	PHPV/PTVL	3	0.1%	3	0.2%
110.320	vitreal degeneration	5	0.1%	5	0.3%
FUNDUS					
97.110	choroidal hypoplasia	48	1.4%	8	0.5%
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	63	1.8%	17	1.0%
120.180	retinal dysplasia, geographic	9	0.3%	0	
120.190	retinal dysplasia, detached	1	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	30	0.9%	3	0.2%
120.400	retinal hemorrhage	2	0.1%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	2	0.1%
120.960	retinopathy	13	0.4%	3	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	4	0.1%	0	
130.150	optic disc coloboma	23	0.7%	15	0.9%
OTHER					
900.000	other, unspecified	73	2.1%	0	
900.100	other, not inherited	79	2.3%	10	0.6%
900.110	other. suspect not inherited/significance unknown	46	1.3%	98	6.0%
NORMAL					
0.000	normal globe	2,601	76.2%	1,006	61.3%

BRACCO ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Bracco Italiano breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BRACCO ITALIANO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 115 #	%	2016-2020 86 #	%
EYELIDS						
20.160	macropalpebral fissure		1	0.9%	0	
21.000	entropion, unspecified		4	3.5%	7	8.1%
25.110	distichiasis		9	7.8%	10	11.6%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.9%	1	1.2%
52.110	prolapsed gland of the third eyelid		1	0.9%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	1.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	2.3%
LENS						
100.210	cataract. suspect not inherited/significance unknown		10	8.7%	4	4.7%
100.301	punctate cataract, anterior cortex		2	1.7%	0	
100.302	punctate cataract, posterior cortex		3	2.6%	0	
100.311	incipient cataract, anterior cortex		1	0.9%	2	2.3%
100.312	incipient cataract, posterior cortex		8	7.0%	1	1.2%
100.313	incipient cataract, equatorial cortex		3	2.6%	1	1.2%
100.316	incipient cataract, nucleus		2	1.7%	0	
100.317	incipient cataract, capsular		2	1.7%	0	
100.328	y-suture tip opacities		0		1	1.2%
100.345	*significant cataracts (summary)*		*21*	*18.3%*	*5*	*5.8%*
VITREOUS						
110.135	PHPV/PTVL		1	0.9%	1	1.2%
110.320	vitreal degeneration		0		2	2.3%
RETINA						
120.170	retinal dysplasia, folds		6	5.2%	4	4.7%
120.960	retinopathy		1	0.9%	1	1.2%
OTHER						
900.000	other, unspecified		2	1.7%	0	
900.100	other, not inherited		3	2.6%	0	
900.110	other. suspect not inherited/significance unknown		1	0.9%	4	4.7%
NORMAL						
0.000	normal globe		75	65.2%	54	62.8%

OCULAR DISORDERS REPORT
BRAQUE D'AUVERGNE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BRAQUE D'AUVERGNE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BRAQUE D'AUVERGNE

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 18 #	 %	2016-2020 28 #	 %
GLOBE					
0.110	microphthalmia	0		1	3.6%
EYELIDS					
25.110	distichiasis	0		1	3.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	5.6%	4	14.3%
93.720	persistent pupillary membranes, iris to lens	0		1	3.6%
93.730	persistent pupillary membranes, iris to cornea	0		1	3.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	16.7%	4	14.3%
100.303	punctate cataract, equatorial cortex	0		1	3.6%
100.312	incipient cataract, posterior cortex	0		1	3.6%
100.317	incipient cataract, capsular	0		1	3.6%
100.345	*significant cataracts (summary)*	*0*		*3*	*10.7%*
RETINA					
120.170	retinal dysplasia, folds	0		1	3.6%
OTHER					
900.100	other, not inherited	0		1	3.6%
900.110	other. suspect not inherited/significance unknown	0		4	14.3%
NORMAL					
0.000	normal globe	14	77.8%	13	46.4%

BRAQUE FRANCAIS

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BRAQUE FRANCAIS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 32 #	 %	2016-2020 66 #	 %
EYELIDS						
25.110	distichiasis		2	6.2%	1	1.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		2	3.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		3	4.5%
93.999	uveal cysts		0		1	1.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		4	12.5%	4	6.1%
100.301	punctate cataract, anterior cortex		0		1	1.5%
100.311	incipient cataract, anterior cortex		0		1	1.5%
100.312	incipient cataract, posterior cortex		1	3.1%	0	
100.317	incipient cataract, capsular		0		1	1.5%
100.322	incomplete cataract, posterior cortex		0		2	3.0%
100.323	incomplete cataract, equatorial cortex		0		1	1.5%
100.326	incomplete cataract, nucleus		0		1	1.5%
100.345	*significant cataracts (summary)*		*1*	*3.1%*	*7*	*10.6%*
OTHER						
900.110	other. suspect not inherited/significance unknown		3	9.4%	6	9.1%
NORMAL						
0.000	normal globe		24	75.0%	48	72.7%

BRAZILIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Multifocal retinopathy	Autosomal recessive	1	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Brazilian Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

BRIARD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
C.	Cataract	Not defined	1	NO	
D.	Retinal dystrophy formerly Congenital stationary night blindness (*CSNB*)	Autosomal recessive	1-3	NO	Mutation in the *LRIT3* gene

Description and Comments

A. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal dystrophy formerly Congenital stationary night blindness (*CSNB*)

A non-progressive retinal function defect characterized primarily by night blindness; day vision is normal to severely compromised. CSNB is an autosomal recessive trait caused by a mutation in the RPE65 gene. The condition is detected by 5-6 weeks of age, after the postnatal maturation of the retina is completed. Nystagmus is present in some dogs, particularly in those having night blindness and severely compromised day vision. Ophthalmoscopic examination shows no abnormalities. Abnormalities in serum lipids (mild hypercholesterolemia) and elevated arachidonic acid have been noted in some animals. The ERG results are specific and diagnostic for the disorder. ERG testing is essential to distinguish this disorder from more central visual pathway defects which may appear clinically similar.

The gene mutation RPE65 has been identified. This is the same mutation as causes Leber's congenital amaurosis, also sometimes called juvenile retinitis pigmentosa (RP), in humans. A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Das, R. G., et al. (2019). "Genome-wide association study and whole-genome sequencing identify a deletion in LRIT3 associated with canine congenital stationary night blindness." Sci Rep 9(1): 14166. PMID: 31578364

3. Oh, A., et al. (2018). "Phenotypic characterization of complete CSNB in the inbred research beagle: how common is CSNB in research and companion dogs?" Doc Ophthalmol 137(2): 87-101. PMID: 30051304

OCULAR DISORDERS REPORT
BRIARD

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**2,221**		**200**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	9	0.4%	1	0.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	1	0.5%
52.110	prolapsed gland of the third eyelid	2	0.1%	0	
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	31	1.4%	6	3.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	20	0.9%	9	4.5%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	1	0.5%
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.3%	7	3.5%
93.999	uveal cysts	10	0.5%	0	
LENS					
100.200	cataract, unspecified	9	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	71	3.2%	10	5.0%
100.301	punctate cataract, anterior cortex	6	0.3%	0	
100.302	punctate cataract, posterior cortex	1	0.0%	0	
100.303	punctate cataract, equatorial cortex	0		1	0.5%
100.305	punctate cataract, posterior sutures	2	0.1%	3	1.5%
100.306	punctate cataract, nucleus	5	0.2%	1	0.5%
100.307	punctate cataract, capsular	4	0.2%	2	1.0%
100.311	incipient cataract, anterior cortex	6	0.3%	0	
100.312	incipient cataract, posterior cortex	9	0.4%	0	
100.313	incipient cataract, equatorial cortex	2	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	0	
100.316	incipient cataract, nucleus	3	0.1%	1	0.5%
100.317	incipient cataract, capsular	2	0.1%	0	
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.328	y-suture tip opacities	0		2	1.0%
100.330	generalized/complete cataract	3	0.1%	0	
100.345	*significant cataracts (summary)*	*54*	*2.4%*	*10*	*5.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	0	
110.135	PHPV/PTVL	3	0.1%	0	
110.320	vitreal degeneration	2	0.1%	1	0.5%

	1991-2015		2016-2020	
FUNDUS				
97.120 coloboma	1	0.0%	0	
RETINA				
120.170 retinal dysplasia, folds	7	0.3%	0	
120.180 retinal dysplasia, geographic	1	0.0%	0	
120.310 generalized progressive retinal atrophy (PRA)	1	0.0%	0	
120.400 retinal hemorrhage	1	0.0%	0	
120.910 retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE				
130.120 optic nerve hypoplasia	1	0.0%	0	
130.150 optic disc coloboma	3	0.1%	0	
OTHER				
900.000 other, unspecified	37	1.7%	0	
900.100 other, not inherited	58	2.6%	0	
900.110 other. suspect not inherited/significance unknown	32	1.4%	8	4.0%
NORMAL				
0.000 normal globe	2,035	91.6%	161	80.5%

BRITTANY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membrane			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membrane (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The exact frequency and significance of cataracts in the Brittany is not known, although it is probably low.

References

There are no references providing detailed descriptions of hereditary conditions of the Brittany breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
BRITTANY

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,242 #	%	2016-2020 856 #	%
EYELIDS						
25.110	distichiasis		54	2.4%	14	1.6%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.0%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.1%	0	
CORNEA						
70.700	corneal dystrophy		5	0.2%	2	0.2%
70.730	corneal endothelial degeneration		3	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		33	1.5%	15	1.8%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		8	0.4%	18	2.1%
93.999	uveal cysts		1	0.0%	1	0.1%
LENS						
100.200	cataract, unspecified		10	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown		94	4.2%	42	4.9%
100.301	punctate cataract, anterior cortex		13	0.6%	3	0.4%
100.302	punctate cataract, posterior cortex		27	1.2%	9	1.1%
100.303	punctate cataract, equatorial cortex		2	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures		1	0.0%	0	
100.305	punctate cataract, posterior sutures		6	0.3%	0	
100.306	punctate cataract, nucleus		1	0.0%	2	0.2%
100.307	punctate cataract, capsular		9	0.4%	2	0.2%
100.311	incipient cataract, anterior cortex		10	0.4%	4	0.5%
100.312	incipient cataract, posterior cortex		36	1.6%	20	2.3%
100.313	incipient cataract, equatorial cortex		13	0.6%	0	
100.314	incipient cataract, anterior sutures		2	0.1%	0	
100.315	incipient cataract, posterior sutures		9	0.4%	3	0.4%
100.316	incipient cataract, nucleus		7	0.3%	1	0.1%
100.317	incipient cataract, capsular		4	0.2%	4	0.5%
100.321	incomplete cataract, anterior cortex		1	0.0%	0	
100.322	incomplete cataract, posterior cortex		1	0.0%	0	
100.323	incomplete cataract, equatorial cortex		1	0.0%	0	
100.327	incomplete cataract, capsular		1	0.0%	3	0.4%
100.328	y-suture tip opacities		1	0.0%	1	0.1%
100.330	generalized/complete cataract		4	0.2%	0	
100.340	resorbing/hypermature cataract		0		1	0.1%
100.345	*significant cataracts (summary)*		*159*	*7.1%*	*54*	*6.3%*
100.375	*subluxation/luxation, unspecified*		*3*	*0.1%*	*1*	*0.1%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		3	0.1%	7	0.8%
110.135	PHPV/PTVL		1	0.0%	1	0.1%
110.200	vitreous degeneration-anterior chamber		0		4	0.5%
110.320	vitreal degeneration		14	0.6%	5	0.6%

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	7	0.3%	3	0.4%
120.180	retinal dysplasia, geographic	6	0.3%	3	0.4%
120.310	generalized progressive retinal atrophy (PRA)	21	0.9%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	2	0.1%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	17	0.8%	0	
900.100	other, not inherited	61	2.7%	2	0.2%
900.110	other. suspect not inherited/significance unknown	17	0.8%	47	5.5%
NORMAL					
0.000	normal globe	1,946	86.8%	666	77.8%

BRUSSELS GRIFFON

	DISORDER	INHERITANCE	REFERENCES	BREEDING ADVICE
A.	Exposure keratopathy syndrome	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Lens luxation	Autosomal recessive	1	NO
F.	Vitreous degeneration	Not defined	1, 2	Breeder option
G.	Retinal atrophy - generalized	Not defined	1	NO
H.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Exposure keratopathy syndrome/macroblepharon

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Krishnan, H., et al. (2020). "Vitreous degeneration and associated ocular abnormalities in the dog." Vet Ophthalmol 23(2): 219-224. PMID: 31464365.

OCULAR DISORDERS REPORT
BRUSSELS GRIFFON

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,374**		**336**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.140	ectopic cilia	8	0.6%	0	
21.000	entropion, unspecified	3	0.2%	3	0.9%
25.110	distichiasis	30	2.2%	6	1.8%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	3	0.2%	0	
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	23	1.7%	5	1.5%
70.700	corneal dystrophy	10	0.7%	3	0.9%
UVEA					
93.110	iris hypoplasia	2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	121	8.8%	35	10.4%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	9	0.7%	12	3.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.3%	1	0.3%
93.999	uveal cysts	2	0.1%	0	
97.150	chorioretinal coloboma, congenital	1	0.1%	0	
LENS					
100.200	cataract, unspecified	8	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	53	3.9%	8	2.4%
100.301	punctate cataract, anterior cortex	23	1.7%	2	0.6%
100.302	punctate cataract, posterior cortex	11	0.8%	1	0.3%
100.303	punctate cataract, equatorial cortex	5	0.4%	0	
100.304	punctate cataract, anterior sutures	3	0.2%	1	0.3%
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.307	punctate cataract, capsular	4	0.3%	0	
100.311	incipient cataract, anterior cortex	78	5.7%	6	1.8%
100.312	incipient cataract, posterior cortex	35	2.5%	2	0.6%
100.313	incipient cataract, equatorial cortex	43	3.1%	1	0.3%
100.314	incipient cataract, anterior sutures	7	0.5%	0	
100.315	incipient cataract, posterior sutures	5	0.4%	0	
100.316	incipient cataract, nucleus	5	0.4%	0	
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	1	0.1%	4	1.2%
100.322	incomplete cataract, posterior cortex	0		1	0.3%
100.330	generalized/complete cataract	29	2.1%	0	
100.345	*significant cataracts (summary)*	*260*	*18.9%*	*18*	*5.4%*
100.375	*subluxation/luxation, unspecified*	*8*	*0.6%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.7%	2	0.6%
110.135	PHPV/PTVL	2	0.1%	0	
110.200	vitreous degeneration-anterior chamber	15	1.1%	11	3.3%

VITREOUS CONTINUED		1991-2015		2016-2020	
110.320	vitreal degeneration	320	23.3%	22	6.5%
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	21	1.5%	14	4.2%
120.180	retinal dysplasia, geographic	13	0.9%	3	0.9%
120.190	retinal dysplasia, detached	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	23	1.7%	0	
120.400	retinal hemorrhage	2	0.1%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	0		1	0.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	3	0.2%	0	
130.150	optic disc coloboma	19	1.4%	1	0.3%
OTHER					
900.000	other, unspecified	26	1.9%	0	
900.100	other, not inherited	27	2.0%	2	0.6%
900.110	other. suspect not inherited/significance unknown	21	1.5%	17	5.1%
NORMAL					
0.000	normal globe	825	60.0%	219	65.2%

OCULAR DISORDERS REPORT
BULL TERRIER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BULL TERRIER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BULL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 246 #	 %	2016-2020 15 #	 %
GLOBE						
0.110	microphthalmia		3	1.2%	0	
EYELIDS						
21.000	entropion, unspecified		2	0.8%	0	
22.000	ectropion, unspecified		1	0.4%	0	
25.110	distichiasis		5	2.0%	0	
CORNEA						
70.700	corneal dystrophy		1	0.4%	0	
70.730	corneal endothelial degeneration		5	2.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		8	3.3%	0	
93.720	persistent pupillary membranes, iris to lens		4	1.6%	0	
93.730	persistent pupillary membranes, iris to cornea		12	4.9%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.4%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.4%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		6	2.4%	0	
100.301	punctate cataract, anterior cortex		2	0.8%	1	6.7%
100.302	punctate cataract, posterior cortex		2	0.8%	0	
100.303	punctate cataract, equatorial cortex		2	0.8%	0	
100.304	punctate cataract, anterior sutures		1	0.4%	0	
100.306	punctate cataract, nucleus		1	0.4%	0	
100.307	punctate cataract, capsular		1	0.4%	0	
100.311	incipient cataract, anterior cortex		1	0.4%	0	
100.312	incipient cataract, posterior cortex		1	0.4%	0	
100.313	incipient cataract, equatorial cortex		2	0.8%	2	13.3%
100.314	incipient cataract, anterior sutures		1	0.4%	0	
100.315	incipient cataract, posterior sutures		1	0.4%	0	
100.330	generalized/complete cataract		3	1.2%	0	
100.345	*significant cataracts (summary)*		*18*	*7.3%*	*3*	*20.0%*
100.375	*subluxation/luxation, unspecified*		*7*	*2.8%*	*0*	
VITREOUS						
110.320	vitreal degeneration		5	2.0%	0	
RETINA						
120.170	retinal dysplasia, folds		1	0.4%	0	
120.180	retinal dysplasia, geographic		0		1	6.7%
120.310	generalized progressive retinal atrophy (PRA)		1	0.4%	0	
120.910	retinal detachment without dialysis		2	0.8%	0	
OPTIC NERVE						
130.110	micropapilla		3	1.2%	0	
130.120	optic nerve hypoplasia		3	1.2%	0	

	1991-2015	2016-2020
OTHER		
900.000 other, unspecified	5 2.0%	0
900.100 other, not inherited	8 3.3%	0
900.110 other. suspect not inherited/significance unknown	3 1.2%	0
NORMAL		
0.000 normal globe	194 78.9%	12 80.0%

BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1, 5, 6	NO	
B.	Entropion	Not defined	1	Breeder option	
C.	Ectropion	Not defined	1	Breeder option	
D.	Distichiasis	Not defined	1	Breeder option	
E.	Ectopic cilia	Not defined	1	Breeder option	
F.	Prolapsed gland of third eyelid	Not defined	1, 2-4	Breeder option	
G.	Exposure/Pigmentary Keratitis	Not defined	1	Breeder option	
H.	Secondary keratitis - chronic	Not defined	1	Passes with no notation	
I.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to cornea	Not defined	1	NO	
J.	Cataract	Not defined	1	NO	
K.	Retinal dysplasia - folds	Not defined	1	Breeder option	
L.	Multifocal retinopathy - *cmr1*	Autosomal recessive	7, 8	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Bulldog, ectropion is associated with an exceptionally large palpebral fissure and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid. This causes severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

In the Bulldog, these abnormal eyelashes may be associated with significant clinical disease and breeding of affected animals should be discouraged.

E. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

F. Prolapse of the gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated and severe chronic inflammation or keratoconjunctivitis sicca/dry eye syndrome may ensue. Commonly referred to as "cherry eye."

Bulldogs were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 100% of the prolapsed glands in Bulldogs occurred before 1 year of age. Bulldogs were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

G. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the

globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

H. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

I. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

J. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

L. Multifocal Retinopathy

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write multifocal retinopathy.

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog. The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal

thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas. Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

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OCULAR DISORDERS REPORT
BULLDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 1,142 #	 %	2016-2020 416 #	 %
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.140	ectopic cilia	8	0.7%	5	1.2%
20.160	macropalpebral fissure	16	1.4%	0	
21.000	entropion, unspecified	172	15.1%	63	15.1%
22.000	ectropion, unspecified	63	5.5%	13	3.1%
25.110	distichiasis	258	22.6%	108	26.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	4	0.4%	2	0.5%
40.910	keratoconjunctivitis sicca	2	0.2%	10	2.4%
NICTITANS					
52.110	prolapsed gland of the third eyelid	16	1.4%	7	1.7%
CORNEA					
70.210	corneal pannus	9	0.8%	4	1.0%
70.220	pigmentary keratitis	24	2.1%	8	1.9%
70.700	corneal dystrophy	10	0.9%	2	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	7	0.6%	6	1.4%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	11	1.0%	4	1.0%
LENS					
100.200	cataract, unspecified	1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	32	2.8%	4	1.0%
100.301	punctate cataract, anterior cortex	4	0.4%	0	
100.302	punctate cataract, posterior cortex	2	0.2%	0	
100.303	punctate cataract, equatorial cortex	0		1	0.2%
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.2%
100.306	punctate cataract, nucleus	0		1	0.2%
100.311	incipient cataract, anterior cortex	5	0.4%	1	0.2%
100.312	incipient cataract, posterior cortex	2	0.2%	0	
100.313	incipient cataract, equatorial cortex	3	0.3%	1	0.2%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	3	0.3%	1	0.2%
100.317	incipient cataract, capsular	1	0.1%	0	
100.328	y-suture tip opacities	0		1	0.2%
100.330	generalized/complete cataract	5	0.4%	0	
100.345	*significant cataracts (summary)*	*28*	*2.5%*	*7*	*1.7%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.2%*	*1*	*0.2%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.320	vitreal degeneration	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	69	6.0%	18	4.3%
120.180	retinal dysplasia, geographic	3	0.3%	1	0.2%
120.190	retinal dysplasia, detached	2	0.2%	0	
120.960	retinopathy	1	0.1%	0	
OTHER					
900.000	other, unspecified	7	0.6%	0	
900.100	other, not inherited	39	3.4%	2	0.5%
900.110	other. suspect not inherited/significance unknown	36	3.2%	37	8.9%
NORMAL					
0.000	normal globe	665	58.2%	198	47.6%

BULLMASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Ectropion	Not defined	1	Breeder option	
C.	Distichiasis	Not defined	1	Breeder option	
D.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to cornea	Not defined	1	NO	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy (*RHO)*	Autosomal dominant	2	NO	Mutation in the *RHO* gene
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	
H.	Multifocal retinopathy - *cmr1*	Autosomal recessive	3	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Bullmastiff, the palpebral fissures may become vertical and/or shaped like a "pagoda." Entropion in the Bullmastiff is severe and may require multiple surgical corrections.

B. Ectropion

A conformational defect resulting in eversion (rolling-out) of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the

conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - *RHO*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA in the Bullmastiff is inherited as an autosomal dominant trait. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid, or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat

like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
BULLMASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,629 #	%	2016-2020 669 #	%
GLOBE						
0.110	microphthalmia		5	0.3%	0	
EYELIDS						
20.160	macropalpebral fissure		16	1.0%	0	
21.000	entropion, unspecified		96	5.9%	33	4.9%
22.000	ectropion, unspecified		24	1.5%	10	1.5%
25.110	distichiasis		42	2.6%	16	2.4%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		0		1	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.1%	2	0.3%
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.210	corneal pannus		2	0.1%	0	
70.220	pigmentary keratitis		4	0.2%	3	0.4%
70.700	corneal dystrophy		2	0.1%	1	0.1%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.1%	0	
93.150	iris coloboma		3	0.2%	1	0.1%
93.710	persistent pupillary membranes, iris to iris		54	3.3%	39	5.8%
93.720	persistent pupillary membranes, iris to lens		9	0.6%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		23	1.4%	5	0.7%
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	0.4%	1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.2%	5	0.7%
93.999	uveal cysts		9	0.6%	5	0.7%
97.150	chorioretinal coloboma, congenital		1	0.1%	0	
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		51	3.1%	17	2.5%
100.301	punctate cataract, anterior cortex		5	0.3%	2	0.3%
100.302	punctate cataract, posterior cortex		4	0.2%	1	0.1%
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	1	0.1%
100.307	punctate cataract, capsular		2	0.1%	0	
100.311	incipient cataract, anterior cortex		11	0.7%	4	0.6%
100.312	incipient cataract, posterior cortex		13	0.8%	4	0.6%
100.313	incipient cataract, equatorial cortex		9	0.6%	4	0.6%
100.315	incipient cataract, posterior sutures		2	0.1%	0	
100.316	incipient cataract, nucleus		4	0.2%	0	
100.321	incomplete cataract, anterior cortex		1	0.1%	0	
100.322	incomplete cataract, posterior cortex		3	0.2%	1	0.1%
100.323	incomplete cataract, equatorial cortex		1	0.1%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.326	incomplete cataract, nucleus	1	0.1%	0	
100.328	y-suture tip opacities	1	0.1%	2	0.3%
100.330	generalized/complete cataract	7	0.4%	1	0.1%
100.345	*significant cataracts (summary)*	*67*	*4.1%*	*20*	*3.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		2	0.3%
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	3	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	74	4.5%	46	6.9%
120.180	retinal dysplasia, geographic	3	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.2%	0	
120.960	retinopathy	4	0.2%	3	0.4%
OPTIC NERVE					
130.110	micropapilla	7	0.4%	1	0.1%
130.120	optic nerve hypoplasia	6	0.4%	2	0.3%
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	25	1.5%	0	
900.100	other, not inherited	42	2.6%	3	0.4%
900.110	other. suspect not inherited/significance unknown	19	1.2%	28	4.2%
NORMAL					
0.000	normal globe	1,248	76.6%	476	71.2%

CAIRN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ocular melanosis with and without glaucoma	Presumed autosomal dominant	1, 2	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
	- endothelial opacity/no strands	Not defined	1	NO
C.	Cataract	Not defined	1	NO
D.	Vitreous degeneration	Not defined	1	Breeder option
E.	Persistent hyaloid artery	Not defined	1	Breeder option

Description and Comments

A. Ocular melanosis with and without glaucoma
(Previously ocular melanosis with secondary glaucoma, previously pigmentary glaucoma)

A proliferation of melanocytes within the uveal tract associated with an elevation in intraocular pressure. Obstruction of the aqueous outflow pathways occurs resulting in glaucoma. This condition has been identified most commonly in the Cairn Terrier. The condition is familial but the exact mode of inheritance is unknown (pedigree anaylsis has ruled out a sex-linked disorder). In the Cairn Terrier, the disease is very slowly progressive and blindness ultimately results. Some dogs develop episodes of anterior uveitis associated with the shedding of large amounts of pigment from the iris surface. There is a long pre-glaucomatous phase of the disease in which diagnosis of the condition is possible. Age of onset varies from 2-14 years.

B. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Petersen-Jones SM, Forcier J, Mentzer AL. Ocular melanosis in the Cairn Terrier: clinical description and investigation of mode of inheritance. *Vet Ophthalmol*. 2007;10 Suppl 1:63-69.

OCULAR DISORDERS REPORT
CAIRN TERRIER

Diagnostic Name		1991-2015 3,840 #	%	2016-2020 812 #	%
GLOBE					
0.110	microphthalmia	1	0.0%	1	0.1%
10.000	glaucoma	3	0.1%	0	
EYELIDS					
25.110	distichiasis	14	0.4%	7	0.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.1%
40.910	keratoconjunctivitis sicca	6	0.2%	2	0.2%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	1	0.0%	1	0.1%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.220	pigmentary keratitis	7	0.2%	0	
70.700	corneal dystrophy	25	0.7%	3	0.4%
70.730	corneal endothelial degeneration	3	0.1%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	1	0.0%	1	0.1%
93.710	persistent pupillary membranes, iris to iris	323	8.4%	129	15.9%
93.720	persistent pupillary membranes, iris to lens	10	0.3%	5	0.6%
93.730	persistent pupillary membranes, iris to cornea	5	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	23	0.6%	31	3.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	7	0.2%	9	1.1%
93.810	uveal melanoma	0		2	0.2%
93.930	ocular melanocytosis	9	0.2%	0	
93.999	uveal cysts	1	0.0%	0	
LENS					
100.200	cataract, unspecified	11	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	224	5.8%	61	7.5%
100.301	punctate cataract, anterior cortex	25	0.7%	19	2.3%
100.302	punctate cataract, posterior cortex	24	0.6%	11	1.4%
100.303	punctate cataract, equatorial cortex	14	0.4%	4	0.5%
100.305	punctate cataract, posterior sutures	5	0.1%	0	
100.306	punctate cataract, nucleus	1	0.0%	2	0.2%
100.307	punctate cataract, capsular	5	0.1%	7	0.9%
100.311	incipient cataract, anterior cortex	35	0.9%	5	0.6%
100.312	incipient cataract, posterior cortex	59	1.5%	7	0.9%
100.313	incipient cataract, equatorial cortex	28	0.7%	5	0.6%
100.315	incipient cataract, posterior sutures	10	0.3%	0	
100.316	incipient cataract, nucleus	3	0.1%	2	0.2%
100.317	incipient cataract, capsular	5	0.1%	0	
100.321	incomplete cataract, anterior cortex	10	0.3%	2	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.322	incomplete cataract, posterior cortex	9	0.2%	5	0.6%
100.323	incomplete cataract, equatorial cortex	3	0.1%	1	0.1%
100.324	incomplete cataract, anterior sutures	0		1	0.1%
100.326	incomplete cataract, nucleus	2	0.1%	1	0.1%
100.328	y-suture tip opacities	1	0.0%	1	0.1%
100.330	generalized/complete cataract	32	0.8%	1	0.1%
100.340	resorbing/hypermature cataract	2	0.1%	2	0.2%
100.345	*significant cataracts (summary)*	*284*	*7.4%*	*76*	*9.4%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	33	0.9%	21	2.6%
110.135	PHPV/PTVL	6	0.2%	0	
110.320	vitreal degeneration	44	1.1%	16	2.0%
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	20	0.5%	2	0.2%
120.180	retinal dysplasia, geographic	8	0.2%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	22	0.6%	1	0.1%
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	8	0.2%	0	
130.150	optic disc coloboma	11	0.3%	0	
OTHER					
900.000	other, unspecified	76	2.0%	0	
900.100	other, not inherited	123	3.2%	8	1.0%
900.110	other. suspect not inherited/significance unknown	121	3.2%	30	3.7%
NORMAL					
0.000	normal globe	2,984	77.7%	487	60.0%

CANAAN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Canaan Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
CANAAN DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 509 #	 %	2016-2020 82 #	 %
EYELIDS					
25.110	distichiasis	15	2.9%	1	1.2%
CORNEA					
70.700	corneal dystrophy	4	0.8%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	21	4.1%	2	2.4%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.999	uveal cysts	2	0.4%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	18	3.5%	5	6.1%
100.302	punctate cataract, posterior cortex	2	0.4%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.2%	0	
100.306	punctate cataract, nucleus	3	0.6%	0	
100.307	punctate cataract, capsular	0		1	1.2%
100.311	incipient cataract, anterior cortex	2	0.4%	1	1.2%
100.312	incipient cataract, posterior cortex	7	1.4%	0	
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	12	2.4%	0	
100.322	incomplete cataract, posterior cortex	1	0.2%	0	
100.323	incomplete cataract, equatorial cortex	1	0.2%	0	
100.328	y-suture tip opacities	0		1	1.2%
100.330	generalized/complete cataract	13	2.6%	0	
100.345	*significant cataracts (summary)*	*45*	*8.8%*	*3*	*3.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.2%	1	1.2%
RETINA					
120.170	retinal dysplasia, folds	2	0.4%	1	1.2%
120.310	generalized progressive retinal atrophy (PRA)	9	1.8%	0	
OTHER					
900.000	other, unspecified	6	1.2%	0	
900.100	other, not inherited	18	3.5%	0	
900.110	other. suspect not inherited/significance unknown	4	0.8%	3	3.7%
NORMAL					
0.000	normal globe	415	81.5%	69	84.1%

CANADIAN ESKIMO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Canadian Eskimo Dog breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
CANADIAN ESKIMO DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 19 #	 %	2016-2020 27 #	 %
CORNEA					
70.700	corneal dystrophy	1	5.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	3	15.8%	6	22.2%
LENS					
100.302	punctate cataract, posterior cortex	0		1	3.7%
100.307	punctate cataract, capsular	1	5.3%	0	
100.345	*significant cataracts (summary)*	*1*	*5.3%*	*1*	*3.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	5.3%	0	
RETINA					
120.180	retinal dysplasia, geographic	1	5.3%	0	
OTHER					
900.110	other. suspect not inherited/significance unknown	2	10.5%	0	
NORMAL					
0.000	normal globe	15	78.9%	20	74.1%

CANE CORSO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Multifocal retinopathy - *cmr1*	Autosomal recessive	2, 3	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breed Report.

2. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

3. Guziewicz KE, Slavik J, Lindauer SP et al. Molecular consequences of BEST1 gene mutations in canine multifocal retinopathy predict functional implications for human bestrophinopathies. IOVS 52(7) 2011; 4497-505.

OCULAR DISORDERS REPORT
CANE CORSO

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 123 #	%	2016-2020 154 #	%
EYELIDS					
21.000	entropion, unspecified	4	3.3%	2	1.3%
22.000	ectropion, unspecified	10	8.1%	5	3.2%
25.110	distichiasis	5	4.1%	10	6.5%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.8%	0	
52.110	prolapsed gland of the third eyelid	2	1.6%	1	0.6%
CORNEA					
70.700	corneal dystrophy	1	0.8%	0	
UVEA					
93.110	iris hypoplasia	0		1	0.6%
93.710	persistent pupillary membranes, iris to iris	3	2.4%	0	
93.730	persistent pupillary membranes, iris to cornea	0		1	0.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.8%	2	1.3%
93.999	uveal cysts	2	1.6%	2	1.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	4	3.3%	7	4.5%
100.301	punctate cataract, anterior cortex	1	0.8%	0	
100.302	punctate cataract, posterior cortex	1	0.8%	2	1.3%
100.305	punctate cataract, posterior sutures	0		1	0.6%
100.328	y-suture tip opacities	0		2	1.3%
100.330	generalized/complete cataract	1	0.8%	0	
100.345	*significant cataracts (summary)*	*3*	*2.4%*	*5*	*3.2%*
100.375	*subluxation/luxation, unspecified*	*0*		*1*	*0.6%*
VITREOUS					
110.135	PHPV/PTVL	1	0.8%	0	
110.320	vitreal degeneration	0		1	0.6%
RETINA					
120.170	retinal dysplasia, folds	0		2	1.3%
120.180	retinal dysplasia, geographic	0		1	0.6%
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.6%
120.960	retinopathy	1	0.8%	0	
OTHER					
900.000	other, unspecified	1	0.8%	0	
900.100	other, not inherited	0		1	0.6%
900.110	other. suspect not inherited/significance unknown	0		4	2.6%
NORMAL					
0.000	normal globe	98	79.7%	120	77.9%

CARDIGAN WELSH CORGI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)	Presumed autosomal recessive	1, 2-4	NO	Mutation in the *PDE6A* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin that may cause ocular irritation. Distichiasis may occur any time in the life of the dog. It is difficult to make a strong recommendation about breeding dogs with this entity. The hereditary basis is not known although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

D. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Cardigan Welsh Corgi is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Petersen-Jones SM, Entz DD, Sargan DR. cGMP phosphodiesterase-alpha mutation causes progressive retinal atrophy in the Cardigan Welsh Corgi dog. *Invest Ophthalmol Vis Sci*. 1999;40:1637-1644.

3. Petersen-Jones SM, Entz DD. An improved DNA-based test for detection of the codon 616 mutation in the alpha cyclic GMP phosphodiesterase gene that causes progressive retinal atrophy in the Cardigan Welsh Corgi. *Vet Ophthalmol*. 2002;5:103-106.

4. Keep JM. Clinical aspects of progressive retinal atrophy in the Cardigan Welsh Corgi. *Aust Vet J*. 1972;48:197-199.

OCULAR DISORDERS REPORT
CARDIGAN WELSH CORGI

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**3,671**		**557**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
25.110	distichiasis	137	3.7%	19	3.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.2%
CORNEA					
70.700	corneal dystrophy	15	0.4%	2	0.4%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.180	liris sphincter dysplasia	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	105	2.9%	15	2.7%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	9	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.810	uveal melanoma	1	0.0%	0	
LENS					
100.200	cataract, unspecified	15	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	108	2.9%	30	5.4%
100.301	punctate cataract, anterior cortex	10	0.3%	1	0.2%
100.302	punctate cataract, posterior cortex	11	0.3%	0	
100.303	punctate cataract, equatorial cortex	13	0.4%	1	0.2%
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	4	0.1%	0	
100.306	punctate cataract, nucleus	2	0.1%	0	
100.311	incipient cataract, anterior cortex	33	0.9%	1	0.2%
100.312	incipient cataract, posterior cortex	18	0.5%	4	0.7%
100.313	incipient cataract, equatorial cortex	15	0.4%	1	0.2%
100.314	incipient cataract, anterior sutures	3	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures	2	0.1%	1	0.2%
100.316	incipient cataract, nucleus	7	0.2%	1	0.2%
100.317	incipient cataract, capsular	2	0.1%	1	0.2%
100.321	incomplete cataract, anterior cortex	1	0.0%	0	
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.328	y-suture tip opacities	3	0.1%	0	
100.330	generalized/complete cataract	8	0.2%	0	
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*150*	*4.1%*	*13*	*2.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.1%	1	0.2%
110.200	vitreous degeneration-anterior chamber	1	0.0%	1	0.2%
110.320	vitreal degeneration	7	0.2%	1	0.2%

		1991-2015		2016-2020	
FUNDUS					
97.110	choroidal hypoplasia	3	0.1%	0	
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	24	0.7%	1	0.2%
120.180	retinal dysplasia, geographic	6	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	9	0.2%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	0		1	0.2%
OPTIC NERVE					
130.120	optic nerve hypoplasia	3	0.1%	0	
OTHER					
900.000	other, unspecified	16	0.4%	0	
900.100	other, not inherited	39	1.1%	1	0.2%
900.110	other. suspect not inherited/significance unknown	19	0.5%	14	2.5%
NORMAL					
0.000	normal globe	3,232	88.0%	466	83.7%

CAVALIER KING CHARLES SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Keratoconjunctivitis sicca	Not defined	3	NO
C.	Congenital KCS and ichthyosiform dermatosis	Autosomal recessive	4, 5	NO
D.	Distichiasis	Not defined	1	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	1, 6	Breeder option
F.	Exposure/pigmentary keratitis	Not defined	1	Breeder option
G.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
H.	Cataract	Not defined	1, 7	NO
I.	Y-suture tip opacity	Not defined	1	Breeder option
J.	Vitreous degeneration	Not defined	1	Breeder option
K.	Retinal dysplasia - folds	Not defined	1	Breeder option
L.	Retinal dysplasia - geographic	Not defined	1	NO

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens and/or retina.

B. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

C. Congenital KCS and ichthyosiform dermatosis

A syndrome in which dogs are born with severe to absolute keratoconjunctivitis sicca (KCS) which is poorly responsive to lacrimostimulant treatment. Co-morbid congenital dermatopathy affecting haircoat, skin and footpads is severe and requires intensive life-long care. Clinical signs are so devastating that affected dogs are often euthanized.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Cavalier King Charles Spaniel, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

F. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

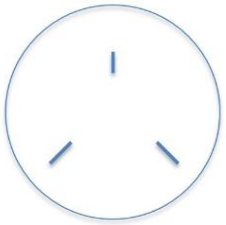
A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

In the Cavalier King Charles Spaniel, onset is at an early age (less than 6 months), affecting the cortex and nucleus with rapid progression to complete cataract, resulting in blindness.

I. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

J. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

L. Retinal dysplasia – geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

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1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Narfstrom K, Dubielzig R. Posterior lenticonus, cataracts and microphthalmia: Congenital defects in the Cavalier King Charles spaniel. *J Small Anim Pract*. 1984;25.

3. Sanchez RF, Innocent G, Mould J, et al. Canine keratoconjunctivitis sicca: disease trends in a review of 229 cases. *J Small Anim Pract*. 2007;48:211-217.

4. Hartley C, Donaldson D, Smith KC, et al. Congenital keratoconjunctivitis sicca and ichthyosiform dermatosis in 25 Cavalier King Charles spaniel dogs – part I: clinical signs, histopathology, and inheritance. *Vet Ophthalmol*. 2012;15:315-326.

5. Barnett KC. Congenital keratoconjunctivitis sicca and ichthyosiform dermatosis in the Cavalier King Charles Spaniel. *J Small Anim Pract*. 2006;47:524-528.

6. Crispin SM, Barnett KC. Dystrophy, degeneration and infiltration of the canine cornea. *J Small Anim Pract*. 1983;24:63-83.

7. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305-316.

OCULAR DISORDERS REPORT
CAVALIER KING CHARLES SPANIEL

	TOTAL DOGS EXAMINED	1991-2015 49,732		2016-2020 15,634	
	Diagnostic Name	**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	73	0.1%	22	0.1%
10.000	glaucoma	3	0.0%	0	
EYELIDS					
20.140	ectopic cilia	3	0.0%	1	0.0%
20.160	macropalpebral fissure	126	0.3%	0	
21.000	entropion, unspecified	208	0.4%	65	0.4%
22.000	ectropion, unspecified	10	0.0%	1	0.0%
25.110	distichiasis	4,529	9.1%	1,359	8.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	25	0.1%	51	0.3%
40.910	keratoconjunctivitis sicca	87	0.2%	37	0.2%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	1	0.0%
51.100	third eyelid cartilage anomaly	6	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	18	0.0%	2	0.0%
CORNEA					
70.210	corneal pannus	14	0.0%	4	0.0%
70.220	pigmentary keratitis	245	0.5%	118	0.8%
70.700	corneal dystrophy	4,415	8.9%	1,245	8.0%
70.730	corneal endothelial degeneration	51	0.1%	13	0.1%
UVEA					
93.110	iris hypoplasia	4	0.0%	0	
93.140	corneal endothelial pigment without PPM	7	0.0%	0	
93.150	iris coloboma	4	0.0%	1	0.0%
93.180	liris sphincter dysplasia	0		3	0.0%
93.710	persistent pupillary membranes, iris to iris	519	1.0%	191	1.2%
93.720	persistent pupillary membranes, iris to lens	36	0.1%	5	0.0%
93.730	persistent pupillary membranes, iris to cornea	33	0.1%	3	0.0%
93.740	persistent pupillary membranes, iris sheets	44	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	28	0.1%	42	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	11	0.0%	2	0.0%
93.999	uveal cysts	22	0.0%	6	0.0%
97.150	chorioretinal coloboma, congenital	0		10	0.1%
LENS					
100.200	cataract, unspecified	57	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	1,837	3.7%	470	3.0%
100.301	punctate cataract, anterior cortex	254	0.5%	100	0.6%
100.302	punctate cataract, posterior cortex	111	0.2%	34	0.2%
100.303	punctate cataract, equatorial cortex	85	0.2%	26	0.2%
100.304	punctate cataract, anterior sutures	44	0.1%	12	0.1%
100.305	punctate cataract, posterior sutures	104	0.2%	42	0.3%
100.306	punctate cataract, nucleus	115	0.2%	35	0.2%
100.307	punctate cataract, capsular	41	0.1%	28	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.311	incipient cataract, anterior cortex	361	0.7%	101	0.6%
100.312	incipient cataract, posterior cortex	261	0.5%	70	0.4%
100.313	incipient cataract, equatorial cortex	149	0.3%	34	0.2%
100.314	incipient cataract, anterior sutures	26	0.1%	5	0.0%
100.315	incipient cataract, posterior sutures	76	0.2%	24	0.2%
100.316	incipient cataract, nucleus	220	0.4%	48	0.3%
100.317	incipient cataract, capsular	61	0.1%	14	0.1%
100.321	incomplete cataract, anterior cortex	23	0.0%	20	0.1%
100.322	incomplete cataract, posterior cortex	28	0.1%	40	0.3%
100.323	incomplete cataract, equatorial cortex	7	0.0%	6	0.0%
100.325	incomplete cataract, posterior sutures	4	0.0%	1	0.0%
100.326	incomplete cataract, nucleus	16	0.0%	22	0.1%
100.327	incomplete cataract, capsular	4	0.0%	10	0.1%
100.328	y-suture tip opacities	26	0.1%	66	0.4%
100.330	generalized/complete cataract	217	0.4%	12	0.1%
100.340	resorbing/hypermature cataract	9	0.0%	3	0.0%
100.345	*significant cataracts (summary)*	*2,299*	*4.6%*	*753*	*4.8%*
100.375	*subluxation/luxation, unspecified*	*16*	*0.0%*	*2*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	82	0.2%	32	0.2%
110.135	PHPV/PTVL	31	0.1%	3	0.0%
110.200	vitreous degeneration-anterior chamber	4	0.0%	10	0.1%
110.320	vitreal degeneration	221	0.4%	69	0.4%
FUNDUS					
97.110	choroidal hypoplasia	8	0.0%	1	0.0%
97.120	coloboma	4	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	3,617	7.3%	589	3.8%
120.180	retinal dysplasia, geographic	1,463	2.9%	266	1.7%
120.190	retinal dysplasia, detached	163	0.3%	23	0.1%
120.310	generalized progressive retinal atrophy (PRA)	151	0.3%	15	0.1%
120.400	retinal hemorrhage	6	0.0%	0	
120.910	retinal detachment without dialysis	20	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	3	0.0%
120.960	retinopathy	24	0.0%	35	0.2%
OPTIC NERVE					
130.110	micropapilla	24	0.0%	7	0.0%
130.120	optic nerve hypoplasia	12	0.0%	6	0.0%
130.150	optic disc coloboma	22	0.0%	29	0.2%
OTHER					
900.000	other, unspecified	596	1.2%	0	
900.100	other, not inherited	1,138	2.3%	39	0.2%
900.110	other. suspect not inherited/significance unknown	574	1.2%	739	4.7%
NORMAL					
0.000	normal globe	36,151	72.7%	10,582	67.7%

OCULAR DISORDERS REPORT
CESKY TERRIER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CESKY TERRIER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CESKY TERRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 117 #	 %	2016-2020 19 #	 %
EYELIDS					
25.110	distichiasis	19	16.2%	0	
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.9%	0	
CORNEA					
70.700	corneal dystrophy	8	6.8%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	3	2.6%	3	15.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.9%	0	
97.150	chorioretinal coloboma, congenital	1	0.9%	0	
LENS					
100.200	cataract, unspecified	1	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown	1	0.9%	0	
100.301	punctate cataract, anterior cortex	1	0.9%	0	
100.307	punctate cataract, capsular	2	1.7%	0	
100.311	incipient cataract, anterior cortex	1	0.9%	0	
100.312	incipient cataract, posterior cortex	1	0.9%	1	5.3%
100.345	*significant cataracts (summary)*	*6*	*5.1%*	*1*	*5.3%*
FUNDUS					
97.110	choroidal hypoplasia	1	0.9%	0	
RETINA					
120.170	retinal dysplasia, folds	8	6.8%	0	
120.910	retinal detachment without dialysis	1	0.9%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.9%	0	
OTHER					
900.000	other, unspecified	1	0.9%	0	
900.100	other, not inherited	4	3.4%	0	
900.110	other. suspect not inherited/significance unknown	1	0.9%	0	
NORMAL					
0.000	normal globe	79	67.5%	15	78.9%

CHESAPEAKE BAY RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
C.	Cataract	Presumed incomplete dominant	1, 2	NO	
D.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 3	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located in the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Hereditary cataracts have been described in the Chesapeake Bay Retriever and affect the young adult dog. They appear as posterior cortical, axial, triangular opacities and the Y suture tips can be affected in both the anterior and posterior cortices. Extension of the cataract into the posterior cortex and progression to impair vision can occur. An autosomal dominant inheritance with incomplete penetrance has been proposed; however, the genetics have not been completely defined and additional studies will be required.

D. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chesapeake Bay Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available. It is important to note than in all breeds in which a molecular diagnostic test for the disease is available, it is possible to have dogs diagnosed clinically as affected, yet the DNA test results are normal. This suggests that other genetic causes of PRA exist or that the diagnosed affected dog has an acquired disease that mimics the inherited disorder.

A second, less common form of PRA is also present in the Chesapeake Bay Retriever with ophthalmoscopic abnormalities characteristic of mid-stage disease found in dogs between 8-12 months of age. The lesions are progressive and end-stage lesions are evident by 2-3 years of age. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gelatt KN. Cataracts in Chesapeake Bay retrievers. *J Am Vet Med Assoc*. 1979;175:1176-1178.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
CHESAPEAKE BAY RETRIEVER

		1991-2015 12,682		2016-2020 1,866	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	7	0.1%	1	0.1%
10.000	glaucoma	4	0.0%	0	
EYELIDS					
20.140	ectopic cilia	2	0.0%	0	
20.160	macropalpebral fissure	3	0.0%	0	
21.000	entropion, unspecified	54	0.4%	4	0.2%
22.000	ectropion, unspecified	7	0.1%	0	
25.110	distichiasis	913	7.2%	171	9.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.0%	1	0.1%
52.110	prolapsed gland of the third eyelid	2	0.0%	0	
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	76	0.6%	14	0.8%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	0		1	0.1%
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	221	1.7%	57	3.1%
93.720	persistent pupillary membranes, iris to lens	11	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	14	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	41	0.3%	57	3.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	0	
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	25	0.2%	11	0.6%
LENS					
100.200	cataract, unspecified	74	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	537	4.2%	101	5.4%
100.301	punctate cataract, anterior cortex	44	0.3%	13	0.7%
100.302	punctate cataract, posterior cortex	109	0.9%	20	1.1%
100.303	punctate cataract, equatorial cortex	34	0.3%	5	0.3%
100.304	punctate cataract, anterior sutures	9	0.1%	5	0.3%
100.305	punctate cataract, posterior sutures	40	0.3%	3	0.2%
100.306	punctate cataract, nucleus	7	0.1%	3	0.2%
100.307	punctate cataract, capsular	16	0.1%	15	0.8%
100.311	incipient cataract, anterior cortex	52	0.4%	12	0.6%
100.312	incipient cataract, posterior cortex	218	1.7%	33	1.8%
100.313	incipient cataract, equatorial cortex	53	0.4%	7	0.4%
100.314	incipient cataract, anterior sutures	7	0.1%	0	
100.315	incipient cataract, posterior sutures	44	0.3%	7	0.4%

LENS CONTINUED		1991-2015		2016-2020	
100.316	incipient cataract, nucleus	18	0.1%	2	0.1%
100.317	incipient cataract, capsular	22	0.2%	4	0.2%
100.321	incomplete cataract, anterior cortex	1	0.0%	0	
100.322	incomplete cataract, posterior cortex	3	0.0%	5	0.3%
100.323	incomplete cataract, equatorial cortex	0		2	0.1%
100.325	incomplete cataract, posterior sutures	2	0.0%	2	0.1%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	y-suture tip opacities	6	0.0%	10	0.5%
100.330	generalized/complete cataract	43	0.3%	1	0.1%
100.345	*significant cataracts (summary)*	*802*	*6.3%*	*150*	*8.0%*
100.375	*subluxation/luxation, unspecified*	*7*	*0.1%*	*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	20	0.2%	2	0.1%
110.135	PHPV/PTVL	10	0.1%	0	
110.200	vitreous degeneration-anterior chamber	17	0.1%	15	0.8%
110.320	vitreal degeneration	72	0.6%	12	0.6%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	80	0.6%	7	0.4%
120.180	retinal dysplasia, geographic	49	0.4%	5	0.3%
120.190	retinal dysplasia, detached	2	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	91	0.7%	5	0.3%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	10	0.5%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	127	1.0%	0	
900.100	other, not inherited	331	2.6%	7	0.4%
900.110	other. suspect not inherited/significance unknown	142	1.1%	112	6.0%
NORMAL					
0.000	normal globe	10,406	82.1%	1,293	69.3%

CHIHUAHUA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - endothelial	Not defined	1, 2	NO	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Vitreous degeneration	Not defined	1	Breeder option	
F.	Retinal atrophy (*prcd*)	Autosomal recessive	3, 4	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - endothelial

An abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

In the Chihuahua, this is a primary degenerative endothelial disease leading to progressive and permanent corneal edema. It is suspected to be a heritable disorder. There is no sex predilection. The condition is observed in older dogs, 6 to 13 years of age with a mean of 9.5 years. The corneal edema starts asymptomatically in the dorsal temporal corneal quadrant of one eye and slowly progresses medially, eventually involving the entire cornea. Typically, it becomes bilateral. In the later stages, discomfort, intracorneal bullae with subsequent ulceration and keratoconus may develop. Histologically, the primary endothelial disease appears slightly different from the

clinically similar disorder of the Boston Terrier.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chihuahua is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Martin CL and Dice PF. Corneal endothelial dystrophy in the dog. *J Am Anim Hosp Assoc.* 1982;18:327.

3. Hyama M, Tada N, Mitsui H, et al. Real-time PCR genotyping in assay for canine progressive rod-cone degeneration and mutant allele frequency in Toy Poodles, Chihuahuas, and Miniature Dachshunds in Japan. J Vet Med Sci 2016; 78(3): 481.

4. Downs LM, Hitti R, Pregnolato S, et al. Genetic screening for PRA-associated mutations in multiple dog breeds shows that PRA is heterogeneous within and between breeds. *Vet Ophthalmol*. 2014;17:126-130.

OCULAR DISORDERS REPORT
CHIHUAHUA

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,476**		**1,054**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	0		1	0.1%
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	3	0.2%	3	0.3%
25.110	distichiasis	80	5.4%	36	3.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.2%	3	0.3%
40.910	keratoconjunctivitis sicca	1	0.1%	2	0.2%
NICTITANS					
52.110	prolapsed gland of the third eyelid	4	0.3%	2	0.2%
CORNEA					
70.220	pigmentary keratitis	2	0.1%	3	0.3%
70.700	corneal dystrophy	3	0.2%	3	0.3%
70.730	corneal endothelial degeneration	5	0.3%	3	0.3%
UVEA					
93.710	persistent pupillary membranes, iris to iris	112	7.6%	55	5.2%
93.720	persistent pupillary membranes, iris to lens	4	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.5%	4	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.1%	0	
LENS					
100.200	cataract, unspecified	3	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	44	3.0%	21	2.0%
100.301	punctate cataract, anterior cortex	7	0.5%	6	0.6%
100.302	punctate cataract, posterior cortex	0		1	0.1%
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	3	0.2%	0	
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	1	0.1%	3	0.3%
100.311	incipient cataract, anterior cortex	25	1.7%	7	0.7%
100.312	incipient cataract, posterior cortex	16	1.1%	5	0.5%
100.313	incipient cataract, equatorial cortex	6	0.4%	3	0.3%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.1%	1	0.1%
100.316	incipient cataract, nucleus	6	0.4%	3	0.3%
100.317	incipient cataract, capsular	2	0.1%	3	0.3%
100.321	incomplete cataract, anterior cortex	2	0.1%	3	0.3%
100.325	incomplete cataract, posterior sutures	1	0.1%	0	
100.326	incomplete cataract, nucleus	1	0.1%	2	0.2%
100.328	y-suture tip opacities	1	0.1%	0	
100.330	generalized/complete cataract	12	0.8%	0	
100.345	*significant cataracts (summary)*	*92*	*6.2%*	*37*	*3.5%*

LENS CONTINUED		1991-2015		2016-2020	
100.375	subluxation/luxation, unspecified	1	0.1%	2	0.2%
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	0	
110.135	PHPV/PTVL	2	0.1%	0	
110.200	vitreous degeneration-anterior chamber	5	0.3%	15	1.4%
110.320	vitreal degeneration	58	3.9%	15	1.4%
FUNDUS					
97.110	choroidal hypoplasia	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	7	0.5%	2	0.2%
120.180	retinal dysplasia, geographic	3	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	0.7%	1	0.1%
120.960	retinopathy	1	0.1%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	1	0.1%
130.120	optic nerve hypoplasia	0		1	0.1%
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	21	1.4%	0	
900.100	other, not inherited	23	1.6%	1	0.1%
900.110	other. suspect not inherited/significance unknown	25	1.7%	41	3.9%
NORMAL					
0.000	normal globe	1,179	79.9%	854	81.0%

CHINESE CRESTED

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	4	NO	
D.	Lens luxation	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17 gene*
E.	Vitreous degeneration	Not defined	1, 3-5	Breeder option	
F.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 5	NO	Mutation in the *prcd* gene
G.	Retinal atrophy - rod-cone dysplasia type 3 (rcd3)	Presumed autosomal recessive	5	NO	Mutation in the PDE6A gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from its normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chinese Crested is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

In the Chinese Crested, a second, but very infrequency type of PRA has been identified that is caused by the mutation in the *PDE6A* gene that causes PRA in Cardigan Welsh Corgis. However, most cases of PRA that test normal for the *prcd* gene defect likely results from a gene defect that is still to be identified.

G. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Chinese Crested is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

4. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

5. Downs LM, Hitti R, Pregnolato S, et al. Genetic screening for PRA-associated mutations in multiple dog breeds shows that PRA is heterogeneous within and between breeds. *Vet Ophthalmol*. 2014; 17:126-130.

OCULAR DISORDERS REPORT
CHINESE CRESTED

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	6,493		504	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	4	0.1%	0	
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	2	0.0%	0	
21.000	entropion, unspecified	4	0.1%	0	
25.110	distichiasis	39	0.6%	5	1.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.0%	2	0.4%
40.910	keratoconjunctivitis sicca	18	0.3%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.0%	0	
CORNEA					
70.210	corneal pannus	5	0.1%	0	
70.220	pigmentary keratitis	7	0.1%	1	0.2%
70.700	corneal dystrophy	34	0.5%	3	0.6%
70.730	corneal endothelial degeneration	2	0.0%	1	0.2%
UVEA					
93.110	iris hypoplasia	5	0.1%	0	
93.150	iris coloboma	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	164	2.5%	17	3.4%
93.720	persistent pupillary membranes, iris to lens	11	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	10	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.0%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	1	0.2%
93.999	uveal cysts	4	0.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	152	2.3%	19	3.8%
100.301	punctate cataract, anterior cortex	29	0.4%	8	1.6%
100.302	punctate cataract, posterior cortex	17	0.3%	1	0.2%
100.303	punctate cataract, equatorial cortex	12	0.2%	2	0.4%
100.304	punctate cataract, anterior sutures	2	0.0%	1	0.2%
100.305	punctate cataract, posterior sutures	6	0.1%	1	0.2%
100.306	punctate cataract, nucleus	8	0.1%	1	0.2%
100.307	punctate cataract, capsular	5	0.1%	3	0.6%
100.311	incipient cataract, anterior cortex	41	0.6%	3	0.6%
100.312	incipient cataract, posterior cortex	30	0.5%	1	0.2%
100.313	incipient cataract, equatorial cortex	29	0.4%	1	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	5	0.1%	1	0.2%
100.316	incipient cataract, nucleus	5	0.1%	0	
100.317	incipient cataract, capsular	1	0.0%	1	0.2%
100.321	incomplete cataract, anterior cortex	2	0.0%	2	0.4%

LENS CONTINUED		1991-2015		2016-2020	
100.322	incomplete cataract, posterior cortex	2	0.0%	2	0.4%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.326	incomplete cataract, nucleus	0		1	0.2%
100.327	incomplete cataract, capsular	0		1	0.2%
100.328	y-suture tip opacities	2	0.0%	1	0.2%
100.330	generalized/complete cataract	26	0.4%	1	0.2%
100.340	resorbing/hypermature cataract	0		2	0.4%
100.345	*significant cataracts (summary)*	*225*	*3.5%*	*34*	*6.7%*
100.375	*subluxation/luxation, unspecified*	*25*	*0.4%*	*5*	*1.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	2	0.4%
110.135	PHPV/PTVL	2	0.0%	0	
110.200	vitreous degeneration-anterior chamber	20	0.3%	25	5.0%
110.320	vitreal degeneration	736	11.3%	30	6.0%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	31	0.5%	1	0.2%
120.180	retinal dysplasia, geographic	6	0.1%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	96	1.5%	3	0.6%
120.400	retinal hemorrhage	4	0.1%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.960	retinopathy	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	4	0.1%	0	
130.120	optic nerve hypoplasia	13	0.2%	0	
130.150	optic disc coloboma	8	0.1%	0	
OTHER					
900.000	other, unspecified	68	1.0%	0	
900.100	other, not inherited	152	2.3%	2	0.4%
900.110	other. suspect not inherited/significance unknown	44	0.7%	20	4.0%
NORMAL					
0.000	normal globe	5,513	84.9%	391	77.6%

CHINESE FOO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Chinese Foo Dog. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

CHINESE SHAR-PEI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma – POAG	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene
B.	Entropion	Not defined	1, 3-6	NO	
C.	Secondary keratitis - chronic	Not defined	1	Breeder option	
D.	Lens luxation	Autosomal recessive	1, 7	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

A 6 base pair deletion in exon 22 of *ADAMTS17* has been found in some affected Chinese Shar-Pei. Results supported phenotype is an autosomal recessive trait. A genetic test is available.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

The condition is a particularly severe problem in the Chinese Shar-Pei and is compounded by breeder selection for facial conformation with heavy skin folds which encourages formation of entropion.

C. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

A 6 base pair deletion in exon 22 of *ADAMTS17* has been found in some affected Chinese Shar-Pei. Results supported phenotype is an autosomal recessive trait. A genetic test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Oliver, JAC, Rustidge S, Pettit L, et al. Evaluation of ADAMTS17 in Chinese Shar-Pei with primary open-angle glaucoma, primary lens luxation, or both. *Am J Vet Res.* 2018 Jan; 79(1): 98-106.

3. Lenarduzzi R. Management of eyelid problems in Chinese Shar-Pei puppies. *Vet Med Small Anim Clin*. 1983;78:548-550.

4. Bedford PGC. Entropion in Shar-Peis (Correspondence). *Vet Rec*. 1984;115:666.

5. Startup FG. Entropion in the Shar-Pei (Correspondence). *Vet Rec*. 1985;116:57.

6. Barnett KC. Inherited eye disease in the dog and cat. *J Small Anim Pract*. 1988;29:462-475.

7. Lazarus JA, Pickett JP, Champagne ES. Primary lens luxation in the Chinese Shar-Pei: clinical and hereditary characteristics. *Vet Ophthalmol*. 1998;1:101-107.

OCULAR DISORDERS REPORT
CHINESE SHAR-PEI

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	603		94	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.2%	1	1.1%
10.000	glaucoma	0		1	1.1%
EYELIDS					
21.000	entropion, unspecified	306	50.7%	27	28.7%
22.000	ectropion, unspecified	12	2.0%	0	
25.110	distichiasis	3	0.5%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.2%	1	1.1%
52.110	prolapsed gland of the third eyelid	2	0.3%	1	1.1%
CORNEA					
70.210	corneal pannus	29	4.8%	0	
70.220	pigmentary keratitis	11	1.8%	10	10.6%
70.700	corneal dystrophy	4	0.7%	0	
70.730	corneal endothelial degeneration	6	1.0%	1	1.1%
UVEA					
93.710	persistent pupillary membranes, iris to iris	15	2.5%	1	1.1%
93.720	persistent pupillary membranes, iris to lens	5	0.8%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.8%	3	3.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.3%	2	2.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
93.810	uveal melanoma	1	0.2%	0	
LENS					
100.200	cataract, unspecified	4	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	13	2.2%	3	3.2%
100.301	punctate cataract, anterior cortex	2	0.3%	0	
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	2	0.3%	0	
100.306	punctate cataract, nucleus	1	0.2%	0	
100.307	punctate cataract, capsular	1	0.2%	0	
100.311	incipient cataract, anterior cortex	2	0.3%	0	
100.312	incipient cataract, posterior cortex	5	0.8%	1	1.1%
100.313	incipient cataract, equatorial cortex	0		1	1.1%
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.3%	0	
100.316	incipient cataract, nucleus	1	0.2%	0	
100.330	generalized/complete cataract	2	0.3%	0	
100.345	*significant cataracts (summary)*	*24*	*4.0%*	*2*	*2.1%*
100.375	*subluxation/luxation, unspecified*	*9*	*1.5%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	0	
110.320	vitreal degeneration	1	0.2%	0	

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	4	0.7%	0	
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.3%	0	
120.910	retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.2%	0	
OTHER					
900.000	other, unspecified	9	1.5%	0	
900.100	other, not inherited	17	2.8%	1	1.1%
900.110	other. suspect not inherited/significance unknown	21	3.5%	7	7.4%
NORMAL					
0.000	normal globe	286	47.4%	48	51.1%

CHINOOK

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes	Not defined	1	Breeder option
	- iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
CHINOOK

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,396**		**262**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
25.110	distichiasis	5	0.4%	0	
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	3	0.2%	3	1.1%
CORNEA					
70.700	corneal dystrophy	2	0.1%	1	0.4%
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	86	6.2%	9	3.4%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	1	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.810	uveal melanoma	1	0.1%	0	
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	75	5.4%	17	6.5%
100.301	punctate cataract, anterior cortex	6	0.4%	1	0.4%
100.302	punctate cataract, posterior cortex	1	0.1%	1	0.4%
100.303	punctate cataract, equatorial cortex	0		1	0.4%
100.305	punctate cataract, posterior sutures	2	0.1%	0	
100.306	punctate cataract, nucleus	6	0.4%	1	0.4%
100.307	punctate cataract, capsular	0		1	0.4%
100.311	incipient cataract, anterior cortex	8	0.6%	2	0.8%
100.312	incipient cataract, posterior cortex	16	1.1%	2	0.8%
100.313	incipient cataract, equatorial cortex	7	0.5%	1	0.4%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	9	0.6%	0	
100.316	incipient cataract, nucleus	7	0.5%	1	0.4%
100.317	incipient cataract, capsular	5	0.4%	0	
100.321	incomplete cataract, anterior cortex	1	0.1%	0	
100.322	incomplete cataract, posterior cortex	2	0.1%	1	0.4%
100.328	y-suture tip opacities	1	0.1%	1	0.4%
100.330	generalized/complete cataract	9	0.6%	1	0.4%
100.345	*significant cataracts (summary)*	*83*	*5.9%*	*14*	*5.3%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	0	
110.320	vitreal degeneration	16	1.1%	3	1.1%

		1991-2015		2016-2020	
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.4%
RETINA					
120.170	retinal dysplasia, folds	63	4.5%	2	0.8%
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.4%
OTHER					
900.000	other, unspecified	19	1.4%	0	
900.100	other, not inherited	41	2.9%	0	
900.110	other. suspect not inherited/significance unknown	11	0.8%	9	3.4%
NORMAL					
0.000	normal globe	1,177	84.3%	210	80.2%

CHOW CHOW

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Autosomal recessive	1-3	NO
B.	Entropion	Not defined	1	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- iris to cornea	Not defined	1	NO
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
	- endothelial opacity/no strands	Not defined		NO
D.	Cataract	Not defined	1, 4	NO

DESCRIPTION AND COMMENTS

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

Age of onset in the Chow Chow appears to be anywhere between 3-6 years of age and has been observed as a bilateral condition. Gonioscopy has shown extremely narrow iridocorneal angles and in many regions no evidence of trabecular meshwork.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

Entropion in the Chow Chow has been observed for decades and is definitely related to the amount of skin covering the head and face. Because of the conformation admired by both fanciers and the judges, it is doubtful that we will see a significant change in the incidence of

entropion as folds are, in many cases, desired by these individuals. Entropion requires surgical correction in the Chow Chow to return comfort and decrease chances for vision loss.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Major PPM's have been observed in the Chow Chow. Many ophthalmologists have observed puppies so severely affected that they are temporarily or permanently blind. The blindness is due to adherence of the membranes to the cornea and/or lens.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Chow Chow, the only reported cataract is congenital. The clinical appearance is variable, ranging from small nuclear or capsular opacities to generalized opacity. The central lens (nucleus) is most consistently affected with variable involvement of the peripheral lens (cortex). Concurrent ocular anomalies may include entropion, microphthalmia, persistent pupillary membranes, and retinal folds, although any direct relationship of these latter conditions to the cataract is unclear.

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OCULAR DISORDERS REPORT
CHOW CHOW

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,326 #	 %	2016-2020 196 #	 %
GLOBE						
0.110	microphthalmia		4	0.3%	0	
EYELIDS						
20.160	macropalpebral fissure		3	0.2%	0	
21.000	entropion, unspecified		365	27.5%	35	17.9%
22.000	ectropion, unspecified		22	1.7%	4	2.0%
25.110	distichiasis		8	0.6%	2	1.0%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		2	0.2%	0	
CORNEA						
70.210	corneal pannus		9	0.7%	0	
70.220	pigmentary keratitis		25	1.9%	2	1.0%
70.700	corneal dystrophy		8	0.6%	1	0.5%
70.730	corneal endothelial degeneration		17	1.3%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		5	0.4%	0	
93.710	persistent pupillary membranes, iris to iris		458	34.5%	62	31.6%
93.720	persistent pupillary membranes, iris to lens		17	1.3%	1	0.5%
93.730	persistent pupillary membranes, iris to cornea		54	4.1%	8	4.1%
93.740	persistent pupillary membranes, iris sheets		8	0.6%	1	0.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands		12	0.9%	7	3.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.2%	7	3.6%
LENS						
100.210	cataract. suspect not inherited/significance unknown		29	2.2%	3	1.5%
100.301	punctate cataract, anterior cortex		2	0.2%	0	
100.302	punctate cataract, posterior cortex		5	0.4%	0	
100.303	punctate cataract, equatorial cortex		2	0.2%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.306	punctate cataract, nucleus		2	0.2%	0	
100.307	punctate cataract, capsular		1	0.1%	0	
100.311	incipient cataract, anterior cortex		5	0.4%	0	
100.312	incipient cataract, posterior cortex		9	0.7%	1	0.5%
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		3	0.2%	0	
100.326	incomplete cataract, nucleus		0		1	0.5%
100.328	y-suture tip opacities		1	0.1%	0	
100.330	generalized/complete cataract		1	0.1%	0	
100.345	*significant cataracts (summary)*		*33*	*2.5%*	*2*	*1.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		5	0.4%	0	
110.320	vitreal degeneration		2	0.2%	1	0.5%

	1991-2015		2016-2020	
RETINA				
120.170 retinal dysplasia, folds	2	0.2%	0	
120.180 retinal dysplasia, geographic	1	0.1%	0	
120.190 retinal dysplasia, detached	1	0.1%	0	
120.310 generalized progressive retinal atrophy (PRA)	8	0.6%	0	
OPTIC NERVE				
130.120 optic nerve hypoplasia	1	0.1%	0	
OTHER				
900.000 other, unspecified	17	1.3%	0	
900.100 other, not inherited	22	1.7%	0	
900.110 other. suspect not inherited/significance unknown	21	1.6%	7	3.6%
NORMAL				
0.000 normal globe	597	45.0%	86	43.9%

CLUMBER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1, 2	Breeder option
B.	Ectropion	Not defined	1	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids, which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

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OCULAR DISORDERS REPORT
CLUMBER SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,686 #	%	2016-2020 266 #	%
GLOBE						
0.110	microphthalmia		6	0.2%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
20.160	macropalpebral fissure		167	6.2%	0	
21.000	entropion, unspecified		583	21.7%	56	21.1%
22.000	ectropion, unspecified		435	16.2%	30	11.3%
25.110	distichiasis		192	7.1%	29	10.9%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		5	0.2%	0	
40.910	keratoconjunctivitis sicca		18	0.7%	3	1.1%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		13	0.5%	0	
70.220	pigmentary keratitis		11	0.4%	1	0.4%
70.700	corneal dystrophy		5	0.2%	0	
70.730	corneal endothelial degeneration		0		1	0.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		62	2.3%	7	2.6%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		6	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.1%	0	
LENS						
100.200	cataract, unspecified		15	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		86	3.2%	14	5.3%
100.300	punctate cataract, unspecified		0		1	0.4%
100.301	punctate cataract, anterior cortex		20	0.7%	3	1.1%
100.302	punctate cataract, posterior cortex		28	1.0%	1	0.4%
100.303	punctate cataract, equatorial cortex		5	0.2%	0	
100.304	punctate cataract, anterior sutures		1	0.0%	0	
100.305	punctate cataract, posterior sutures		15	0.6%	3	1.1%
100.306	punctate cataract, nucleus		5	0.2%	2	0.8%
100.307	punctate cataract, capsular		1	0.0%	0	
100.311	incipient cataract, anterior cortex		15	0.6%	1	0.4%
100.312	incipient cataract, posterior cortex		41	1.5%	4	1.5%
100.313	incipient cataract, equatorial cortex		7	0.3%	0	
100.314	incipient cataract, anterior sutures		2	0.1%	0	
100.315	incipient cataract, posterior sutures		15	0.6%	1	0.4%
100.316	incipient cataract, nucleus		7	0.3%	0	
100.317	incipient cataract, capsular		5	0.2%	0	
100.322	incomplete cataract, posterior cortex		1	0.0%	1	0.4%
100.323	incomplete cataract, equatorial cortex		0		1	0.4%

LENS CONTINUED		1991-2015		2016-2020	
100.325	incomplete cataract, posterior sutures	0		2	0.8%
100.326	incomplete cataract, nucleus	0		1	0.4%
100.328	y-suture tip opacities	2	0.1%	3	1.1%
100.330	generalized/complete cataract	5	0.2%	0	
100.345	*significant cataracts (summary)*	*190*	*7.1%*	*24*	*9.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.2%	0	
110.135	PHPV/PTVL	3	0.1%	0	
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
97.120	coloboma	3	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	181	6.7%	3	1.1%
120.180	retinal dysplasia, geographic	8	0.3%	2	0.8%
120.190	retinal dysplasia, detached	0		1	0.4%
120.310	generalized progressive retinal atrophy (PRA)	15	0.6%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	25	0.9%	0	
900.100	other, not inherited	64	2.4%	2	0.8%
900.110	other. suspect not inherited/significance unknown	29	1.1%	5	1.9%
NORMAL					
0.000	normal globe	1,426	53.1%	128	48.1%

COCKER SPANIEL

(*American)

*The official breed name is Cocker Spaniel. The designation "American" has been used to avoid confusion and emphasize the distinction from the English Cocker Spaniel breed.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO	
B.	Glaucoma	Not defined	1, 3, 4	NO	
C.	Ectropion	Not defined	1	Breeder option	
D.	Distichiasis	Not defined	1, 2, 5, 6	Breeder option	
E.	Imperforate lacrimal punctum	Not defined	1	Breeder option	
F.	Prolapsed gland of the third eyelid	Not defined	1, 7	Breeder option	
G.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
H.	Secondary keratitis – chronic	Not defined	1	Passes with no notation	
I.	Cataract	Presumed autosomal recessive	1, 2, 8-11	NO	
J.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 12-14	NO	Mutation in the *prcd* gene
K.	Retinal dysplasia - folds	Not defined	1, 15	Breeder option	

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct adjacent to the eye. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

F. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

G. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

H. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In this breed, the onset of cataract may occur at an early age (less than 2 years) with rapid progression to maturity and associated with significant lens-induced inflammation.

J. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Cocker Spaniel is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
COCKER SPANIEL

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**56,961**		**6,373**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	35	0.1%	1	0.0%
10.000	glaucoma	34	0.1%	6	0.1%
EYELIDS					
20.110	eyelid dermoid	2	0.0%	0	
20.140	ectopic cilia	55	0.1%	2	0.0%
20.160	macropalpebral fissure	179	0.3%	0	
21.000	entropion, unspecified	158	0.3%	7	0.1%
22.000	ectropion, unspecified	981	1.7%	35	0.5%
25.110	distichiasis	28,697	50.4%	3,104	48.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	473	0.8%	241	3.8%
40.910	keratoconjunctivitis sicca	341	0.6%	93	1.5%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.0%
51.100	third eyelid cartilage anomaly	8	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	218	0.4%	21	0.3%
CORNEA					
70.210	corneal pannus	497	0.9%	1	0.0%
70.220	pigmentary keratitis	487	0.9%	123	1.9%
70.700	corneal dystrophy	1,581	2.8%	137	2.1%
70.730	corneal endothelial degeneration	37	0.1%	6	0.1%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	2	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	8	0.0%	2	0.0%
93.180	Iiris sphincter dysplasia	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	160	0.3%	29	0.5%
93.720	persistent pupillary membranes, iris to lens	30	0.1%	2	0.0%
93.730	persistent pupillary membranes, iris to cornea	35	0.1%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	28	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	36	0.1%	35	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	3	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	20	0.0%	4	0.1%
97.150	chorioretinal coloboma, congenital	5	0.0%	1	0.0%
LENS					
100.200	cataract, unspecified	1,023	1.8%	0	
100.210	cataract. suspect not inherited/significance unknown	3,354	5.9%	418	6.6%
100.301	punctate cataract, anterior cortex	926	1.6%	143	2.2%
100.302	punctate cataract, posterior cortex	526	0.9%	66	1.0%
100.303	punctate cataract, equatorial cortex	139	0.2%	24	0.4%
100.304	punctate cataract, anterior sutures	134	0.2%	11	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.305	punctate cataract, posterior sutures	188	0.3%	40	0.6%
100.306	punctate cataract, nucleus	76	0.1%	7	0.1%
100.307	punctate cataract, capsular	58	0.1%	24	0.4%
100.311	incipient cataract, anterior cortex	1,032	1.8%	130	2.0%
100.312	incipient cataract, posterior cortex	1,201	2.1%	130	2.0%
100.313	incipient cataract, equatorial cortex	310	0.5%	42	0.7%
100.314	incipient cataract, anterior sutures	105	0.2%	6	0.1%
100.315	incipient cataract, posterior sutures	182	0.3%	19	0.3%
100.316	incipient cataract, nucleus	190	0.3%	18	0.3%
100.317	incipient cataract, capsular	80	0.1%	23	0.4%
100.321	incomplete cataract, anterior cortex	45	0.1%	62	1.0%
100.322	incomplete cataract, posterior cortex	43	0.1%	71	1.1%
100.323	incomplete cataract, equatorial cortex	6	0.0%	17	0.3%
100.324	incomplete cataract, anterior sutures	1	0.0%	2	0.0%
100.325	incomplete cataract, posterior sutures	4	0.0%	2	0.0%
100.326	incomplete cataract, nucleus	9	0.0%	21	0.3%
100.327	incomplete cataract, capsular	1	0.0%	2	0.0%
100.328	y-suture tip opacities	19	0.0%	30	0.5%
100.330	generalized/complete cataract	1,015	1.8%	50	0.8%
100.340	resorbing/hypermature cataract	16	0.0%	21	0.3%
100.345	*significant cataracts (summary)*	*7,329*	*12.9%*	*961*	*15.1%*
100.375	*subluxation/luxation, unspecified*	*70*	*0.1%*	*20*	*0.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	42	0.1%	9	0.1%
110.135	PHPV/PTVL	9	0.0%	1	0.0%
110.200	vitreous degeneration-anterior chamber	4	0.0%	5	0.1%
110.320	vitreal degeneration	151	0.3%	16	0.3%
FUNDUS					
97.110	choroidal hypoplasia	33	0.1%	0	
97.120	coloboma	14	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	6,764	11.9%	338	5.3%
120.180	retinal dysplasia, geographic	166	0.3%	9	0.1%
120.190	retinal dysplasia, detached	9	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	460	0.8%	14	0.2%
120.400	retinal hemorrhage	7	0.0%	0	
120.910	retinal detachment without dialysis	14	0.0%	0	
120.960	retinopathy	19	0.0%	23	0.4%
OPTIC NERVE					
130.110	micropapilla	4	0.0%	0	
130.120	optic nerve hypoplasia	10	0.0%	0	
130.150	optic disc coloboma	111	0.2%	3	0.0%
OTHER					
900.000	other, unspecified	451	0.8%	0	
900.100	other, not inherited	1,059	1.9%	17	0.3%
900.110	other. suspect not inherited/significance unknown	872	1.5%	310	4.9%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	23,461 41.2%	2,211 34.7%

COLLIE

(Rough and Smooth varieties)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia	Not defined	1, 2	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Persistent pupillary membranes - iris to iris - iris to lens	 Not defined Not defined	 1 1	 Breeder option NO	
E.	Cataract	Not defined	1	NO	
F.	Persistent hyaloid artery	Not defined	1	Breeder option	
G.	Retinal atrophy - generalized	Not defined	1	NO	
H.	Retinal atrophy- Rod/cone dysplasia type 2- (*rcd2*)	Autosomal recessive	3-66	NO	Mutation in the *RD3* gene
I.	Retinal dysplasia - folds	Not defined	1	Breeder option	
J.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1, 7-31	NO	Mutation in the *NHEJ1* gene

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Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially

microphthalmia) and deafness in a number of canine breeds including the Collie. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. In the Collie, because there is significant clinical disease associated with the abnormal hairs, breeding of affected animals should be discouraged.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Collie, this is a particularly serious problem noted frequently on routine screening examination. The majority of persistent pupillary membranes identified on routine screening examinations include iris sheets, and bridging from the iris to cornea and the iris to lens. These may result in vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds. In the Collie, the

rod/cone degeneration occurs very rarely and in those cases has not been caused by any of the known genetic mutations.

H. Retinal atrophy - Rod-cone dysplasia type 2- (*rcd2*)

An inherited retinal disease characterized by abortive or abnormal development of rods and cones. The disease can be detected histologically by 6 weeks. Clinical night blindness is observed as early as 6 weeks with total blindness by 1 year of age. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. This form of retinal dysplasia is clinically similar to, but genetically distinct from that seen in the Irish Setter. This condition is caused by an insertion in *RD3.* A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
COLLIE

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 55,225 #	 %	2016-2020 8,566 #	 %
GLOBE					
0.110	microphthalmia	835	1.5%	310	3.6%
10.000	glaucoma	7	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	5	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	55	0.1%	3	0.0%
22.000	ectropion, unspecified	8	0.0%	0	
25.110	distichiasis	1,043	1.9%	128	1.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	8	0.0%	1	0.0%
40.910	keratoconjunctivitis sicca	5	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	8	0.0%	5	0.1%
52.110	prolapsed gland of the third eyelid	2	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.0%	1	0.0%
70.220	pigmentary keratitis	7	0.0%	1	0.0%
70.700	corneal dystrophy	386	0.7%	35	0.4%
70.730	corneal endothelial degeneration	12	0.0%	0	
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	3	0.0%	5	0.1%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	23	0.0%	1	0.0%
93.180	liris sphincter dysplasia	1	0.0%	2	0.0%
93.710	persistent pupillary membranes, iris to iris	8,796	15.9%	2,233	26.1%
93.720	persistent pupillary membranes, iris to lens	432	0.8%	133	1.6%
93.730	persistent pupillary membranes, iris to cornea	123	0.2%	14	0.2%
93.740	persistent pupillary membranes, iris sheets	65	0.1%	4	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	29	0.1%	21	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	12	0.0%	2	0.0%
93.810	uveal melanoma	2	0.0%	3	0.0%
93.999	uveal cysts	21	0.0%	10	0.1%
97.150	chorioretinal coloboma, congenital	159	0.3%	290	3.4%
LENS					
100.200	cataract, unspecified	114	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	525	1.0%	100	1.2%
100.301	punctate cataract, anterior cortex	78	0.1%	10	0.1%
100.302	punctate cataract, posterior cortex	22	0.0%	3	0.0%
100.303	punctate cataract, equatorial cortex	5	0.0%	0	
100.304	punctate cataract, anterior sutures	25	0.0%	4	0.0%
100.305	punctate cataract, posterior sutures	20	0.0%	5	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.306	punctate cataract, nucleus	129	0.2%	27	0.3%
100.307	punctate cataract, capsular	29	0.1%	8	0.1%
100.311	incipient cataract, anterior cortex	90	0.2%	13	0.2%
100.312	incipient cataract, posterior cortex	107	0.2%	4	0.0%
100.313	incipient cataract, equatorial cortex	35	0.1%	7	0.1%
100.314	incipient cataract, anterior sutures	34	0.1%	7	0.1%
100.315	incipient cataract, posterior sutures	23	0.0%	3	0.0%
100.316	incipient cataract, nucleus	134	0.2%	27	0.3%
100.317	incipient cataract, capsular	27	0.0%	5	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	1	0.0%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.0%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	2	0.0%	4	0.0%
100.327	incomplete cataract, capsular	0		1	0.0%
100.328	y-suture tip opacities	4	0.0%	2	0.0%
100.330	generalized/complete cataract	49	0.1%	0	
100.345	*significant cataracts (summary)*	*929*	*1.7%*	*134*	*1.6%*
100.375	*subluxation/luxation, unspecified*	*8*	*0.0%*	*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	372	0.7%	35	0.4%
110.135	PHPV/PTVL	48	0.1%	4	0.0%
110.320	vitreal degeneration	46	0.1%	2	0.0%
FUNDUS					
97.110	choroidal hypoplasia	37,676	68.2%	6,424	75.0%
97.120	coloboma	2,298	4.2%	0	
RETINA					
120.170	retinal dysplasia, folds	3,704	6.7%	699	8.2%
120.180	retinal dysplasia, geographic	55	0.1%	6	0.1%
120.190	retinal dysplasia, detached	86	0.2%	29	0.3%
120.310	generalized progressive retinal atrophy (PRA)	813	1.5%	2	0.0%
120.400	retinal hemorrhage	105	0.2%	0	
120.910	retinal detachment without dialysis	823	1.5%	0	
120.920	retinal detachment with dialysis	59	0.1%	111	1.3%
120.960	retinopathy	1	0.0%	1	0.0%
OPTIC NERVE					
130.110	micropapilla	132	0.2%	47	0.5%
130.120	optic nerve hypoplasia	231	0.4%	36	0.4%
130.150	optic disc coloboma	4,319	7.8%	789	9.2%
OTHER					
900.000	other, unspecified	132	0.2%	0	
900.100	other, not inherited	286	0.5%	17	0.2%
900.110	other. suspect not inherited/significance unknown	608	1.1%	36	0.4%
NORMAL					
0.000	normal globe	14,182	25.7%	1,378	16.1%

COTON DE TULEAR

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Prolapsed gland of third eyelid	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Vitreous degeneration	Not defined	1	Breeder option	
G.	Retinal atrophy (*prcd*)	Not defined	1	NO	Mutation in the *prcd* gene
H.	Multifocal retinopathy - *cmr2*	Autosomal recessive	2, 3	Breeder Option	Mutation in the *BEST1* gene

Description and Comments

A. Prolapse of the gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated and severe chronic inflammation or keratoconjunctivitis sicca/dry eye syndrome may ensue. Commonly referred to as "cherry eye."

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to

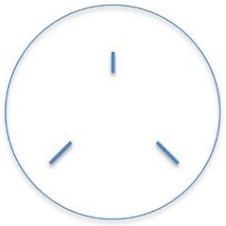
lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Coton de Tulear is *prcd* which is a

late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

H. Multifocal retinopathy – *cmr2*

Canine Multifocal Retinopathy type 2 (*cmr2*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There is typically a serous sub-retinal fluid in the Coton de Tulear, although there may be accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 15 weeks to 1 year of age. The lesions typically remain static in size and color beyond 1 year of age. The bullae appear to gradually lose the serous sub-retinal fluid after 4-5 years of age. Discrete areas of tapetal hyper-reflectivity might also be seen. Most dogs exhibit no noticeable problem with vision despite their abnormal appearing retinas. Electroretinograms reveal significant differences in photopic flickers in affected dogs.

Canine Multifocal Retinopathy type 2 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Coton du Tulear. A DNA test is available.

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OCULAR DISORDERS REPORT
COTON DE TULEAR

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 5,075 #	%	2016-2020 736 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
21.000	entropion, unspecified		4	0.1%	2	0.3%
25.110	distichiasis		43	0.8%	4	0.5%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	10	1.4%
40.910	keratoconjunctivitis sicca		1	0.0%	1	0.1%
NICTITANS						
52.110	prolapsed gland of the third eyelid		13	0.3%	10	1.4%
CORNEA						
70.220	pigmentary keratitis		1	0.0%	0	
70.700	corneal dystrophy		47	0.9%	12	1.6%
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.110	iris hypoplasia		2	0.0%	0	
93.150	iris coloboma		2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		438	8.6%	63	8.6%
93.720	persistent pupillary membranes, iris to lens		8	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		6	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.0%	2	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		8	0.2%	0	
93.999	uveal cysts		4	0.1%	0	
97.150	chorioretinal coloboma, congenital		1	0.0%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		173	3.4%	35	4.8%
100.301	punctate cataract, anterior cortex		8	0.2%	1	0.1%
100.302	punctate cataract, posterior cortex		4	0.1%	0	
100.303	punctate cataract, equatorial cortex		3	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		11	0.2%	1	0.1%
100.306	punctate cataract, nucleus		2	0.0%	0	
100.307	punctate cataract, capsular		3	0.1%	5	0.7%
100.311	incipient cataract, anterior cortex		13	0.3%	2	0.3%
100.312	incipient cataract, posterior cortex		15	0.3%	2	0.3%
100.313	incipient cataract, equatorial cortex		10	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures		2	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures		2	0.0%	4	0.5%
100.316	incipient cataract, nucleus		4	0.1%	1	0.1%
100.317	incipient cataract, capsular		6	0.1%	0	
100.321	incomplete cataract, anterior cortex		1	0.0%	0	
100.322	incomplete cataract, posterior cortex		0		1	0.1%
100.328	y-suture tip opacities		5	0.1%	9	1.2%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	7	0.1%	1	0.1%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*96*	*1.9%*	*31*	*4.2%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	3	0.4%
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitreous degeneration-anterior chamber	2	0.0%	0	
110.320	vitreal degeneration	46	0.9%	9	1.2%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	1	0.1%
RETINA					
120.170	retinal dysplasia, folds	21	0.4%	0	
120.180	retinal dysplasia, geographic	11	0.2%	0	
120.190	retinal dysplasia, detached	3	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	31	0.6%	5	0.7%
120.370	multifocal retinopathy	2	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	3	0.4%
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	44	0.9%	0	
900.100	other, not inherited	151	3.0%	2	0.3%
900.110	other. suspect not inherited/significance unknown	51	1.0%	36	4.9%
NORMAL					
0.000	normal globe	4,345	85.6%	558	75.8%

CURLY-COATED RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	2	NO
D.	Y-suture tip opacity	Not defined	1	Breeder option
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membrane (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

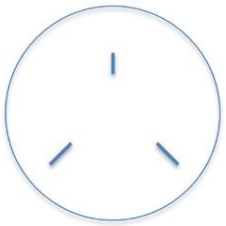
In the Curly-Coated Retriever the following cataracts have been reported:

1. **Anterior cortical subcapsular cataract:** Anterior subcapsular striate cortical cataracts usually occur bilaterally, slowly progress and usually occur between 5-8 years of age.

2. **Posterior subcapsular cataract:** Posterior polar subcapsular opacities occur at 2-4 years of age and progress slowly.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Retinal dysplasia – folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
CURLY-COATED RETRIEVER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,900**		**182**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.140	ectopic cilia	4	0.2%	0	
21.000	entropion, unspecified	11	0.6%	0	
22.000	ectropion, unspecified	3	0.2%	0	
25.110	distichiasis	149	7.8%	13	7.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	1	0.5%
52.110	prolapsed gland of the third eyelid	1	0.1%	0	
CORNEA					
70.700	corneal dystrophy	14	0.7%	0	
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
90.250	pigmentary uveitis	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	70	3.7%	11	6.0%
93.720	persistent pupillary membranes, iris to lens	4	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	12	0.6%	11	6.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	1	0.1%	0	
LENS					
100.200	cataract, unspecified	19	1.0%	0	
100.210	cataract. suspect not inherited/significance unknown	108	5.7%	29	15.9%
100.301	punctate cataract, anterior cortex	11	0.6%	2	1.1%
100.302	punctate cataract, posterior cortex	12	0.6%	1	0.5%
100.303	punctate cataract, equatorial cortex	2	0.1%	1	0.5%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	12	0.6%	8	4.4%
100.307	punctate cataract, capsular	8	0.4%	0	
100.311	incipient cataract, anterior cortex	11	0.6%	0	
100.312	incipient cataract, posterior cortex	13	0.7%	0	
100.313	incipient cataract, equatorial cortex	11	0.6%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	5	0.3%	1	0.5%
100.316	incipient cataract, nucleus	3	0.2%	0	
100.317	incipient cataract, capsular	3	0.2%	0	
100.328	y-suture tip opacities	3	0.2%	8	4.4%
100.345	*significant cataracts (summary)*	*115*	*6.1%*	*21*	*11.5%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	2	1.1%
110.320	vitreal degeneration	20	1.1%	0	

		1991-2015		2016-2020	
FUNDUS					
97.110	choroidal hypoplasia	13	0.7%	0	
RETINA					
120.170	retinal dysplasia, folds	17	0.9%	5	2.7%
120.180	retinal dysplasia, geographic	3	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	0.6%	1	0.5%
120.960	retinopathy	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	0.5%
130.120	optic nerve hypoplasia	3	0.2%	0	
130.150	optic disc coloboma	13	0.7%	0	
OTHER					
900.000	other, unspecified	16	0.8%	0	
900.100	other, not inherited	34	1.8%	1	0.5%
900.110	other. suspect not inherited/significance unknown	27	1.4%	9	4.9%
NORMAL					
0.000	normal globe	1,523	80.2%	105	57.7%

DACHSHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia and multiple ocular defects	Not defined	1-3	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Pigmentary keratitis	Not defined	4	NO	
D.	Corneal dystrophy - endothelial	Not defined	1, 5, 6	NO	
E.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1 1	Breeder option Passes with no notation	
F.	Cataract	Not defined	1	NO	
G.	Retinal atrophy (*crd1)*	Autosomal recessive	1, 7-18	NO	Mutation in the *NPHP4* gene
H.	Retinopathy - associated with ceroid lipufuscinosis	Autosomal recessive	2, 19-20	NO	Mutation in the *TPP1* gene

Description and Comments

A. Microphthalmia and multiple ocular anomalies

Microphthalmia is a congenital defect characterized by a small eye often with associated defects of the cornea, anterior chamber, lens and/or retina. An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Dachshund. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Punctate keratitis

Focal circular rings usually affecting the central sub-epithelial and/or anterior portion of the cornea. There often is an associated dry eye with corneal erosions. The mode of inheritance is unknown.

D. Corneal dystrophy - endothelial

An abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal atrophy – *crd1*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram before it is apparent clinically.

In Miniature Dachshunds there is a recessively inherited disorder caused by a 44 base pair insertion in the *RPGRIP1* gene. The insertion presumably truncates the protein and its major C-terminal RPGR binding domain. The resulting disease is called cone-rod dystrophy 1 (crd1) as the salient clinical abnormalities are a cone ERG dysfunction which does not correlate with photopic vision defects. The onset of the disease is variable, and is influenced by a second modifier locus which also is located on canine chromosome 15. Dogs homozygous for both defects have retinal abnormalities on ophthalmoscopy before 1-2 years of age. Dogs homozygous only for the *RPGRIP* insertion may have a late onset (>6 years) retinal degeneration diagnosed by ophthalmoscopy. Although the *RPGRIP1* molecular defect can be identified by means of a DNA test, questions have been raised about its validity given the poor genotype-phenotype correlation. A DNA test is available.

In a previous study using an inbred research colony, a 44-nucleotide insertion (ins44) in exon 2 of RPGRIP1 was associated with retinal degeneration. Despite concordance of ins44 with retinal degeneration, evidence indicate that there was phenotype-genotype discordance within the

miniature long-haired dachshunds that were not directly related to the experimental colony as not all dogs that were homozygous for ins44 were developing early onset retinal degeneration, but were developing retinal degeneration at a much later stage or not at all. In this investigation MAP9 deletion associated with early retinal degeneration onset was identified. Given the new genome assembly, the nominal title is CanFam3.1MAP9 corrected. Deletion was confirmed in early onset retinal degeneration cases and not late onset retinal degeneration cases, there is a variable age of onset and demonstrate the interaction of two independent loci that contribute to the phenotype. This study has shown that RPGRIP1 ins44/ins44 dogs with early onset retinal degeneration has several polymorphisms in MAP9, some of them potentially harmful, when compared with MAP9 in late onset retinal degeneration dogs. Detection of the presence or absence of MAP early onset retinal degeneration by qPCR can be used to specify early onset or late onset status for ins44 homozygotes. The story, however, is not as straightforward as suggested by the Forman et al. 2016 paper. Unpublished work by K. Miyadera and G. Aguirre in a research colony in which one of the founders originated from a MLHD at the Animal Health Trust finds that dogs that are homozygous for the RPGRIP1 ins 44 and the newly identified MAP9 deletion still do not show early-onset retinal degeneration. This suggests that there probably is a third genetic locus that interacts with MAP9 and RPGRIP1 in determining the age of disease onset and severity of the phenotype. Regardless, the identification of the MAP9 deletion is a major finding that will help unravel the complex genetics of this retinal disorder.

H. Retinopathy associated with ceroid lipufuscinosis

Progressive, multifocal serous retinal detachments first appear in Longhaired Dachshunds with late infantile neuronal ceroid lipofuscinosis at age 5-10 months. Late infantile ceroid neuronal lipofuscinosis in Miniature Dachshunds is a fatal, autosomal recessive, inherited lysosomal storage disease characterized by progressive neurodegeneration. The disease results from a defect in the *TPP1* (Tripeptidyl peptidase) gene. Inheritance of the retinopathy is linked to the gene causing late infantile neuronal ceroid lipofuscinosis.

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OCULAR DISORDERS REPORT
DACHSHUND

	TOTAL DOGS EXAMINED	1991-2015 6,154		2016-2020 1,368	
	Diagnostic Name	**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	22	0.4%	2	0.1%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	7	0.1%	1	0.1%
25.110	distichiasis	374	6.1%	118	8.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.1%
40.910	keratoconjunctivitis sicca	2	0.0%	3	0.2%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	0	
51.100	third eyelid cartilage anomaly	2	0.0%	0	
52.110	prolapsed gland of the third eyelid	8	0.1%	2	0.1%
CORNEA					
70.210	corneal pannus	3	0.0%	0	
70.700	corneal dystrophy	33	0.5%	2	0.1%
70.730	corneal endothelial degeneration	9	0.1%	0	
UVEA					
93.110	iris hypoplasia	7	0.1%	6	0.4%
93.150	iris coloboma	25	0.4%	0	
93.180	Iiris sphincter dysplasia	0		2	0.1%
93.710	persistent pupillary membranes, iris to iris	250	4.1%	72	5.3%
93.720	persistent pupillary membranes, iris to lens	25	0.4%	5	0.4%
93.730	persistent pupillary membranes, iris to cornea	31	0.5%	3	0.2%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	75	1.2%	78	5.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	11	0.2%	5	0.4%
93.999	uveal cysts	4	0.1%	0	
97.150	chorioretinal coloboma, congenital	1	0.0%	2	0.1%
LENS					
100.200	cataract, unspecified	43	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	255	4.1%	40	2.9%
100.301	punctate cataract, anterior cortex	29	0.5%	3	0.2%
100.302	punctate cataract, posterior cortex	15	0.2%	3	0.2%
100.303	punctate cataract, equatorial cortex	10	0.2%	1	0.1%
100.304	punctate cataract, anterior sutures	4	0.1%	0	
100.305	punctate cataract, posterior sutures	9	0.1%	5	0.4%
100.306	punctate cataract, nucleus	8	0.1%	2	0.1%
100.307	punctate cataract, capsular	10	0.2%	5	0.4%
100.311	incipient cataract, anterior cortex	49	0.8%	2	0.1%
100.312	incipient cataract, posterior cortex	22	0.4%	2	0.1%
100.313	incipient cataract, equatorial cortex	14	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	18	0.3%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.316	incipient cataract, nucleus	9	0.1%	1	0.1%
100.317	incipient cataract, capsular	7	0.1%	3	0.2%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.1%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.328	y-suture tip opacities	0		6	0.4%
100.330	generalized/complete cataract	39	0.6%	2	0.1%
100.340	resorbing/hypermature cataract	2	0.0%	1	0.1%
100.345	*significant cataracts (summary)*	*292*	*4.7%*	*40*	*2.9%*
100.375	*subluxation/luxation, unspecified*	*7*	*0.1%*	*2*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	39	0.6%	4	0.3%
110.135	PHPV/PTVL	15	0.2%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	1	0.1%
110.320	vitreal degeneration	35	0.6%	5	0.4%
FUNDUS					
97.110	choroidal hypoplasia	5	0.1%	2	0.1%
97.120	coloboma	14	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	56	0.9%	16	1.2%
120.180	retinal dysplasia, geographic	7	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	119	1.9%	8	0.6%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	5	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	2	0.1%
120.960	retinopathy	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	19	0.3%	5	0.4%
130.120	optic nerve hypoplasia	40	0.6%	0	
130.150	optic disc coloboma	26	0.4%	0	
OTHER					
900.000	other, unspecified	89	1.4%	0	
900.100	other, not inherited	198	3.2%	5	0.4%
900.110	other. suspect not inherited/significance unknown	96	1.6%	72	5.3%
NORMAL					
0.000	normal globe	4,807	78.1%	971	71.0%

DALMATIAN

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris hypoplasia/sphincter dysplasia.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Iris hypoplasia	Not defined	1	Breeder option
E.	Iris sphincter dysplasia	Not defined	1	Passes with no notation
F.	Persistent pupillary membrane - iris to iris	Not defined	1	Breeder option
G.	Cataract	Not defined	1, 2	NO
H.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris Hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

E. Iris sphincter dysplasia

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue at the level of the iris sphincter, causing pupillary dilation. This abnormality has been noted in the Dalmatian breed.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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3. Slater MR, Erb HN. Effects of risk factors and prophylactic treatment on primary glaucoma in the dog. *J Am Vet Med Assoc*. 1986;188:1028-1030.

OCULAR DISORDERS REPORT
DALMATIAN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 2,765 #	%	2016-2020 1,067 #	%
GLOBE					
0.110	microphthalmia	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	5	0.2%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	125	4.5%	61	5.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.1%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	77	2.8%	23	2.2%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.110	iris hypoplasia	50	1.8%	10	0.9%
93.150	iris coloboma	15	0.5%	1	0.1%
93.180	liris sphincter dysplasia	14	0.5%	10	0.9%
93.710	persistent pupillary membranes, iris to iris	24	0.9%	9	0.8%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	1	0.1%
93.999	uveal cysts	3	0.1%	1	0.1%
97.150	chorioretinal coloboma, congenital	1	0.0%	0	
LENS					
100.110	microphakia, congenital	0		1	0.1%
100.200	cataract, unspecified	1	0.0%	0	
100.210	cataract. suspect not inherited/significance unknown	55	2.0%	22	2.1%
100.301	punctate cataract, anterior cortex	6	0.2%	4	0.4%
100.302	punctate cataract, posterior cortex	5	0.2%	1	0.1%
100.303	punctate cataract, equatorial cortex	7	0.3%	3	0.3%
100.305	punctate cataract, posterior sutures	0		2	0.2%
100.306	punctate cataract, nucleus	3	0.1%	0	
100.307	punctate cataract, capsular	1	0.0%	1	0.1%
100.311	incipient cataract, anterior cortex	17	0.6%	7	0.7%
100.312	incipient cataract, posterior cortex	11	0.4%	1	0.1%
100.313	incipient cataract, equatorial cortex	12	0.4%	1	0.1%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	0	
100.316	incipient cataract, nucleus	5	0.2%	1	0.1%
100.317	incipient cataract, capsular	2	0.1%	2	0.2%
100.321	incomplete cataract, anterior cortex	3	0.1%	2	0.2%
100.322	incomplete cataract, posterior cortex	2	0.1%	2	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.327	incomplete cataract, capsular	1	0.0%	0	
100.328	y-suture tip opacities	0		1	0.1%
100.330	generalized/complete cataract	6	0.2%	0	
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*88*	*3.2%*	*28*	*2.6%*
100.375	*subluxation/luxation, unspecified*	*4*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		4	0.4%
110.135	PHPV/PTVL	2	0.1%	0	
110.200	vitreous degeneration-anterior chamber	2	0.1%	1	0.1%
110.320	vitreal degeneration	28	1.0%	2	0.2%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	12	0.4%	7	0.7%
120.180	retinal dysplasia, geographic	0		4	0.4%
120.310	generalized progressive retinal atrophy (PRA)	5	0.2%	3	0.3%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	4	0.4%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	1	0.1%
OTHER					
900.000	other, unspecified	43	1.6%	0	
900.100	other, not inherited	88	3.2%	3	0.3%
900.110	other. suspect not inherited/significance unknown	112	4.1%	33	3.1%
NORMAL					
0.000	normal globe	2,282	82.5%	881	82.6%

DANDIE DINMONT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	2, 3	NO
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Dandie Dinmont terrier a 9.5 Mb susceptibility locus has been identified on canine chromosome 8. The definitive mutation has not been determined. A genetic test is not yet available.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

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1. ACVO Genetics Committee and/or Data from /OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
DANDIE DINMONT TERRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 259 #	 %	2016-2020 29 #	 %
GLOBE					
0.110	microphthalmia	1	0.4%	0	
10.000	glaucoma	1	0.4%	0	
EYELIDS					
25.110	distichiasis	20	7.7%	1	3.4%
CORNEA					
70.700	corneal dystrophy	6	2.3%	1	3.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	26	10.0%	3	10.3%
93.720	persistent pupillary membranes, iris to lens	1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.8%	3	10.3%
93.999	uveal cysts	2	0.8%	0	
LENS					
100.200	cataract, unspecified	4	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown	28	10.8%	1	3.4%
100.301	punctate cataract, anterior cortex	2	0.8%	1	3.4%
100.302	punctate cataract, posterior cortex	3	1.2%	0	
100.305	punctate cataract, posterior sutures	1	0.4%	0	
100.307	punctate cataract, capsular	3	1.2%	0	
100.311	incipient cataract, anterior cortex	2	0.8%	3	10.3%
100.312	incipient cataract, posterior cortex	1	0.4%	0	
100.330	generalized/complete cataract	5	1.9%	0	
100.345	*significant cataracts (summary)*	*21*	*8.1%*	*4*	*13.8%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.4%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	1.2%	0	
OTHER					
900.000	other, unspecified	6	2.3%	0	
900.100	other, not inherited	7	2.7%	0	
900.110	other. suspect not inherited/significance unknown	5	1.9%	2	6.9%
NORMAL					
0.000	normal globe	176	68.0%	18	62.1%

DOBERMAN PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1-5	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1-5	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Persistent hyperplastic primary vitreous/ Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Presumed dominant/ incomplete penetrance	1, 6-14	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option
G.	Ligneous conjunctivitis	Not defined	15	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia). Note that this syndrome is distinct from "E," PHPV/PHTVL, which may also be associated with microphthalmia.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

Cataracts have been infrequently observed in the Doberman Pinscher and there is no specific location attributed to cataracts within the Doberman lens. Most cataracts are bilateral, usually observed within the first two years of life, and may cause significant vision loss.

E. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The condition in the Doberman includes a spectrum of malformations ranging from spots of pigment on the posterior surface of the lens to posterior lenticonus, cataract and a dense fibrous plaque on the posterior surface of the lens. In the more severe forms, partial or complete vision impairment occurs. PHPV has been extensively studied in the Doberman in Europe. This disorder has been observed occasionally in the Doberman in the United States.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire Terrier.

References

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OCULAR DISORDERS REPORT
DOBERMAN PINSCHER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 5,267 #	%	2016-2020 1,222 #	%
GLOBE						
0.110	microphthalmia		7	0.1%	0	
10.000	glaucoma		0		1	0.1%
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
21.000	entropion, unspecified		6	0.1%	1	0.1%
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		87	1.7%	19	1.6%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.0%	1	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		7	0.1%	2	0.2%
52.110	prolapsed gland of the third eyelid		7	0.1%	0	
CORNEA						
70.700	corneal dystrophy		10	0.2%	1	0.1%
70.730	corneal endothelial degeneration		4	0.1%	0	
UVEA						
93.110	iris hypoplasia		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		2	0.0%	0	
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		116	2.2%	19	1.6%
93.720	persistent pupillary membranes, iris to lens		33	0.6%	2	0.2%
93.730	persistent pupillary membranes, iris to cornea		8	0.2%	2	0.2%
93.740	persistent pupillary membranes, iris sheets		4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		79	1.5%	137	11.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	4	0.3%
93.810	uveal melanoma		3	0.1%	1	0.1%
93.999	uveal cysts		7	0.1%	7	0.6%
97.150	chorioretinal coloboma, congenital		0		1	0.1%
LENS						
100.200	cataract, unspecified		32	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		288	5.5%	56	4.6%
100.301	punctate cataract, anterior cortex		15	0.3%	1	0.1%
100.302	punctate cataract, posterior cortex		4	0.1%	3	0.2%
100.303	punctate cataract, equatorial cortex		1	0.0%	0	
100.304	punctate cataract, anterior sutures		4	0.1%	0	
100.305	punctate cataract, posterior sutures		10	0.2%	1	0.1%
100.306	punctate cataract, nucleus		6	0.1%	4	0.3%
100.307	punctate cataract, capsular		16	0.3%	3	0.2%
100.311	incipient cataract, anterior cortex		9	0.2%	3	0.2%
100.312	incipient cataract, posterior cortex		18	0.3%	2	0.2%
100.313	incipient cataract, equatorial cortex		7	0.1%	3	0.2%
100.315	incipient cataract, posterior sutures		8	0.2%	0	
100.316	incipient cataract, nucleus		16	0.3%	4	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.317	incipient cataract, capsular	10	0.2%	4	0.3%
100.321	incomplete cataract, anterior cortex	0		2	0.2%
100.322	incomplete cataract, posterior cortex	0		3	0.2%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.326	incomplete cataract, nucleus	0		2	0.2%
100.328	y-suture tip opacities	1	0.0%	1	0.1%
100.330	generalized/complete cataract	14	0.3%	1	0.1%
100.345	*significant cataracts (summary)*	*171*	*3.2%*	*38*	*3.1%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.0%*	*3*	*0.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	19	0.4%	8	0.7%
110.135	PHPV/PTVL	43	0.8%	9	0.7%
110.200	vitreous degeneration-anterior chamber	0		1	0.1%
110.320	vitreal degeneration	10	0.2%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	97	1.8%	5	0.4%
120.180	retinal dysplasia, geographic	12	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	12	0.2%	3	0.2%
120.910	retinal detachment without dialysis	2	0.0%	0	
120.920	retinal detachment with dialysis	0		2	0.2%
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	3	0.1%	0	
OTHER					
900.000	other, unspecified	57	1.1%	0	
900.100	other, not inherited	167	3.2%	7	0.6%
900.110	other. suspect not inherited/significance unknown	86	1.6%	90	7.4%
NORMAL					
0.000	normal globe	4,428	84.1%	878	71.8%
SCLERA					
80.810	limbal melanoma	0		1	0.1%

DOGUE DE BORDEAUX

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Entropion	Not defined	1	Breeder option	
C.	Ectropion	Not defined	1	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
E.	Cataract	Not defined	1	NO	
F.	Multifocal retinopathy - *cmr1*	Autosomal recessive	2	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
DOGUE DE BORDEAUX

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**302**		**100**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.160	macropalpebral fissure	9	3.0%	0	
21.000	entropion, unspecified	16	5.3%	21	21.0%
22.000	ectropion, unspecified	33	10.9%	13	13.0%
25.110	distichiasis	30	9.9%	7	7.0%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.3%	0	
CORNEA					
70.700	corneal dystrophy	6	2.0%	6	6.0%
70.730	corneal endothelial degeneration	1	0.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	13	4.3%	4	4.0%
93.720	persistent pupillary membranes, iris to lens	1	0.3%	1	1.0%
93.730	persistent pupillary membranes, iris to cornea	4	1.3%	1	1.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	1.7%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.3%	1	1.0%
93.999	uveal cysts	3	1.0%	3	3.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	9	3.0%	0	
100.301	punctate cataract, anterior cortex	1	0.3%	1	1.0%
100.302	punctate cataract, posterior cortex	0		1	1.0%
100.306	punctate cataract, nucleus	3	1.0%	0	
100.311	incipient cataract, anterior cortex	1	0.3%	0	
100.313	incipient cataract, equatorial cortex	0		2	2.0%
100.316	incipient cataract, nucleus	1	0.3%	1	1.0%
100.321	incomplete cataract, anterior cortex	0		1	1.0%
100.345	*significant cataracts (summary)*	*6*	*2.0%*	*6*	*6.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	6	2.0%	1	1.0%
120.960	retinopathy	1	0.3%	0	
OTHER					
900.000	other, unspecified	6	2.0%	0	
900.100	other, not inherited	10	3.3%	0	
900.110	other. suspect not inherited/significance unknown	4	1.3%	6	6.0%
NORMAL					
0.000	normal globe	206	68.2%	54	54.0%

DUTCH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Dutch Shepherd breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
DUTCH SHEPHERD

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 48 #	 %	2016-2020 76 #	 %
EYELIDS					
25.110	distichiasis	3	6.2%	0	
CORNEA					
70.210	corneal pannus	0		1	1.3%
70.700	corneal dystrophy	1	2.1%	2	2.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		3	3.9%
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	4.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	7	14.6%	9	11.8%
100.301	punctate cataract, anterior cortex	1	2.1%	1	1.3%
100.302	punctate cataract, posterior cortex	0		1	1.3%
100.303	punctate cataract, equatorial cortex	0		2	2.6%
100.304	punctate cataract, anterior sutures	1	2.1%	0	
100.306	punctate cataract, nucleus	0		2	2.6%
100.307	punctate cataract, capsular	1	2.1%	1	1.3%
100.311	incipient cataract, anterior cortex	1	2.1%	0	
100.312	incipient cataract, posterior cortex	1	2.1%	0	
100.313	incipient cataract, equatorial cortex	1	2.1%	1	1.3%
100.345	*significant cataracts (summary)*	*6*	*12.5%*	*8*	*10.5%*
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	1	2.1%	0	
OTHER					
900.000	other, unspecified	3	6.2%	0	
900.100	other, not inherited	0		1	1.3%
900.110	other. suspect not inherited/significance unknown	3	6.2%	3	3.9%
NORMAL					
0.000	normal globe	37	77.1%	56	73.7%

ENGLISH COCKER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1	NO	
B.	Glaucoma	Not defined	1, 3-4	NO	
C.	Distichiasis	Not defined	1, 4, 5	Breeder option	
D.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 6	Breeder option	
	- iris to cornea	Not defined	1, 6	NO	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
E.	Cataract	Not defined	1, 6-9	NO	
F.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 10-13	NO	Mutation in the *prcd* gene
G.	Central progressive retinal atrophy	Not defined	14-16	NO	
H.	Retinal dysplasia - folds	Presumed autosomal recessive	1	Breeder option	

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

Glaucoma in the English Cocker Spaniel is recognized in England. The frequency and significance of this disease in the breed in the United States is not known, but is probably low.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the English Cocker Spaniel, this is a particularly serious problem as the majority of PPMs identified on routine screening examination bridge from the iris to the cornea and are associated with corneal opacities which may result in vision impairment.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Congenital cataracts have been reported in Red Cocker Spaniels, presumably English Cocker Spaniels, in Denmark. The cataracts affected the anterior capsule; in some cases the cortex and/or nucleus were opaque. Associated findings in some dogs were persistent pupillary membrane (PPM) and/or microphthalmia. It is likely that these cataracts are part of a syndrome characterized by multiple congenital ocular anomalies. The condition is familial, but a specific mode of inheritance has not been defined.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the English Cocker Spaniel is *prcd*

which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However, in the English Cocker Spaniel, the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

G. Central progressive retinal atrophy (CPRA)

A progressive retinal degeneration in which photoreceptor degeneration occurs secondary to disease of the underlying pigment epithelium. Progression is slow and some animals may never lose vision. CPRA is a frequent occurrence in England, but is uncommon elsewhere.

CPRA is characterized by the appearance of brown spots and patches primarily in the tapetal fundus and retinal degeneration. These areas are created by an accumulation of autofluorescent lipopigment within the retinal pigment epithelium cells. These changes are consistent with retinal changes observed in Vitamin E deficiency. Neurologic signs including ataxia and proprioceptive deficits have also been identified in affected dogs.

In the English Cocker Spaniel, retinal lesions of CPRA have been related to an underlying abnormal metabolism of Vitamin E resulting in a systemic deficiency.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
ENGLISH COCKER SPANIEL

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**10,945**		**1,065**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	14	0.1%	1	0.1%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	6	0.1%	0	
20.160	macropalpebral fissure	3	0.0%	0	
21.000	entropion, unspecified	46	0.4%	5	0.5%
22.000	ectropion, unspecified	97	0.9%	1	0.1%
25.110	distichiasis	1,966	18.0%	157	14.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	18	0.2%	8	0.8%
40.910	keratoconjunctivitis sicca	12	0.1%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	6	0.1%	0	
CORNEA					
70.210	corneal pannus	10	0.1%	1	0.1%
70.220	pigmentary keratitis	11	0.1%	0	
70.700	corneal dystrophy	95	0.9%	10	0.9%
70.730	corneal endothelial degeneration	37	0.3%	0	
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.140	corneal endothelial pigment without PPM	6	0.1%	0	
93.150	iris coloboma	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	135	1.2%	25	2.3%
93.720	persistent pupillary membranes, iris to lens	41	0.4%	3	0.3%
93.730	persistent pupillary membranes, iris to cornea	184	1.7%	7	0.7%
93.740	persistent pupillary membranes, iris sheets	10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	36	0.3%	37	3.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	17	0.2%	10	0.9%
93.999	uveal cysts	5	0.0%	0	
LENS					
100.200	cataract, unspecified	172	1.6%	0	
100.210	cataract. suspect not inherited/significance unknown	674	6.2%	58	5.4%
100.301	punctate cataract, anterior cortex	97	0.9%	8	0.8%
100.302	punctate cataract, posterior cortex	50	0.5%	2	0.2%
100.303	punctate cataract, equatorial cortex	19	0.2%	1	0.1%
100.304	punctate cataract, anterior sutures	11	0.1%	2	0.2%
100.305	punctate cataract, posterior sutures	31	0.3%	2	0.2%
100.306	punctate cataract, nucleus	23	0.2%	3	0.3%
100.307	punctate cataract, capsular	8	0.1%	5	0.5%
100.311	incipient cataract, anterior cortex	130	1.2%	4	0.4%
100.312	incipient cataract, posterior cortex	133	1.2%	3	0.3%
100.313	incipient cataract, equatorial cortex	85	0.8%	2	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.314	incipient cataract, anterior sutures	8	0.1%	0	
100.315	incipient cataract, posterior sutures	26	0.2%	1	0.1%
100.316	incipient cataract, nucleus	60	0.5%	2	0.2%
100.317	incipient cataract, capsular	16	0.1%	3	0.3%
100.321	incomplete cataract, anterior cortex	0		5	0.5%
100.322	incomplete cataract, posterior cortex	1	0.0%	6	0.6%
100.323	incomplete cataract, equatorial cortex	0		5	0.5%
100.326	incomplete cataract, nucleus	1	0.0%	2	0.2%
100.327	incomplete cataract, capsular	1	0.0%	0	
100.328	y-suture tip opacities	1	0.0%	3	0.3%
100.330	generalized/complete cataract	100	0.9%	1	0.1%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*973*	*8.9%*	*61*	*5.7%*
100.375	*subluxation/luxation, unspecified*	*9*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	3	0.3%
110.135	PHPV/PTVL	4	0.0%	1	0.1%
110.320	vitreal degeneration	25	0.2%	4	0.4%
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.1%
RETINA					
120.170	retinal dysplasia, folds	161	1.5%	21	2.0%
120.180	retinal dysplasia, geographic	14	0.1%	2	0.2%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	423	3.9%	1	0.1%
120.400	retinal hemorrhage	3	0.0%	0	
120.960	retinopathy	2	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	2	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	1	0.1%
130.150	optic disc coloboma	15	0.1%	0	
OTHER					
900.000	other, unspecified	47	0.4%	0	
900.100	other, not inherited	242	2.2%	4	0.4%
900.110	other. suspect not inherited/significance unknown	160	1.5%	54	5.1%
NORMAL					
0.000	normal globe	7,413	67.7%	703	66.0%

ENGLISH SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 2	NO	
E.	Retinal atrophy - rod-cone dysplasia recessive type 1 (*rcd4*)	Autosomal recessive	3	NO	Mutation in the *C2orf71* gene
F.	Retinal dysplasia-folds	Not defined	1, 4	Breeder option	
G.	Ceroid lipofuscinosis	Autosomal recessive	5-9	NO	Mutation in the *CLN8* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy – generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

E. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Ceroid lipofuscinosis

An inherited disease of humans and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's Disease.) A DNA test is available.

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OCULAR DISORDERS REPORT
ENGLISH SETTER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 1,721 #	 %	2016-2020 103 #	 %
EYELIDS					
21.000	entropion, unspecified	8	0.5%	3	2.9%
22.000	ectropion, unspecified	3	0.2%	0	
25.110	distichiasis	70	4.1%	1	1.0%
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.1%	0	
CORNEA					
70.700	corneal dystrophy	13	0.8%	1	1.0%
70.730	corneal endothelial degeneration	3	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	63	3.7%	5	4.9%
93.720	persistent pupillary membranes, iris to lens	5	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	7	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	1.9%
93.810	uveal melanoma	0		1	1.0%
93.999	uveal cysts	1	0.1%	0	
LENS					
100.200	cataract, unspecified	5	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	63	3.7%	5	4.9%
100.301	punctate cataract, anterior cortex	5	0.3%	1	1.0%
100.302	punctate cataract, posterior cortex	10	0.6%	2	1.9%
100.305	punctate cataract, posterior sutures	3	0.2%	0	
100.306	punctate cataract, nucleus	2	0.1%	0	
100.307	punctate cataract, capsular	2	0.1%	0	
100.311	incipient cataract, anterior cortex	5	0.3%	0	
100.312	incipient cataract, posterior cortex	8	0.5%	1	1.0%
100.313	incipient cataract, equatorial cortex	1	0.1%	0	
100.315	incipient cataract, posterior sutures	2	0.1%	0	
100.316	incipient cataract, nucleus	2	0.1%	0	
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	1.0%
100.322	incomplete cataract, posterior cortex	0		2	1.9%
100.326	incomplete cataract, nucleus	0		1	1.0%
100.328	y-suture tip opacities	3	0.2%	0	
100.330	generalized/complete cataract	3	0.2%	1	1.0%
100.345	*significant cataracts (summary)*	*53*	*3.1%*	*9*	*8.7%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	7	0.4%	0	
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	4	0.2%	1	1.0%
RETINA					
120.170	retinal dysplasia, folds	35	2.0%	3	2.9%
120.180	retinal dysplasia, geographic	15	0.9%	0	
120.190	retinal dysplasia, detached	1	0.1%	0	

RETINA CONTINUED	1991-2015		2016-2020	
120.310 generalized progressive retinal atrophy (PRA)	22	1.3%	0	
OPTIC NERVE				
130.110 micropapilla	1	0.1%	0	
130.120 optic nerve hypoplasia	1	0.1%	0	
OTHER				
900.000 other, unspecified	6	0.3%	0	
900.100 other, not inherited	53	3.1%	0	
900.110 other. suspect not inherited/significance unknown	5	0.3%	2	1.9%
NORMAL				
0.000 normal globe	1,451	84.3%	75	72.8%

ENGLISH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	2	NO	Mutation in the *prcd* gene
B.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	1, 3-4	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the English Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

B. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a

recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

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OCULAR DISORDERS REPORT
ENGLISH SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 120 #	 %	2016-2020 33 #	 %
GLOBE						
0.110	microphthalmia		2	1.7%	0	
EYELIDS						
21.000	entropion, unspecified		5	4.2%	0	
25.110	distichiasis		0		3	9.1%
CORNEA						
70.210	corneal pannus		1	0.8%	0	
70.700	corneal dystrophy		1	0.8%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	4.2%	2	6.1%
93.720	persistent pupillary membranes, iris to lens		1	0.8%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		3	2.5%	1	3.0%
100.301	punctate cataract, anterior cortex		2	1.7%	0	
100.306	punctate cataract, nucleus		0		1	3.0%
100.315	incipient cataract, posterior sutures		1	0.8%	0	
100.317	incipient cataract, capsular		1	0.8%	0	
100.321	incomplete cataract, anterior cortex		2	1.7%	0	
100.322	incomplete cataract, posterior cortex		3	2.5%	0	
100.330	generalized/complete cataract		4	3.3%	0	
100.345	*significant cataracts (summary)*		*13*	*10.8%*	*1*	*3.0%*
RETINA						
120.170	retinal dysplasia, folds		2	1.7%	0	
OTHER						
900.100	other, not inherited		4	3.3%	0	
900.110	other. suspect not inherited/significance unknown		4	3.3%	6	18.2%
NORMAL						
0.000	normal globe		97	80.8%	21	63.6%

ENGLISH SPRINGER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 1	 Breeder option Passes with no notation	
E.	Cataract	Not defined	1	NO	
F.	Persistent hyaloid artery	Not defined	1	Breeder option	
G.	Retinal atrophy - generalized	Not defined	3	NO	
H.	Retinal atrophy - *cord-1*	Autosomal recessive	4	NO	Mutation in the *RPGRIP1* gene
I.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 5-7, 10-11	NO	
J.	Retinal dysplasia - geographic	Not defined	1, 11	NO	
K.	Refractive error	Not defined	8, 9	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the English Springer Spaniel this usually involves the lower lateral lid margin.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted

E. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

Cataract in the English Springer Spaniel is reported to be a familial trait usually involving the posterior subcapsular region of the lens that progresses slowly.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

I. Retinal atrophy - *cord-1*

Cord-1 PRA in the English Springer Spaniel has an onset of clinical signs at 2 to 9 years of age leading to blindness in most affected dogs. *Cord1* PRA in the English Springer Spaniel has been described as beginning with increased granularity of the fundus or tiny hyporeflective brown or grey patches in the far peripheral tapetum. Over time, these abnormalities become more diffuse with mottling over much of the tapetum. Vessel attenuation accompanies the more diffuse changes. In advanced cases, there is generalized tapetal hyperreflectivity and vessel attenuation. Pedigree analysis has shown cord-1 in the English Springer Spaniel to be an autosomal recessive trait. A mutation in the *RPGRIP1* gene in cone-rod dystrophy (*cord1*) was found through genetic testing to be associated with one form of PRA in English Springer Spaniels, but not all clinically affected dogs have the *RPGRIP1* mutation, implying that other mutations have yet to be identified. A DNA test is available. The test is accurate only for this mutation and will not identify other forms of PRA. Not all dogs homozygous for the *RPGRIP1* genotype demonstrate the phenotype clinically.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

The relationship between folds and geographic/detached lesions has been a topic of dispute for many years. It is the consensus of the English Springer Spaniel Field Trial Association Heritable Defects Committee (the parent breed club in the United States) that none of the forms of retinal dysplasia are desirable in a breeding animal.

K. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

L. Refractive Myopia

A condition of the eye where the light that comes in does not directly focus on the retina but in front of it. In common terminology, "near-sighted." This condition has been shown to have a genetic component in English Springer Spaniels, although the exact mode of inheritance has not been determined.

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OCULAR DISORDERS REPORT
ENGLISH SPRINGER SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 46,296 #	%	2016-2020 7,409 #	%
GLOBE						
0.110	microphthalmia		26	0.1%	3	0.0%
10.000	glaucoma		5	0.0%	2	0.0%
EYELIDS						
20.110	eyelid dermoid		2	0.0%	0	
20.160	macropalpebral fissure		3	0.0%	0	
21.000	entropion, unspecified		278	0.6%	48	0.6%
22.000	ectropion, unspecified		56	0.1%	7	0.1%
25.110	distichiasis		371	0.8%	49	0.7%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		3	0.0%	8	0.1%
40.910	keratoconjunctivitis sicca		11	0.0%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		0		1	0.0%
52.110	prolapsed gland of the third eyelid		8	0.0%	0	
CORNEA						
70.210	corneal pannus		6	0.0%	1	0.0%
70.220	pigmentary keratitis		4	0.0%	0	
70.700	corneal dystrophy		564	1.2%	110	1.5%
70.730	corneal endothelial degeneration		12	0.0%	1	0.0%
UVEA						
93.110	iris hypoplasia		11	0.0%	3	0.0%
93.140	corneal endothelial pigment without PPM		4	0.0%	0	
93.150	iris coloboma		28	0.1%	3	0.0%
93.180	liris sphincter dysplasia		0		1	0.0%
93.710	persistent pupillary membranes, iris to iris		3,465	7.5%	615	8.3%
93.720	persistent pupillary membranes, iris to lens		113	0.2%	11	0.1%
93.730	persistent pupillary membranes, iris to cornea		90	0.2%	2	0.0%
93.740	persistent pupillary membranes, iris sheets		48	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		68	0.1%	59	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		16	0.0%	1	0.0%
93.810	uveal melanoma		2	0.0%	0	
93.999	uveal cysts		17	0.0%	7	0.1%
97.150	chorioretinal coloboma, congenital		0		1	0.0%
LENS						
100.200	cataract, unspecified		97	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		1,164	2.5%	181	2.4%
100.301	punctate cataract, anterior cortex		145	0.3%	25	0.3%
100.302	punctate cataract, posterior cortex		96	0.2%	15	0.2%
100.303	punctate cataract, equatorial cortex		46	0.1%	6	0.1%
100.304	punctate cataract, anterior sutures		20	0.0%	2	0.0%
100.305	punctate cataract, posterior sutures		82	0.2%	11	0.1%
100.306	punctate cataract, nucleus		33	0.1%	4	0.1%
100.307	punctate cataract, capsular		34	0.1%	15	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.311	incipient cataract, anterior cortex	185	0.4%	26	0.4%
100.312	incipient cataract, posterior cortex	186	0.4%	39	0.5%
100.313	incipient cataract, equatorial cortex	93	0.2%	9	0.1%
100.314	incipient cataract, anterior sutures	23	0.0%	2	0.0%
100.315	incipient cataract, posterior sutures	41	0.1%	4	0.1%
100.316	incipient cataract, nucleus	60	0.1%	14	0.2%
100.317	incipient cataract, capsular	28	0.1%	10	0.1%
100.321	incomplete cataract, anterior cortex	4	0.0%	4	0.1%
100.322	incomplete cataract, posterior cortex	1	0.0%	11	0.1%
100.323	incomplete cataract, equatorial cortex	0		1	0.0%
100.326	incomplete cataract, nucleus	0		4	0.1%
100.327	incomplete cataract, capsular	2	0.0%	3	0.0%
100.328	y-suture tip opacities	8	0.0%	15	0.2%
100.330	generalized/complete cataract	86	0.2%	5	0.1%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.345	*significant cataracts (summary)*	*1,270*	*2.7%*	*226*	*3.1%*
100.375	*subluxation/luxation, unspecified*	*27*	*0.1%*	*3*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	230	0.5%	54	0.7%
110.135	PHPV/PTVL	38	0.1%	4	0.1%
110.200	vitreous degeneration-anterior chamber	3	0.0%	0	
110.320	vitreal degeneration	193	0.4%	41	0.6%
FUNDUS					
97.110	choroidal hypoplasia	4	0.0%	0	
97.120	coloboma	5	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	1,872	4.0%	166	2.2%
120.180	retinal dysplasia, geographic	714	1.5%	44	0.6%
120.190	retinal dysplasia, detached	125	0.3%	4	0.1%
120.310	generalized progressive retinal atrophy (PRA)	479	1.0%	27	0.4%
120.400	retinal hemorrhage	8	0.0%	0	
120.910	retinal detachment without dialysis	57	0.1%	0	
120.920	retinal detachment with dialysis	2	0.0%	1	0.0%
120.960	retinopathy	17	0.0%	8	0.1%
OPTIC NERVE					
130.110	micropapilla	9	0.0%	5	0.1%
130.120	optic nerve hypoplasia	7	0.0%	2	0.0%
130.150	optic disc coloboma	13	0.0%	0	
OTHER					
900.000	other, unspecified	336	0.7%	0	
900.100	other, not inherited	722	1.6%	11	0.1%
900.110	other. suspect not inherited/significance unknown	394	0.9%	207	2.8%
NORMAL					
0.000	normal globe	38,123	82.3%	5,797	78.2%

ENGLISH TOY SPANIEL

(King Charles, Prince Charles, Ruby, Blenheim)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Exposure keratopathy syndrome	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Persistent hyperplastic primary vitreous /Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Presumed dominant/ incomplete penetrance	1	NO
G.	Persistent hyaloid artery	Not defined	1	Breeder option
H.	Retinal dysplasia - folds	Presumed autosomal recessive	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures, which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded;

breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Exposure keratopathy syndrome

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Onset of cataract in the English Toy Spaniel is at an early age (less than 6 months), affecting the cortex and nucleus with rapid progression to complete cataract, resulting in blindness.

F. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

G. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA**)** or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal

dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the English Toy Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
ENGLISH TOY SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,061 #	%	2016-2020 381 #	%
GLOBE						
0.110	microphthalmia		4	0.4%	3	0.8%
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
20.160	macropalpebral fissure		10	0.9%	0	
21.000	entropion, unspecified		56	5.3%	6	1.6%
22.000	ectropion, unspecified		3	0.3%	0	
25.110	distichiasis		124	11.7%	27	7.1%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		2	0.2%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		0		1	0.3%
52.110	prolapsed gland of the third eyelid		2	0.2%	0	
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		20	1.9%	4	1.0%
70.700	corneal dystrophy		134	12.6%	68	17.8%
70.730	corneal endothelial degeneration		4	0.4%	1	0.3%
UVEA						
93.710	persistent pupillary membranes, iris to iris		12	1.1%	4	1.0%
93.720	persistent pupillary membranes, iris to lens		2	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		4	0.4%	3	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.999	uveal cysts		1	0.1%	1	0.3%
97.150	chorioretinal coloboma, congenital		0		1	0.3%
LENS						
100.200	cataract, unspecified		10	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown		62	5.8%	14	3.7%
100.301	punctate cataract, anterior cortex		7	0.7%	3	0.8%
100.302	punctate cataract, posterior cortex		16	1.5%	1	0.3%
100.303	punctate cataract, equatorial cortex		2	0.2%	0	
100.305	punctate cataract, posterior sutures		6	0.6%	0	
100.306	punctate cataract, nucleus		3	0.3%	0	
100.307	punctate cataract, capsular		13	1.2%	9	2.4%
100.311	incipient cataract, anterior cortex		21	2.0%	7	1.8%
100.312	incipient cataract, posterior cortex		21	2.0%	5	1.3%
100.313	incipient cataract, equatorial cortex		2	0.2%	3	0.8%
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		13	1.2%	0	
100.317	incipient cataract, capsular		13	1.2%	1	0.3%
100.321	incomplete cataract, anterior cortex		3	0.3%	5	1.3%
100.322	incomplete cataract, posterior cortex		3	0.3%	6	1.6%
100.323	incomplete cataract, equatorial cortex		1	0.1%	2	0.5%

LENS CONTINUED		1991-2015		2016-2020	
100.326	incomplete cataract, nucleus	0		6	1.6%
100.327	incomplete cataract, capsular	1	0.1%	1	0.3%
100.328	y-suture tip opacities	3	0.3%	0	
100.330	generalized/complete cataract	20	1.9%	1	0.3%
100.340	resorbing/hypermature cataract	3	0.3%	0	
100.345	*significant cataracts (summary)*	*162*	*15.3%*	*50*	*13.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	74	7.0%	50	13.1%
110.135	PHPV/PTVL	14	1.3%	5	1.3%
110.320	vitreal degeneration	21	2.0%	0	
RETINA					
120.170	retinal dysplasia, folds	57	5.4%	17	4.5%
120.180	retinal dysplasia, geographic	7	0.7%	4	1.0%
120.190	retinal dysplasia, detached	1	0.1%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	6	0.6%	1	0.3%
120.920	retinal detachment with dialysis	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	55	5.2%	0	
900.100	other, not inherited	38	3.6%	1	0.3%
900.110	other. suspect not inherited/significance unknown	48	4.5%	22	5.8%
NORMAL					
0.000	normal globe	543	51.2%	170	44.6%

ENTLEBUCHER MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	2	NO	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
C.	Cataract	Presumed autosomal recessive	2, 3	NO	
D.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 2, 4	NO	Mutation in the *prcd* gene
E.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Cataracts in the Entlebucher Mountain Dog generally become evident in young to middle-aged dogs (5.5 +/- 2.6 years). The opacities typically begin in the posterior subcapsular/capsular polar region along the suture lines as early as 1-2 years of age. Most dogs are affected with bilaterally symmetrical cataracts, which may or may not progress. Pedigree analysis suggests an autosomal recessive mode of inheritance.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

E. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Entlebucher Mountain Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Spiess BM. [Inherited eye diseases in the Entlebucher Mountain Dog]. *Schweizer Archiv fur Tierheilkunde*. 1994;136:105-110. Vererbte Augenkrankheiten beim Entlebucher Sennenhund.

3. Heitmann M, Hamann H, Brahm R, et al. Analysis of prevalence of presumed inherited eye diseases in Entlebucher Mountain Dogs. *Vet Ophthalmol*. 2005;8:145-151.

4. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
ENTLEBUCHER MOUNTAIN DOG

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**980**		**305**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	1	0.1%	0	
25.110	distichiasis	11	1.1%	1	0.3%
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.3%	0	
CORNEA					
70.700	corneal dystrophy	5	0.5%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	48	4.9%	11	3.6%
93.720	persistent pupillary membranes, iris to lens	4	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.7%	10	3.3%
93.999	uveal cysts	2	0.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	61	6.2%	24	7.9%
100.301	punctate cataract, anterior cortex	3	0.3%	2	0.7%
100.302	punctate cataract, posterior cortex	32	3.3%	9	3.0%
100.303	punctate cataract, equatorial cortex	5	0.5%	3	1.0%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	3	0.3%	1	0.3%
100.306	punctate cataract, nucleus	2	0.2%	0	
100.307	punctate cataract, capsular	7	0.7%	3	1.0%
100.311	incipient cataract, anterior cortex	13	1.3%	1	0.3%
100.312	incipient cataract, posterior cortex	69	7.0%	19	6.2%
100.313	incipient cataract, equatorial cortex	9	0.9%	2	0.7%
100.315	incipient cataract, posterior sutures	4	0.4%	1	0.3%
100.316	incipient cataract, nucleus	4	0.4%	0	
100.317	incipient cataract, capsular	10	1.0%	1	0.3%
100.322	incomplete cataract, posterior cortex	2	0.2%	2	0.7%
100.330	generalized/complete cataract	9	0.9%	0	
100.345	*significant cataracts (summary)*	*173*	*17.7%*	*44*	*14.4%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.200	vitreous degeneration-anterior chamber	0		2	0.7%
110.320	vitreal degeneration	5	0.5%	9	3.0%
RETINA					
120.170	retinal dysplasia, folds	26	2.7%	5	1.6%
120.180	retinal dysplasia, geographic	7	0.7%	1	0.3%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	30	3.1%	0	
120.960	retinopathy	2	0.2%	0	

		1991-2015		2016-2020	
OPTIC NERVE					
130.110	micropapilla	2	0.2%	1	0.3%
130.120	optic nerve hypoplasia	1	0.1%	0	
OTHER					
900.000	other, unspecified	20	2.0%	0	
900.100	other, not inherited	39	4.0%	3	1.0%
900.110	other. suspect not inherited/significance unknown	23	2.3%	25	8.2%
NORMAL					
0.000	normal globe	725	74.0%	209	68.5%

OCULAR DISORDERS REPORT
EPAGNEUL BRETON

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the EPAGNEUL BRETON breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
EPAGNEUL BRETON

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 3 #	%	2016-2020 29 #	%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	33.3%	1	3.4%
LENS						
100.311	incipient cataract, anterior cortex		0		1	3.4%
100.313	incipient cataract, equatorial cortex		0		1	3.4%
100.328	y-suture tip opacities		0		1	3.4%
100.345	*significant cataracts (summary)*		*0*		*3*	*10.3%*
VITREOUS						
110.320	vitreal degeneration		0		1	3.4%
OTHER						
900.110	other. suspect not inherited/significance unknown		0		2	6.9%
NORMAL						
0.000	normal globe		2	66.7%	24	82.8%

EURASIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	2, 3	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Cataracts	Not defined	1	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Cataracts

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Strom AR, Hassig M, Iburg TM, et al. Epidemiology of canine glaucoma presented to University of Zurich from 1995 to 2009. Part 1: Congenital and primary glaucoma (4 and 123 cases). *Vet Ophthalmol*. 2011;14:121-126. Epub 2011/03/04.

3. Rosolen SG, Boillot T, Dulaurent T, et al. Morphological, biometrical and biochemical susceptibilities for glaucoma in a healthy Eurasier dog - ECVO 2014 abstract #44. *Vet Ophthalmol*. 2014;17:E23.

OCULAR DISORDERS REPORT
EURASIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 100 #	1991-2015 100 %	2016-2020 94 #	2016-2020 94 %
EYELIDS						
25.110	distichiasis		34	34.0%	19	20.2%
CORNEA						
70.700	corneal dystrophy		3	3.0%	3	3.2%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	1.0%	3	3.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	2.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	1.1%
LENS						
100.210	cataract. suspect not inherited/significance unknown		5	5.0%	6	6.4%
100.301	punctate cataract, anterior cortex		0		1	1.1%
100.302	punctate cataract, posterior cortex		2	2.0%	0	
100.305	punctate cataract, posterior sutures		0		2	2.1%
100.307	punctate cataract, capsular		1	1.0%	0	
100.312	incipient cataract, posterior cortex		0		3	3.2%
100.315	incipient cataract, posterior sutures		0		1	1.1%
100.328	y-suture tip opacities		0		1	1.1%
100.345	*significant cataracts (summary)*		*3*	*3.0%*	*8*	*8.5%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	1.0%	0	
110.320	vitreal degeneration		0		1	1.1%
OPTIC NERVE						
130.110	micropapilla		0		1	1.1%
OTHER						
900.000	other, unspecified		5	5.0%	0	
900.100	other, not inherited		5	5.0%	0	
900.110	other. suspect not inherited/significance unknown		4	4.0%	0	
NORMAL						
0.000	normal globe		63	63.0%	56	59.6%

FIELD SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Imperforate lacrimal punctum	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1 1	Breeder option Passes with no notation	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy (*prcd)*	Autosomal recessive	1	NO	Mutation in the *prcd* gene
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal

layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Field Spaniel is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
FIELD SPANIEL

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 2,411 #	%	2016-2020 738 #	%
GLOBE					
0.110	microphthalmia	0		2	0.3%
EYELIDS					
20.160	macropalpebral fissure	6	0.2%	0	
21.000	entropion, unspecified	10	0.4%	0	
22.000	ectropion, unspecified	11	0.5%	0	
25.110	distichiasis	156	6.5%	32	4.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	4	0.2%	13	1.8%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	28	1.2%	6	0.8%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	137	5.7%	68	9.2%
93.720	persistent pupillary membranes, iris to lens	6	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	7	0.3%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	16	0.7%	26	3.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.2%	3	0.4%
LENS					
100.200	cataract, unspecified	3	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	117	4.9%	33	4.5%
100.301	punctate cataract, anterior cortex	14	0.6%	7	0.9%
100.302	punctate cataract, posterior cortex	3	0.1%	0	
100.304	punctate cataract, anterior sutures	2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	1	0.0%	0	
100.306	punctate cataract, nucleus	2	0.1%	0	
100.307	punctate cataract, capsular	7	0.3%	1	0.1%
100.311	incipient cataract, anterior cortex	14	0.6%	3	0.4%
100.312	incipient cataract, posterior cortex	5	0.2%	3	0.4%
100.313	incipient cataract, equatorial cortex	1	0.0%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	5	0.2%	0	
100.316	incipient cataract, nucleus	7	0.3%	1	0.1%
100.317	incipient cataract, capsular	4	0.2%	1	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	0	
100.322	incomplete cataract, posterior cortex	1	0.0%	0	
100.328	y-suture tip opacities	3	0.1%	1	0.1%
100.330	generalized/complete cataract	2	0.1%	1	0.1%
100.345	*significant cataracts (summary)*	*77*	*3.2%*	*20*	*2.7%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	1	0.1%
110.135	PHPV/PTVL	4	0.2%	0	
110.200	vitreous degeneration-anterior chamber	0		4	0.5%
110.320	vitreal degeneration	2	0.1%	0	
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	250	10.4%	43	5.8%
120.180	retinal dysplasia, geographic	9	0.4%	4	0.5%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	2	0.3%
120.400	retinal hemorrhage	4	0.2%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	2	0.3%
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	0		2	0.3%
OTHER					
900.000	other, unspecified	47	1.9%	0	
900.100	other, not inherited	61	2.5%	0	
900.110	other. suspect not inherited/significance unknown	48	2.0%	37	5.0%
NORMAL					
0.000	normal globe	1,770	73.4%	515	69.8%

FINNISH LAPPHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Retinal atrophy (*prcd)*	Autosomal recessive	2	NO	Mutation in the *prcd* gene
D.	Multifocal retinopathy - *cmr3*	Autosomal recessive	3	NO	Mutation in the *BEST1* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the form of PRA in the Finnish Lapphund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in

dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

D. Multifocal retinopathy (*cmr3*)

Canine Multifocal Retinopathy type 3 (*cmr3*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Clinically the disease is similar to that seen in the Bullmastiff and Coton deTulear, but the mutation in the Bestrophin 1 gene (*BEST1* alias *VMD2*) is different. The multifocal retinopathy seen in the Lapponian Herder is caused by a deletion at position 1,388 and a substitution at position 1,466 and is therefore called *cmr3*. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

3. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci.* 2007 May;48:1959-1967.

OCULAR DISORDERS REPORT
FINNISH LAPPHUND

TOTAL DOGS EXAMINED		1991-2015 520		2016-2020 171	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	1	0.2%	1	0.6%
CORNEA					
70.220	pigmentary keratitis	1	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	51	9.8%	19	11.1%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	6	1.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.2%	5	2.9%
LENS					
100.210	cataract. suspect not inherited/significance unknown	37	7.1%	8	4.7%
100.301	punctate cataract, anterior cortex	1	0.2%	0	
100.302	punctate cataract, posterior cortex	7	1.3%	1	0.6%
100.303	punctate cataract, equatorial cortex	0		1	0.6%
100.305	punctate cataract, posterior sutures	2	0.4%	1	0.6%
100.306	punctate cataract, nucleus	2	0.4%	0	
100.307	punctate cataract, capsular	0		2	1.2%
100.311	incipient cataract, anterior cortex	1	0.2%	1	0.6%
100.312	incipient cataract, posterior cortex	1	0.2%	2	1.2%
100.313	incipient cataract, equatorial cortex	2	0.4%	1	0.6%
100.315	incipient cataract, posterior sutures	0		1	0.6%
100.316	incipient cataract, nucleus	0		1	0.6%
100.328	y-suture tip opacities	0		1	0.6%
100.330	generalized/complete cataract	1	0.2%	1	0.6%
100.345	*significant cataracts (summary)*	*17*	*3.3%*	*13*	*7.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.6%
RETINA					
120.170	retinal dysplasia, folds	10	1.9%	1	0.6%
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	0	
120.960	retinopathy	1	0.2%	0	
OTHER					
900.000	other, unspecified	10	1.9%	0	
900.100	other, not inherited	14	2.7%	0	
900.110	other. suspect not inherited/significance unknown	9	1.7%	2	1.2%
NORMAL					
0.000	normal globe	427	82.1%	124	72.5%

FINNISH SPITZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Finnish Spitz breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
FINNISH SPITZ

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 247 #	 %	2016-2020 15 #	 %
EYELIDS					
20.140	ectopic cilia	1	0.4%	0	
CORNEA					
70.700	corneal dystrophy	2	0.8%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	0.8%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.8%	8	53.3%
LENS					
100.200	cataract, unspecified	1	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	33	13.4%	1	6.7%
100.301	punctate cataract, anterior cortex	2	0.8%	0	
100.302	punctate cataract, posterior cortex	1	0.4%	0	
100.304	punctate cataract, anterior sutures	1	0.4%	0	
100.307	punctate cataract, capsular	2	0.8%	0	
100.311	incipient cataract, anterior cortex	1	0.4%	0	
100.312	incipient cataract, posterior cortex	1	0.4%	0	
100.345	*significant cataracts (summary)*	*9*	*3.6%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	1.6%	0	
110.320	vitreal degeneration	3	1.2%	1	6.7%
RETINA					
120.170	retinal dysplasia, folds	2	0.8%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	2.4%	0	
OTHER					
900.000	other, unspecified	3	1.2%	0	
900.100	other, not inherited	8	3.2%	0	
900.110	other. suspect not inherited/significance unknown	2	0.8%	0	
NORMAL					
0.000	normal globe	195	78.9%	7	46.7%

FLAT-COATED RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	2-4	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Y-suture tip opacity	Not defined	1	Breeder option
F.	Retinopathy	Not defined	1	Breeder Option

Description and Comments

A. Glaucoma (with pectinate ligament abnormality)

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

Flat-Coated Retrievers have been shown to have a higher prevalence of pectinate ligament abnormalities compared with other breeds. There is a significant association between pectinate ligament abnormalities and glaucoma in this breed. The heritability of pectinate ligament abnormalities in Flat-Coated Retrievers is estimated at 0.7. Since glaucoma and pectinate ligament abnormalities are closely associated, glaucoma may also be heritable.

In a recent report, pectinate ligament abnormalities were prevalent and significantly associated with age in a population of Flat-Coated Retrievers in the UK.

Due to the incidence of PLD in the breed and the increased progression observed with age, it may be prudent to perform repeated gonioscopy examinations over time.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong

recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

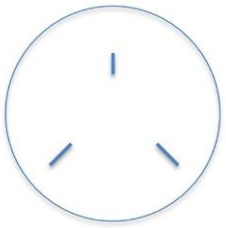
Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Read RA, Wood JL, Lakhani KH, Read RA. Pectinate ligament dysplasia (PLD) and glaucoma in Flat-Coated Retrievers. I. Objectives, technique and results of a PLD survey. *Vet Ophthalmol*. 1998;1:85-90.

3. Read RA, Wood JL, Lakhani KH, Read RA. Pectinate ligament dysplasia (PLD) and glaucoma in Flat-Coated Retrievers. II. Assessment of prevalence and heritability. *Vet Ophthalmol.* 1998;1:91-99.

4. Oliver JA, Ekiri A, Mellersh CS. Prevalence of pectinate ligament dysplasia and associations with age, sex and intraocular pressure in the Basset Hound, Flat-Coated Retriever and Dandie Dinmont Terrier. Can Genet Epidemiol 2016 March 12;3:1doi: 10.1186/s40575-016-0033-1.

OCULAR DISORDERS REPORT
FLAT-COATED RETRIEVER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**8,690**		**1,922**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.0%	1	0.1%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	9	0.1%	1	0.1%
20.160	macropalpebral fissure	2	0.0%	0	
21.000	entropion, unspecified	16	0.2%	4	0.2%
22.000	ectropion, unspecified	33	0.4%	2	0.1%
25.110	distichiasis	1,097	12.6%	245	12.7%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	4	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	2	0.0%	1	0.1%
70.700	corneal dystrophy	52	0.6%	12	0.6%
70.730	corneal endothelial degeneration	3	0.0%	0	
UVEA					
93.110	iris hypoplasia	2	0.0%	0	
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	208	2.4%	77	4.0%
93.720	persistent pupillary membranes, iris to lens	14	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	3	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	60	0.7%	62	3.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	5	0.1%	0	
93.810	uveal melanoma	1	0.0%	3	0.2%
93.999	uveal cysts	28	0.3%	6	0.3%
LENS					
100.200	cataract, unspecified	16	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	987	11.4%	292	15.2%
100.301	punctate cataract, anterior cortex	74	0.9%	25	1.3%
100.302	punctate cataract, posterior cortex	17	0.2%	4	0.2%
100.303	punctate cataract, equatorial cortex	8	0.1%	4	0.2%
100.304	punctate cataract, anterior sutures	24	0.3%	7	0.4%
100.305	punctate cataract, posterior sutures	16	0.2%	10	0.5%
100.306	punctate cataract, nucleus	10	0.1%	4	0.2%
100.307	punctate cataract, capsular	9	0.1%	12	0.6%
100.311	incipient cataract, anterior cortex	38	0.4%	12	0.6%
100.312	incipient cataract, posterior cortex	21	0.2%	5	0.3%
100.313	incipient cataract, equatorial cortex	16	0.2%	5	0.3%
100.314	incipient cataract, anterior sutures	6	0.1%	4	0.2%
100.315	incipient cataract, posterior sutures	10	0.1%	2	0.1%
100.316	incipient cataract, nucleus	5	0.1%	4	0.2%
100.317	incipient cataract, capsular	4	0.0%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	y-suture tip opacities	8	0.1%	28	1.5%
100.330	generalized/complete cataract	6	0.1%	2	0.1%
100.345	*significant cataracts (summary)*	*289*	*3.3%*	*131*	*6.8%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	13	0.1%	7	0.4%
110.135	PHPV/PTVL	5	0.1%	0	
110.200	vitreous degeneration-anterior chamber	0		2	0.1%
110.320	vitreal degeneration	1	0.0%	3	0.2%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	18	0.2%	8	0.4%
120.180	retinal dysplasia, geographic	12	0.1%	3	0.2%
120.190	retinal dysplasia, detached	0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	51	0.6%	5	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	3	0.2%
120.960	retinopathy	14	0.2%	18	0.9%
OPTIC NERVE					
130.110	micropapilla	5	0.1%	4	0.2%
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	21	0.2%	8	0.4%
OTHER					
900.000	other, unspecified	160	1.8%	0	
900.100	other, not inherited	267	3.1%	6	0.3%
900.110	other. suspect not inherited/significance unknown	150	1.7%	155	8.1%
NORMAL					
0.000	normal globe	6,576	75.7%	1,129	58.7%

FRENCH BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Imperforate lacrimal punctum	Not defined	1	Breeder option	
D.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to cornea	Not defined	1	NO	
	- endothelial opacity/no strands	Not defined	1	NO	
E.	Cataract	Autosomal recessive	1, 2	NO	Mutation in the *HSF4* gene
F.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the French Bulldog, the condition is inherited as an autosomal recessive mutation in the *HSF4* gene (*HSF4-1*). A DNA test is available.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Mellersh CS, Pettitt L, Forman OP, et al. Identification of mutations in HSF4 in dogs of three different breeds with hereditary cataracts. *Vet Ophthalmol*. 2006;9:369-378.

OCULAR DISORDERS REPORT
FRENCH BULLDOG

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	3,852		2,322	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.0%	1	0.0%
EYELIDS					
20.140	ectopic cilia	1	0.0%	2	0.1%
20.160	macropalpebral fissure	3	0.1%	0	
21.000	entropion, unspecified	40	1.0%	23	1.0%
22.000	ectropion, unspecified	6	0.2%	2	0.1%
25.110	distichiasis	261	6.8%	131	5.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	26	0.7%	49	2.1%
40.910	keratoconjunctivitis sicca	3	0.1%	1	0.0%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	6	0.2%	4	0.2%
CORNEA					
70.210	corneal pannus	4	0.1%	0	
70.220	pigmentary keratitis	20	0.5%	12	0.5%
70.700	corneal dystrophy	32	0.8%	16	0.7%
70.730	corneal endothelial degeneration	6	0.2%	1	0.0%
UVEA					
93.150	iris coloboma	1	0.0%	2	0.1%
93.710	persistent pupillary membranes, iris to iris	98	2.5%	65	2.8%
93.720	persistent pupillary membranes, iris to lens	6	0.2%	1	0.0%
93.730	persistent pupillary membranes, iris to cornea	55	1.4%	20	0.9%
93.740	persistent pupillary membranes, iris sheets	3	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	8	0.2%	4	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	37	1.0%	41	1.8%
93.810	uveal melanoma	1	0.0%	1	0.0%
93.999	uveal cysts	9	0.2%	2	0.1%
97.150	chorioretinal coloboma, congenital	1	0.0%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	91	2.4%	41	1.8%
100.301	punctate cataract, anterior cortex	11	0.3%	7	0.3%
100.302	punctate cataract, posterior cortex	4	0.1%	2	0.1%
100.303	punctate cataract, equatorial cortex	7	0.2%	4	0.2%
100.305	punctate cataract, posterior sutures	2	0.1%	1	0.0%
100.306	punctate cataract, nucleus	2	0.1%	8	0.3%
100.307	punctate cataract, capsular	1	0.0%	4	0.2%
100.311	incipient cataract, anterior cortex	40	1.0%	6	0.3%
100.312	incipient cataract, posterior cortex	14	0.4%	1	0.0%
100.313	incipient cataract, equatorial cortex	17	0.4%	4	0.2%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.1%	0	
100.316	incipient cataract, nucleus	10	0.3%	6	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.317	incipient cataract, capsular	5	0.1%	6	0.3%
100.321	incomplete cataract, anterior cortex	1	0.0%	3	0.1%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.1%
100.323	incomplete cataract, equatorial cortex	0		1	0.0%
100.326	incomplete cataract, nucleus	1	0.0%	5	0.2%
100.330	generalized/complete cataract	18	0.5%	1	0.0%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.345	*significant cataracts (summary)*	*141*	*3.7%*	*62*	*2.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	15	0.4%	19	0.8%
110.135	PHPV/PTVL	1	0.0%	2	0.1%
110.320	vitreal degeneration	7	0.2%	7	0.3%
RETINA					
120.170	retinal dysplasia, folds	86	2.2%	44	1.9%
120.180	retinal dysplasia, geographic	10	0.3%	10	0.4%
120.310	generalized progressive retinal atrophy (PRA)	1	0.0%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	2	0.1%	1	0.0%
OPTIC NERVE					
130.110	micropapilla	0		1	0.0%
OTHER					
900.000	other, unspecified	65	1.7%	0	
900.100	other, not inherited	88	2.3%	9	0.4%
900.110	other. suspect not inherited/significance unknown	48	1.2%	104	4.5%
NORMAL					
0.000	normal globe	3,174	82.4%	1,748	75.3%

GERMAN PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder Option
B.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Persistent hyperplastic tunica vasculosa lentis (PHTVL)	Not defined	1-3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

There may be more than one type of inherited cataract in German Pinschers. One form is reported in Finland with a later age of onset in which a pedigree analysis suggested autosomal recessive or incomplete dominant inheritance (4). Another form is reported in Germany with an earlier age of onset in which a pedigree analysis suggested autosomal recessive inheritance (5). Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent tunica vasculosa lentis results from the failure of regression of the embryologic vascular network which surrounds the developing lens. This disorder has been observed in German Pinschers in Finland and Germany. A pedigree analysis suggested recessive or incomplete dominant inheritance (4).

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OCULAR DISORDERS REPORT
GERMAN PINSCHER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 1,124 #	 %	2016-2020 422 #	 %
EYELIDS					
25.110	distichiasis	5	0.4%	9	2.1%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	0	
CORNEA					
70.220	pigmentary keratitis	0		2	0.5%
70.700	corneal dystrophy	19	1.7%	1	0.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	8	0.7%	2	0.5%
93.720	persistent pupillary membranes, iris to lens	5	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	10	0.9%	14	3.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	74	6.6%	36	8.5%
100.301	punctate cataract, anterior cortex	15	1.3%	4	0.9%
100.302	punctate cataract, posterior cortex	24	2.1%	4	0.9%
100.303	punctate cataract, equatorial cortex	0		2	0.5%
100.304	punctate cataract, anterior sutures	6	0.5%	0	
100.305	punctate cataract, posterior sutures	9	0.8%	0	
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	6	0.5%	4	0.9%
100.311	incipient cataract, anterior cortex	19	1.7%	7	1.7%
100.312	incipient cataract, posterior cortex	37	3.3%	7	1.7%
100.313	incipient cataract, equatorial cortex	7	0.6%	3	0.7%
100.314	incipient cataract, anterior sutures	6	0.5%	0	
100.315	incipient cataract, posterior sutures	8	0.7%	1	0.2%
100.316	incipient cataract, nucleus	5	0.4%	2	0.5%
100.317	incipient cataract, capsular	8	0.7%	4	0.9%
100.321	incomplete cataract, anterior cortex	0		3	0.7%
100.322	incomplete cataract, posterior cortex	1	0.1%	4	0.9%
100.325	incomplete cataract, posterior sutures	0		2	0.5%
100.327	incomplete cataract, capsular	0		1	0.2%
100.328	y-suture tip opacities	1	0.1%	0	
100.330	generalized/complete cataract	8	0.7%	2	0.5%
100.345	*significant cataracts (summary)*	*161*	*14.3%*	*50*	*11.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	0	
110.135	PHPV/PTVL	4	0.4%	0	
110.320	vitreal degeneration	14	1.2%	2	0.5%
RETINA					
120.170	retinal dysplasia, folds	2	0.2%	0	
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.960	retinopathy	2	0.2%	0	

		1991-2015		2016-2020	
OPTIC NERVE					
130.110	micropapilla	10	0.9%	5	1.2%
130.120	optic nerve hypoplasia	6	0.5%	1	0.2%
OTHER					
900.000	other, unspecified	26	2.3%	0	
900.100	other, not inherited	31	2.8%	1	0.2%
900.110	other. suspect not inherited/significance unknown	17	1.5%	33	7.8%
NORMAL					
0.000	normal globe	913	81.2%	293	69.4%

GERMAN SHEPHERD DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Plasmoma/atypical pannus	Not defined	1	NO	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1, 2	Breeder option	
D.	Chronic superficial keratitis/pannus	Not defined	1, 3-9	NO	
E.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 1	 Breeder option Passes with no notation	
F.	Cataract - Cortical	Presumed autosomal recessive	1, 10	NO	
G.	Y-suture tip opacity	Not defined	1	Breeder option	
H.	Cone degeneration - hemeralopia/ achromatopsia	Autosomal recessive	11	NO	Mutation in the *CNGA3* gene
I.	Retinal dysplasia - folds	Not defined	1, 12	Breeder option	
J.	Micropapilla	Not defined	1	Breeder option	
K.	Limbal melanoma	Not defined	1, 13	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Plasmoma/atypical pannus

Bilateral lymphocytic/plasmocytic infiltration of the nictitating membranes which may occur independent of corneal Pannus.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans which may also occur independent of corneal disease.

The German Shepherd Dog has a higher incidence of pannus than any other breed. The MHC class II risk haplotype has been shown. Although there are likely several other genes and environmental factors that contribute to CSK, a recent paper suggested that MHC class II is a major genetic risk factor. Dogs with the risk haplotype were 2.7 times more likely to develop CSK. Homozygosity of the risk haplotype increased the risk of CSK to over eightfold.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

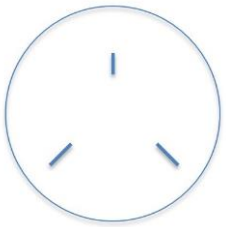
A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Cortical: Reported by Barnett in Great Britain, opacities are first apparent at 8-12 weeks of age, in the posterior cortex and progress to involve the Y-sutures and nucleus. The equatorial subcapsular cortex is unaffected. No progression is noted after 1-2 years of age. Test breeding suggests an autosomal recessive mode of inheritance.

G. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

H. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness and colorblindness. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A 5-month-old German Shepherd puppy with vision loss during daylight hours was recently identified with a mutation in the *CNGA3* gene.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic,

detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

K. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

L. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition have been noted in the German Shepherd, Labrador and Golden Retriever.

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OCULAR DISORDERS REPORT
GERMAN SHEPHERD DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 4,694 #	%	2016-2020 961 #	%
GLOBE						
0.110	microphthalmia		7	0.1%	2	0.2%
10.000	glaucoma		3	0.1%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		3	0.1%	2	0.2%
22.000	ectropion, unspecified		4	0.1%	0	
25.110	distichiasis		53	1.1%	4	0.4%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	0	
40.910	keratoconjunctivitis sicca		3	0.1%	0	
NICTITANS						
50.210	pannus of third eyelid		10	0.2%	15	1.6%
51.100	third eyelid cartilage anomaly		3	0.1%	1	0.1%
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		109	2.3%	16	1.7%
70.220	pigmentary keratitis		1	0.0%	1	0.1%
70.700	corneal dystrophy		217	4.6%	43	4.5%
70.730	corneal endothelial degeneration		2	0.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		64	1.4%	16	1.7%
93.720	persistent pupillary membranes, iris to lens		16	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		8	0.2%	3	0.3%
93.740	persistent pupillary membranes, iris sheets		2	0.0%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		12	0.3%	10	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	2	0.2%
93.810	uveal melanoma		1	0.0%	2	0.2%
93.999	uveal cysts		22	0.5%	7	0.7%
LENS						
100.200	cataract, unspecified		28	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		242	5.2%	85	8.8%
100.301	punctate cataract, anterior cortex		27	0.6%	9	0.9%
100.302	punctate cataract, posterior cortex		14	0.3%	3	0.3%
100.303	punctate cataract, equatorial cortex		13	0.3%	0	
100.304	punctate cataract, anterior sutures		1	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures		14	0.3%	6	0.6%
100.306	punctate cataract, nucleus		31	0.7%	11	1.1%
100.307	punctate cataract, capsular		8	0.2%	2	0.2%
100.311	incipient cataract, anterior cortex		34	0.7%	7	0.7%
100.312	incipient cataract, posterior cortex		30	0.6%	8	0.8%
100.313	incipient cataract, equatorial cortex		20	0.4%	3	0.3%
100.314	incipient cataract, anterior sutures		3	0.1%	2	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.315	incipient cataract, posterior sutures	7	0.1%	2	0.2%
100.316	incipient cataract, nucleus	58	1.2%	11	1.1%
100.317	incipient cataract, capsular	2	0.0%	5	0.5%
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.322	incomplete cataract, posterior cortex	1	0.0%	1	0.1%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	2	0.2%
100.327	incomplete cataract, capsular	1	0.0%	1	0.1%
100.328	y-suture tip opacities	5	0.1%	7	0.7%
100.330	generalized/complete cataract	21	0.4%	5	0.5%
100.345	*significant cataracts (summary)*	*319*	*6.8%*	*89*	*9.3%*
100.375	*subluxation/luxation, unspecified*	*8*	*0.2%*	*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	3	0.3%
110.135	PHPV/PTVL	3	0.1%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	1	0.1%
110.320	vitreal degeneration	13	0.3%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	89	1.9%	13	1.4%
120.180	retinal dysplasia, geographic	17	0.4%	2	0.2%
120.310	generalized progressive retinal atrophy (PRA)	20	0.4%	1	0.1%
120.910	retinal detachment without dialysis	4	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.1%
120.960	retinopathy	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	25	0.5%	12	1.2%
130.120	optic nerve hypoplasia	35	0.7%	2	0.2%
130.150	optic disc coloboma	3	0.1%	1	0.1%
OTHER					
900.000	other, unspecified	58	1.2%	0	
900.100	other, not inherited	144	3.1%	6	0.6%
900.110	other. suspect not inherited/significance unknown	75	1.6%	60	6.2%
NORMAL					
0.000	normal globe	3,603	76.8%	654	68.1%

GERMAN SHORTHAIRED POINTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Nictitans cartilage anomaly/eversion	Not defined	1, 2	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Persistent hyaloid artery	Not defined	1	Breeder option	
F.	Retinal dysplasia - folds	Not defined	1	Breeder option	
G.	Cone degeneration - (achromatopsia)	Autosomal recessive	3	NO	Mutation in the *CNGB3* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA**)** or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A missense mutation in the same gene (*CNGB3*) that has been identified in CD-affected Alaskan Malamute-derived dogs has been detected in German Shorthaired Pointers affected with a clinically identical allelic disorder. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Martin CL. Everted membrana nictitans in German Shorthaired Pointers. *J Am Vet Med Assoc*. 1970 Nov 1;157:1229-1232.

3. Sidjanin DJ, Lowe JK, McElwee JL, et al. Canine CNGB3 mutations establish cone degeneration as orthologous to the human achromatopsia locus ACHM3. *Human Molecular Genetics*. 2002;11:1823-1833.

OCULAR DISORDERS REPORT
GERMAN SHORTHAIRED POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 6,095 #	%	2016-2020 2,028 #	%
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	10	0.2%	6	0.3%
22.000	ectropion, unspecified	4	0.1%	1	0.0%
25.110	distichiasis	221	3.6%	106	5.2%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	3	0.0%	0	
52.110	prolapsed gland of the third eyelid	1	0.0%	1	0.0%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	20	0.3%	1	0.0%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	412	6.8%	133	6.6%
93.720	persistent pupillary membranes, iris to lens	17	0.3%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	5	0.1%	4	0.2%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	16	0.3%	29	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.0%	1	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	6	0.1%	4	0.2%
97.150	chorioretinal coloboma, congenital	0		1	0.0%
LENS					
100.200	cataract, unspecified	9	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	313	5.1%	75	3.7%
100.301	punctate cataract, anterior cortex	25	0.4%	6	0.3%
100.302	punctate cataract, posterior cortex	48	0.8%	10	0.5%
100.303	punctate cataract, equatorial cortex	12	0.2%	2	0.1%
100.304	punctate cataract, anterior sutures	2	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures	11	0.2%	6	0.3%
100.306	punctate cataract, nucleus	15	0.2%	3	0.1%
100.307	punctate cataract, capsular	9	0.1%	6	0.3%
100.311	incipient cataract, anterior cortex	18	0.3%	3	0.1%
100.312	incipient cataract, posterior cortex	91	1.5%	16	0.8%
100.313	incipient cataract, equatorial cortex	20	0.3%	1	0.0%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	16	0.3%	3	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.316	incipient cataract, nucleus	18	0.3%	5	0.2%
100.317	incipient cataract, capsular	12	0.2%	6	0.3%
100.321	incomplete cataract, anterior cortex	1	0.0%	1	0.0%
100.322	incomplete cataract, posterior cortex	6	0.1%	1	0.0%
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.326	incomplete cataract, nucleus	1	0.0%	1	0.0%
100.328	y-suture tip opacities	1	0.0%	8	0.4%
100.330	generalized/complete cataract	14	0.2%	1	0.0%
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*333*	*5.5%*	*80*	*3.9%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.1%	21	1.0%
110.135	PHPV/PTVL	13	0.2%	3	0.1%
110.200	vitreous degeneration-anterior chamber	1	0.0%	0	
110.320	vitreal degeneration	22	0.4%	9	0.4%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	129	2.1%	19	0.9%
120.180	retinal dysplasia, geographic	24	0.4%	3	0.1%
120.310	generalized progressive retinal atrophy (PRA)	9	0.1%	0	
120.920	retinal detachment with dialysis	2	0.0%	1	0.0%
120.960	retinopathy	4	0.1%	4	0.2%
OPTIC NERVE					
130.110	micropapilla	3	0.0%	0	
130.120	optic nerve hypoplasia	4	0.1%	1	0.0%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	99	1.6%	0	
900.100	other, not inherited	134	2.2%	5	0.2%
900.110	other. suspect not inherited/significance unknown	67	1.1%	87	4.3%
NORMAL					
0.000	normal globe	4,949	81.2%	1,535	75.7%

GERMAN SPITZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy *(prcd)*	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the German Spitz is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the German Spitz breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
GERMAN SPITZ

Diagnostic Name		1991-2015 5 #	%	2016-2020 28 #	%
TOTAL DOGS EXAMINED					
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	20.0%	1	3.6%
93.720	persistent pupillary membranes, iris to lens	0		1	3.6%
LENS					
100.311	incipient cataract, anterior cortex	0		1	3.6%
100.345	*significant cataracts (summary)*	*0*		*1*	*3.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		5	17.9%
RETINA					
120.960	retinopathy	1	20.0%	0	
NORMAL					
0.000	normal globe	4	80.0%	21	75.0%

GERMAN WIREHAIRED POINTER

(Drathaar, Deutsch Drathaar)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the German Wirehaired Pointer breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
GERMAN WIREHAIRED POINTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 666 #	%	2016-2020 385 #	%
EYELIDS						
20.160	macropalpebral fissure		1	0.2%	0	
25.110	distichiasis		9	1.4%	6	1.6%
CORNEA						
70.730	corneal endothelial degeneration		0		1	0.3%
UVEA						
93.110	iris hypoplasia		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris		8	1.2%	14	3.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.3%
93.999	uveal cysts		0		1	0.3%
LENS						
100.200	cataract, unspecified		5	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		18	2.7%	15	3.9%
100.301	punctate cataract, anterior cortex		2	0.3%	0	
100.302	punctate cataract, posterior cortex		5	0.8%	2	0.5%
100.305	punctate cataract, posterior sutures		1	0.2%	2	0.5%
100.312	incipient cataract, posterior cortex		10	1.5%	2	0.5%
100.315	incipient cataract, posterior sutures		1	0.2%	0	
100.316	incipient cataract, nucleus		0		2	0.5%
100.317	incipient cataract, capsular		3	0.5%	0	
100.327	incomplete cataract, capsular		0		1	0.3%
100.328	y-suture tip opacities		0		2	0.5%
100.330	generalized/complete cataract		2	0.3%	0	
100.345	*significant cataracts (summary)*		*29*	*4.4%*	*11*	*2.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.3%	2	0.5%
110.200	vitreous degeneration-anterior chamber		0		1	0.3%
110.320	vitreal degeneration		2	0.3%	1	0.3%
RETINA						
120.170	retinal dysplasia, folds		3	0.5%	0	
120.180	retinal dysplasia, geographic		1	0.2%	1	0.3%
120.190	retinal dysplasia, detached		1	0.2%	0	
120.910	retinal detachment without dialysis		1	0.2%	0	
OTHER						
900.000	other, unspecified		9	1.4%	0	
900.100	other, not inherited		8	1.2%	0	
900.110	other. suspect not inherited/significance unknown		14	2.1%	11	2.9%
NORMAL						
0.000	normal globe		589	88.4%	328	85.2%

GIANT SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
B.	Cataract	Not defined	1	NO	
C.	Y-suture tip opacity	Not defined	1	Breeder option	
D.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene
	Retinal Atrophy	Autosomal recessive	2	NO	Mutation in the *NECAP1* gene
E.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

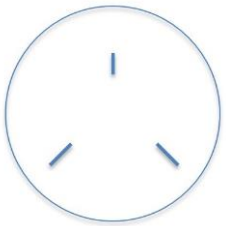
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

D. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A genetic test is available.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Hitti, R. J., et al. (2019). "Whole Genome Sequencing of Giant Schnauzer Dogs with Progressive Retinal Atrophy Establishes NECAP1 as a Novel Candidate Gene for Retinal Degeneration." Genes (Basel) 10(5). PMID: 31117272

OCULAR DISORDERS REPORT
GIANT SCHNAUZER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,129**		**387**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	0		1	0.3%
25.110	distichiasis	5	0.4%	2	0.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.5%
NICTITANS					
51.100	third eyelid cartilage anomaly	10	0.9%	3	0.8%
52.110	prolapsed gland of the third eyelid	2	0.2%	0	
CORNEA					
70.700	corneal dystrophy	1	0.1%	2	0.5%
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	55	4.9%	12	3.1%
93.720	persistent pupillary membranes, iris to lens	4	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.6%	11	2.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	2	0.2%	2	0.5%
LENS					
100.200	cataract, unspecified	5	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	56	5.0%	20	5.2%
100.301	punctate cataract, anterior cortex	4	0.4%	1	0.3%
100.302	punctate cataract, posterior cortex	8	0.7%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	2	0.2%	2	0.5%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	7	0.6%	3	0.8%
100.311	incipient cataract, anterior cortex	3	0.3%	1	0.3%
100.312	incipient cataract, posterior cortex	24	2.1%	4	1.0%
100.313	incipient cataract, equatorial cortex	8	0.7%	1	0.3%
100.315	incipient cataract, posterior sutures	4	0.4%	1	0.3%
100.316	incipient cataract, nucleus	2	0.2%	1	0.3%
100.317	incipient cataract, capsular	2	0.2%	3	0.8%
100.322	incomplete cataract, posterior cortex	0		1	0.3%
100.328	y-suture tip opacities	1	0.1%	5	1.3%
100.330	generalized/complete cataract	2	0.2%	0	
100.345	*significant cataracts (summary)*	*74*	*6.6%*	*23*	*5.9%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.4%	4	1.0%
110.135	PHPV/PTVL	5	0.4%	0	

VITREOUS CONTINUED	1991-2015		2016-2020	
110.320 vitreal degeneration	2	0.2%	0	
RETINA				
120.170 retinal dysplasia, folds	27	2.4%	2	0.5%
120.180 retinal dysplasia, geographic	1	0.1%	2	0.5%
120.310 generalized progressive retinal atrophy (PRA)	8	0.7%	0	
120.960 retinopathy	1	0.1%	1	0.3%
OPTIC NERVE				
130.110 micropapilla	0		1	0.3%
OTHER				
900.000 other, unspecified	26	2.3%	0	
900.100 other, not inherited	19	1.7%	1	0.3%
900.110 other. suspect not inherited/significance unknown	12	1.1%	15	3.9%
NORMAL				
0.000 normal globe	950	84.1%	304	78.6%

GLEN OF IMAAL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Retinal atrophy - generalized	Not defined	1, 2	NO	
D.	Cone rod dystrophy (*crd3*)	Autosomal recessive	3, 4	NO	Mutation in the *ADAM9* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy-generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

D. Cone rod dystrophy

A form of late-onset PRA identified in Glen of Imaal Terriers. Ophthalmoscopic lesions are typically diagnosed by 5 years of age, however lesions may be present as early as 3 years of age in affected dogs. Two distinct phenotypes are observed in affected Glen of Imaal Terriers. The most common phenotype is subtle but generalized tapetal hyperreflectivity and retinal vascular attenuation that progresses over 1 - 2 years after initial examination. The less common phenotype is a focal mid-temporal (area centralis) area of distinct tapetal hyperreflectivity without generalized retinal disease. This lesion may remain unchanged for over a year but will progress to generalized retinal atrophy by 2 - 4 years after initial examination. ERG dysfunction can be observed as early as 15 weeks of age. The disorder is caused by a mutation present in the *ADAM9* gene. A DNA test is available that will unequivocally identify normal, affected, and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Kijas JW, Zanger B, Miller B, et al. Cloning of the canine ABCA4 gene and evaluation in canine cone-rod dystrophies and progressive retinal atrophies. *Mol Vis*. 2004;10:223-232.

3. Goldstein O, Mezey JG, Boyko AR, et al. An *ADAM9* mutation in canine cone-rod dystrophy 3 establishes homology with human cone-rod dystrophy 9. *Mol Vis*. 2010;16:1549-1569.

4. Kropatsch R, Petrasch-Parwez E, Seelow D, et al. Generalized progressive retinal atrophy in the Irish Glen of Imaal Terrier is associated with a deletion in the ADAM9 gene. *Mol Cell Probes*. 2010;24:357-363.

OCULAR DISORDERS REPORT
GLEN OF IMAAL TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 606 #	%	2016-2020 189 #	%
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.3%	0	
25.110	distichiasis	21	3.5%	9	4.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.5%
CORNEA					
70.220	pigmentary keratitis	0		1	0.5%
UVEA					
93.720	persistent pupillary membranes, iris to lens	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	1.1%
93.999	uveal cysts	1	0.2%	1	0.5%
97.150	chorioretinal coloboma, congenital	0		1	0.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	55	9.1%	7	3.7%
100.301	punctate cataract, anterior cortex	4	0.7%	1	0.5%
100.302	punctate cataract, posterior cortex	1	0.2%	1	0.5%
100.303	punctate cataract, equatorial cortex	4	0.7%	2	1.1%
100.305	punctate cataract, posterior sutures	0		1	0.5%
100.306	punctate cataract, nucleus	2	0.3%	0	
100.307	punctate cataract, capsular	3	0.5%	1	0.5%
100.311	incipient cataract, anterior cortex	3	0.5%	3	1.6%
100.312	incipient cataract, posterior cortex	0		1	0.5%
100.313	incipient cataract, equatorial cortex	5	0.8%	1	0.5%
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.3%	0	
100.316	incipient cataract, nucleus	1	0.2%	0	
100.321	incomplete cataract, anterior cortex	1	0.2%	0	
100.322	incomplete cataract, posterior cortex	1	0.2%	0	
100.330	generalized/complete cataract	1	0.2%	0	
100.345	*significant cataracts (summary)*	*29*	*4.8%*	*11*	*5.8%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.5%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	1	0.5%
110.320	vitreal degeneration	2	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	7	1.2%	0	
120.180	retinal dysplasia, geographic	4	0.7%	0	
120.310	generalized progressive retinal atrophy (PRA)	23	3.8%	1	0.5%
120.960	retinopathy	1	0.2%	0	

	1991-2015		2016-2020	
OPTIC NERVE				
130.120 optic nerve hypoplasia	1	0.2%	0	
130.150 optic disc coloboma	4	0.7%	1	0.5%
OTHER				
900.000 other, unspecified	12	2.0%	0	
900.100 other, not inherited	12	2.0%	2	1.1%
900.110 other. suspect not inherited/significance unknown	26	4.3%	7	3.7%
NORMAL				
0.000 normal globe	488	80.5%	156	82.5%

GOLDEN RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmos	Autosomal recessive	2	NO	Mutation in the *SIX6* gene
B.	Entropion	Not defined	1	Breeder option	
C.	Distichiasis	Not defined	1	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
E.	Uveal cysts	Not defined	1, 3-5	Breeder option	
F.	Pigmentary uveitis	Not defined	1, 3-6	NO	
G.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	7	Passes with no notation	
H.	Cataract	Not defined	1, 7-12	NO	
I.	Y-suture tip opacity	Not defined	1	Breeder option	
J.	Persistent hyaloid artery	Not defined	1	Breeder option	
K.	Vitreous degeneration	Not defined	1	Breeder option	
L.	Retinal atrophy				
	prcd	Autosomal recessive	1, 12-15	NO	Mutation in the *prcd* gene
	PRA1	Autosomal recessive	13	NO	Mutation in the *SLC4A3* gene
	PRA2	Autosomal recessive	3	NO	Mutation in the *TTC8* gene

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
M.	Retinal dysplasia - folds	Not defined	1, 16	Breeder option	
N.	Retinal dysplasia - geographic	Not defined	1, 16	NO	
O.	Limbal melanoma	Not defined	17	NO	

Description and Comments

A. Micropthalmos

A congenital anomaly in which the globe is abnormally small. Commonly associated with multiple ocular malformations and when severe, may affect vision.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge

on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Pigmentary uveitis

A unique uveitis observed in the Golden Retriever that is not associated with other ocular or systemic disorders. Adhesions develop between iris and lens and the peripheral iris and cornea. Pigment dispersion (exfoliation) occurs across the anterior lens capsule from the pigmented cells of the posterior iris. Other complications include secondary cataract and obstructive glaucoma. Onset is usually between 5-10 years of age.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

H. Cataract

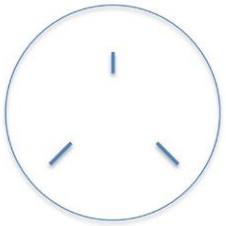
A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most common cataract reported in the Golden Retriever is a posterior polar (posterior cortical) cataract. These are generally bilateral, although an occasional unilateral affliction may be observed. These focal opacities will occasionally remain stationary. These cataracts are usually observed between 9 months and 3 years of age. A more generalized cataract is also observed in this breed and is not always associated with the previously mentioned polar cataract. There are also cataract changes involving the Y sutures which may or may not progress.

The existence of cataracts in the Golden Retriever, often with limited clinical significance, presents problems with breeder recognition as the majority of these dogs do not evidence visual impairment. It is strongly recommended that all Golden Retrievers that are used in breeding programs be examined annually as cataract changes have been observed in multiple locations of the lens and variable age of onset.

I. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

J. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

K. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

L. Retinal atrophy

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.
Studies have shown that one form of PRA in the Golden Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is

recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

In addition, two other known mutations that cause PRA are present in the breed. Golden Retriever PRA 1 (GR PRA1) is an autosomal recessive trait and is the predominant form in European lines of Golden Retrievers. Golden Retriever PRA 2 (GR PRA2) has also been identified within the breed. Therefore three different DNA tests are available. However these tests will only detect these three mutations.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

N. Retinal dysplasia – geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

O. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predispositions have been noted in the German Shepherd Dog, and Labrador and Golden Retrievers.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
GOLDEN RETRIEVER

		1991-2015 156,875		2016-2020 43,394	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	51	0.0%	7	0.0%
10.000	glaucoma	32	0.0%	1	0.0%
EYELIDS					
20.110	eyelid dermoid	3	0.0%	0	
20.140	ectopic cilia	53	0.0%	5	0.0%
20.160	macropalpebral fissure	22	0.0%	0	
21.000	entropion, unspecified	366	0.2%	76	0.2%
22.000	ectropion, unspecified	103	0.1%	9	0.0%
25.110	distichiasis	16,913	10.8%	3,798	8.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	30	0.0%	42	0.1%
40.910	keratoconjunctivitis sicca	5	0.0%	2	0.0%
NICTITANS					
50.210	pannus of third eyelid	2	0.0%	0	
51.100	third eyelid cartilage anomaly	16	0.0%	5	0.0%
52.110	prolapsed gland of the third eyelid	41	0.0%	1	0.0%
CORNEA					
70.210	corneal pannus	11	0.0%	0	
70.220	pigmentary keratitis	15	0.0%	13	0.0%
70.700	corneal dystrophy	632	0.4%	207	0.5%
70.730	corneal endothelial degeneration	37	0.0%	5	0.0%
UVEA					
90.200	uveitis	0		7	0.0%
90.250	pigmentary uveitis	967	0.6%	503	1.2%
93.110	iris hypoplasia	3	0.0%	3	0.0%
93.140	corneal endothelial pigment without PPM	17	0.0%	0	
93.150	iris coloboma	20	0.0%	1	0.0%
93.180	Iiris sphincter dysplasia	1	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	3,378	2.2%	1,279	2.9%
93.720	persistent pupillary membranes, iris to lens	115	0.1%	20	0.0%
93.730	persistent pupillary membranes, iris to cornea	83	0.1%	10	0.0%
93.740	persistent pupillary membranes, iris sheets	111	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	416	0.3%	605	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	44	0.0%	20	0.0%
93.810	uveal melanoma	22	0.0%	17	0.0%
93.999	uveal cysts	7,785	5.0%	3,531	8.1%
97.150	chorioretinal coloboma, congenital	1	0.0%	2	0.0%
LENS					
100.200	cataract, unspecified	952	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	9,430	6.0%	3,104	7.2%
100.300	punctate cataract, unspecified	0		1	0.0%
100.301	punctate cataract, anterior cortex	708	0.5%	313	0.7%
100.302	punctate cataract, posterior cortex	2,239	1.4%	488	1.1%

LENS CONTINUED		1991-2015		2016-2020	
100.303	punctate cataract, equatorial cortex	450	0.3%	183	0.4%
100.304	punctate cataract, anterior sutures	102	0.1%	36	0.1%
100.305	punctate cataract, posterior sutures	781	0.5%	168	0.4%
100.306	punctate cataract, nucleus	209	0.1%	120	0.3%
100.307	punctate cataract, capsular	317	0.2%	169	0.4%
100.311	incipient cataract, anterior cortex	863	0.6%	266	0.6%
100.312	incipient cataract, posterior cortex	3,117	2.0%	732	1.7%
100.313	incipient cataract, equatorial cortex	932	0.6%	315	0.7%
100.314	incipient cataract, anterior sutures	65	0.0%	18	0.0%
100.315	incipient cataract, posterior sutures	730	0.5%	127	0.3%
100.316	incipient cataract, nucleus	328	0.2%	157	0.4%
100.317	incipient cataract, capsular	276	0.2%	139	0.3%
100.320	incomplete cataract, unspecified	0		3	0.0%
100.321	incomplete cataract, anterior cortex	31	0.0%	55	0.1%
100.322	incomplete cataract, posterior cortex	68	0.0%	113	0.3%
100.323	incomplete cataract, equatorial cortex	13	0.0%	43	0.1%
100.324	incomplete cataract, anterior sutures	1	0.0%	1	0.0%
100.325	incomplete cataract, posterior sutures	6	0.0%	21	0.0%
100.326	incomplete cataract, nucleus	13	0.0%	37	0.1%
100.327	incomplete cataract, capsular	7	0.0%	20	0.0%
100.328	y-suture tip opacities	68	0.0%	147	0.3%
100.330	generalized/complete cataract	349	0.2%	29	0.1%
100.340	resorbing/hypermature cataract	2	0.0%	9	0.0%
100.345	*significant cataracts (summary)*	*12,627*	*8.0%*	*3,710*	*8.5%*
100.375	*subluxation/luxation, unspecified*	*31*	*0.0%*	*3*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	150	0.1%	89	0.2%
110.135	PHPV/PTVL	37	0.0%	9	0.0%
110.200	vitreous degeneration-anterior chamber	4	0.0%	6	0.0%
110.320	vitreal degeneration	272	0.2%	87	0.2%
FUNDUS					
97.110	choroidal hypoplasia	9	0.0%	0	
97.120	coloboma	8	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	1,962	1.3%	465	1.1%
120.180	retinal dysplasia, geographic	786	0.5%	222	0.5%
120.190	retinal dysplasia, detached	38	0.0%	5	0.0%
120.310	generalized progressive retinal atrophy (PRA)	173	0.1%	12	0.0%
120.400	retinal hemorrhage	18	0.0%	0	
120.910	retinal detachment without dialysis	28	0.0%	0	
120.920	retinal detachment with dialysis	3	0.0%	3	0.0%
120.960	retinopathy	33	0.0%	45	0.1%
OPTIC NERVE					
130.110	micropapilla	10	0.0%	12	0.0%
130.120	optic nerve hypoplasia	37	0.0%	7	0.0%
130.150	optic disc coloboma	56	0.0%	12	0.0%

		1991-2015		2016-2020	
OTHER					
900.000	other, unspecified	1,783	1.1%	0	
900.100	other, not inherited	3,017	1.9%	84	0.2%
900.110	other. suspect not inherited/significance unknown	2,066	1.3%	1,932	4.5%
NORMAL					
0.000	normal globe	118,528	75.6%	28,185	65.0%

GORDON SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Ectropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Persistent hyaloid artery	Not defined	1	Breeder option	
F.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*)	Autosomal recessive	2	NO	Mutation in the *C2orf71* gene
G.	Cone degeneration - achromatopsia	Not defined	3	NO	
H.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded;

breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

G. Cone degeneration - achromatopsia

Suspected inherited retinopathy characterized by degeneration of the cone receptors and loss of vision in bright light. Age of onset is variable. Ophthalmoscopic examination is normal. The ERG abnormalities are more suggestive of a cone-rod dystrophy. The mode of inheritance and genetic mutation are not yet known.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal

dysplasia is undetermined.

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OCULAR DISORDERS REPORT
GORDON SETTER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**2,217**		**322**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	9	0.4%	0	
21.000	entropion, unspecified	15	0.7%	3	0.9%
22.000	ectropion, unspecified	52	2.3%	4	1.2%
25.110	distichiasis	42	1.9%	4	1.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.3%
40.910	keratoconjunctivitis sicca	3	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
CORNEA					
70.210	corneal pannus	3	0.1%	0	
70.700	corneal dystrophy	8	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	112	5.1%	40	12.4%
93.720	persistent pupillary membranes, iris to lens	7	0.3%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	4	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	15	0.7%	17	5.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.2%	0	
93.999	uveal cysts	19	0.9%	2	0.6%
LENS					
100.200	cataract, unspecified	9	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	79	3.6%	16	5.0%
100.301	punctate cataract, anterior cortex	5	0.2%	2	0.6%
100.302	punctate cataract, posterior cortex	9	0.4%	2	0.6%
100.303	punctate cataract, equatorial cortex	3	0.1%	0	
100.305	punctate cataract, posterior sutures	4	0.2%	0	
100.306	punctate cataract, nucleus	5	0.2%	2	0.6%
100.307	punctate cataract, capsular	1	0.0%	0	
100.311	incipient cataract, anterior cortex	7	0.3%	0	
100.312	incipient cataract, posterior cortex	14	0.6%	3	0.9%
100.313	incipient cataract, equatorial cortex	8	0.4%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	1	0.3%
100.316	incipient cataract, nucleus	4	0.2%	0	
100.317	incipient cataract, capsular	4	0.2%	1	0.3%
100.327	incomplete cataract, capsular	1	0.0%	0	
100.328	y-suture tip opacities	2	0.1%	0	
100.330	generalized/complete cataract	10	0.5%	0	
100.345	*significant cataracts (summary)*	*87*	*3.9%*	*11*	*3.4%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	12	0.5%	3	0.9%
110.135	PHPV/PTVL	5	0.2%	2	0.6%
110.320	vitreal degeneration	5	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	32	1.4%	7	2.2%
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	17	0.8%	1	0.3%
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	8	0.4%	0	
130.120	optic nerve hypoplasia	8	0.4%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	40	1.8%	0	
900.100	other, not inherited	59	2.7%	0	
900.110	other. suspect not inherited/significance unknown	31	1.4%	12	3.7%
NORMAL					
0.000	normal globe	1,807	81.5%	230	71.4%

OCULAR DISORDERS REPORT
GRAND BASSET GRIFFON VENDEEN

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the GRAND BASSET GRIFFON VENDEEN breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
GRAND BASSET GRIFFON VENDEEN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 64 #	%	2016-2020 67 #	%
EYELIDS						
25.110	distichiasis		1	1.6%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		4	6.2%	3	4.5%
93.730	persistent pupillary membranes, iris to cornea		5	7.8%	2	3.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands		5	7.8%	1	1.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		2	3.1%	6	9.0%
100.311	incipient cataract, anterior cortex		0		1	1.5%
100.317	incipient cataract, capsular		0		1	1.5%
100.321	incomplete cataract, anterior cortex		0		1	1.5%
100.327	incomplete cataract, capsular		1	1.6%	0	
100.345	*significant cataracts (summary)*		*1*	*1.6%*	*3*	*4.5%*
VITREOUS						
110.135	PHPV/PTVL		1	1.6%	0	
RETINA						
120.170	retinal dysplasia, folds		1	1.6%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	1.6%	0	
OTHER						
900.000	other, unspecified		2	3.1%	0	
900.100	other, not inherited		1	1.6%	0	
900.110	other. suspect not inherited/significance unknown		0		2	3.0%
NORMAL						
0.000	normal globe		46	71.9%	51	76.1%

GREAT DANE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects associated with partial albinism	Presumed autosomal dominant	1, 2	NO
B.	Glaucoma	Not defined	1, 3	NO
C.	Entropion	Not defined	1	Breeder option
D.	Ectropion	Not defined	1	Breeder option
E.	Distichiasis	Not defined	1	Breeder option
F.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
G.	Prolapsed gland of the third eyelid	Not defined	4	Breeder option
H.	Uveal cysts	Not defined	1, 5	Breeder option
I.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
J.	Cataract	Not defined	1	NO

Description and Comments

A. Microphthalmia with multiple ocular defects associated with partial albinism

Multiple ocular defects are seen associated with partial albinism (white or light coat color) and deafness in Great Danes. The abnormalities are thought to stem from a common developmental defect. Ocular defects are anterior segment dysgenesis, equatorial staphylomas, microphthalmia, cortical cataracts, lens luxation, spherophakia, iris coloboma, and blue irides. An autosomal dominant mode of inheritance is suspected. The hearing loss is attributable to cochlea-saccular degeneration.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis

and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion and ectropion often occur together in this breed, associated with an abnormally large palpebral fissure.

D. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

G. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

Great Danes were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 83% of the prolapsed glands in Great Danes occurred before 1 year of age. Great Danes were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

H. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs. In the Great Dane, pigmented cysts may also arise from pigmented epithelial cells of the ciliary body. Ciliary body cysts may predispose to glaucoma in the Great Dane.

I. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

J. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

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OCULAR DISORDERS REPORT
GREAT DANE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 6,711 #	%	2016-2020 2,648 #	%
GLOBE					
0.110	microphthalmia	24	0.4%	3	0.1%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	124	1.8%	0	
21.000	entropion, unspecified	168	2.5%	108	4.1%
22.000	ectropion, unspecified	263	3.9%	111	4.2%
25.110	distichiasis	366	5.5%	135	5.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.1%	1	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	135	2.0%	83	3.1%
52.110	prolapsed gland of the third eyelid	13	0.2%	11	0.4%
CORNEA					
70.210	corneal pannus	2	0.0%	0	
70.220	pigmentary keratitis	4	0.1%	2	0.1%
70.700	corneal dystrophy	28	0.4%	8	0.3%
UVEA					
90.250	pigmentary uveitis	1	0.0%	1	0.0%
93.110	iris hypoplasia	6	0.1%	6	0.2%
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	18	0.3%	4	0.2%
93.180	liris sphincter dysplasia	0		2	0.1%
93.710	persistent pupillary membranes, iris to iris	69	1.0%	28	1.1%
93.720	persistent pupillary membranes, iris to lens	15	0.2%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	8	0.1%	2	0.1%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	18	0.3%	22	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	2	0.1%
93.810	uveal melanoma	3	0.0%	2	0.1%
93.999	uveal cysts	85	1.3%	59	2.2%
LENS					
100.110	microphakia, congenital	0		1	0.0%
100.200	cataract, unspecified	15	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	241	3.6%	85	3.2%
100.301	punctate cataract, anterior cortex	25	0.4%	12	0.5%
100.302	punctate cataract, posterior cortex	66	1.0%	27	1.0%
100.303	punctate cataract, equatorial cortex	17	0.3%	3	0.1%
100.304	punctate cataract, anterior sutures	4	0.1%	1	0.0%
100.305	punctate cataract, posterior sutures	27	0.4%	4	0.2%
100.306	punctate cataract, nucleus	13	0.2%	2	0.1%
100.307	punctate cataract, capsular	12	0.2%	10	0.4%
100.311	incipient cataract, anterior cortex	63	0.9%	22	0.8%

LENS CONTINUED		1991-2015		2016-2020	
100.312	incipient cataract, posterior cortex	153	2.3%	34	1.3%
100.313	incipient cataract, equatorial cortex	43	0.6%	14	0.5%
100.314	incipient cataract, anterior sutures	6	0.1%	0	
100.315	incipient cataract, posterior sutures	19	0.3%	8	0.3%
100.316	incipient cataract, nucleus	33	0.5%	6	0.2%
100.317	incipient cataract, capsular	21	0.3%	10	0.4%
100.321	incomplete cataract, anterior cortex	6	0.1%	4	0.2%
100.322	incomplete cataract, posterior cortex	6	0.1%	10	0.4%
100.323	incomplete cataract, equatorial cortex	0		3	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	2	0.0%	2	0.1%
100.327	incomplete cataract, capsular	2	0.0%	0	
100.328	y-suture tip opacities	5	0.1%	3	0.1%
100.330	generalized/complete cataract	52	0.8%	3	0.1%
100.345	*significant cataracts (summary)*	*590*	*8.8%*	*179*	*6.8%*
100.375	*subluxation/luxation, unspecified*	*9*	*0.1%*	*5*	*0.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	11	0.2%	13	0.5%
110.135	PHPV/PTVL	15	0.2%	2	0.1%
110.200	vitreous degeneration-anterior chamber	3	0.0%	8	0.3%
110.320	vitreal degeneration	36	0.5%	8	0.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	3	0.1%
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	23	0.3%	5	0.2%
120.180	retinal dysplasia, geographic	3	0.0%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	7	0.1%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.0%	2	0.1%
130.120	optic nerve hypoplasia	3	0.0%	1	0.0%
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	60	0.9%	0	
900.100	other, not inherited	137	2.0%	21	0.8%
900.110	other. suspect not inherited/significance unknown	89	1.3%	107	4.0%
NORMAL					
0.000	normal globe	5,276	78.6%	1,878	70.9%

GREAT PYRENEES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Multifocal retinopathy - *cmr1*	Autosomal recessive	2-4	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid, or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities

despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

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OCULAR DISORDERS REPORT
GREAT PYRENEES

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,224 #	 %	2016-2020 141 #	 %
GLOBE						
0.110	microphthalmia		2	0.2%	0	
EYELIDS						
20.160	macropalpebral fissure		3	0.2%	0	
21.000	entropion, unspecified		15	1.2%	0	
22.000	ectropion, unspecified		3	0.2%	0	
25.110	distichiasis		16	1.3%	0	
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.1%	0	
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.700	corneal dystrophy		14	1.1%	3	2.1%
70.730	corneal endothelial degeneration		3	0.2%	0	
UVEA						
93.110	iris hypoplasia		1	0.1%	0	
93.150	iris coloboma		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		305	24.9%	36	25.5%
93.720	persistent pupillary membranes, iris to lens		11	0.9%	2	1.4%
93.730	persistent pupillary membranes, iris to cornea		7	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.2%	0	
93.810	uveal melanoma		1	0.1%	0	
93.999	uveal cysts		6	0.5%	5	3.5%
LENS						
100.200	cataract, unspecified		3	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		51	4.2%	5	3.5%
100.301	punctate cataract, anterior cortex		11	0.9%	1	0.7%
100.302	punctate cataract, posterior cortex		12	1.0%	1	0.7%
100.303	punctate cataract, equatorial cortex		6	0.5%	0	
100.304	punctate cataract, anterior sutures		3	0.2%	0	
100.305	punctate cataract, posterior sutures		3	0.2%	0	
100.306	punctate cataract, nucleus		3	0.2%	1	0.7%
100.307	punctate cataract, capsular		1	0.1%	0	
100.311	incipient cataract, anterior cortex		22	1.8%	3	2.1%
100.312	incipient cataract, posterior cortex		18	1.5%	3	2.1%
100.313	incipient cataract, equatorial cortex		20	1.6%	3	2.1%
100.315	incipient cataract, posterior sutures		5	0.4%	0	
100.316	incipient cataract, nucleus		1	0.1%	0	
100.317	incipient cataract, capsular		4	0.3%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.7%
100.322	incomplete cataract, posterior cortex		0		1	0.7%
100.323	incomplete cataract, equatorial cortex		0		1	0.7%
100.325	incomplete cataract, posterior sutures		0		1	0.7%
100.330	generalized/complete cataract		5	0.4%	0	
100.345	*significant cataracts (summary)*		*117*	*9.6%*	*16*	*11.3%*

LENS CONTINUED	1991-2015		2016-2020	
100.375 subluxation/luxation, unspecified	1	0.1%	0	
VITREOUS				
110.135 PHPV/PTVL	1	0.1%	0	
FUNDUS				
97.110 choroidal hypoplasia	2	0.2%	0	
97.120 coloboma	1	0.1%	0	
RETINA				
120.170 retinal dysplasia, folds	9	0.7%	0	
120.180 retinal dysplasia, geographic	15	1.2%	1	0.7%
120.190 retinal dysplasia, detached	2	0.2%	0	
120.310 generalized progressive retinal atrophy (PRA)	5	0.4%	0	
120.910 retinal detachment without dialysis	4	0.3%	0	
120.960 retinopathy	3	0.2%	8	5.7%
OPTIC NERVE				
130.110 micropapilla	6	0.5%	0	
130.120 optic nerve hypoplasia	5	0.4%	0	
130.150 optic disc coloboma	2	0.2%	0	
OTHER				
900.000 other, unspecified	7	0.6%	0	
900.100 other, not inherited	35	2.9%	0	
900.110 other. suspect not inherited/significance unknown	16	1.3%	3	2.1%
NORMAL				
0.000 normal globe	813	66.4%	81	57.4%

GREATER SWISS MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO
D.	Persistent hyaloid artery	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Greater Swiss Mountain Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
GREATER SWISS MOUNTAIN DOG

		1991-2015 3,022		2016-2020 656	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	20	0.7%	2	0.3%
22.000	ectropion, unspecified	3	0.1%	0	
25.110	distichiasis	1,009	33.4%	152	23.2%
NICTITANS					
51.100	third eyelid cartilage anomaly	5	0.2%	0	
CORNEA					
70.210	corneal pannus	2	0.1%	0	
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	13	0.4%	2	0.3%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	101	3.3%	22	3.4%
93.720	persistent pupillary membranes, iris to lens	6	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.2%	1	0.2%
93.740	persistent pupillary membranes, iris sheets	5	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	5	0.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	267	8.8%	37	5.6%
100.301	punctate cataract, anterior cortex	55	1.8%	7	1.1%
100.302	punctate cataract, posterior cortex	51	1.7%	12	1.8%
100.303	punctate cataract, equatorial cortex	26	0.9%	2	0.3%
100.304	punctate cataract, anterior sutures	2	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures	11	0.4%	3	0.5%
100.306	punctate cataract, nucleus	5	0.2%	0	
100.307	punctate cataract, capsular	10	0.3%	8	1.2%
100.311	incipient cataract, anterior cortex	56	1.9%	12	1.8%
100.312	incipient cataract, posterior cortex	86	2.8%	23	3.5%
100.313	incipient cataract, equatorial cortex	66	2.2%	12	1.8%
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	12	0.4%	1	0.2%
100.316	incipient cataract, nucleus	8	0.3%	1	0.2%
100.317	incipient cataract, capsular	11	0.4%	2	0.3%
100.321	incomplete cataract, anterior cortex	3	0.1%	1	0.2%
100.322	incomplete cataract, posterior cortex	1	0.0%	3	0.5%
100.323	incomplete cataract, equatorial cortex	0		4	0.6%
100.326	incomplete cataract, nucleus	1	0.0%	0	
100.327	incomplete cataract, capsular	0		1	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.328	y-suture tip opacities	1	0.0%	2	0.3%
100.330	generalized/complete cataract	7	0.2%	0	
100.345	*significant cataracts (summary)*	*414*	*13.7%*	*95*	*14.5%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.3%	7	1.1%
110.135	PHPV/PTVL	4	0.1%	0	
110.320	vitreal degeneration	3	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	16	0.5%	3	0.5%
120.180	retinal dysplasia, geographic	7	0.2%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	2	0.3%
OPTIC NERVE					
130.110	micropapilla	7	0.2%	0	
130.120	optic nerve hypoplasia	5	0.2%	0	
OTHER					
900.000	other, unspecified	29	1.0%	0	
900.100	other, not inherited	71	2.3%	0	
900.110	other. suspect not inherited/significance unknown	23	0.8%	22	3.4%
NORMAL					
0.000	normal globe	1,747	57.8%	384	58.5%

GREYHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Chronic superficial keratitis/pannus	Not defined	1, 2	NO
B.	Cataract	Not defined	1	NO

Description and Comments

A. Chronic superficial keratitis/Pannus

A bilateral disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Peiffer RL, Jr., Gelatt KN, Gwin RM. Chronic superficial keratitis. *Vet Med Small Anim Clin*. 1977;72:35-37.

OCULAR DISORDERS REPORT
GREYHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 652 #	1991-2015 652 %	2016-2020 110 #	2016-2020 110 %
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
25.110	distichiasis	2	0.3%	0	
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.2%	0	
NICTITANS					
50.210	pannus of third eyelid	0		2	1.8%
51.100	third eyelid cartilage anomaly	2	0.3%	0	
CORNEA					
70.210	corneal pannus	21	3.2%	0	
70.700	corneal dystrophy	5	0.8%	1	0.9%
70.730	corneal endothelial degeneration	1	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.3%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
LENS					
100.200	cataract, unspecified	2	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	21	3.2%	8	7.3%
100.301	punctate cataract, anterior cortex	5	0.8%	0	
100.302	punctate cataract, posterior cortex	2	0.3%	0	
100.304	punctate cataract, anterior sutures	2	0.3%	0	
100.306	punctate cataract, nucleus	1	0.2%	1	0.9%
100.307	punctate cataract, capsular	1	0.2%	0	
100.311	incipient cataract, anterior cortex	6	0.9%	0	
100.312	incipient cataract, posterior cortex	8	1.2%	2	1.8%
100.313	incipient cataract, equatorial cortex	6	0.9%	0	
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	2	0.3%	0	
100.317	incipient cataract, capsular	2	0.3%	0	
100.322	incomplete cataract, posterior cortex	0		1	0.9%
100.330	generalized/complete cataract	1	0.2%	0	
100.345	*significant cataracts (summary)*	*39*	*6.0%*	*4*	*3.6%*
100.375	*subluxation/luxation, unspecified*	*2*	*0.3%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	1	0.9%
110.320	vitreal degeneration	16	2.5%	0	
RETINA					
120.170	retinal dysplasia, folds	3	0.5%	2	1.8%
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	0.9%	1	0.9%

RETINA CONTINUED	1991-2015		2016-2020	
120.920 retinal detachment with dialysis	0		1	0.9%
OPTIC NERVE				
130.110 micropapilla	2	0.3%	0	
130.120 optic nerve hypoplasia	2	0.3%	0	
OTHER				
900.000 other, unspecified	8	1.2%	0	
900.100 other, not inherited	14	2.1%	0	
900.110 other. suspect not inherited/significance unknown	25	3.8%	9	8.2%
NORMAL				
0.000 normal globe	534	81.9%	84	76.4%

OCULAR DISORDERS REPORT
HARRIER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the HARRIER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
HARRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 399 #	 %	2016-2020 38 #	 %
EYELIDS					
21.000	entropion, unspecified	1	0.3%	0	
25.110	distichiasis	2	0.5%	0	
CORNEA					
70.210	corneal pannus	1	0.3%	0	
70.700	corneal dystrophy	0		1	2.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	12	3.0%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.3%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	8	2.0%	0	
100.302	punctate cataract, posterior cortex	2	0.5%	0	
100.306	punctate cataract, nucleus	1	0.3%	0	
100.311	incipient cataract, anterior cortex	4	1.0%	0	
100.312	incipient cataract, posterior cortex	3	0.8%	0	
100.322	incomplete cataract, posterior cortex	0		1	2.6%
100.345	*significant cataracts (summary)*	*10*	*2.5%*	*1*	*2.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.3%	0	
FUNDUS					
97.120	coloboma	1	0.3%	0	
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	3	0.8%	0	
OPTIC NERVE					
130.150	optic disc coloboma	1	0.3%	0	
OTHER					
900.000	other, unspecified	2	0.5%	0	
900.100	other, not inherited	11	2.8%	0	
900.110	other. suspect not inherited/significance unknown	4	1.0%	1	2.6%
NORMAL					
0.000	normal globe	368	92.2%	36	94.7%

HAVANA SILK DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Havana Silk Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
HAVANA SILK DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 621 #	 %	2016-2020 100 #	 %
EYELIDS					
25.110	distichiasis	32	5.2%	3	3.0%
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.5%	0	
CORNEA					
70.700	corneal dystrophy	9	1.4%	2	2.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	32	5.2%	2	2.0%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	18	2.9%	4	4.0%
100.301	punctate cataract, anterior cortex	1	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.2%	0	
100.311	incipient cataract, anterior cortex	2	0.3%	0	
100.312	incipient cataract, posterior cortex	3	0.5%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.316	incipient cataract, nucleus	1	0.2%	0	
100.330	generalized/complete cataract	2	0.3%	0	
100.345	*significant cataracts (summary)*	*11*	*1.8%*	*0*	
100.375	*subluxation/luxation, unspecified*	*1*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.3%	0	
110.320	vitreal degeneration	7	1.1%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.2%	0	
OTHER					
900.000	other, unspecified	7	1.1%	0	
900.100	other, not inherited	1	0.2%	0	
900.110	other. suspect not inherited/significance unknown	6	1.0%	1	1.0%
NORMAL					
0.000	normal globe	535	86.2%	88	88.0%

HAVANESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1, 2	NO
D.	Y-suture tip opacity	Not defined	1	Breeder option
E.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

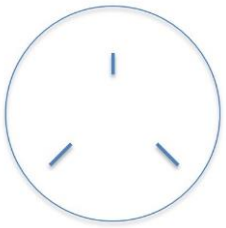
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Starr AN, Famula TR, Markward NJ, et al. Hereditary evaluation of multiple developmental abnormalities in the Havanese dog breed. *J Hered.* 2007;98:510-517.

OCULAR DISORDERS REPORT
HAVANESE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 27,503 #	%	2016-2020 6,037 #	%
GLOBE					
0.110	microphthalmia	6	0.0%	1	0.0%
EYELIDS					
20.140	ectopic cilia	10	0.0%	2	0.0%
21.000	entropion, unspecified	18	0.1%	3	0.0%
22.000	ectropion, unspecified	4	0.0%	0	
25.110	distichiasis	1,372	5.0%	296	4.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	8	0.0%	5	0.1%
40.910	keratoconjunctivitis sicca	9	0.0%	1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	126	0.5%	30	0.5%
CORNEA					
70.210	corneal pannus	1	0.0%	1	0.0%
70.220	pigmentary keratitis	3	0.0%	4	0.1%
70.700	corneal dystrophy	108	0.4%	34	0.6%
70.730	corneal endothelial degeneration	3	0.0%	2	0.0%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	0		2	0.0%
93.140	corneal endothelial pigment without PPM	3	0.0%	0	
93.150	iris coloboma	1	0.0%	2	0.0%
93.710	persistent pupillary membranes, iris to iris	1,699	6.2%	314	5.2%
93.720	persistent pupillary membranes, iris to lens	28	0.1%	4	0.1%
93.730	persistent pupillary membranes, iris to cornea	13	0.0%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	18	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	30	0.1%	25	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	2	0.0%
93.810	uveal melanoma	3	0.0%	0	
93.999	uveal cysts	3	0.0%	2	0.0%
LENS					
100.200	cataract, unspecified	22	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	1,592	5.8%	365	6.0%
100.301	punctate cataract, anterior cortex	116	0.4%	41	0.7%
100.302	punctate cataract, posterior cortex	93	0.3%	41	0.7%
100.303	punctate cataract, equatorial cortex	34	0.1%	5	0.1%
100.304	punctate cataract, anterior sutures	26	0.1%	9	0.1%
100.305	punctate cataract, posterior sutures	190	0.7%	72	1.2%
100.306	punctate cataract, nucleus	16	0.1%	8	0.1%
100.307	punctate cataract, capsular	38	0.1%	21	0.3%
100.311	incipient cataract, anterior cortex	113	0.4%	27	0.4%
100.312	incipient cataract, posterior cortex	211	0.8%	39	0.6%
100.313	incipient cataract, equatorial cortex	46	0.2%	15	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.314	incipient cataract, anterior sutures	14	0.1%	3	0.0%
100.315	incipient cataract, posterior sutures	92	0.3%	17	0.3%
100.316	incipient cataract, nucleus	20	0.1%	2	0.0%
100.317	incipient cataract, capsular	47	0.2%	7	0.1%
100.321	incomplete cataract, anterior cortex	4	0.0%	5	0.1%
100.322	incomplete cataract, posterior cortex	9	0.0%	11	0.2%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	1	0.0%	2	0.0%
100.326	incomplete cataract, nucleus	2	0.0%	1	0.0%
100.327	incomplete cataract, capsular	1	0.0%	0	
100.328	y-suture tip opacities	46	0.2%	133	2.2%
100.330	generalized/complete cataract	123	0.4%	6	0.1%
100.340	resorbing/hypermature cataract	2	0.0%	3	0.0%
100.345	*significant cataracts (summary)*	*1,267*	*4.6%*	*468*	*7.8%*
100.375	*subluxation/luxation, unspecified*	*11*	*0.0%*	*3*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	29	0.1%	4	0.1%
110.135	PHPV/PTVL	3	0.0%	2	0.0%
110.200	vitreous degeneration-anterior chamber	13	0.0%	20	0.3%
110.320	vitreal degeneration	493	1.8%	71	1.2%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
97.120	coloboma	4	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	138	0.5%	10	0.2%
120.180	retinal dysplasia, geographic	22	0.1%	6	0.1%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	104	0.4%	8	0.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	12	0.0%	0	
120.920	retinal detachment with dialysis	0		4	0.1%
120.960	retinopathy	12	0.0%	13	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	3	0.0%	1	0.0%
130.150	optic disc coloboma	7	0.0%	1	0.0%
OTHER					
900.000	other, unspecified	257	0.9%	0	
900.100	other, not inherited	558	2.0%	12	0.2%
900.110	other. suspect not inherited/significance unknown	200	0.7%	204	3.4%
NORMAL					
0.000	normal globe	22,829	83.0%	4,472	74.1%

HOKKAIDO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

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OCULAR DISORDERS REPORT
HOKKAIDO KEN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2 #	%	2016-2020 17 #	%
EYELIDS						
25.110	distichiasis		0		1	5.9%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		5	29.4%
93.720	persistent pupillary membranes, iris to lens		0		1	5.9%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	5.9%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	50.0%	0	
100.311	incipient cataract, anterior cortex		0		2	11.8%
100.321	incomplete cataract, anterior cortex		0		1	5.9%
100.330	generalized/complete cataract		0		1	5.9%
100.345	*significant cataracts (summary)*		*0*		*4*	*23.5%*
FUNDUS						
97.110	choroidal hypoplasia		0		5	29.4%
RETINA						
120.170	retinal dysplasia, folds		0		1	5.9%
OTHER						
900.100	other, not inherited		1	50.0%	0	
NORMAL						
0.000	normal globe		0		7	41.2%

IBIZAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Ibizan Hound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
IBIZAN HOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,278 #	 %	2016-2020 520 #	 %
GLOBE						
0.110	microphthalmia		3	0.2%	1	0.2%
EYELIDS						
25.110	distichiasis		4	0.3%	0	
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.1%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.1%	0	
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.700	corneal dystrophy		8	0.6%	3	0.6%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.1%	0	
93.150	iris coloboma		0		1	0.2%
93.710	persistent pupillary membranes, iris to iris		155	12.1%	57	11.0%
93.720	persistent pupillary membranes, iris to lens		1	0.1%	1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		12	0.9%	6	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		5	0.4%	0	
93.999	uveal cysts		4	0.3%	1	0.2%
97.150	chorioretinal coloboma, congenital		0		1	0.2%
LENS						
100.200	cataract, unspecified		4	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		81	6.3%	12	2.3%
100.301	punctate cataract, anterior cortex		3	0.2%	2	0.4%
100.302	punctate cataract, posterior cortex		2	0.2%	3	0.6%
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures		1	0.1%	5	1.0%
100.306	punctate cataract, nucleus		7	0.5%	0	
100.307	punctate cataract, capsular		2	0.2%	4	0.8%
100.311	incipient cataract, anterior cortex		6	0.5%	1	0.2%
100.312	incipient cataract, posterior cortex		9	0.7%	2	0.4%
100.313	incipient cataract, equatorial cortex		4	0.3%	1	0.2%
100.314	incipient cataract, anterior sutures		1	0.1%	1	0.2%
100.316	incipient cataract, nucleus		19	1.5%	11	2.1%
100.317	incipient cataract, capsular		2	0.2%	1	0.2%
100.322	incomplete cataract, posterior cortex		1	0.1%	0	
100.327	incomplete cataract, capsular		1	0.1%	0	
100.328	y-suture tip opacities		1	0.1%	1	0.2%
100.330	generalized/complete cataract		2	0.2%	0	
100.345	*significant cataracts (summary)*		*67*	*5.2%*	*33*	*6.3%*
100.375	*subluxation/luxation, unspecified*		*3*	*0.2%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.2%	3	0.6%
110.200	vitreous degeneration-anterior chamber	1	0.1%	1	0.2%
110.320	vitreal degeneration	15	1.2%	1	0.2%
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.2%
RETINA					
120.170	retinal dysplasia, folds	11	0.9%	0	
120.180	retinal dysplasia, geographic	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	0.3%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	1	0.1%	0	
OPTIC NERVE					
130.150	optic disc coloboma	3	0.2%	0	
OTHER					
900.000	other, unspecified	24	1.9%	0	
900.100	other, not inherited	20	1.6%	1	0.2%
900.110	other. suspect not inherited/significance unknown	11	0.9%	19	3.7%
NORMAL					
0.000	normal globe	1,021	79.9%	394	75.8%

ICELANDIC SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Icelandic Sheepdog breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
ICELANDIC SHEEPDOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,896 #	 %	2016-2020 920 #	 %
EYELIDS						
21.000	entropion, unspecified		5	0.3%	0	
25.110	distichiasis		16	0.8%	8	0.9%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.1%
NICTITANS						
50.210	pannus of third eyelid		0		1	0.1%
CORNEA						
70.210	corneal pannus		0		1	0.1%
70.220	pigmentary keratitis		0		1	0.1%
70.700	corneal dystrophy		9	0.5%	0	
UVEA						
93.110	iris hypoplasia		2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		102	5.4%	24	2.6%
93.720	persistent pupillary membranes, iris to lens		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	2	0.2%
LENS						
100.210	cataract. suspect not inherited/significance unknown		47	2.5%	32	3.5%
100.301	punctate cataract, anterior cortex		3	0.2%	5	0.5%
100.302	punctate cataract, posterior cortex		4	0.2%	2	0.2%
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		4	0.2%	5	0.5%
100.307	punctate cataract, capsular		0		2	0.2%
100.311	incipient cataract, anterior cortex		3	0.2%	0	
100.312	incipient cataract, posterior cortex		13	0.7%	2	0.2%
100.313	incipient cataract, equatorial cortex		3	0.2%	0	
100.315	incipient cataract, posterior sutures		8	0.4%	0	
100.317	incipient cataract, capsular		2	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex		1	0.1%	3	0.3%
100.322	incomplete cataract, posterior cortex		3	0.2%	1	0.1%
100.328	y-suture tip opacities		1	0.1%	6	0.7%
100.330	generalized/complete cataract		1	0.1%	0	
100.345	*significant cataracts (summary)*		*48*	*2.5%*	*28*	*3.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		3	0.2%	1	0.1%
110.320	vitreal degeneration		4	0.2%	1	0.1%
RETINA						
120.170	retinal dysplasia, folds		9	0.5%	0	
120.180	retinal dysplasia, geographic		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.1%	0	
120.960	retinopathy		0		3	0.3%

	1991-2015		2016-2020	
OPTIC NERVE				
130.150 optic disc coloboma	2	0.1%	0	
OTHER				
900.000 other, unspecified	25	1.3%	0	
900.100 other, not inherited	31	1.6%	1	0.1%
900.110 other. suspect not inherited/significance unknown	24	1.3%	49	5.3%
NORMAL				
0.000 normal globe	1,730	91.2%	787	85.5%

IRISH RED AND WHITE SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)	Autosomal recessive	2-21	NO	Mutation of the *PDE6B* gene
B.	Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)	Autosomal recessive	22	NO	mutation of the *C2orf71* gene
C.	Cataract	Not defined	1	NO	

Description and Comments

A. Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)

A form of PRA identified in Irish Setters and Irish Red and White Setters. Clinical night blindness is observed as early as 6 weeks of age progressing to total blindness by one year. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. The disorder is caused by a mutation present in exon 21/codon 807 of the *PDE6B* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

B. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

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OCULAR DISORDERS REPORT
IRISH RED & WHITE SETTER

	TOTAL DOGS EXAMINED	1991-2015 441		2016-2020 222	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
21.000	entropion, unspecified	1	0.2%	0	
25.110	distichiasis	21	4.8%	2	0.9%
CORNEA					
70.210	corneal pannus	2	0.5%	0	
70.700	corneal dystrophy	1	0.2%	0	
70.730	corneal endothelial degeneration	0		1	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	7	1.6%	1	0.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.2%	2	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
93.999	uveal cysts	3	0.7%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	17	3.9%	9	4.1%
100.301	punctate cataract, anterior cortex	3	0.7%	2	0.9%
100.302	punctate cataract, posterior cortex	6	1.4%	2	0.9%
100.304	punctate cataract, anterior sutures	1	0.2%	0	
100.307	punctate cataract, capsular	2	0.5%	3	1.4%
100.311	incipient cataract, anterior cortex	4	0.9%	1	0.5%
100.312	incipient cataract, posterior cortex	7	1.6%	1	0.5%
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	1	0.2%	2	0.9%
100.317	incipient cataract, capsular	0		1	0.5%
100.321	incomplete cataract, anterior cortex	1	0.2%	1	0.5%
100.322	incomplete cataract, posterior cortex	1	0.2%	1	0.5%
100.345	*significant cataracts (summary)*	*27*	*6.1%*	*14*	*6.3%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.2%*	*0*	
VITREOUS					
110.135	PHPV/PTVL	1	0.2%	0	
110.200	vitreous degeneration-anterior chamber	1	0.2%	0	
110.320	vitreal degeneration	4	0.9%	2	0.9%
RETINA					
120.170	retinal dysplasia, folds	4	0.9%	1	0.5%
120.180	retinal dysplasia, geographic	2	0.5%	1	0.5%
120.310	generalized progressive retinal atrophy (PRA)	3	0.7%	0	
120.960	retinopathy	1	0.2%	0	
OTHER					
900.000	other, unspecified	5	1.1%	0	
900.100	other, not inherited	7	1.6%	0	
900.110	other. suspect not inherited/significance unknown	10	2.3%	20	9.0%
NORMAL					
0.000	normal globe	371	84.1%	179	80.6%

IRISH SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Persistent hyaloid artery	Not defined	1	Breeder option	
F.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 2-23	NO	
G.	Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)	Autosomal recessive	1, 2-21	NO	Mutation of the *PDE6B* gene
H.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*)	Autosomal recessive	25	NO	Mutation of the *C2orf71* gene
I.	Amblyopia with quadriplegia	Autosomal recessive	24-25	NO	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Irish Setter, the entropion usually involves the lower eyelids.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Irish Setter, a later form of progressive retinal atrophy has been observed by several ophthalmologists at 4-5 years of age. Cases seen in this category appear to advance more rapidly than those with rod-cone dysplasia.

G. Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)

A form of PRA identified in Irish Setters. Clinical night blindness is observed as early as 6 weeks of age progressing to total blindness by one year. It may be diagnosed as early as 24

days with an ERG. Histologically the disease can be detected by 6 weeks. The disorder is caused by a mutation present in exon 21/codon 807 of the *PDE6B* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

H. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

I. Amblyopia with quadriplegia

A congenital quadriplegia and amblyopia. The main symptoms include inability to stand or walk, amblyopia, tremor, nystagmus and possible seizures. Pathologic lesions are confined to the cerebellum. The condition was shown to be due to a fully penetrant autosomal recessive gene that is post-natally lethal in the homozygote.

References

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OCULAR DISORDERS REPORT
IRISH SETTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,047 #	%	2016-2020 257 #	%
GLOBE						
0.110	microphthalmia		2	0.1%	0	
10.000	glaucoma		1	0.0%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
20.160	macropalpebral fissure		2	0.1%	0	
21.000	entropion, unspecified		53	2.6%	3	1.2%
22.000	ectropion, unspecified		9	0.4%	0	
25.110	distichiasis		115	5.6%	15	5.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	1	0.4%
40.910	keratoconjunctivitis sicca		1	0.0%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		3	0.1%	0	
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.220	pigmentary keratitis		1	0.0%	0	
70.700	corneal dystrophy		6	0.3%	0	
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		81	4.0%	19	7.4%
93.720	persistent pupillary membranes, iris to lens		7	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		6	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		21	1.0%	12	4.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	1	0.4%
93.810	uveal melanoma		1	0.0%	0	
93.999	uveal cysts		3	0.1%	2	0.8%
LENS						
100.200	cataract, unspecified		31	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown		105	5.1%	5	1.9%
100.301	punctate cataract, anterior cortex		8	0.4%	3	1.2%
100.302	punctate cataract, posterior cortex		10	0.5%	2	0.8%
100.303	punctate cataract, equatorial cortex		4	0.2%	0	
100.304	punctate cataract, anterior sutures		1	0.0%	0	
100.305	punctate cataract, posterior sutures		2	0.1%	1	0.4%
100.306	punctate cataract, nucleus		4	0.2%	0	
100.307	punctate cataract, capsular		8	0.4%	2	0.8%
100.311	incipient cataract, anterior cortex		19	0.9%	1	0.4%
100.312	incipient cataract, posterior cortex		20	1.0%	1	0.4%
100.313	incipient cataract, equatorial cortex		5	0.2%	0	
100.314	incipient cataract, anterior sutures		4	0.2%	0	
100.315	incipient cataract, posterior sutures		4	0.2%	0	
100.316	incipient cataract, nucleus		8	0.4%	1	0.4%

LENS CONTINUED		1991-2015		2016-2020	
100.317	incipient cataract, capsular	3	0.1%	1	0.4%
100.321	incomplete cataract, anterior cortex	1	0.0%	0	
100.322	incomplete cataract, posterior cortex	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.328	y-suture tip opacities	0		1	0.4%
100.330	generalized/complete cataract	18	0.9%	0	
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*153*	*7.5%*	*13*	*5.1%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	22	1.1%	5	1.9%
110.135	PHPV/PTVL	10	0.5%	0	
110.320	vitreal degeneration	4	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	10	0.5%	2	0.8%
120.180	retinal dysplasia, geographic	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	18	0.9%	0	
120.960	retinopathy	0		1	0.4%
OPTIC NERVE					
130.120	optic nerve hypoplasia	4	0.2%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	19	0.9%	0	
900.100	other, not inherited	38	1.9%	0	
900.110	other. suspect not inherited/significance unknown	41	2.0%	11	4.3%
NORMAL					
0.000	normal globe	1,564	76.4%	187	72.8%

IRISH WATER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Irish Water Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report

OCULAR DISORDERS REPORT
IRISH WATER SPANIEL

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,081**		**209**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	10	0.9%	0	
22.000	ectropion, unspecified	3	0.3%	0	
25.110	distichiasis	277	25.6%	53	25.4%
CORNEA					
70.700	corneal dystrophy	4	0.4%	3	1.4%
UVEA					
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	40	3.7%	21	10.0%
93.730	persistent pupillary membranes, iris to cornea	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.2%	1	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	2	0.2%	0	
LENS					
100.200	cataract, unspecified	3	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	97	9.0%	21	10.0%
100.301	punctate cataract, anterior cortex	13	1.2%	6	2.9%
100.302	punctate cataract, posterior cortex	9	0.8%	1	0.5%
100.303	punctate cataract, equatorial cortex	4	0.4%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.306	punctate cataract, nucleus	0		1	0.5%
100.311	incipient cataract, anterior cortex	14	1.3%	1	0.5%
100.312	incipient cataract, posterior cortex	23	2.1%	0	
100.313	incipient cataract, equatorial cortex	10	0.9%	1	0.5%
100.314	incipient cataract, anterior sutures	2	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.2%	0	
100.316	incipient cataract, nucleus	5	0.5%	1	0.5%
100.317	incipient cataract, capsular	5	0.5%	0	
100.326	incomplete cataract, nucleus	1	0.1%	0	
100.330	generalized/complete cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*93*	*8.6%*	*11*	*5.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	3	1.4%
110.320	vitreal degeneration	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	5	0.5%	1	0.5%
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.5%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.920	retinal detachment with dialysis	0		2	1.0%
120.960	retinopathy	2	0.2%	1	0.5%

	1991-2015		2016-2020	
OTHER				
900.000 other, unspecified	20	1.9%	0	
900.100 other, not inherited	15	1.4%	0	
900.110 other. suspect not inherited/significance unknown	12	1.1%	7	3.3%
NORMAL				
0.000 normal globe	742	68.6%	109	52.2%

IRISH WOLFHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Uveal cysts	Not defined	1	Breeder option
F.	Cataract	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option
H.	Optic nerve hypoplasia	Not defined	1	NO
I.	Micropapilla	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

I. Micropapilla

A congenital anomaly which results in a small optic disk diameter without vision loss. Contrast with optic nerve hypoplasia, which may have a similar ophthalmoscopic appearance with vision loss.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
IRISH WOLFHOUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 1,774 #	 %	2016-2020 540 #	 %
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	6	0.3%	0	
25.110	distichiasis	87	4.9%	29	5.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.2%
NICTITANS					
50.210	pannus of third eyelid	1	0.1%	0	
51.100	third eyelid cartilage anomaly	17	1.0%	8	1.5%
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	38	2.1%	3	0.6%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	19	1.1%	8	1.5%
93.720	persistent pupillary membranes, iris to lens	7	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	11	0.6%	0	
93.740	persistent pupillary membranes, iris sheets	5	0.3%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.1%	0	
93.810	uveal melanoma	1	0.1%	0	
93.999	uveal cysts	92	5.2%	48	8.9%
LENS					
100.200	cataract, unspecified	12	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	80	4.5%	35	6.5%
100.301	punctate cataract, anterior cortex	10	0.6%	2	0.4%
100.302	punctate cataract, posterior cortex	21	1.2%	5	0.9%
100.303	punctate cataract, equatorial cortex	2	0.1%	2	0.4%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	8	0.5%	0	
100.306	punctate cataract, nucleus	5	0.3%	1	0.2%
100.307	punctate cataract, capsular	3	0.2%	2	0.4%
100.311	incipient cataract, anterior cortex	11	0.6%	3	0.6%
100.312	incipient cataract, posterior cortex	33	1.9%	9	1.7%
100.313	incipient cataract, equatorial cortex	8	0.5%	2	0.4%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	10	0.6%	4	0.7%
100.316	incipient cataract, nucleus	9	0.5%	2	0.4%
100.317	incipient cataract, capsular	1	0.1%	3	0.6%
100.322	incomplete cataract, posterior cortex	1	0.1%	1	0.2%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.326	incomplete cataract, nucleus	1	0.1%	0	
100.330	generalized/complete cataract	4	0.2%	1	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*141*	*7.9%*	*38*	*7.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.3%	2	0.4%
110.320	vitreal degeneration	6	0.3%	2	0.4%
RETINA					
120.170	retinal dysplasia, folds	25	1.4%	8	1.5%
120.180	retinal dysplasia, geographic	11	0.6%	0	
120.190	retinal dysplasia, detached	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.1%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	1	0.1%	1	0.2%
OPTIC NERVE					
130.110	micropapilla	12	0.7%	7	1.3%
130.120	optic nerve hypoplasia	26	1.5%	3	0.6%
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	22	1.2%	0	
900.100	other, not inherited	59	3.3%	0	
900.110	other. suspect not inherited/significance unknown	34	1.9%	28	5.2%
NORMAL					
0.000	normal globe	1,354	76.3%	369	68.3%

ITALIAN GREYHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Vitreous degeneration	Not defined	1, 2	Breeder option	
C.	Retinal atrophy (*IG-PRA1*)	Autosomal recessive	1, 3	NO	A genetic test for susceptibility is available

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Italian Greyhound, posterior subcapsular and cortical cataracts at two to three years of age appear to be the more common location of occurrence, with progression noted in an undetermined percentage of dogs.

B. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

C. Retinal atrophy - *IG-PRA1*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Italian Greyhound PRA (*IG-PRA1*) is considered a "late onset" PRA with clinical signs detected between 3-5 years of age. Dogs initially lose night vision followed by decreased vision in bright light conditions. Clinically increases in tapetal reflectivity and retinal vessel attenuation are noted. The risk allele is known, but the genetic mutation has not been determined. The disease has been presumed to be inherited as an autosomal recessive trait. However some affected dogs had only one copy of the risk allele suggesting an autosomal dominant with incomplete penetrance mode of inheritance. A DNA test is available for the risk allele. At least one other form of PRA appears to be present in the

breed and will not be detected with this test.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
ITALIAN GREYHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 7,573 #	%	2016-2020 646 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	1	0.2%
EYELIDS						
21.000	entropion, unspecified		0		1	0.2%
25.110	distichiasis		20	0.3%	3	0.5%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		3	0.0%	6	0.9%
CORNEA						
70.210	corneal pannus		7	0.1%	0	
70.220	pigmentary keratitis		2	0.0%	0	
70.700	corneal dystrophy		19	0.3%	2	0.3%
UVEA						
93.110	iris hypoplasia		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		3	0.0%	0	
93.150	iris coloboma		6	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		51	0.7%	3	0.5%
93.720	persistent pupillary membranes, iris to lens		6	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		5	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		7	0.1%	1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.1%	1	0.2%
93.999	uveal cysts		2	0.0%	1	0.2%
LENS						
100.200	cataract, unspecified		17	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		327	4.3%	38	5.9%
100.301	punctate cataract, anterior cortex		88	1.2%	11	1.7%
100.302	punctate cataract, posterior cortex		85	1.1%	1	0.2%
100.303	punctate cataract, equatorial cortex		26	0.3%	3	0.5%
100.304	punctate cataract, anterior sutures		5	0.1%	0	
100.305	punctate cataract, posterior sutures		16	0.2%	2	0.3%
100.306	punctate cataract, nucleus		7	0.1%	0	
100.307	punctate cataract, capsular		11	0.1%	1	0.2%
100.311	incipient cataract, anterior cortex		172	2.3%	12	1.9%
100.312	incipient cataract, posterior cortex		170	2.2%	16	2.5%
100.313	incipient cataract, equatorial cortex		98	1.3%	7	1.1%
100.314	incipient cataract, anterior sutures		7	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures		16	0.2%	2	0.3%
100.316	incipient cataract, nucleus		14	0.2%	1	0.2%
100.317	incipient cataract, capsular		16	0.2%	3	0.5%
100.321	incomplete cataract, anterior cortex		7	0.1%	4	0.6%
100.322	incomplete cataract, posterior cortex		7	0.1%	7	1.1%
100.323	incomplete cataract, equatorial cortex		3	0.0%	2	0.3%
100.324	incomplete cataract, anterior sutures		0		1	0.2%
100.326	incomplete cataract, nucleus		1	0.0%	0	
100.328	y-suture tip opacities		0		2	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	49	0.6%	1	0.2%
100.345	*significant cataracts (summary)*	*815*	*10.8%*	*77*	*11.9%*
100.375	*subluxation/luxation, unspecified*	*36*	*0.5%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	22	0.3%	2	0.3%
110.135	PHPV/PTVL	3	0.0%	0	
110.200	vitreous degeneration-anterior chamber	168	2.2%	131	20.3%
110.320	vitreal degeneration	2,493	32.9%	107	16.6%
FUNDUS					
97.110	choroidal hypoplasia	22	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	24	0.3%	2	0.3%
120.180	retinal dysplasia, geographic	4	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	244	3.2%	7	1.1%
120.400	retinal hemorrhage	19	0.3%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	2	0.3%
120.960	retinopathy	6	0.1%	3	0.5%
OPTIC NERVE					
130.110	micropapilla	20	0.3%	2	0.3%
130.120	optic nerve hypoplasia	34	0.4%	3	0.5%
130.150	optic disc coloboma	4	0.1%	0	
OTHER					
900.000	other, unspecified	63	0.8%	0	
900.100	other, not inherited	138	1.8%	5	0.8%
900.110	other. suspect not inherited/significance unknown	89	1.2%	35	5.4%
NORMAL					
0.000	normal globe	4,967	65.6%	379	58.7%

JACK RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	1, 2-7	NO	Mutation of the *ADAMTS17* gene
E.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene
F.	Vitreous degeneration	Not defined	1, 2	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens

completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from its normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Retinal Atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Jack Russell Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.
2. Lawson DD. Luxation of the crystalline lens in the dog. J Small Anim Pract. 1969;10:461-463.
3. Curtis R, Barnett KC. Primary lens luxation in the dog. J Small Anim Pract. 1980;21:657-668.
4. Curtis R, Barnett KC, Lewis SJ. Clinical and pathological observations concerning the aetiology of primary lens luxation in the dog. Vet Rec. 1983;112:238-246.
5. Oberbauer AM, Hollingsworth SR, Belanger JM, et al. Inheritance of cataracts and primary lens luxation in Jack Russell Terriers. Am J Vet Res. 2008;69:222-227.
6. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. Invest Ophthalmol Vis Sci. 2010;51:4716-4721.

7. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Vet Ophthalmol. 2011;14:378-384.

OCULAR DISORDERS REPORT
JACK RUSSELL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 15,323 #	 %	2016-2020 1,604 #	 %
GLOBE						
0.110	microphthalmia		5	0.0%	0	
10.000	glaucoma		3	0.0%	0	
EYELIDS						
20.140	ectopic cilia		2	0.0%	0	
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		3	0.0%	0	
25.110	distichiasis		354	2.3%	25	1.6%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		2	0.0%	1	0.1%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.220	pigmentary keratitis		9	0.1%	0	
70.700	corneal dystrophy		59	0.4%	9	0.6%
70.730	corneal endothelial degeneration		9	0.1%	2	0.1%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		4	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		694	4.5%	64	4.0%
93.720	persistent pupillary membranes, iris to lens		40	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		18	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets		10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		11	0.1%	6	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		6	0.0%	0	
93.999	uveal cysts		7	0.0%	0	
LENS						
100.200	cataract, unspecified		4	0.0%	0	
100.210	cataract. suspect not inherited/significance unknown		534	3.5%	50	3.1%
100.301	punctate cataract, anterior cortex		73	0.5%	13	0.8%
100.302	punctate cataract, posterior cortex		78	0.5%	9	0.6%
100.303	punctate cataract, equatorial cortex		21	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures		14	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		49	0.3%	8	0.5%
100.306	punctate cataract, nucleus		19	0.1%	4	0.2%
100.307	punctate cataract, capsular		18	0.1%	4	0.2%
100.311	incipient cataract, anterior cortex		184	1.2%	12	0.7%
100.312	incipient cataract, posterior cortex		373	2.4%	26	1.6%
100.313	incipient cataract, equatorial cortex		64	0.4%	8	0.5%
100.314	incipient cataract, anterior sutures		8	0.1%	0	
100.315	incipient cataract, posterior sutures		133	0.9%	16	1.0%
100.316	incipient cataract, nucleus		30	0.2%	2	0.1%
100.317	incipient cataract, capsular		26	0.2%	2	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	1	0.0%	3	0.2%
100.322	incomplete cataract, posterior cortex	6	0.0%	7	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.328	y-suture tip opacities	5	0.0%	5	0.3%
100.330	generalized/complete cataract	94	0.6%	3	0.2%
100.345	*significant cataracts (summary)*	*1,200*	*7.8%*	*127*	*7.9%*
100.375	*subluxation/luxation, unspecified*	*81*	*0.5%*	*2*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	18	0.1%	3	0.2%
110.135	PHPV/PTVL	4	0.0%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	5	0.3%
110.320	vitreal degeneration	232	1.5%	15	0.9%
FUNDUS					
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	58	0.4%	1	0.1%
120.180	retinal dysplasia, geographic	20	0.1%	0	
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	84	0.5%	1	0.1%
120.400	retinal hemorrhage	4	0.0%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.960	retinopathy	2	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	7	0.0%	0	
130.120	optic nerve hypoplasia	12	0.1%	1	0.1%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	113	0.7%	0	
900.100	other, not inherited	645	4.2%	3	0.2%
900.110	other. suspect not inherited/significance unknown	112	0.7%	71	4.4%
NORMAL					
0.000	normal globe	12,682	82.8%	1,285	80.1%

JAGDTERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Jagdterrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Vet Ophthalmol. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
JAGDTERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 0 #	 %	2016-2020 2 #	 %
NORMAL					
0.000 normal globe		0		2	100.0%

JAMTHUND

(Swedish Elkhound)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Jamthund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Jamthund. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
JAMTHUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 0 # %	2016-2020 1 # %
NORMAL			
0.000 normal globe		0	1 100.0%

JAPANESE AKITA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Japanese Akita breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
JAPANESE AKITA

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 26 #	 %	2016-2020 155 #	 %
EYELIDS					
25.110	distichiasis	0		2	1.3%
CORNEA					
70.700	corneal dystrophy	0		5	3.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	7.7%	19	12.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	3.8%	10	6.5%
100.301	punctate cataract, anterior cortex	1	3.8%	1	0.6%
100.302	punctate cataract, posterior cortex	0		1	0.6%
100.305	punctate cataract, posterior sutures	0		3	1.9%
100.317	incipient cataract, capsular	0		3	1.9%
100.328	y-suture tip opacities	0		3	1.9%
100.345	*significant cataracts (summary)*	*1*	*3.8%*	*11*	*7.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		5	3.2%
RETINA					
120.170	retinal dysplasia, folds	0		2	1.3%
120.920	retinal detachment with dialysis	1	3.8%	0	
120.960	retinopathy	0		2	1.3%
OTHER					
900.100	other, not inherited	1	3.8%	0	
900.110	other. suspect not inherited/significance unknown	1	3.8%	17	11.0%
NORMAL					
0.000	normal globe	20	76.9%	102	65.8%

JAPANESE CHIN
(JAPANESE SPANIEL)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Exposure keratopathy syndrome	Not defined	1	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
E.	Cataract	Not defined	1	NO	
F.	Vitreous degeneration	Not defined	1	Breeder option	
G.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 2	NO	Mutation of the *prcd* gene

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Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Exposure keratopathy syndrome

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and

macropalpebral fissure.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Japanese Chin is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl, B., et al. (2006). "Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans." Genomics 88(5): 551-563. PMID: 16938425

OCULAR DISORDERS REPORT
JAPANESE CHIN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,123 #	 %	2016-2020 291 #	 %
EYELIDS						
20.160	macropalpebral fissure		13	1.2%	0	
21.000	entropion, unspecified		88	7.8%	21	7.2%
22.000	ectropion, unspecified		1	0.1%	0	
25.110	distichiasis		55	4.9%	8	2.7%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.1%	0	
40.910	keratoconjunctivitis sicca		1	0.1%	2	0.7%
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.2%	0	
CORNEA						
70.210	corneal pannus		9	0.8%	2	0.7%
70.220	pigmentary keratitis		44	3.9%	7	2.4%
70.700	corneal dystrophy		2	0.2%	1	0.3%
70.730	corneal endothelial degeneration		2	0.2%	2	0.7%
UVEA						
93.150	iris coloboma		1	0.1%	1	0.3%
93.710	persistent pupillary membranes, iris to iris		121	10.8%	25	8.6%
93.720	persistent pupillary membranes, iris to lens		6	0.5%	0	
93.730	persistent pupillary membranes, iris to cornea		7	0.6%	0	
93.740	persistent pupillary membranes, iris sheets		6	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	0	
93.999	uveal cysts		0		1	0.3%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		53	4.7%	13	4.5%
100.301	punctate cataract, anterior cortex		17	1.5%	5	1.7%
100.302	punctate cataract, posterior cortex		8	0.7%	0	
100.303	punctate cataract, equatorial cortex		6	0.5%	1	0.3%
100.304	punctate cataract, anterior sutures		4	0.4%	3	1.0%
100.305	punctate cataract, posterior sutures		4	0.4%	2	0.7%
100.306	punctate cataract, nucleus		1	0.1%	1	0.3%
100.307	punctate cataract, capsular		2	0.2%	0	
100.311	incipient cataract, anterior cortex		37	3.3%	12	4.1%
100.312	incipient cataract, posterior cortex		24	2.1%	7	2.4%
100.313	incipient cataract, equatorial cortex		23	2.0%	5	1.7%
100.314	incipient cataract, anterior sutures		1	0.1%	1	0.3%
100.315	incipient cataract, posterior sutures		7	0.6%	1	0.3%
100.316	incipient cataract, nucleus		4	0.4%	3	1.0%
100.317	incipient cataract, capsular		11	1.0%	2	0.7%
100.321	incomplete cataract, anterior cortex		3	0.3%	4	1.4%
100.328	y-suture tip opacities		0		1	0.3%
100.330	generalized/complete cataract		7	0.6%	1	0.3%
100.345	*significant cataracts (summary)*		*160*	*14.2%*	*49*	*16.8%*
100.375	*subluxation/luxation, unspecified*		*6*	*0.5%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	15	1.3%	4	1.4%
110.135	PHPV/PTVL	13	1.2%	0	
110.200	vitreous degeneration-anterior chamber	4	0.4%	1	0.3%
110.320	vitreal degeneration	50	4.5%	15	5.2%
FUNDUS					
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	2	0.2%	1	0.3%
120.180	retinal dysplasia, geographic	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	15	1.3%	1	0.3%
120.910	retinal detachment without dialysis	1	0.1%	0	
120.920	retinal detachment with dialysis	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	2	0.2%	0	
OTHER					
900.000	other, unspecified	28	2.5%	0	
900.100	other, not inherited	43	3.8%	3	1.0%
900.110	other. suspect not inherited/significance unknown	33	2.9%	28	9.6%
NORMAL					
0.000	normal globe	726	64.6%	153	52.6%

KAI KEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Kai Ken breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
KAI KEN

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 2 #	 %	2016-2020 28 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	3.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	50.0%	7	25.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		2	7.1%
RETINA					
120.960	retinopathy	0		1	3.6%
NORMAL					
0.000	normal globe	1	50.0%	18	64.3%

KARELIAN BEAR DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST AVAILABLE
A.	Retinal atrophy (*prcd)*	Autosomal recessive	1-3	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited. A genetic test is available to detect the progressive rod cone degeneration form of PRA caused by a mutation in the *prcd*-gene. A second form of PRA is also present in the Karelian Bear Dog for which the causative mutation is not yet known.

References

1. ACVO Genetics Committee and Data from OFA All-Breeds Report.

2. Ahonen S, Lohi H, editors. Progressive retinal atrophy in the Karelian Bear Dog: A large animal model for retinitis pigmentosa. ARVO 2014 Annual Meeting; 2014; Orlando, FL. Program number: 3270.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. Epub 2006/08/30. PMID: 16938425

OCULAR DISORDERS REPORT
KARELIAN BEAR DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 103 #	 %	2016-2020 13 #	 %
EYELIDS					
25.110	distichiasis	2	1.9%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	7.7%
70.700	corneal dystrophy	4	3.9%	1	7.7%
70.730	corneal endothelial degeneration	1	1.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	10	9.7%	2	15.4%
93.730	persistent pupillary membranes, iris to cornea	3	2.9%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	1.0%	2	15.4%
100.307	punctate cataract, capsular	2	1.9%	0	
100.311	incipient cataract, anterior cortex	3	2.9%	0	
100.312	incipient cataract, posterior cortex	4	3.9%	0	
100.314	incipient cataract, anterior sutures	0		1	7.7%
100.317	incipient cataract, capsular	1	1.0%	1	7.7%
100.345	*significant cataracts (summary)*	*10*	*9.7%*	*2*	*15.4%*
RETINA					
120.170	retinal dysplasia, folds	4	3.9%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	1.0%	0	
120.960	retinopathy	1	1.0%	0	
OTHER					
900.000	other, unspecified	1	1.0%	0	
900.100	other, not inherited	1	1.0%	0	
900.110	other. suspect not inherited/significance unknown	0		2	15.4%
NORMAL					
0.000	normal globe	79	76.7%	6	46.2%

KEESHOND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO
D.	Y-suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located in the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

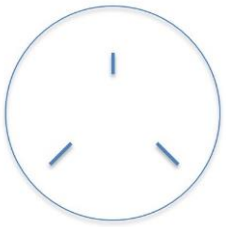
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Keeshond breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
KEESHOND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 3,174 #	 %	2016-2020 634 #	 %
GLOBE					
0.110	microphthalmia	1	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	9	0.3%	0	
25.110	distichiasis	188	5.9%	23	3.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.2%
70.700	corneal dystrophy	12	0.4%	0	
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	29	0.9%	3	0.5%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	2	0.1%	0	
LENS					
100.200	cataract, unspecified	18	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	274	8.6%	79	12.5%
100.301	punctate cataract, anterior cortex	12	0.4%	1	0.2%
100.302	punctate cataract, posterior cortex	16	0.5%	1	0.2%
100.303	punctate cataract, equatorial cortex	11	0.3%	0	
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	50	1.6%	25	3.9%
100.306	punctate cataract, nucleus	1	0.0%	2	0.3%
100.307	punctate cataract, capsular	1	0.0%	7	1.1%
100.311	incipient cataract, anterior cortex	7	0.2%	1	0.2%
100.312	incipient cataract, posterior cortex	34	1.1%	2	0.3%
100.313	incipient cataract, equatorial cortex	9	0.3%	0	
100.314	incipient cataract, anterior sutures	1	0.0%	0	
100.315	incipient cataract, posterior sutures	18	0.6%	7	1.1%
100.316	incipient cataract, nucleus	13	0.4%	0	
100.317	incipient cataract, capsular	2	0.1%	3	0.5%
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.326	incomplete cataract, nucleus	1	0.0%	0	
100.327	incomplete cataract, capsular	1	0.0%	1	0.2%
100.328	y-suture tip opacities	6	0.2%	47	7.4%
100.330	generalized/complete cataract	7	0.2%	1	0.2%
100.345	*significant cataracts (summary)*	*211*	*6.6%*	*99*	*15.6%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	1	0.2%
110.320	vitreal degeneration	7	0.2%	4	0.6%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	6	0.2%	0	
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	10	0.3%	1	0.2%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	3	0.1%	2	0.3%
OPTIC NERVE					
130.110	micropapilla	6	0.2%	3	0.5%
130.120	optic nerve hypoplasia	12	0.4%	1	0.2%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	21	0.7%	0	
900.100	other, not inherited	44	1.4%	3	0.5%
900.110	other. suspect not inherited/significance unknown	29	0.9%	28	4.4%
NORMAL					
0.000	normal globe	2,555	80.5%	449	70.8%

KERRY BLUE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Kerry Blue Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
KERRY BLUE TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 731 #	 %	2016-2020 86 #	 %
EYELIDS						
25.110	distichiasis		11	1.5%	4	4.7%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.700	corneal dystrophy		3	0.4%	1	1.2%
UVEA						
93.710	persistent pupillary membranes, iris to iris		10	1.4%	4	4.7%
93.720	persistent pupillary membranes, iris to lens		2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	2.3%
LENS						
100.200	cataract, unspecified		6	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		28	3.8%	3	3.5%
100.301	punctate cataract, anterior cortex		15	2.1%	0	
100.302	punctate cataract, posterior cortex		3	0.4%	0	
100.306	punctate cataract, nucleus		3	0.4%	0	
100.312	incipient cataract, posterior cortex		4	0.5%	0	
100.313	incipient cataract, equatorial cortex		3	0.4%	0	
100.330	generalized/complete cataract		6	0.8%	0	
100.345	*significant cataracts (summary)*		*40*	*5.5%*	*0*	
VITREOUS						
110.320	vitreal degeneration		10	1.4%	0	
RETINA						
120.310	generalized progressive retinal atrophy (PRA)		2	0.3%	1	1.2%
OTHER						
900.000	other, unspecified		1	0.1%	0	
900.100	other, not inherited		21	2.9%	0	
900.110	other. suspect not inherited/significance unknown		2	0.3%	3	3.5%
NORMAL						
0.000	normal globe		647	88.5%	72	83.7%

KOMONDOR

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Appears to be relatively young age for onset in the Komondor (<4yr) and mainly anterior cortical.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Komondor breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
KOMONDOR

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 342 #	 %	2016-2020 46 #	 %
EYELIDS						
21.000	entropion, unspecified		1	0.3%	0	
22.000	ectropion, unspecified		1	0.3%	0	
25.110	distichiasis		0		1	2.2%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.3%	0	
CORNEA						
70.700	corneal dystrophy		1	0.3%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	1.5%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.6%	0	
LENS						
100.200	cataract, unspecified		14	4.1%	0	
100.210	cataract. suspect not inherited/significance unknown		26	7.6%	3	6.5%
100.303	punctate cataract, equatorial cortex		2	0.6%	0	
100.306	punctate cataract, nucleus		4	1.2%	0	
100.307	punctate cataract, capsular		2	0.6%	0	
100.312	incipient cataract, posterior cortex		3	0.9%	1	2.2%
100.313	incipient cataract, equatorial cortex		5	1.5%	0	
100.314	incipient cataract, anterior sutures		1	0.3%	0	
100.315	incipient cataract, posterior sutures		3	0.9%	1	2.2%
100.316	incipient cataract, nucleus		5	1.5%	0	
100.326	incomplete cataract, nucleus		1	0.3%	0	
100.328	y-suture tip opacities		0		1	2.2%
100.330	generalized/complete cataract		1	0.3%	0	
100.345	*significant cataracts (summary)*		*41*	*12.0%*	*3*	*6.5%*
RETINA						
120.170	retinal dysplasia, folds		1	0.3%	0	
OTHER						
900.000	other, unspecified		7	2.0%	0	
900.100	other, not inherited		6	1.8%	0	
900.110	other. suspect not inherited/significance unknown		1	0.3%	0	
NORMAL						
0.000	normal globe		280	81.9%	41	89.1%

KUVASZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 2	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the form of PRA in the Kuvasz is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
KUVASZ

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**542**		**12**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.4%	0	
EYELIDS					
20.140	ectopic cilia	1	0.2%	0	
20.160	macropalpebral fissure	1	0.2%	0	
22.000	ectropion, unspecified	2	0.4%	0	
25.110	distichiasis	21	3.9%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.2%	0	
CORNEA					
70.700	corneal dystrophy	6	1.1%	0	
70.730	corneal endothelial degeneration	1	0.2%	0	
UVEA					
93.150	iris coloboma	2	0.4%	0	
93.710	persistent pupillary membranes, iris to iris	23	4.2%	0	
93.720	persistent pupillary membranes, iris to lens	3	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.6%	0	
LENS					
100.200	cataract, unspecified	2	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	15	2.8%	1	8.3%
100.301	punctate cataract, anterior cortex	1	0.2%	0	
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.2%	0	
100.312	incipient cataract, posterior cortex	1	0.2%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.316	incipient cataract, nucleus	3	0.6%	0	
100.330	generalized/complete cataract	5	0.9%	0	
100.345	*significant cataracts (summary)*	*16*	*3.0%*	*0*	
VITREOUS					
110.320	vitreal degeneration	1	0.2%	0	
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	4	0.7%	0	
OTHER					
900.000	other, unspecified	1	0.2%	0	
900.100	other, not inherited	12	2.2%	0	
900.110	other. suspect not inherited/significance unknown	3	0.6%	1	8.3%
NORMAL					
0.000	normal globe	454	83.8%	10	83.3%

LABRADOR RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1-3	Breeder option	
B.	Ectropion	Not defined	1	Breeder option	
C.	Distichiasis	Not defined	1	Breeder option	
D.	Corneal dystrophy				
	- epithelial/stromal	Not defined	1, 4	Breeder option	
	- macular	Autosomal recessive	5	NO	Mutation of the *CHST6* gene
E.	Uveal cysts	Not defined	1	Breeder option	
F.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
G.	Cataract				
		Presumed dominant with incomplete penetrance	1-3, 6-8	NO	
		Autosomal recessive	9	NO	
		Not defined	1	NO	
H.	Y-suture tip opacity	Not defined	1	Breeder option	
I.	Persistent hyaloid artery	Not defined	1	Breeder option	
J.	Vitreous degeneration	Not defined	1	Breeder option	
K.	Retinal atrophy				Mutation of the *prcd* gene
	- (*prcd*)	Autosomal recessive	1, 10-14	NO	
	- generalized		15	NO	Mutation of the *ABCA4* gene

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
L.	Achromatopsia Type 2 (ACHM - Type 2)	Autosomal recessive	16, 17	NO	Causative mutation not yet published
M.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 18-27	NO (Breeder option with Normal DNA test for folds)	Mutation in the *COL9A3* gene
N.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive with incomplete dominance for the eyes	1, 18-26, 28	NO	Mutation in the *COL9A3* gene
O.	Limbal melanoma	Not defined	29	NO	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal/macular

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In Labrador Retrievers in Europe, macular corneal dystrophy (MCD) has been shown to be caused by accumulations of glycosaminoglycans in the corneal stroma. This form of corneal dystrophy is caused by a mutation in the *CHST6* gene.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Labrador Retriever, this is a potentially serious problem as many of the PPMs identified on routine screening examinations bridge from the iris to the cornea and/or from iris sheets bridging the pupils. These forms may cause vision impairment.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

G. Cataract

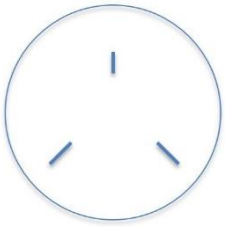
A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most frequently reported cataracts in the Labrador Retriever are bilateral or unilateral, focal, posterior polar (posterior cortical)/subcapsular cataracts which usually present between 1-3 years of age. These are generally stationary or very slowly progressive and generally do not interfere with vision. It has been suggested that these cataracts are inherited as dominant with incomplete penetrance, but definitive breeding studies are still required to verify this hypothesis.

A second type of cataract is a progressive cortical cataract which may involve the entire lens. It is not clear whether this is a distinct entity, or an aberrant form of the posterior polar cataract.

H. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

I. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (**persistent hyaloid remnant**).

J. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

K. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Labrador Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

L. Achromatopsia Type 2 (ACHM – Type 2)

A congenital form of day blindness. Visual deficits become apparent between 8-10 weeks of age. Normal vision is present in low light conditions. Clinical examination is normal. Cone responses are absent on an electroretinogram. The causative genetic mutation has been determined, but not yet published. A DNA test is available.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Labrador Retriever, the presence of retinal folds may be seen in the heterozygous state described in "R" below, thus the recommendation against breeding.

The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog, showing that it is not a carrier of the *COL9A3* mutation.

N. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1) in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs ("downhill" conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

O. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition have been noted in the German Shepherd, Labrador and Golden Retriever.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for Labrador Retriever. However as the condition is no longer identified in the breed, the condition has been removed.

Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

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OCULAR DISORDERS REPORT
LABRADOR RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 229,860 #	%	2016-2020 37,648 #	%
GLOBE						
0.110	microphthalmia		59	0.0%	6	0.0%
10.000	glaucoma		28	0.0%	2	0.0%
EYELIDS						
20.140	ectopic cilia		16	0.0%	2	0.0%
20.160	macropalpebral fissure		86	0.0%	0	
21.000	entropion, unspecified		996	0.4%	185	0.5%
22.000	ectropion, unspecified		485	0.2%	59	0.2%
25.110	distichiasis		2,267	1.0%	344	0.9%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		22	0.0%	21	0.1%
40.910	keratoconjunctivitis sicca		7	0.0%	3	0.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		11	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid		38	0.0%	1	0.0%
CORNEA						
70.210	corneal pannus		9	0.0%	0	
70.220	pigmentary keratitis		18	0.0%	7	0.0%
70.700	corneal dystrophy		2,260	1.0%	377	1.0%
70.730	corneal endothelial degeneration		80	0.0%	10	0.0%
UVEA						
90.250	pigmentary uveitis		2	0.0%	0	
93.110	iris hypoplasia		6	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM		12	0.0%	0	
93.150	iris coloboma		11	0.0%	1	0.0%
93.180	Iiris sphincter dysplasia		0		2	0.0%
93.710	persistent pupillary membranes, iris to iris		6,793	3.0%	1,424	3.8%
93.720	persistent pupillary membranes, iris to lens		144	0.1%	19	0.1%
93.730	persistent pupillary membranes, iris to cornea		153	0.1%	12	0.0%
93.740	persistent pupillary membranes, iris sheets		176	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		280	0.1%	350	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands		28	0.0%	12	0.0%
93.810	uveal melanoma		45	0.0%	36	0.1%
93.999	uveal cysts		399	0.2%	120	0.3%
97.150	chorioretinal coloboma, congenital		0		1	0.0%
LENS						
100.200	cataract, unspecified		728	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		9,963	4.3%	1,770	4.7%
100.301	punctate cataract, anterior cortex		897	0.4%	248	0.7%
100.302	punctate cataract, posterior cortex		1,287	0.6%	153	0.4%
100.303	punctate cataract, equatorial cortex		166	0.1%	30	0.1%
100.304	punctate cataract, anterior sutures		114	0.0%	19	0.1%
100.305	punctate cataract, posterior sutures		710	0.3%	147	0.4%
100.306	punctate cataract, nucleus		174	0.1%	34	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.307	punctate cataract, capsular	239	0.1%	119	0.3%
100.311	incipient cataract, anterior cortex	699	0.3%	94	0.2%
100.312	incipient cataract, posterior cortex	1,886	0.8%	270	0.7%
100.313	incipient cataract, equatorial cortex	488	0.2%	68	0.2%
100.314	incipient cataract, anterior sutures	59	0.0%	9	0.0%
100.315	incipient cataract, posterior sutures	456	0.2%	69	0.2%
100.316	incipient cataract, nucleus	299	0.1%	39	0.1%
100.317	incipient cataract, capsular	235	0.1%	75	0.2%
100.320	incomplete cataract, unspecified	0		1	0.0%
100.321	incomplete cataract, anterior cortex	13	0.0%	20	0.1%
100.322	incomplete cataract, posterior cortex	48	0.0%	55	0.1%
100.323	incomplete cataract, equatorial cortex	14	0.0%	11	0.0%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	6	0.0%	9	0.0%
100.326	incomplete cataract, nucleus	9	0.0%	15	0.0%
100.327	incomplete cataract, capsular	6	0.0%	12	0.0%
100.328	y-suture tip opacities	124	0.1%	216	0.6%
100.330	generalized/complete cataract	350	0.2%	11	0.0%
100.340	resorbing/hypermature cataract	1	0.0%	5	0.0%
100.345	*significant cataracts (summary)*	*9,009*	*3.9%*	*1,729*	*4.6%*
100.375	*subluxation/luxation, unspecified*	*51*	*0.0%*	*7*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	576	0.3%	129	0.3%
110.135	PHPV/PTVL	150	0.1%	15	0.0%
110.200	vitreous degeneration-anterior chamber	9	0.0%	24	0.1%
110.320	vitreal degeneration	821	0.4%	149	0.4%
FUNDUS					
97.110	choroidal hypoplasia	14	0.0%	0	
97.120	coloboma	11	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	5,030	2.2%	400	1.1%
120.180	retinal dysplasia, geographic	1,984	0.9%	170	0.5%
120.190	retinal dysplasia, detached	182	0.1%	13	0.0%
120.310	generalized progressive retinal atrophy (PRA)	985	0.4%	16	0.0%
120.400	retinal hemorrhage	34	0.0%	0	
120.910	retinal detachment without dialysis	73	0.0%	0	
120.920	retinal detachment with dialysis	6	0.0%	7	0.0%
120.960	retinopathy	58	0.0%	41	0.1%
OPTIC NERVE					
130.110	micropapilla	102	0.0%	21	0.1%
130.120	optic nerve hypoplasia	86	0.0%	5	0.0%
130.150	optic disc coloboma	43	0.0%	6	0.0%
OTHER					
900.000	other, unspecified	1,697	0.7%	0	
900.100	other, not inherited	4,315	1.9%	50	0.1%
900.110	other. suspect not inherited/significance unknown	1,949	0.8%	1,420	3.8%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	198,107 86.2%	30,139 80.1%

LAGOTTO ROMAGNOLO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Lagotto Romagnolo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary conditions of the Lagotto Romagnolo breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
LAGOTTO ROMAGNOLO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 287 #	 %	2016-2020 877 #	 %
EYELIDS						
25.110	distichiasis		26	9.1%	79	9.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.3%	0	
52.110	prolapsed gland of the third eyelid		1	0.3%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		12	4.2%	39	4.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	1.0%	9	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.1%
93.999	uveal cysts		0		1	0.1%
LENS						
100.210	cataract. suspect not inherited/significance unknown		7	2.4%	20	2.3%
100.301	punctate cataract, anterior cortex		1	0.3%	5	0.6%
100.302	punctate cataract, posterior cortex		0		3	0.3%
100.303	punctate cataract, equatorial cortex		1	0.3%	4	0.5%
100.305	punctate cataract, posterior sutures		1	0.3%	0	
100.306	punctate cataract, nucleus		0		1	0.1%
100.311	incipient cataract, anterior cortex		0		2	0.2%
100.313	incipient cataract, equatorial cortex		2	0.7%	1	0.1%
100.315	incipient cataract, posterior sutures		0		1	0.1%
100.316	incipient cataract, nucleus		0		1	0.1%
100.321	incomplete cataract, anterior cortex		1	0.3%	2	0.2%
100.322	incomplete cataract, posterior cortex		1	0.3%	1	0.1%
100.323	incomplete cataract, equatorial cortex		0		2	0.2%
100.326	incomplete cataract, nucleus		1	0.3%	0	
100.328	y-suture tip opacities		0		3	0.3%
100.345	*significant cataracts (summary)*		*8*	*2.8%*	*26*	*3.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		6	0.7%
RETINA						
120.170	retinal dysplasia, folds		2	0.7%	4	0.5%
120.310	generalized progressive retinal atrophy (PRA)		0		1	0.1%
120.960	retinopathy		0		1	0.1%
OPTIC NERVE						
130.110	micropapilla		0		6	0.7%
OTHER						
900.000	other, unspecified		3	1.0%	0	
900.100	other, not inherited		0		1	0.1%
900.110	other. suspect not inherited/significance unknown		6	2.1%	15	1.7%
NORMAL						
0.000	normal globe		239	83.3%	703	80.2%

LAKELAND TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder Option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
B.	Lens luxation	Autosomal recessive	2	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
LAKELAND TERRIER

Diagnostic Name		1991-2015 228 #	1991-2015 228 %	2016-2020 38 #	2016-2020 38 %
EYELIDS					
25.110	distichiasis	8	3.5%	4	10.5%
CORNEA					
70.700	corneal dystrophy	0		1	2.6%
70.730	corneal endothelial degeneration	2	0.9%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	33	14.5%	5	13.2%
93.720	persistent pupillary membranes, iris to lens	2	0.9%	0	
93.730	persistent pupillary membranes, iris to cornea	4	1.8%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	8	3.5%	6	15.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	5	2.2%	0	
100.305	punctate cataract, posterior sutures	0		1	2.6%
100.311	incipient cataract, anterior cortex	3	1.3%	0	
100.312	incipient cataract, posterior cortex	4	1.8%	0	
100.328	y-suture tip opacities	0		1	2.6%
100.330	generalized/complete cataract	3	1.3%	0	
100.345	*significant cataracts (summary)*	*10*	*4.4%*	*2*	*5.3%*
RETINA					
120.180	retinal dysplasia, geographic	1	0.4%	0	
OTHER					
900.000	other, unspecified	2	0.9%	0	
900.100	other, not inherited	6	2.6%	0	
NORMAL					
0.000	normal globe	174	76.3%	25	65.8%

LANCASHIRE HEELER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membrane - iris to iris	Not defined	1	Breeder option	
B.	Lens luxation	Autosomal recessive	2-4	NO	Mutation of the *ADAMTS17* gene
C.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	5-7	NO	Deletion in the *NHEJ1* gene
D.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

C. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve

(coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

D. Retinal Atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Lancashire Heeler is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Sargan DR, Withers D, Pettitt L, et al. Mapping the mutation causing lens luxation in several terrier breeds. *J Hered*. 2007;98:534-538.

3. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

5. Bedford PG. Collie eye anomaly in the Lancashire Heeler. *Vet Rec*. 1998;143:354-356.

6. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

7. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for Collie eye anomaly. *Genomics*. 2003;82:86-95.

OCULAR DISORDERS REPORT
LANCASHIRE HEELER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 141 #	 %	2016-2020 28 #	 %
EYELIDS					
25.110	distichiasis	1	0.7%	0	
CORNEA					
70.700	corneal dystrophy	0		1	3.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	58	41.1%	4	14.3%
93.720	persistent pupillary membranes, iris to lens	1	0.7%	0	
93.730	persistent pupillary membranes, iris to cornea	2	1.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	10.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	0.7%	0	
100.317	incipient cataract, capsular	1	0.7%	0	
100.345	*significant cataracts (summary)*	*1*	*0.7%*	*0*	
100.375	*subluxation/luxation, unspecified*	*1*	*0.7%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	1.4%	0	
110.200	vitreous degeneration-anterior chamber	1	0.7%	0	
110.320	vitreal degeneration	4	2.8%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.7%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.7%	0	
OTHER					
900.110	other. suspect not inherited/significance unknown	0		2	7.1%
NORMAL					
0.000	normal globe	93	66.0%	20	71.4%

LAPPONIAN HERDER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene
B.	Multifocal retinopathy - *cmr3*	Autosomal recessive	2	NO	Mutation of the *BEST1* gene

Description and Comments

A. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Lapponian Herder is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

B. Multifocal retinopathy (*cmr3*)

Canine Multifocal Retinopathy type 3 (*cmr3*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Clinically the disease is similar to that seen in the Bullmastiff and Coton deTulear, but the mutation in the Bestrophin 1 gene (*BEST1* alias *VMD2*) is different. The multifocal retinopathy seen in the Lapponian Herder is caused by a deletion at position 1,388 and a

substitution at position 1,466 and is therefore called cmr3. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Lapponian Herder. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

2. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

OCULAR DISORDERS REPORT
LAPPONIAN HERDER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 0 # %	2016-2020 1 # %
NORMAL			
0.000 normal globe		0	1 100.0%

OCULAR DISORDERS REPORT
LARGE MUNSTERLANDER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the LARGE MUNSTERLANDER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
LARGE MUNSTERLANDER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 0 # %	2016-2020 1 # %
NORMAL			
0.000 normal globe		0	1 100.0%

LEONBERGER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Entropion	Not defined	1, 2	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
E.	Uveal cysts	Not defined	1	Breeder option
F.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined		Passes with no notation
G.	Cataract	Not defined	1	NO
H.	Retinal dysplasia – folds	Not defined	1	Breeder option

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds.

Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Heinrich CL, Lakhani KH, Featherstone HJ, et al. Cataract in the UK Leonberger population. *Vet Ophthalmol.* 2006 Sep-Oct;9:350-356.

OCULAR DISORDERS REPORT
LEONBERGER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,834**		**657**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.160	macropalpebral fissure	35	1.9%	0	
21.000	entropion, unspecified	58	3.2%	31	4.7%
22.000	ectropion, unspecified	26	1.4%	11	1.7%
25.110	distichiasis	45	2.5%	13	2.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	23	1.3%	13	2.0%
52.110	prolapsed gland of the third eyelid	1	0.1%	2	0.3%
CORNEA					
70.700	corneal dystrophy	5	0.3%	0	
UVEA					
93.110	iris hypoplasia	1	0.1%	1	0.2%
93.710	persistent pupillary membranes, iris to iris	392	21.4%	156	23.7%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	10	0.5%	8	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	1	0.2%
93.810	uveal melanoma	1	0.1%	0	
93.999	uveal cysts	15	0.8%	10	1.5%
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	154	8.4%	52	7.9%
100.301	punctate cataract, anterior cortex	22	1.2%	12	1.8%
100.302	punctate cataract, posterior cortex	23	1.3%	8	1.2%
100.303	punctate cataract, equatorial cortex	3	0.2%	0	
100.304	punctate cataract, anterior sutures	3	0.2%	1	0.2%
100.305	punctate cataract, posterior sutures	12	0.7%	7	1.1%
100.306	punctate cataract, nucleus	6	0.3%	10	1.5%
100.307	punctate cataract, capsular	4	0.2%	7	1.1%
100.311	incipient cataract, anterior cortex	9	0.5%	9	1.4%
100.312	incipient cataract, posterior cortex	30	1.6%	10	1.5%
100.313	incipient cataract, equatorial cortex	1	0.1%	0	
100.314	incipient cataract, anterior sutures	5	0.3%	1	0.2%
100.315	incipient cataract, posterior sutures	8	0.4%	3	0.5%
100.316	incipient cataract, nucleus	19	1.0%	10	1.5%
100.317	incipient cataract, capsular	3	0.2%	7	1.1%
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.322	incomplete cataract, posterior cortex	1	0.1%	2	0.3%
100.326	incomplete cataract, nucleus	0		1	0.2%
100.328	y-suture tip opacities	3	0.2%	5	0.8%
100.330	generalized/complete cataract	4	0.2%	0	
100.345	*significant cataracts (summary)*	*158*	*8.6%*	*94*	*14.3%*

LENS CONTINUED		1991-2015		2016-2020	
100.375	subluxation/luxation, unspecified	5	0.3%	3	0.5%
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.2%	6	0.9%
110.135	PHPV/PTVL	4	0.2%	1	0.2%
110.200	vitreous degeneration-anterior chamber	0		1	0.2%
110.320	vitreal degeneration	6	0.3%	2	0.3%
RETINA					
120.170	retinal dysplasia, folds	8	0.4%	9	1.4%
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.3%	0	
120.960	retinopathy	1	0.1%	1	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	2	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	32	1.7%	0	
900.100	other, not inherited	53	2.9%	1	0.2%
900.110	other. suspect not inherited/significance unknown	22	1.2%	38	5.8%
NORMAL					
0.000	normal globe	1,208	65.9%	335	51.0%

LHASA APSO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gelatt KN, Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005;8:101-111.

OCULAR DISORDERS REPORT
LHASA APSO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 794 #	1991-2015 794 %	2016-2020 90 #	2016-2020 90 %
GLOBE						
0.110	microphthalmia		1	0.1%	0	
EYELIDS						
20.160	macropalpebral fissure		3	0.4%	0	
21.000	entropion, unspecified		11	1.4%	3	3.3%
25.110	distichiasis		32	4.0%	2	2.2%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.1%	0	
40.910	keratoconjunctivitis sicca		3	0.4%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.1%	0	
52.110	prolapsed gland of the third eyelid		4	0.5%	0	
CORNEA						
70.210	corneal pannus		8	1.0%	0	
70.220	pigmentary keratitis		20	2.5%	3	3.3%
70.700	corneal dystrophy		16	2.0%	0	
UVEA						
93.110	iris hypoplasia		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		10	1.3%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	2.2%
93.999	uveal cysts		1	0.1%	0	
LENS						
100.200	cataract, unspecified		6	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		27	3.4%	2	2.2%
100.301	punctate cataract, anterior cortex		6	0.8%	1	1.1%
100.302	punctate cataract, posterior cortex		5	0.6%	0	
100.303	punctate cataract, equatorial cortex		3	0.4%	0	
100.306	punctate cataract, nucleus		1	0.1%	0	
100.311	incipient cataract, anterior cortex		13	1.6%	3	3.3%
100.312	incipient cataract, posterior cortex		14	1.8%	0	
100.313	incipient cataract, equatorial cortex		3	0.4%	1	1.1%
100.314	incipient cataract, anterior sutures		4	0.5%	0	
100.315	incipient cataract, posterior sutures		2	0.3%	0	
100.316	incipient cataract, nucleus		3	0.4%	0	
100.322	incomplete cataract, posterior cortex		0		1	1.1%
100.330	generalized/complete cataract		18	2.3%	1	1.1%
100.345	*significant cataracts (summary)*		*78*	*9.8%*	*7*	*7.8%*
100.375	*subluxation/luxation, unspecified*		*1*	*0.1%*	*0*	
VITREOUS						
110.200	vitreous degeneration-anterior chamber		1	0.1%	1	1.1%
110.320	vitreal degeneration		9	1.1%	0	

		1991-2015		2016-2020	
FUNDUS					
97.110	choroidal hypoplasia	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	4	0.5%	3	3.3%
120.180	retinal dysplasia, geographic	3	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	7	0.9%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	2	0.3%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.100	other, not inherited	12	1.5%	0	
900.110	other. suspect not inherited/significance unknown	20	2.5%	4	4.4%
NORMAL					
0.000	normal globe	609	76.7%	65	72.2%

LOUISIANA CATAHOULA LEOPARD DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Iris coloboma	Not defined	1	NO

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma and persistent pupillary membranes.

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
LOUISIANA CATAHOULA LEOPARD DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 372 #	 %	2016-2020 71 #	 %
GLOBE					
0.110	microphthalmia	5	1.3%	0	
EYELIDS					
25.110	distichiasis	3	0.8%	0	
CORNEA					
70.700	corneal dystrophy	1	0.3%	0	
UVEA					
93.110	iris hypoplasia	3	0.8%	1	1.4%
93.150	iris coloboma	12	3.2%	1	1.4%
93.710	persistent pupillary membranes, iris to iris	38	10.2%	6	8.5%
93.720	persistent pupillary membranes, iris to lens	1	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	0		1	1.4%
97.150	chorioretinal coloboma, congenital	1	0.3%	0	
LENS					
100.200	cataract, unspecified	1	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	5	1.3%	2	2.8%
100.302	punctate cataract, posterior cortex	1	0.3%	1	1.4%
100.306	punctate cataract, nucleus	0		1	1.4%
100.311	incipient cataract, anterior cortex	4	1.1%	2	2.8%
100.312	incipient cataract, posterior cortex	2	0.5%	1	1.4%
100.313	incipient cataract, equatorial cortex	2	0.5%	0	
100.316	incipient cataract, nucleus	0		1	1.4%
100.322	incomplete cataract, posterior cortex	0		2	2.8%
100.330	generalized/complete cataract	0		1	1.4%
100.345	*significant cataracts (summary)*	*10*	*2.7%*	*9*	*12.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.5%	0	
110.320	vitreal degeneration	2	0.5%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.3%	1	1.4%
97.120	coloboma	2	0.5%	0	
RETINA					
120.170	retinal dysplasia, folds	9	2.4%	0	
120.910	retinal detachment without dialysis	2	0.5%	0	
120.920	retinal detachment with dialysis	1	0.3%	0	
OPTIC NERVE					
130.150	optic disc coloboma	2	0.5%	2	2.8%
OTHER					
900.100	other, not inherited	4	1.1%	0	
900.110	other. suspect not inherited/significance unknown	12	3.2%	3	4.2%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	304 81.7%	54 76.1%

LOWCHEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Vitreous degeneration	Not defined	1	Breeder option
E.	Retinal atrophy - generalized	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment and/or glaucoma.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Lowchen breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
LOWCHEN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,676 #	 %	2016-2020 390 #	 %
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
21.000	entropion, unspecified		1	0.1%	0	
25.110	distichiasis		78	4.7%	24	6.2%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		0		1	0.3%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.730	corneal endothelial degeneration		2	0.1%	0	
UVEA						
93.150	iris coloboma		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		130	7.8%	41	10.5%
93.720	persistent pupillary membranes, iris to lens		3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.1%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		7	0.4%	10	2.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.999	uveal cysts		1	0.1%	1	0.3%
LENS						
100.200	cataract, unspecified		21	1.3%	0	
100.210	cataract. suspect not inherited/significance unknown		56	3.3%	11	2.8%
100.301	punctate cataract, anterior cortex		8	0.5%	1	0.3%
100.302	punctate cataract, posterior cortex		12	0.7%	0	
100.303	punctate cataract, equatorial cortex		4	0.2%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		5	0.3%	1	0.3%
100.306	punctate cataract, nucleus		2	0.1%	0	
100.307	punctate cataract, capsular		1	0.1%	1	0.3%
100.311	incipient cataract, anterior cortex		21	1.3%	3	0.8%
100.312	incipient cataract, posterior cortex		24	1.4%	3	0.8%
100.313	incipient cataract, equatorial cortex		5	0.3%	3	0.8%
100.314	incipient cataract, anterior sutures		2	0.1%	0	
100.315	incipient cataract, posterior sutures		4	0.2%	0	
100.316	incipient cataract, nucleus		1	0.1%	1	0.3%
100.317	incipient cataract, capsular		2	0.1%	0	
100.321	incomplete cataract, anterior cortex		1	0.1%	1	0.3%
100.322	incomplete cataract, posterior cortex		1	0.1%	0	
100.323	incomplete cataract, equatorial cortex		1	0.1%	0	
100.328	y-suture tip opacities		0		1	0.3%
100.330	generalized/complete cataract		16	1.0%	1	0.3%
100.345	*significant cataracts (summary)*		*132*	*7.9%*	*16*	*4.1%*
100.375	*subluxation/luxation, unspecified*		*2*	*0.1%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		3	0.2%	3	0.8%
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitreous degeneration-anterior chamber		1	0.1%	0	

VITREOUS CONTINUED		1991-2015		2016-2020	
110.320	vitreal degeneration	51	3.0%	3	0.8%
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	3	0.2%	0	
120.180	retinal dysplasia, geographic	0		1	0.3%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	38	2.3%	3	0.8%
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	4	0.2%	2	0.5%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	13	0.8%	0	
900.100	other, not inherited	39	2.3%	0	
900.110	other. suspect not inherited/significance unknown	7	0.4%	8	2.1%
NORMAL					
0.000	normal globe	1,343	80.1%	283	72.6%

LUCAS TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Lucas Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

MALTESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	1, 2	NO
E.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in inversion of the eyelid margin which may cause ocular irritation. It is likely that entropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

B. Distichiasis

The presence of abnormally oriented eyelashes, frequently protruding from Meibomian gland ductal openings.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gelatt KN and Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005 Mar-Apr;8:101-111.

OCULAR DISORDERS REPORT
MALTESE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 313 #	%	2016-2020 269 #	%
GLOBE						
0.110	microphthalmia		1	0.3%	0	
EYELIDS						
21.000	entropion, unspecified		4	1.3%	7	2.6%
25.110	distichiasis		12	3.8%	3	1.1%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.3%	0	
40.910	keratoconjunctivitis sicca		2	0.6%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.6%	2	0.7%
CORNEA						
70.220	pigmentary keratitis		0		4	1.5%
70.700	corneal dystrophy		2	0.6%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		18	5.8%	2	0.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.4%
93.999	uveal cysts		1	0.3%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		17	5.4%	0	
100.301	punctate cataract, anterior cortex		2	0.6%	3	1.1%
100.302	punctate cataract, posterior cortex		4	1.3%	1	0.4%
100.303	punctate cataract, equatorial cortex		2	0.6%	0	
100.304	punctate cataract, anterior sutures		1	0.3%	0	
100.305	punctate cataract, posterior sutures		2	0.6%	0	
100.306	punctate cataract, nucleus		1	0.3%	0	
100.307	punctate cataract, capsular		1	0.3%	1	0.4%
100.311	incipient cataract, anterior cortex		9	2.9%	3	1.1%
100.312	incipient cataract, posterior cortex		9	2.9%	1	0.4%
100.313	incipient cataract, equatorial cortex		2	0.6%	0	
100.314	incipient cataract, anterior sutures		0		1	0.4%
100.315	incipient cataract, posterior sutures		1	0.3%	1	0.4%
100.316	incipient cataract, nucleus		2	0.6%	0	
100.317	incipient cataract, capsular		1	0.3%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.4%
100.322	incomplete cataract, posterior cortex		0		1	0.4%
100.323	incomplete cataract, equatorial cortex		0		1	0.4%
100.328	y-suture tip opacities		1	0.3%	1	0.4%
100.330	generalized/complete cataract		4	1.3%	0	
100.345	*significant cataracts (summary)*		*42*	*13.4%*	*15*	*5.6%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.3%	0	
110.200	vitreous degeneration-anterior chamber		0		1	0.4%
110.320	vitreal degeneration		8	2.6%	6	2.2%

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	3	1.0%	1	0.4%
120.180	retinal dysplasia, geographic	5	1.6%	0	
120.190	retinal dysplasia, detached	0		1	0.4%
120.310	generalized progressive retinal atrophy (PRA)	4	1.3%	1	0.4%
120.920	retinal detachment with dialysis	0		1	0.4%
OTHER					
900.000	other, unspecified	8	2.6%	0	
900.100	other, not inherited	6	1.9%	0	
900.110	other. suspect not inherited/significance unknown	3	1.0%	10	3.7%
NORMAL					
0.000	normal globe	230	73.5%	222	82.5%

MANCHESTER TERRIER

Standard & Toy Varieties

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal Atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Manchester Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with

signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Manchester Terrier breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
MANCHESTER TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**193**		**133**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	1	0.5%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	12	6.2%	5	3.8%
93.730	persistent pupillary membranes, iris to cornea	1	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	2.1%	3	2.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	1.0%	0	
93.999	uveal cysts	1	0.5%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	6	3.1%	6	4.5%
100.301	punctate cataract, anterior cortex	1	0.5%	2	1.5%
100.302	punctate cataract, posterior cortex	2	1.0%	2	1.5%
100.303	punctate cataract, equatorial cortex	1	0.5%	0	
100.305	punctate cataract, posterior sutures	1	0.5%	1	0.8%
100.307	punctate cataract, capsular	0		1	0.8%
100.311	incipient cataract, anterior cortex	2	1.0%	0	
100.312	incipient cataract, posterior cortex	2	1.0%	3	2.3%
100.313	incipient cataract, equatorial cortex	1	0.5%	0	
100.317	incipient cataract, capsular	2	1.0%	1	0.8%
100.328	y-suture tip opacities	0		1	0.8%
100.345	*significant cataracts (summary)*	*12*	*6.2%*	*11*	*8.3%*
VITREOUS					
110.135	PHPV/PTVL	3	1.6%	0	
110.320	vitreal degeneration	7	3.6%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.5%	1	0.8%
120.960	retinopathy	1	0.5%	0	
OTHER					
900.000	other, unspecified	6	3.1%	0	
900.110	other. suspect not inherited/significance unknown	2	1.0%	5	3.8%
NORMAL					
0.000	normal globe	165	85.5%	107	80.5%

MAREMMA SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Corneal dystrophy	Not defined	1	Breeder option
C.	Chronic superficial keratitis/pannus	Not defined	1	NO
D.	Cataract	Not defined	1	NO
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans. This has been reported in the Italian population of the breed.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. This has been reported in the Italian population of the breed.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined. This has been reported in the Italian population of the breed.

References

1. Guandalini A, Di Girolamo N, Santillo D, Andreani V, Corvi R, Bandini M, and Peruccio C. (2017) Epidemiology of ocular disorders presumed to be inherited in three large Italian dog breeds in Italy. *Vet Ophthalmol*, 20: 420-426. doi:10.1111/vop.12442.

OCULAR DISORDERS REPORT
MAREMMA SHEEPDOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 13 #	 %	2016-2020 18 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	15.4%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	15.4%	1	5.6%
100.301	punctate cataract, anterior cortex	0		1	5.6%
100.328	y-suture tip opacities	0		1	5.6%
100.345	*significant cataracts (summary)*	*0*		*2*	*11.1%*
VITREOUS					
110.320	vitreal degeneration	1	7.7%	0	
OTHER					
900.000	other, unspecified	1	7.7%	0	
900.110	other. suspect not inherited/significance unknown	0		1	5.6%
NORMAL					
0.000	normal globe	9	69.2%	15	83.3%

MARKIESJE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Markiesje is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Markiesje breed. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

MASTIFF

(English)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Ectropion	Not defined	1	Breeder option	
C.	Distichiasis	Not defined	1	Breeder option	
D.	Uveal cysts	Not defined	1	Breeder option	
E.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to cornea	Not defined	1	NO	
	- endothelial opacity/no strands	Not defined	4	NO	
F.	Cataract	Not defined	1	NO	
G.	Retinal atrophy *(RHO)*	Autosomal dominant	1, 2	NO	Mutation of the *RHO* gene
H.	Multifocal retinopathy - *cmr1*	Autosomal recessive	3	Breeder option	Mutation of the *BEST1* gene
I.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

B. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin

covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Mastiff, the strands most often bridge from the iris to the cornea and may potentially cause vision impairment. Thus, the strong recommendations against breeding animals with any form of this abnormality.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal atrophy - *RHO*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. The ERG is normal at 3-6 months of age, but abnormal by 13 months of age. Increased exposure to bright light causes more rapid loss of neurons. PRA in the Mastiff is inherited as an autosomal dominant trait. The mutation is a single nucleotide transversion of the *RHO* gene. A DNA test is available.

H. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
MASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 8,815 #	%	2016-2020 761 #	%
GLOBE						
0.110	microphthalmia		19	0.2%	3	0.4%
10.000	glaucoma		2	0.0%	0	
EYELIDS						
20.160	macropalpebral fissure		344	3.9%	0	
21.000	entropion, unspecified		387	4.4%	48	6.3%
22.000	ectropion, unspecified		622	7.1%	62	8.1%
25.110	distichiasis		92	1.0%	4	0.5%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		4	0.0%	3	0.4%
NICTITANS						
51.100	third eyelid cartilage anomaly		11	0.1%	1	0.1%
52.110	prolapsed gland of the third eyelid		18	0.2%	2	0.3%
CORNEA						
70.210	corneal pannus		3	0.0%	0	
70.220	pigmentary keratitis		3	0.0%	1	0.1%
70.700	corneal dystrophy		37	0.4%	3	0.4%
70.730	corneal endothelial degeneration		51	0.6%	1	0.1%
UVEA						
90.250	pigmentary uveitis		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		7	0.1%	0	
93.150	iris coloboma		3	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		274	3.1%	25	3.3%
93.720	persistent pupillary membranes, iris to lens		59	0.7%	3	0.4%
93.730	persistent pupillary membranes, iris to cornea		455	5.2%	20	2.6%
93.740	persistent pupillary membranes, iris sheets		19	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		7	0.1%	3	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		40	0.5%	13	1.7%
93.810	uveal melanoma		3	0.0%	0	
93.999	uveal cysts		94	1.1%	12	1.6%
LENS						
100.200	cataract, unspecified		19	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		402	4.6%	36	4.7%
100.301	punctate cataract, anterior cortex		64	0.7%	8	1.1%
100.302	punctate cataract, posterior cortex		12	0.1%	3	0.4%
100.303	punctate cataract, equatorial cortex		6	0.1%	0	
100.304	punctate cataract, anterior sutures		12	0.1%	0	
100.305	punctate cataract, posterior sutures		10	0.1%	1	0.1%
100.306	punctate cataract, nucleus		12	0.1%	3	0.4%
100.307	punctate cataract, capsular		15	0.2%	5	0.7%
100.311	incipient cataract, anterior cortex		69	0.8%	7	0.9%
100.312	incipient cataract, posterior cortex		42	0.5%	2	0.3%
100.313	incipient cataract, equatorial cortex		20	0.2%	3	0.4%
100.314	incipient cataract, anterior sutures		8	0.1%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.315	incipient cataract, posterior sutures	6	0.1%	1	0.1%
100.316	incipient cataract, nucleus	36	0.4%	8	1.1%
100.317	incipient cataract, capsular	10	0.1%	2	0.3%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.3%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	1	0.1%
100.327	incomplete cataract, capsular	1	0.0%	0	
100.328	y-suture tip opacities	1	0.0%	3	0.4%
100.330	generalized/complete cataract	40	0.5%	1	0.1%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*385*	*4.4%*	*52*	*6.8%*
100.375	*subluxation/luxation, unspecified*	*5*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	1	0.1%
110.135	PHPV/PTVL	5	0.1%	0	
110.320	vitreal degeneration	11	0.1%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	653	7.4%	33	4.3%
120.180	retinal dysplasia, geographic	51	0.6%	1	0.1%
120.190	retinal dysplasia, detached	5	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	151	1.7%	0	
120.910	retinal detachment without dialysis	4	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	8	0.1%	2	0.3%
OPTIC NERVE					
130.110	micropapilla	4	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	4	0.0%	0	
OTHER					
900.000	other, unspecified	59	0.7%	0	
900.100	other, not inherited	164	1.9%	5	0.7%
900.110	other. suspect not inherited/significance unknown	92	1.0%	28	3.7%
NORMAL					
0.000	normal globe	6,007	68.1%	490	64.4%

MI-KI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Vitreous degeneration	Not defined	1	Breeder option	
G.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Mi-Ki, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose

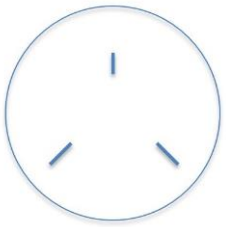
the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Mi-Ki is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Mi-Ki breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
MI-KI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,354 #	%	2016-2020 422 #	%
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
20.160	macropalpebral fissure		2	0.1%	0	
21.000	entropion, unspecified		10	0.7%	1	0.2%
25.110	distichiasis		188	13.9%	65	15.4%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		4	0.3%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.1%	2	0.5%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		3	0.2%	2	0.5%
70.700	corneal dystrophy		24	1.8%	4	0.9%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		171	12.6%	26	6.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.1%	1	0.2%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		117	8.6%	23	5.5%
100.301	punctate cataract, anterior cortex		5	0.4%	1	0.2%
100.302	punctate cataract, posterior cortex		5	0.4%	0	
100.303	punctate cataract, equatorial cortex		0		1	0.2%
100.305	punctate cataract, posterior sutures		25	1.8%	1	0.2%
100.306	punctate cataract, nucleus		0		1	0.2%
100.311	incipient cataract, anterior cortex		3	0.2%	4	0.9%
100.312	incipient cataract, posterior cortex		6	0.4%	0	
100.313	incipient cataract, equatorial cortex		11	0.8%	1	0.2%
100.314	incipient cataract, anterior sutures		1	0.1%	0	
100.315	incipient cataract, posterior sutures		21	1.6%	0	
100.316	incipient cataract, nucleus		1	0.1%	1	0.2%
100.317	incipient cataract, capsular		0		1	0.2%
100.322	incomplete cataract, posterior cortex		0		1	0.2%
100.327	incomplete cataract, capsular		0		1	0.2%
100.328	y-suture tip opacities		8	0.6%	1	0.2%
100.330	generalized/complete cataract		1	0.1%	0	
100.345	*significant cataracts (summary)*		*88*	*6.5%*	*14*	*3.3%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.1%	1	0.2%
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitreous degeneration-anterior chamber		4	0.3%	7	1.7%
110.320	vitreal degeneration		123	9.1%	22	5.2%

		1991-2015		2016-2020	
FUNDUS					
97.110	choroidal hypoplasia	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	11	0.8%	2	0.5%
120.180	retinal dysplasia, geographic	8	0.6%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	5	0.4%	2	0.5%
120.920	retinal detachment with dialysis	1	0.1%	1	0.2%
120.960	retinopathy	6	0.4%	6	1.4%
OPTIC NERVE					
130.110	micropapilla	2	0.1%	1	0.2%
130.120	optic nerve hypoplasia	2	0.1%	0	
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	24	1.8%	0	
900.100	other, not inherited	55	4.1%	2	0.5%
900.110	other. suspect not inherited/significance unknown	33	2.4%	31	7.3%
NORMAL					
0.000	normal globe	863	63.7%	263	62.3%

MINIATURE AMERICAN SHEPHERD (AKC)/ MINIATURE AUSTRALIAN SHEPHERD

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Iris hypoplasia	Not defined	1	Breeder option	
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
F.	Cataract	Autosomal co-dominant	1, 7, 8	NO	Mutation of the *HSF4* gene
G.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 9	NO	Mutation of the *prcd* gene
H.	Cone degeneration - day blindness	Autosomal recessive	10	NO	Mutation of the *CNGB3* gene
I.	Multifocal retinopathy - *cmr1*	Autosomal recessive	11	Breeder option	Mutation of the *BEST1* gene

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
J.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	1, 12-15	NO	Mutation of the *NHEJ1* gene
K.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO	

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merled coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress

normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

G. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Miniature American/Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

H. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

I. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal

detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

J. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

K. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

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OCULAR DISORDERS REPORT
MINIATURE AMERICAN(AKC)/MINIATURE AUSTRALIAN SHEPHERD

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	13,491		5,368	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	18	0.1%	9	0.2%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	0		1	0.0%
25.110	distichiasis	639	4.7%	145	2.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	2	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	2	0.0%	0	
70.700	corneal dystrophy	92	0.7%	116	2.2%
70.730	corneal endothelial degeneration	5	0.0%	1	0.0%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	51	0.4%	83	1.5%
93.150	iris coloboma	259	1.9%	111	2.1%
93.180	Iiris sphincter dysplasia	3	0.0%	11	0.2%
93.710	persistent pupillary membranes, iris to iris	1,229	9.1%	707	13.2%
93.720	persistent pupillary membranes, iris to lens	19	0.1%	17	0.3%
93.730	persistent pupillary membranes, iris to cornea	7	0.1%	2	0.0%
93.740	persistent pupillary membranes, iris sheets	9	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.0%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.0%	1	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	0		1	0.0%
97.150	chorioretinal coloboma, congenital	5	0.0%	2	0.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	149	1.1%	61	1.1%
100.301	punctate cataract, anterior cortex	19	0.1%	9	0.2%
100.302	punctate cataract, posterior cortex	8	0.1%	0	
100.303	punctate cataract, equatorial cortex	6	0.0%	1	0.0%
100.304	punctate cataract, anterior sutures	3	0.0%	0	
100.305	punctate cataract, posterior sutures	8	0.1%	8	0.1%
100.306	punctate cataract, nucleus	4	0.0%	6	0.1%
100.307	punctate cataract, capsular	7	0.1%	2	0.0%
100.311	incipient cataract, anterior cortex	22	0.2%	11	0.2%
100.312	incipient cataract, posterior cortex	25	0.2%	5	0.1%
100.313	incipient cataract, equatorial cortex	7	0.1%	5	0.1%
100.315	incipient cataract, posterior sutures	1	0.0%	1	0.0%
100.316	incipient cataract, nucleus	5	0.0%	2	0.0%
100.317	incipient cataract, capsular	6	0.0%	8	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	0		2	0.0%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.0%
100.323	incomplete cataract, equatorial cortex	0		2	0.0%
100.327	incomplete cataract, capsular	1	0.0%	1	0.0%
100.328	y-suture tip opacities	1	0.0%	12	0.2%
100.330	generalized/complete cataract	5	0.0%	1	0.0%
100.345	*significant cataracts (summary)*	*129*	*1.0%*	*78*	*1.5%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	40	0.3%	46	0.9%
110.135	PHPV/PTVL	13	0.1%	2	0.0%
110.200	vitreous degeneration-anterior chamber	5	0.0%	7	0.1%
110.320	vitreal degeneration	70	0.5%	12	0.2%
FUNDUS					
97.110	choroidal hypoplasia	24	0.2%	13	0.2%
97.120	coloboma	8	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	45	0.3%	12	0.2%
120.180	retinal dysplasia, geographic	1	0.0%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	28	0.2%	1	0.0%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	2	0.0%	3	0.1%
OPTIC NERVE					
130.110	micropapilla	65	0.5%	14	0.3%
130.120	optic nerve hypoplasia	19	0.1%	4	0.1%
130.150	optic disc coloboma	23	0.2%	8	0.1%
OTHER					
900.000	other, unspecified	129	1.0%	0	
900.100	other, not inherited	180	1.3%	4	0.1%
900.110	other. suspect not inherited/significance unknown	85	0.6%	146	2.7%
NORMAL					
0.000	normal globe	11,433	84.7%	4,003	74.6%

MINIATURE BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to lens	Not defined	1	NO	
	- iris to cornea	Not defined	1	NO	
B.	Cataract	Not defined	1	NO	
C.	Lens luxation	Autosomal recessive	2, 3	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Although the total number of Miniature Bull Terriers presented for OFA/CERF examination is not large, the incidence of PPM in this breed is approximately 10% in recent years. Some of these PPM's have been iris to cornea and iris to lens. Considerable discretion should be used before breeding a dog with the latter more severe forms of PPM.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

Two loci with potentially enhancing effects on the ADAMTS17 mutation are associated with primary lens luxation (PLL) in Australian Miniature Bull Terriers. PLL associated allele of the BICF2G630420272 SNP increases the risk of PLL in the presence of the ADAMTS17 mutation. Candidate genes in the two regions of interest included CPE on chromosome 15 and CTCF on chromosome 1. The ADAMTS17 mutation is also associated with abnormal foot and nail shapes, pedal hyperkeratosis, and persistent pupillary membranes. Association of the ADAMTS17 mutation with possible pedal skeletal abnormalities in the Miniature Bull Terriers supports primary lens luxation in this breed and Marchesani syndrome-like disease in humans as being homologous diseases.

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OCULAR DISORDERS REPORT
MINIATURE BULL TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,228**		**105**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	3	0.2%	0	
10.000	glaucoma	1	0.1%	0	
EYELIDS					
22.000	ectropion, unspecified	1	0.1%	0	
25.110	distichiasis	0		1	1.0%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	5	0.4%	1	1.0%
CORNEA					
70.700	corneal dystrophy	3	0.2%	2	1.9%
70.730	corneal endothelial degeneration	13	1.1%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	4	0.3%	0	
93.710	persistent pupillary membranes, iris to iris	80	6.5%	0	
93.720	persistent pupillary membranes, iris to lens	52	4.2%	0	
93.730	persistent pupillary membranes, iris to cornea	81	6.6%	2	1.9%
93.740	persistent pupillary membranes, iris sheets	8	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	6	0.5%	3	2.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	14	1.1%	2	1.9%
LENS					
100.200	cataract, unspecified	2	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	51	4.2%	4	3.8%
100.301	punctate cataract, anterior cortex	11	0.9%	0	
100.302	punctate cataract, posterior cortex	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.307	punctate cataract, capsular	4	0.3%	0	
100.311	incipient cataract, anterior cortex	15	1.2%	0	
100.312	incipient cataract, posterior cortex	5	0.4%	0	
100.313	incipient cataract, equatorial cortex	1	0.1%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.317	incipient cataract, capsular	12	1.0%	0	
100.330	generalized/complete cataract	4	0.3%	0	
100.345	*significant cataracts (summary)*	*57*	*4.6%*	*0*	
100.375	*subluxation/luxation, unspecified*	*51*	*4.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.200	vitreous degeneration-anterior chamber	0		1	1.0%
110.320	vitreal degeneration	24	2.0%	1	1.0%
RETINA					
120.170	retinal dysplasia, folds	3	0.2%	0	
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	13	1.1%	0	
120.960	retinopathy	0		2	1.9%

		1991-2015		2016-2020	
OPTIC NERVE					
130.110	micropapilla	12	1.0%	0	
130.120	optic nerve hypoplasia	3	0.2%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	9	0.7%	0	
900.100	other, not inherited	33	2.7%	0	
900.110	other. suspect not inherited/significance unknown	22	1.8%	2	1.9%
NORMAL					
0.000	normal globe	909	74.0%	88	83.8%

MINIATURE PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Miniature Pinscher. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
MINIATURE PINSCHER

	TOTAL DOGS EXAMINED	1991-2015 746		2016-2020 311	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	3	0.4%	0	
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	3	0.4%	0	
22.000	ectropion, unspecified	1	0.1%	0	
25.110	distichiasis	5	0.7%	1	0.3%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	0		1	0.3%
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.3%	0	
CORNEA					
70.210	corneal pannus	2	0.3%	0	
70.220	pigmentary keratitis	2	0.3%	4	1.3%
70.700	corneal dystrophy	41	5.5%	16	5.1%
70.730	corneal endothelial degeneration	2	0.3%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	25	3.4%	5	1.6%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	0		1	0.3%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.7%	9	2.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	3	1.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	29	3.9%	6	1.9%
100.301	punctate cataract, anterior cortex	6	0.8%	2	0.6%
100.302	punctate cataract, posterior cortex	5	0.7%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.3%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	3	0.4%	0	
100.306	punctate cataract, nucleus	0		1	0.3%
100.307	punctate cataract, capsular	1	0.1%	1	0.3%
100.311	incipient cataract, anterior cortex	16	2.1%	8	2.6%
100.312	incipient cataract, posterior cortex	10	1.3%	1	0.3%
100.313	incipient cataract, equatorial cortex	3	0.4%	0	
100.314	incipient cataract, anterior sutures	0		1	0.3%
100.315	incipient cataract, posterior sutures	1	0.1%	0	
100.317	incipient cataract, capsular	1	0.1%	0	
100.321	incomplete cataract, anterior cortex	1	0.1%	3	1.0%
100.322	incomplete cataract, posterior cortex	1	0.1%	2	0.6%
100.323	incomplete cataract, equatorial cortex	0		2	0.6%
100.330	generalized/complete cataract	7	0.9%	0	
100.340	resorbing/hypermature cataract	0		1	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*57*	*7.6%*	*23*	*7.4%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.4%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.5%	1	0.3%
110.135	PHPV/PTVL	2	0.3%	0	
110.200	vitreous degeneration-anterior chamber	2	0.3%	1	0.3%
110.320	vitreal degeneration	41	5.5%	2	0.6%
FUNDUS					
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	2	0.3%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	12	1.6%	0	
120.910	retinal detachment without dialysis	3	0.4%	0	
OPTIC NERVE					
130.110	micropapilla	0		3	1.0%
130.120	optic nerve hypoplasia	9	1.2%	0	
OTHER					
900.000	other, unspecified	12	1.6%	0	
900.100	other, not inherited	26	3.5%	1	0.3%
900.110	other. suspect not inherited/significance unknown	9	1.2%	23	7.4%
NORMAL					
0.000	normal globe	562	75.3%	229	73.6%

MINIATURE SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with congenital cataract	Autosomal recessive	1-4	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1 1	Breeder option Passes with no notation
E.	Cataract	Autosomal recessive	1, 5-8	NO
F.	Vitreous degeneration	Not defined	1	Breeder option
G.	Retinal dysplasia with Persistent hyperplastic primary vitreous (PHPV)	Autosomal recessive	11	NO
H.	Retinal atrophy-generalized	Autosomal recessive	1, 9. 10	NO
I.	Ceroid lipofuscinosis	Presumed autosomal recessive	12, 13	NO

Description and Comments

A. Microphthalmia with congenital cataract

Congenital nuclear and posterior cortical lens opacities that progress slowly. In some cases, these cataracts appear similar to the congenital cataracts described in "E" below. An associated abnormality in this defect is microphthalmia that is often mild and is accompanied by a 1-3 mm reduction in the axial length of the globe as determined by ultrasonography. The cataracts often do not become mature and cause blindness until the dogs reach 3-5 years of age. Congenital cataracts and microphthalmia are inherited as an autosomal recessive disorder.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Congenital cataracts in the Miniature Schnauzer are bilateral and appear prior to 6 weeks of age. At this time they may already involve the entire lens. Others will first appear as posterior subcapsular opacities and usually progress to complete cataracts. These congenital cataracts are inherited as an autosomal recessive trait. Later-onset cataracts may represent a genetically distinct entity. There are other types of cataract in the breed which are also likely hereditary.

Note: It is not certain whether A and F are genetically distinct, or different manifestations of the same entity, as eyes affected with cataracts are often smaller than normal.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal dysplasia with persistent hyperplastic primary vitreous (PHPV)

In the Miniature Schnauzer PHPV is associated with retinal dysplasia in some dogs. In this association it may be unilateral or bilateral and most often manifests as small white

posterior lens capsule plaques accompanied by white primary vitreous mass extending to the optic disc. Patent hyaloid arteries and posterior lens capsule vessels may also be present.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most forms of PRA are inherited as recessive traits.

A form of PRA in the Miniature Schnauzer was previously characterized and called photoreceptor dysplasia (now called Type A PRA). The dysplasia results from the abnormal development of visual cells followed by their degeneration. The disorder appears to affect the generation of an electrical signal within the retinal photoreceptor cells. Although fundus abnormalities usually are not present until 2-3 years of age, abnormalities of the electroretinogram can be demonstrated by 8-10 weeks of age. Clinical signs include mildly impaired night vision and variable rate of progression.

Initial studies suggested a mutation in phosducin was responsible, but this was disproven. This disease is extremely rare. The causative gene for Type A PRA has not been published although a DNA test is available. Another more common autosomal recessive form of PRA appears to be present in the Miniature Schnauzer, but the causative gene has not yet been determined; it also affects dogs ~2-4 years of age. Lastly, cases of late-onset PRA in the breed are recognized clinically but the inheritance pattern is unknown. (G. Aguirre personal communication 2016).

I. Ceroid lipofuscinosis

An inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease). This disease is very rare.

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OCULAR DISORDERS REPORT
MINIATURE SCHNAUZER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 28,722 #	%	2016-2020 5,672 #	%
GLOBE					
0.110	microphthalmia	23	0.1%	1	0.0%
EYELIDS					
21.000	entropion, unspecified	5	0.0%	9	0.2%
25.110	distichiasis	602	2.1%	99	1.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	2	0.0%
40.910	keratoconjunctivitis sicca	6	0.0%	2	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	4	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.0%	1	0.0%
70.220	pigmentary keratitis	7	0.0%	1	0.0%
70.700	corneal dystrophy	149	0.5%	18	0.3%
70.730	corneal endothelial degeneration	17	0.1%	1	0.0%
UVEA					
90.250	pigmentary uveitis	2	0.0%	0	
93.110	iris hypoplasia	0		2	0.0%
93.140	corneal endothelial pigment without PPM	10	0.0%	0	
93.150	iris coloboma	0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	473	1.6%	87	1.5%
93.720	persistent pupillary membranes, iris to lens	49	0.2%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	80	0.3%	5	0.1%
93.740	persistent pupillary membranes, iris sheets	12	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	75	0.3%	69	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	13	0.0%	1	0.0%
93.999	uveal cysts	1	0.0%	1	0.0%
LENS					
100.200	cataract, unspecified	61	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	593	2.1%	116	2.0%
100.301	punctate cataract, anterior cortex	94	0.3%	13	0.2%
100.302	punctate cataract, posterior cortex	47	0.2%	6	0.1%
100.303	punctate cataract, equatorial cortex	31	0.1%	6	0.1%
100.304	punctate cataract, anterior sutures	15	0.1%	0	
100.305	punctate cataract, posterior sutures	58	0.2%	15	0.3%
100.306	punctate cataract, nucleus	15	0.1%	5	0.1%
100.307	punctate cataract, capsular	29	0.1%	9	0.2%
100.311	incipient cataract, anterior cortex	103	0.4%	15	0.3%
100.312	incipient cataract, posterior cortex	139	0.5%	22	0.4%
100.313	incipient cataract, equatorial cortex	61	0.2%	12	0.2%
100.314	incipient cataract, anterior sutures	8	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	37	0.1%	1	0.0%
100.316	incipient cataract, nucleus	26	0.1%	13	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.317	incipient cataract, capsular	26	0.1%	5	0.1%
100.321	incomplete cataract, anterior cortex	9	0.0%	10	0.2%
100.322	incomplete cataract, posterior cortex	13	0.0%	11	0.2%
100.323	incomplete cataract, equatorial cortex	1	0.0%	1	0.0%
100.325	incomplete cataract, posterior sutures	1	0.0%	3	0.1%
100.326	incomplete cataract, nucleus	15	0.1%	14	0.2%
100.327	incomplete cataract, capsular	2	0.0%	0	
100.328	y-suture tip opacities	12	0.0%	8	0.1%
100.330	generalized/complete cataract	152	0.5%	4	0.1%
100.340	resorbing/hypermature cataract	1	0.0%	1	0.0%
100.345	*significant cataracts (summary)*	*956*	*3.3%*	*175*	*3.1%*
100.375	*subluxation/luxation, unspecified*	*7*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	36	0.1%	14	0.2%
110.135	PHPV/PTVL	23	0.1%	1	0.0%
110.200	vitreous degeneration-anterior chamber	8	0.0%	10	0.2%
110.320	vitreal degeneration	167	0.6%	19	0.3%
FUNDUS					
97.110	choroidal hypoplasia	4	0.0%	1	0.0%
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	66	0.2%	4	0.1%
120.180	retinal dysplasia, geographic	48	0.2%	1	0.0%
120.190	retinal dysplasia, detached	32	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	150	0.5%	3	0.1%
120.400	retinal hemorrhage	6	0.0%	0	
120.910	retinal detachment without dialysis	14	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.0%
120.960	retinopathy	3	0.0%	3	0.1%
OPTIC NERVE					
130.110	micropapilla	43	0.1%	16	0.3%
130.120	optic nerve hypoplasia	15	0.1%	2	0.0%
130.150	optic disc coloboma	1	0.0%	1	0.0%
OTHER					
900.000	other, unspecified	158	0.6%	0	
900.100	other, not inherited	340	1.2%	5	0.1%
900.110	other. suspect not inherited/significance unknown	161	0.6%	117	2.1%
NORMAL					
0.000	normal globe	26,152	91.1%	5,030	88.7%

MUDI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

Any opacity of the lens and/or its capsule, regardless of size or location within the lens. Cataracts are assumed to be hereditary unless associated with known trauma, ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Mudi breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
MUDI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 58 #	1991-2015 58 %	2016-2020 172 #	2016-2020 172 %
EYELIDS						
25.110	distichiasis		2	3.4%	0	
CORNEA						
70.220	pigmentary keratitis		0		1	0.6%
70.700	corneal dystrophy		0		1	0.6%
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	8.6%	19	11.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.6%
LENS						
100.210	cataract. suspect not inherited/significance unknown		2	3.4%	4	2.3%
100.301	punctate cataract, anterior cortex		0		1	0.6%
100.305	punctate cataract, posterior sutures		0		4	2.3%
100.316	incipient cataract, nucleus		1	1.7%	1	0.6%
100.328	y-suture tip opacities		0		4	2.3%
100.345	*significant cataracts (summary)*		*1*	*1.7%*	*10*	*5.8%*
OTHER						
900.000	other, unspecified		1	1.7%	0	
900.110	other. suspect not inherited/significance unknown		1	1.7%	16	9.3%
NORMAL						
0.000	normal globe		50	86.2%	129	75.0%

NEAPOLITAN MASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Ectropion	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Neapolitan Mastiff breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
NEAPOLITAN MASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 66 #	 %	2016-2020 36 #	 %
EYELIDS						
20.160	macropalpebral fissure		14	21.2%	0	
21.000	entropion, unspecified		13	19.7%	13	36.1%
22.000	ectropion, unspecified		22	33.3%	20	55.6%
25.110	distichiasis		7	10.6%	4	11.1%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	1.5%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		1	1.5%	1	2.8%
52.110	prolapsed gland of the third eyelid		4	6.1%	2	5.6%
CORNEA						
70.220	pigmentary keratitis		2	3.0%	1	2.8%
70.700	corneal dystrophy		1	1.5%	0	
70.730	corneal endothelial degeneration		0		1	2.8%
UVEA						
93.730	persistent pupillary membranes, iris to cornea		1	1.5%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	1.5%	3	8.3%
100.306	punctate cataract, nucleus		1	1.5%	1	2.8%
100.313	incipient cataract, equatorial cortex		1	1.5%	0	
100.316	incipient cataract, nucleus		1	1.5%	0	
100.330	generalized/complete cataract		3	4.5%	0	
100.345	*significant cataracts (summary)*		*6*	*9.1%*	*1*	*2.8%*
RETINA						
120.170	retinal dysplasia, folds		2	3.0%	0	
120.960	retinopathy		1	1.5%	0	
OTHER						
900.000	other, unspecified		1	1.5%	0	
900.100	other, not inherited		0		1	2.8%
900.110	other. suspect not inherited/significance unknown		4	6.1%	6	16.7%
NORMAL						
0.000	normal globe		22	33.3%	10	27.8%

OCULAR DISORDERS REPORT
NEDERLANDSE KOOIKERHONDJE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NEDERLANDSE KOOIKERHONDJE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NEDERLANDSE KOOIKERHONDJE

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 78 #	 %	2016-2020 142 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	1.3%	3	2.1%
93.730	persistent pupillary membranes, iris to cornea	1	1.3%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	6	7.7%	5	3.5%
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	1.3%	2	1.4%
110.320	vitreal degeneration	2	2.6%	3	2.1%
RETINA					
120.960	retinopathy	0		1	0.7%
OTHER					
900.000	other, unspecified	2	2.6%	0	
900.110	other. suspect not inherited/significance unknown	5	6.4%	8	5.6%
NORMAL					
0.000	normal globe	65	83.3%	122	85.9%

OCULAR DISORDERS REPORT
NEW ZEALAND HUNTAWAY

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NEW ZEALAND HUNTAWAY breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NEW ZEALAND HUNTAWAY

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 2 # %	2016-2020 0 # %
UVEA			
93.750	persistent pupillary membranes, lens pigment foci/no strands	1 50.0%	0
NORMAL			
0.000	normal globe	2 100.0%	0

NEWFOUNDLAND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	2	NO
B.	Entropion	Not defined	1	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Uveal cysts	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized	Not defined	3	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

Some Newfoundlands have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmic examination using a slitlamp biomicroscope and an indirect ophthalmoscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. The inheritance of goniodysgenesis in the Newfoundland is not known. Until the inheritance is determined, control should be directed towards removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny afflicted with glaucoma.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation

due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Strom AR, Hassig M, Iburg TM, et al. Epidemiology of canine glaucoma presented to University of Zurich from 1995 to 2009. Part 1: Congenital and primary glaucoma (4 and 123 cases). *Vet Ophthalmol*. 2011 Mar;14:121-126.

3. Dekomien G and Epplen JT. Evaluation of the canine RPE65 gene in affected dogs with generalized progressive retinal atrophy. *Mol Vis*. 2003 Nov 11;9:601-605.

OCULAR DISORDERS REPORT
NEWFOUNDLAND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 3,074 #	%	2016-2020 481 #	%
GLOBE					
0.110	microphthalmia	5	0.2%	1	0.2%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	128	4.2%	0	
21.000	entropion, unspecified	204	6.6%	33	6.9%
22.000	ectropion, unspecified	221	7.2%	21	4.4%
25.110	distichiasis	21	0.7%	1	0.2%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	14	0.5%	3	0.6%
52.110	prolapsed gland of the third eyelid	9	0.3%	1	0.2%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.220	pigmentary keratitis	2	0.1%	0	
70.700	corneal dystrophy	1	0.0%	1	0.2%
70.730	corneal endothelial degeneration	0		1	0.2%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	21	0.7%	2	0.4%
93.720	persistent pupillary membranes, iris to lens	5	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.2%	1	0.2%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	0	
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	52	1.7%	9	1.9%
LENS					
100.200	cataract, unspecified	11	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	101	3.3%	13	2.7%
100.301	punctate cataract, anterior cortex	6	0.2%	2	0.4%
100.302	punctate cataract, posterior cortex	13	0.4%	1	0.2%
100.303	punctate cataract, equatorial cortex	5	0.2%	3	0.6%
100.305	punctate cataract, posterior sutures	6	0.2%	1	0.2%
100.306	punctate cataract, nucleus	3	0.1%	0	
100.307	punctate cataract, capsular	3	0.1%	3	0.6%
100.311	incipient cataract, anterior cortex	17	0.6%	1	0.2%
100.312	incipient cataract, posterior cortex	86	2.8%	14	2.9%
100.313	incipient cataract, equatorial cortex	18	0.6%	4	0.8%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	12	0.4%	2	0.4%
100.316	incipient cataract, nucleus	12	0.4%	1	0.2%
100.317	incipient cataract, capsular	8	0.3%	1	0.2%
100.321	incomplete cataract, anterior cortex	0		2	0.4%
100.322	incomplete cataract, posterior cortex	5	0.2%	2	0.4%

LENS CONTINUED		1991-2015		2016-2020	
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	0		1	0.2%
100.326	incomplete cataract, nucleus	0		1	0.2%
100.328	y-suture tip opacities	1	0.0%	2	0.4%
100.330	generalized/complete cataract	38	1.2%	0	
100.345	*significant cataracts (summary)*	*248*	*8.1%*	*41*	*8.5%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.1%	1	0.2%
110.135	PHPV/PTVL	4	0.1%	0	
110.320	vitreal degeneration	5	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	26	0.8%	3	0.6%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	7	0.2%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	29	0.9%	0	
900.100	other, not inherited	72	2.3%	3	0.6%
900.110	other. suspect not inherited/significance unknown	44	1.4%	15	3.1%
NORMAL					
0.000	normal globe	2,327	75.7%	359	74.6%

NORFOLK TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
	- endothelial opacity/no strands	Not defined	1	NO	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17* gene
E.	Optic nerve hypoplasia	Not defined	1	NO	

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Optic nerve hypoplasia

A congenital anomaly, which results in a small optic disk diameter and vision loss.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

3. Komaromy A. Genetics of canine primary glaucomas. Vet Clin Small Anim. 2015; 45: 1159-1182.

OCULAR DISORDERS REPORT
NORFOLK TERRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 1,313 #	 %	2016-2020 383 #	 %
EYELIDS					
20.160	macropalpebral fissure	1	0.1%	0	
25.110	distichiasis	6	0.5%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.2%	0	
CORNEA					
70.700	corneal dystrophy	12	0.9%	7	1.8%
70.730	corneal endothelial degeneration	1	0.1%	2	0.5%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	269	20.5%	99	25.8%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	4	0.3%	2	0.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	8	0.6%	7	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.2%	4	1.0%
LENS					
100.200	cataract, unspecified	1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	44	3.4%	2	0.5%
100.301	punctate cataract, anterior cortex	5	0.4%	1	0.3%
100.302	punctate cataract, posterior cortex	4	0.3%	0	
100.305	punctate cataract, posterior sutures	8	0.6%	0	
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	2	0.2%	0	
100.311	incipient cataract, anterior cortex	7	0.5%	5	1.3%
100.312	incipient cataract, posterior cortex	16	1.2%	3	0.8%
100.313	incipient cataract, equatorial cortex	5	0.4%	0	
100.315	incipient cataract, posterior sutures	2	0.2%	1	0.3%
100.317	incipient cataract, capsular	4	0.3%	1	0.3%
100.321	incomplete cataract, anterior cortex	0		1	0.3%
100.322	incomplete cataract, posterior cortex	2	0.2%	0	
100.328	y-suture tip opacities	0		1	0.3%
100.330	generalized/complete cataract	4	0.3%	0	
100.345	*significant cataracts (summary)*	*61*	*4.6%*	*13*	*3.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.5%	2	0.5%
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	8	0.6%	0	
FUNDUS					
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	7	0.5%	0	
120.180	retinal dysplasia, geographic	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	10	0.8%	1	0.3%

RETINA CONTINUED	1991-2015		2016-2020	
120.910 retinal detachment without dialysis	1	0.1%	0	
OPTIC NERVE				
130.110 micropapilla	10	0.8%	4	1.0%
130.120 optic nerve hypoplasia	18	1.4%	8	2.1%
130.150 optic disc coloboma	19	1.4%	1	0.3%
OTHER				
900.000 other, unspecified	14	1.1%	0	
900.100 other, not inherited	38	2.9%	0	
900.110 other. suspect not inherited/significance unknown	22	1.7%	14	3.7%
NORMAL				
0.000 normal globe	947	72.1%	240	62.7%

NORBOTTENSPETS

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Norbottenspets is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Norbottenspets. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
NORRBOTTENSPETS

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 99 #	 %	2016-2020 22 #	 %
EYELIDS					
25.110	distichiasis	1	1.0%	1	4.5%
CORNEA					
70.700	corneal dystrophy	1	1.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	6	6.1%	2	9.1%
93.720	persistent pupillary membranes, iris to lens	1	1.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	9.1%
LENS					
100.210	cataract. suspect not inherited/significance unknown	5	5.1%	2	9.1%
100.302	punctate cataract, posterior cortex	2	2.0%	0	
100.305	punctate cataract, posterior sutures	1	1.0%	0	
100.306	punctate cataract, nucleus	1	1.0%	0	
100.311	incipient cataract, anterior cortex	7	7.1%	0	
100.312	incipient cataract, posterior cortex	9	9.1%	0	
100.315	incipient cataract, posterior sutures	1	1.0%	0	
100.316	incipient cataract, nucleus	3	3.0%	0	
100.330	generalized/complete cataract	1	1.0%	0	
100.345	*significant cataracts (summary)*	*25*	*25.3%*	*0*	
RETINA					
120.170	retinal dysplasia, folds	1	1.0%	1	4.5%
120.310	generalized progressive retinal atrophy (PRA)	2	2.0%	0	
OTHER					
900.100	other, not inherited	3	3.0%	0	
900.110	other. suspect not inherited/significance unknown	0		1	4.5%
NORMAL					
0.000	normal globe	75	75.8%	17	77.3%

OCULAR DISORDERS REPORT
NORTH AMERICAN SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NORTH AMERICAN SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NORTH AMERICAN SHEPHERD

Diagnostic Name	1991-2015 TOTAL DOGS EXAMINED 6 # %	2016-2020 0 # %
VITREOUS		
110.200 vitreous degeneration-anterior chamber	1 16.7%	0
NORMAL		
0.000 normal globe	5 83.3%	0

NORTHERN INUIT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive	1	NO	Mutation in the *COL9A3* gene

Description and Comments

A. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1)also occurs in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs ("downhill" conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Northern Inuit. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
NORTHERN INUIT

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 1 #	%	2016-2020 12 #	%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		1	8.3%
NORMAL					
0.000	normal globe	1	100.0%	11	91.7%

NORWEGIAN BUHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1, 3	NO
B.	Cataract - pulverulent	Presumed autosomal dominant	2, 3	Breeder option
C.	Y-suture top opacity	Not defined	1	Breeder option

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

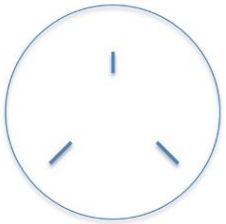
B. Cataract - pulverulent

With the pulverulent cataract in the Norwegian Buhund, initial lens changes may be visible as early as 6.5 weeks of age as small dots parallel to the suture lines behind the nucleus. By the age of 4 to 5.5 years, the opacities progress to involve the fetal nucleus which then resembles a ball of candy floss. The adult nucleus and the cortex remain clear. An autosomal dominant mode of inheritance with a high degree of penetrance has been suggested.

Rates of progression of these cataracts can vary, and have been noted to develop in older animals (over the age of 7) that were previously documented to be free from this condition.

C. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are



considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.

These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

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OCULAR DISORDERS REPORT
NORWEGIAN BUHUND

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**637**		**280**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	0		1	0.4%
EYELIDS					
25.110	distichiasis	2	0.3%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.4%
70.700	corneal dystrophy	5	0.8%	2	0.7%
UVEA					
93.110	iris hypoplasia	0		1	0.4%
93.710	persistent pupillary membranes, iris to iris	2	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.4%
93.999	uveal cysts	0		1	0.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	76	11.9%	33	11.8%
100.301	punctate cataract, anterior cortex	6	0.9%	0	
100.302	punctate cataract, posterior cortex	7	1.1%	4	1.4%
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	4	0.6%	7	2.5%
100.306	punctate cataract, nucleus	9	1.4%	4	1.4%
100.307	punctate cataract, capsular	1	0.2%	1	0.4%
100.311	incipient cataract, anterior cortex	3	0.5%	3	1.1%
100.312	incipient cataract, posterior cortex	17	2.7%	7	2.5%
100.313	incipient cataract, equatorial cortex	0		2	0.7%
100.315	incipient cataract, posterior sutures	10	1.6%	3	1.1%
100.316	incipient cataract, nucleus	14	2.2%	4	1.4%
100.321	incomplete cataract, anterior cortex	1	0.2%	0	
100.322	incomplete cataract, posterior cortex	1	0.2%	0	
100.323	incomplete cataract, equatorial cortex	0		1	0.4%
100.325	incomplete cataract, posterior sutures	1	0.2%	0	
100.328	y-suture tip opacities	0		6	2.1%
100.330	generalized/complete cataract	6	0.9%	0	
100.345	*significant cataracts (summary)*	*81*	*12.7%*	*42*	*15.0%*
VITREOUS					
110.320	vitreal degeneration	0		1	0.4%
RETINA					
120.170	retinal dysplasia, folds	8	1.3%	3	1.1%
120.310	generalized progressive retinal atrophy (PRA)	3	0.5%	0	
120.960	retinopathy	3	0.5%	5	1.8%
OTHER					
900.000	other, unspecified	14	2.2%	0	
900.100	other, not inherited	17	2.7%	6	2.1%
900.110	other. suspect not inherited/significance unknown	13	2.0%	22	7.9%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	484 76.0%	181 64.6%

NORWEGIAN ELKHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-6	NO	
B.	Distichiasis	Not defined	4	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy (*prcd)*	Autosomal recessive	7	NO	Mutation of the *prcd* gene
F.	Retinal atrophy - generalized				
	1. Rod dysplasia (*rd*)	Autosomal recessive	8-11	NO	
	2. Early retinal degeneration (*erd*)	Autosomal recessive	12-16	NO	Mutation of the *STK38L* gene
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

In the Norwegian Elkhound, glaucoma appears to be familial. In most cases the drainage angle is reported to be open. A mutation has been found in *ADAMTS10* in some Norwegian Elkhounds with glaucoma, but a genetic test is not yet available.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that PRA in the Norwegian Elkhound is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

F. Retinal atrophy - generalized

1. **Rod dysplasia (*rd*)**: Inappropriate development of the visual cells resulting in vision impairment in dim light by 6 months and total blindness at 3-5 years. Ophthalmoscopic signs may be evident after 5 months of age, with signs of retinal vascular thinning after 2 years. An ERG can provide a diagnosis as early as 6 weeks of age. In the Norwegian Elkhound, this is an autosomal recessive trait.

2. **Early retinal degeneration (*erd*)**: Another form of PRA reported in the Norwegian Elkhound. Animals are night blind at 6 weeks and blind by 1 year of age. Clinical signs are

evident by 6 months. On histopathologic examination there is an abnormal structural development of the photoreceptors followed by rapid rod/cone degeneration. The mutation is found in the *STK38L* gene and is inherited as an autosomal recessive trait. While a DNA test is available, no Norwegian Elkhounds are thought to exist with this mutation anymore.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
NORWEGIAN ELKHOUND

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**2,540**		**248**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	4	0.2%	0	
10.000	glaucoma	2	0.1%	0	
EYELIDS					
20.160	macropalpebral fissure	16	0.6%	0	
21.000	entropion, unspecified	5	0.2%	0	
22.000	ectropion, unspecified	14	0.6%	0	
25.110	distichiasis	44	1.7%	2	0.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.1%	0	
70.700	corneal dystrophy	9	0.4%	2	0.8%
UVEA					
93.710	persistent pupillary membranes, iris to iris	34	1.3%	3	1.2%
93.720	persistent pupillary membranes, iris to lens	10	0.4%	1	0.4%
93.730	persistent pupillary membranes, iris to cornea	6	0.2%	1	0.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.1%	4	1.6%
93.999	uveal cysts	7	0.3%	0	
LENS					
100.200	cataract, unspecified	23	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown	107	4.2%	17	6.9%
100.301	punctate cataract, anterior cortex	8	0.3%	1	0.4%
100.302	punctate cataract, posterior cortex	8	0.3%	2	0.8%
100.303	punctate cataract, equatorial cortex	4	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	10	0.4%	1	0.4%
100.306	punctate cataract, nucleus	3	0.1%	1	0.4%
100.307	punctate cataract, capsular	2	0.1%	1	0.4%
100.311	incipient cataract, anterior cortex	11	0.4%	1	0.4%
100.312	incipient cataract, posterior cortex	37	1.5%	2	0.8%
100.313	incipient cataract, equatorial cortex	21	0.8%	4	1.6%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	7	0.3%	1	0.4%
100.316	incipient cataract, nucleus	8	0.3%	1	0.4%
100.317	incipient cataract, capsular	9	0.4%	0	
100.321	incomplete cataract, anterior cortex	1	0.0%	1	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.4%
100.326	incomplete cataract, nucleus	0		1	0.4%
100.327	incomplete cataract, capsular	0		1	0.4%
100.328	y-suture tip opacities	1	0.0%	3	1.2%
100.330	generalized/complete cataract	7	0.3%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*164*	*6.5%*	*22*	*8.9%*
100.375	*subluxation/luxation, unspecified*	*4*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	7	0.3%	0	
110.135	PHPV/PTVL	2	0.1%	0	
110.320	vitreal degeneration	7	0.3%	1	0.4%
RETINA					
120.170	retinal dysplasia, folds	44	1.7%	6	2.4%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	10	0.4%	0	
120.400	retinal hemorrhage	3	0.1%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	0.4%
130.120	optic nerve hypoplasia	2	0.1%	1	0.4%
OTHER					
900.000	other, unspecified	22	0.9%	0	
900.100	other, not inherited	32	1.3%	0	
900.110	other. suspect not inherited/significance unknown	16	0.6%	23	9.3%
NORMAL					
0.000	normal globe	2,186	86.1%	180	72.6%

OCULAR DISORDERS REPORT
NORWEGIAN LUNDEHUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NORWEGIAN LUNDEHUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NORWEGIAN LUNDEHUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 48 #	 %	2016-2020 2 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	13	27.1%	0	
93.720	persistent pupillary membranes, iris to lens	1	2.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	8	16.7%	0	
100.301	punctate cataract, anterior cortex	1	2.1%	0	
100.302	punctate cataract, posterior cortex	2	4.2%	0	
100.311	incipient cataract, anterior cortex	2	4.2%	0	
100.313	incipient cataract, equatorial cortex	1	2.1%	0	
100.315	incipient cataract, posterior sutures	2	4.2%	0	
100.330	generalized/complete cataract	3	6.2%	0	
100.345	*significant cataracts (summary)*	*11*	*22.9%*	*0*	
VITREOUS					
110.320	vitreal degeneration	2	4.2%	0	
OTHER					
900.000	other, unspecified	1	2.1%	0	
NORMAL					
0.000	normal globe	29	60.4%	2	100.0%

NORWICH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	2	NO	
D.	Lens luxation	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to

be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
NORWICH TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**3,080**		**611**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	18	0.6%	12	2.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.2%
NICTITANS					
52.110	prolapsed gland of the third eyelid	4	0.1%	0	
CORNEA					
70.700	corneal dystrophy	18	0.6%	5	0.8%
70.730	corneal endothelial degeneration	4	0.1%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	177	5.7%	20	3.3%
93.720	persistent pupillary membranes, iris to lens	4	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	8	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.1%	3	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	5	0.2%	0	
93.999	uveal cysts	1	0.0%	0	
LENS					
100.200	cataract, unspecified	5	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	73	2.4%	11	1.8%
100.301	punctate cataract, anterior cortex	10	0.3%	0	
100.302	punctate cataract, posterior cortex	9	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex	2	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures	6	0.2%	1	0.2%
100.306	punctate cataract, nucleus	3	0.1%	0	
100.307	punctate cataract, capsular	1	0.0%	2	0.3%
100.311	incipient cataract, anterior cortex	15	0.5%	4	0.7%
100.312	incipient cataract, posterior cortex	17	0.6%	2	0.3%
100.313	incipient cataract, equatorial cortex	13	0.4%	2	0.3%
100.314	incipient cataract, anterior sutures	1	0.0%	0	
100.315	incipient cataract, posterior sutures	6	0.2%	0	
100.316	incipient cataract, nucleus	11	0.4%	4	0.7%
100.317	incipient cataract, capsular	1	0.0%	3	0.5%
100.321	incomplete cataract, anterior cortex	1	0.0%	0	
100.322	incomplete cataract, posterior cortex	1	0.0%	1	0.2%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.328	y-suture tip opacities	0		2	0.3%
100.330	generalized/complete cataract	12	0.4%	0	
100.345	*significant cataracts (summary)*	*114*	*3.7%*	*25*	*4.1%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	0	
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	11	0.4%	0	
FUNDUS					
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	6	0.2%	0	
120.180	retinal dysplasia, geographic	4	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	0.5%	0	
120.960	retinopathy	4	0.1%	3	0.5%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	8	0.3%	0	
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	28	0.9%	0	
900.100	other, not inherited	51	1.7%	1	0.2%
900.110	other. suspect not inherited/significance unknown	24	0.8%	11	1.8%
NORMAL					
0.000	normal globe	2,745	89.1%	530	86.7%

NOVA SCOTIA DUCK TOLLING RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris - iris to lens - lens pigment foci/no strands	 Not defined Not defined Not defined	 1 1 1	 Breeder option NO Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Retinal atrophy (*prcd)*	Autosomal recessive	1, 2	NO	Mutation of the *prcd* gene
G.	Choroidal hypoplasia (Collie eye anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1, 3, 4	NO	Mutation of the *NHEJ1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

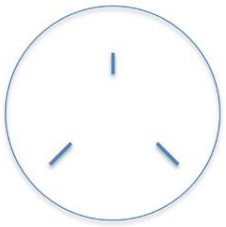
In the Nova Scotia Duck Tolling Retriever, many of the PPMs identified on routine screening examinations bridge from the iris to the lens where they are associated with focal cataract. This may result in vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Nova Scotia Duck Tolling Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

G. Choroidal hypoplasia (Collie eye anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie eye anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics.* 2006 Nov;88:551-563. PMID: 16938425

3. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Genome Res*. 2007 Nov;17:1562-1571.

4. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for Collie eye anomaly. *Genomics*. 2003;82:86-95.

OCULAR DISORDERS REPORT
NOVA SCOTIA DUCK TOLLING RET.

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**5,440**		**1,258**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.0%	2	0.2%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
25.110	distichiasis	670	12.3%	149	11.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.1%	7	0.6%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	5	0.1%	0	
52.110	prolapsed gland of the third eyelid	5	0.1%	0	
CORNEA					
70.700	corneal dystrophy	141	2.6%	36	2.9%
70.730	corneal endothelial degeneration	4	0.1%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	118	2.2%	35	2.8%
93.720	persistent pupillary membranes, iris to lens	53	1.0%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	2	0.0%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	117	2.2%	82	6.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	0	
93.999	uveal cysts	21	0.4%	3	0.2%
LENS					
100.200	cataract, unspecified	18	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	309	5.7%	83	6.6%
100.301	punctate cataract, anterior cortex	19	0.3%	4	0.3%
100.302	punctate cataract, posterior cortex	25	0.5%	2	0.2%
100.303	punctate cataract, equatorial cortex	10	0.2%	1	0.1%
100.305	punctate cataract, posterior sutures	5	0.1%	6	0.5%
100.306	punctate cataract, nucleus	6	0.1%	4	0.3%
100.307	punctate cataract, capsular	9	0.2%	5	0.4%
100.311	incipient cataract, anterior cortex	17	0.3%	2	0.2%
100.312	incipient cataract, posterior cortex	34	0.6%	2	0.2%
100.313	incipient cataract, equatorial cortex	16	0.3%	1	0.1%
100.314	incipient cataract, anterior sutures	1	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures	3	0.1%	1	0.1%
100.316	incipient cataract, nucleus	9	0.2%	0	
100.317	incipient cataract, capsular	7	0.1%	0	
100.321	incomplete cataract, anterior cortex	3	0.1%	0	
100.322	incomplete cataract, posterior cortex	1	0.0%	1	0.1%
100.328	y-suture tip opacities	2	0.0%	11	0.9%
100.330	generalized/complete cataract	7	0.1%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*192*	*3.5%*	*41*	*3.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.2%	15	1.2%
110.135	PHPV/PTVL	7	0.1%	1	0.1%
110.200	vitreous degeneration-anterior chamber	0		1	0.1%
110.320	vitreal degeneration	13	0.2%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	47	0.9%	5	0.4%
120.180	retinal dysplasia, geographic	13	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	97	1.8%	1	0.1%
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	12	0.2%	1	0.1%
130.120	optic nerve hypoplasia	13	0.2%	1	0.1%
130.150	optic disc coloboma	3	0.1%	1	0.1%
OTHER					
900.000	other, unspecified	98	1.8%	0	
900.100	other, not inherited	279	5.1%	1	0.1%
900.110	other. suspect not inherited/significance unknown	89	1.6%	79	6.3%
NORMAL					
0.000	normal globe	4,105	75.5%	812	64.5%

OLD ENGLISH SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular anomalies	Not defined	1, 2	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1, 3	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

Microphthalmia is a developmental anomaly in which the eyeball is abnormally small. This is often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens and/or retina.

Microphthalmia with cataract and retinal abnormalities including retinal detachment, has been reported in litters of Old English Sheepdogs. Lesions were non-progressive. However, blindness did result in some dogs. The mode of inheritance is unknown, but affected dogs should not be bred.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal

layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. In one study of 66 interrelated Old English Sheepdogs, an autosomal recessive mode of inheritance was suggested. Retinal detachment was an associated finding in 5/43 affected dogs in this study. The location of the opacity within the lens and the age of onset was highly variable.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Barrie K. Posterior lenticonus, microphthalmia, cataracts and retinal folds in Old English Sheepdogs. *J Am Anim Hosp Assoc*. 1979;15:715.

3. Koch SA. Cataracts in interrelated Old English Sheepdogs. *J Am Vet Med Assoc*. 1972 Feb 1;160:299-301.

OCULAR DISORDERS REPORT
OLD ENGLISH SHEEPDOG

Diagnostic Name		1991-2015 4,945 #	%	2016-2020 933 #	%
GLOBE					
0.110	microphthalmia	10	0.2%	0	
10.000	glaucoma	4	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	12	0.2%	1	0.1%
22.000	ectropion, unspecified	2	0.0%	0	
25.110	distichiasis	84	1.7%	16	1.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.0%	1	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.700	corneal dystrophy	18	0.4%	3	0.3%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	420	8.5%	148	15.9%
93.720	persistent pupillary membranes, iris to lens	7	0.1%	3	0.3%
93.730	persistent pupillary membranes, iris to cornea	9	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	10	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.0%	3	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.1%	0	
93.810	uveal melanoma	0		1	0.1%
93.999	uveal cysts	0		2	0.2%
LENS					
100.200	cataract, unspecified	35	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	260	5.3%	61	6.5%
100.301	punctate cataract, anterior cortex	33	0.7%	11	1.2%
100.302	punctate cataract, posterior cortex	9	0.2%	1	0.1%
100.303	punctate cataract, equatorial cortex	6	0.1%	3	0.3%
100.304	punctate cataract, anterior sutures	5	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	5	0.1%	2	0.2%
100.306	punctate cataract, nucleus	12	0.2%	4	0.4%
100.307	punctate cataract, capsular	6	0.1%	4	0.4%
100.311	incipient cataract, anterior cortex	44	0.9%	9	1.0%
100.312	incipient cataract, posterior cortex	43	0.9%	8	0.9%
100.313	incipient cataract, equatorial cortex	17	0.3%	1	0.1%
100.314	incipient cataract, anterior sutures	11	0.2%	1	0.1%
100.315	incipient cataract, posterior sutures	13	0.3%	0	
100.316	incipient cataract, nucleus	30	0.6%	3	0.3%
100.317	incipient cataract, capsular	5	0.1%	1	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	2	0.0%	1	0.1%
100.322	incomplete cataract, posterior cortex	2	0.0%	2	0.2%
100.326	incomplete cataract, nucleus	1	0.0%	1	0.1%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	y-suture tip opacities	1	0.0%	3	0.3%
100.330	generalized/complete cataract	61	1.2%	1	0.1%
100.340	resorbing/hypermature cataract	2	0.0%	0	
100.345	*significant cataracts (summary)*	*343*	*6.9%*	*58*	*6.2%*
100.375	*subluxation/luxation, unspecified*	*6*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	16	0.3%	3	0.3%
110.135	PHPV/PTVL	3	0.1%	0	
110.200	vitreous degeneration-anterior chamber	3	0.1%	0	
110.320	vitreal degeneration	26	0.5%	0	
FUNDUS					
97.110	choroidal hypoplasia	3	0.1%	1	0.1%
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	87	1.8%	8	0.9%
120.180	retinal dysplasia, geographic	8	0.2%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	13	0.3%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	9	0.2%	0	
120.960	retinopathy	0		5	0.5%
OPTIC NERVE					
130.110	micropapilla	14	0.3%	9	1.0%
130.120	optic nerve hypoplasia	15	0.3%	0	
130.150	optic disc coloboma	4	0.1%	0	
OTHER					
900.000	other, unspecified	35	0.7%	0	
900.100	other, not inherited	76	1.5%	2	0.2%
900.110	other. suspect not inherited/significance unknown	44	0.9%	28	3.0%
NORMAL					
0.000	normal globe	3,969	80.3%	641	68.7%

OCULAR DISORDERS REPORT
OLDE ENGLISH BULLDOGGE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the OLDE ENGLISH BULLDOGGE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
OLDE ENGLISH BULLDOGGE

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 11 #	 %	2016-2020 17 #	 %
EYELIDS					
21.000	entropion, unspecified	0		2	11.8%
25.110	distichiasis	5	45.5%	3	17.6%
UVEA					
93.110	iris hypoplasia	0		1	5.9%
93.710	persistent pupillary membranes, iris to iris	1	9.1%	0	
93.720	persistent pupillary membranes, iris to lens	1	9.1%	0	
93.999	uveal cysts	0		1	5.9%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		1	5.9%
RETINA					
120.170	retinal dysplasia, folds	0		1	5.9%
120.180	retinal dysplasia, geographic	0		1	5.9%
OTHER					
900.110	other. suspect not inherited/significance unknown	0		2	11.8%
NORMAL					
0.000	normal globe	5	45.5%	8	47.1%

OCULAR DISORDERS REPORT
OTTERHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the OTTERHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
OTTERHOUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 6 #	 %	2016-2020 2 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	16.7%	0	
93.999	uveal cysts	0		1	50.0%
NORMAL					
0.000	normal globe	6	100.0%	1	50.0%

PAPILLON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Vitreous degeneration	Not defined	1	Breeder option	
F.	Retinal atrophy (*CNGB1)*	Autosomal recessive	1, 2-5	NO	Mutation in the *CNGB1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Nuclear and posterior cortical cataracts have been reported in the Papillon.

E. Vitreous degeneration

A liquefaction of the vitreous gel, which may predispose to retinal detachment resulting in blindness.

F. Retinal atrophy - *CNGB1*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In one study of 707 dogs in Sweden, an autosomal recessive mode of inheritance was suggested. Clinical onset is reported at 5-6 years of age. In approximately 70% of cases of PRA in the Papillon, a *CNGB1* mutation is present, leading to an abnormal *CNGA1* protein in the rod outer segments. The mode of transmission is autosomal recessive. A genetic test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Haakanson N, Narfstrom K. Progressive retinal atrophy in Papillon dogs in Sweden: A clinical survey. *Prog Vet Comp Ophthal*. 1995;5:83.

3. Narfstrom K, Ekesten B. Electroretinographic evaluation of Papillons with and without hereditary retinal degeneration. *Am J Vet Res.* 1998;59:221-226.

4. Ahonen SJ, Arumilli M, Lohi H. A CNGB1 frameshift mutation in Papillon and Phalene dogs with progressive retinal atrophy. *PLoS One.* 2013;8:e72122.

5. Winkler PA, Ekenstedt KJ, Occelli LM, et al. A large animal model for CNGB1 autosomal recessive retinitis pigmentosa. *PLoS One*. 2013;8:e72229.

OCULAR DISORDERS REPORT
PAPILLON

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	10,550		1,392	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	9	0.1%	1	0.1%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	16	0.2%	5	0.4%
25.110	distichiasis	145	1.4%	27	1.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.0%	5	0.4%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.0%	0	
CORNEA					
70.210	corneal pannus	5	0.0%	1	0.1%
70.220	pigmentary keratitis	2	0.0%	0	
70.700	corneal dystrophy	99	0.9%	34	2.4%
70.730	corneal endothelial degeneration	4	0.0%	0	
UVEA					
93.110	iris hypoplasia	2	0.0%	1	0.1%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	312	3.0%	57	4.1%
93.720	persistent pupillary membranes, iris to lens	7	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	8	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	6	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	13	0.1%	5	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	5	0.0%	3	0.2%
93.810	uveal melanoma	0		3	0.2%
93.999	uveal cysts	4	0.0%	1	0.1%
LENS					
100.200	cataract, unspecified	19	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	341	3.2%	56	4.0%
100.301	punctate cataract, anterior cortex	53	0.5%	4	0.3%
100.302	punctate cataract, posterior cortex	17	0.2%	2	0.1%
100.303	punctate cataract, equatorial cortex	11	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures	4	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	7	0.1%	4	0.3%
100.306	punctate cataract, nucleus	15	0.1%	3	0.2%
100.307	punctate cataract, capsular	7	0.1%	5	0.4%
100.311	incipient cataract, anterior cortex	80	0.8%	8	0.6%
100.312	incipient cataract, posterior cortex	51	0.5%	6	0.4%
100.313	incipient cataract, equatorial cortex	30	0.3%	2	0.1%
100.314	incipient cataract, anterior sutures	6	0.1%	0	
100.315	incipient cataract, posterior sutures	10	0.1%	0	
100.316	incipient cataract, nucleus	21	0.2%	2	0.1%
100.317	incipient cataract, capsular	10	0.1%	2	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.321	incomplete cataract, anterior cortex	2	0.0%	1	0.1%
100.322	incomplete cataract, posterior cortex	3	0.0%	2	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.326	incomplete cataract, nucleus	3	0.0%	0	
100.328	y-suture tip opacities	0		4	0.3%
100.330	generalized/complete cataract	45	0.4%	3	0.2%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*395*	*3.7%*	*52*	*3.7%*
100.375	*subluxation/luxation, unspecified*	*5*	*0.0%*	*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	38	0.4%	6	0.4%
110.135	PHPV/PTVL	14	0.1%	1	0.1%
110.200	vitreous degeneration-anterior chamber	4	0.0%	11	0.8%
110.320	vitreal degeneration	303	2.9%	23	1.7%
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.1%
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	66	0.6%	5	0.4%
120.180	retinal dysplasia, geographic	11	0.1%	3	0.2%
120.190	retinal dysplasia, detached	3	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	110	1.0%	7	0.5%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.1%
120.960	retinopathy	1	0.0%	3	0.2%
OPTIC NERVE					
130.110	micropapilla	8	0.1%	0	
130.120	optic nerve hypoplasia	10	0.1%	2	0.1%
130.150	optic disc coloboma	3	0.0%	0	
OTHER					
900.000	other, unspecified	77	0.7%	0	
900.100	other, not inherited	202	1.9%	3	0.2%
900.110	other. suspect not inherited/significance unknown	75	0.7%	54	3.9%
NORMAL					
0.000	normal globe	9,138	86.6%	1,081	77.7%

PARSON RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not define	1	Breeder options	
C.	Cataract	Not defined	1, 2	NO	
D.	Lens luxation	Autosomal recessive	3, 4	NO	Mutation in the *ADAMTS17* gene
E.	Vitreous degeneration	Not defined	1	Breeder option	
F.	Retinal atrophy - generalized	Not defined	1	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation may result in blinding retinal detachment and/or elevated intraocular pressure (glaucoma) causing vision impairment, pain, and blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Oberbauer AM, Hollingsworth SR, Belanger JM, et al. Inheritance of cataracts and primary lens luxation in Jack Russell Terriers. *Am J Vet Res*. 2008;69:222-227.

3. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
PARSON RUSSELL TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**2,611**		**291**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	64	2.5%	8	2.7%
NICTITANS					
52.110	prolapsed gland of the third eyelid	0		1	0.3%
CORNEA					
70.700	corneal dystrophy	14	0.5%	0	
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	162	6.2%	34	11.7%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.2%	3	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.1%	2	0.7%
93.999	uveal cysts	2	0.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	82	3.1%	12	4.1%
100.301	punctate cataract, anterior cortex	7	0.3%	3	1.0%
100.302	punctate cataract, posterior cortex	8	0.3%	0	
100.303	punctate cataract, equatorial cortex	4	0.2%	0	
100.304	punctate cataract, anterior sutures	0		1	0.3%
100.305	punctate cataract, posterior sutures	4	0.2%	2	0.7%
100.306	punctate cataract, nucleus	2	0.1%	0	
100.307	punctate cataract, capsular	2	0.1%	1	0.3%
100.311	incipient cataract, anterior cortex	15	0.6%	2	0.7%
100.312	incipient cataract, posterior cortex	39	1.5%	2	0.7%
100.313	incipient cataract, equatorial cortex	6	0.2%	1	0.3%
100.314	incipient cataract, anterior sutures	1	0.0%	0	
100.315	incipient cataract, posterior sutures	13	0.5%	2	0.7%
100.316	incipient cataract, nucleus	1	0.0%	0	
100.317	incipient cataract, capsular	9	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.3%
100.322	incomplete cataract, posterior cortex	2	0.1%	1	0.3%
100.328	y-suture tip opacities	0		2	0.7%
100.330	generalized/complete cataract	11	0.4%	0	
100.345	*significant cataracts (summary)*	*124*	*4.7%*	*18*	*6.2%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.2%	2	0.7%
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	45	1.7%	1	0.3%
FUNDUS					
97.120	coloboma	1	0.0%	0	

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	8	0.3%	2	0.7%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	25	1.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.3%
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	2	0.1%	0	
130.120	optic nerve hypoplasia	2	0.1%	0	
OTHER					
900.000	other, unspecified	39	1.5%	0	
900.100	other, not inherited	97	3.7%	0	
900.110	other. suspect not inherited/significance unknown	24	0.9%	20	6.9%
NORMAL					
0.000	normal globe	2,263	86.7%	208	71.5%

PATTERDALE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens Luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Patterdale Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
PATTERDALE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 15 #	%	2016-2020 2 #	%
EYELIDS					
25.110	distichiasis	1	6.7%	0	
RETINA					
120.170	retinal dysplasia, folds	1	6.7%	0	
120.180	retinal dysplasia, geographic	1	6.7%	0	
NORMAL					
0.000	normal globe	13	86.7%	2	100.0%

PEKINGESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1-3	Breeder option
B.	Entropion	Not defined	1	Breeder option
C.	Exposure keratopathy syndrome	Not defined	1	Breeder option
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Exposure keratopathy syndrome

A corneal disease involving all or part of the cornea, resulting from inadequate blinking. This results from a combination of anatomic features including shallow orbits, exophthalmos, macroblepharon and lagophthalmos. Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Barnett KC. Comparative aspects of canine hereditary eye disease. *Adv Vet Sci Comp Med.* 1976;20:39-67.

3. Gelatt KN. Pediatric ophthalmology in small animal practice. *Vet Clin North Am.* 1973;3:321.

4. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *American Journal of Veterinary Research.* 1974;35:571-574.

OCULAR DISORDERS REPORT
PEKINGESE

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**198**		**102**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.5%	0	
EYELIDS					
20.140	ectopic cilia	2	1.0%	0	
20.160	macropalpebral fissure	12	6.1%	0	
21.000	entropion, unspecified	11	5.6%	32	31.4%
22.000	ectropion, unspecified	2	1.0%	0	
25.110	distichiasis	21	10.6%	6	5.9%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.5%	1	1.0%
CORNEA					
70.210	corneal pannus	7	3.5%	0	
70.220	pigmentary keratitis	29	14.6%	18	17.6%
UVEA					
90.250	pigmentary uveitis	0		1	1.0%
93.710	persistent pupillary membranes, iris to iris	0		1	1.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.5%	0	
LENS					
100.200	cataract, unspecified	3	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown	3	1.5%	2	2.0%
100.301	punctate cataract, anterior cortex	3	1.5%	1	1.0%
100.302	punctate cataract, posterior cortex	2	1.0%	1	1.0%
100.303	punctate cataract, equatorial cortex	0		1	1.0%
100.305	punctate cataract, posterior sutures	1	0.5%	0	
100.311	incipient cataract, anterior cortex	5	2.5%	0	
100.312	incipient cataract, posterior cortex	3	1.5%	0	
100.313	incipient cataract, equatorial cortex	4	2.0%	0	
100.315	incipient cataract, posterior sutures	3	1.5%	0	
100.316	incipient cataract, nucleus	1	0.5%	0	
100.330	generalized/complete cataract	2	1.0%	0	
100.340	resorbing/hypermature cataract	0		1	1.0%
100.345	*significant cataracts (summary)*	*27*	*13.6%*	*4*	*3.9%*
100.375	*subluxation/luxation, unspecified*	*2*	*1.0%*	*0*	
RETINA					
120.170	retinal dysplasia, folds	1	0.5%	0	
120.190	retinal dysplasia, detached	1	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	1.5%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	1.0%
130.120	optic nerve hypoplasia	1	0.5%	0	
OTHER					
900.000	other, unspecified	6	3.0%	0	
900.100	other, not inherited	11	5.6%	0	

OTHER CONTINUED	1991-2015	2016-2020
900.110 other. suspect not inherited/significance unknown	7 3.5%	7 6.9%
NORMAL		
0.000 normal globe	110 55.6%	52 51.0%

PEMBROKE WELSH CORGI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- iris to cornea	Not defined	1	NO
C.	Cataract	Not defined	1	NO
D.	Retinal dysplasia - folds	Not defined	1, 2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.
Persistent pupillary membranes are a significant problem in this breed with frequent documentation of strands bridging from the iris to the cornea noted on routine screening eye examinations. These may be associated with corneal opacity which may result in vision impairment, thus the recommendation against breeding Pembroke Welsh Corgis with PPM.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no specific references providing detailed descriptions of hereditary ocular conditions of the Pembroke Welsh Corgi. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
PEMBROKE WELSH CORGI

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**19,021**		**3,809**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	19	0.1%	2	0.1%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	3	0.0%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	331	1.7%	51	1.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.0%	6	0.2%
40.910	keratoconjunctivitis sicca	6	0.0%	1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	2	0.0%	0	
CORNEA					
70.210	corneal pannus	3	0.0%	0	
70.220	pigmentary keratitis	1	0.0%	1	0.0%
70.700	corneal dystrophy	64	0.3%	10	0.3%
70.730	corneal endothelial degeneration	67	0.4%	4	0.1%
UVEA					
93.110	iris hypoplasia	3	0.0%	3	0.1%
93.140	corneal endothelial pigment without PPM	8	0.0%	0	
93.150	iris coloboma	5	0.0%	0	
93.180	Iiris sphincter dysplasia	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	3,418	18.0%	817	21.4%
93.720	persistent pupillary membranes, iris to lens	63	0.3%	12	0.3%
93.730	persistent pupillary membranes, iris to cornea	397	2.1%	38	1.0%
93.740	persistent pupillary membranes, iris sheets	15	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.0%	1	0.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	49	0.3%	30	0.8%
93.999	uveal cysts	11	0.1%	0	
LENS					
100.200	cataract, unspecified	79	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	433	2.3%	79	2.1%
100.301	punctate cataract, anterior cortex	61	0.3%	13	0.3%
100.302	punctate cataract, posterior cortex	51	0.3%	13	0.3%
100.303	punctate cataract, equatorial cortex	25	0.1%	4	0.1%
100.304	punctate cataract, anterior sutures	3	0.0%	0	
100.305	punctate cataract, posterior sutures	20	0.1%	4	0.1%
100.306	punctate cataract, nucleus	52	0.3%	12	0.3%
100.307	punctate cataract, capsular	22	0.1%	8	0.2%
100.311	incipient cataract, anterior cortex	94	0.5%	21	0.6%
100.312	incipient cataract, posterior cortex	173	0.9%	24	0.6%
100.313	incipient cataract, equatorial cortex	63	0.3%	7	0.2%
100.314	incipient cataract, anterior sutures	7	0.0%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.315	incipient cataract, posterior sutures	19	0.1%	3	0.1%
100.316	incipient cataract, nucleus	186	1.0%	24	0.6%
100.317	incipient cataract, capsular	22	0.1%	6	0.2%
100.321	incomplete cataract, anterior cortex	5	0.0%	5	0.1%
100.322	incomplete cataract, posterior cortex	4	0.0%	11	0.3%
100.323	incomplete cataract, equatorial cortex	2	0.0%	4	0.1%
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.326	incomplete cataract, nucleus	12	0.1%	12	0.3%
100.327	incomplete cataract, capsular	2	0.0%	1	0.0%
100.328	y-suture tip opacities	2	0.0%	6	0.2%
100.330	generalized/complete cataract	76	0.4%	4	0.1%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.345	*significant cataracts (summary)*	*981*	*5.2%*	*183*	*4.8%*
100.375	*subluxation/luxation, unspecified*	*6*	*0.0%*	*3*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	66	0.3%	22	0.6%
110.135	PHPV/PTVL	20	0.1%	4	0.1%
110.200	vitreous degeneration-anterior chamber	5	0.0%	0	
110.320	vitreal degeneration	85	0.4%	12	0.3%
FUNDUS					
97.110	choroidal hypoplasia	4	0.0%	1	0.0%
RETINA					
120.170	retinal dysplasia, folds	1,150	6.0%	161	4.2%
120.180	retinal dysplasia, geographic	170	0.9%	14	0.4%
120.190	retinal dysplasia, detached	3	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	35	0.2%	1	0.0%
120.400	retinal hemorrhage	7	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	2	0.0%	4	0.1%
120.960	retinopathy	5	0.0%	5	0.1%
OPTIC NERVE					
130.110	micropapilla	6	0.0%	0	
130.120	optic nerve hypoplasia	9	0.0%	0	
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	125	0.7%	0	
900.100	other, not inherited	313	1.6%	5	0.1%
900.110	other. suspect not inherited/significance unknown	185	1.0%	118	3.1%
NORMAL					
0.000	normal globe	13,655	71.8%	2,489	65.3%

PERRO DE PRESA CANARIO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Multifocal retinopathy - *cmr1*	Autosomal recessive	1	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

OCULAR DISORDERS REPORT
PERRO DE PRESA CANARIO

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 8 #	 %	2016-2020 5 #	 %
GLOBE					
10.000	glaucoma	0		1	20.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	25.0%	0	
100.302	punctate cataract, posterior cortex	0		1	20.0%
100.345	*significant cataracts (summary)*	*0*		*1*	*20.0%*
OTHER					
900.100	other, not inherited	0		1	20.0%
NORMAL					
0.000	normal globe	6	75.0%	4	80.0%

PERUVIAN INCA ORCHID

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Peruvian Inca Orchid breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
PERUVIAN INCA ORCHID

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 21 #	 %	2016-2020 51 #	 %
GLOBE						
0.110	microphthalmia		1	4.8%	1	2.0%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	4.8%	1	2.0%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	4.8%	0	
100.305	punctate cataract, posterior sutures		0		1	2.0%
100.306	punctate cataract, nucleus		0		1	2.0%
100.311	incipient cataract, anterior cortex		0		4	7.8%
100.312	incipient cataract, posterior cortex		0		1	2.0%
100.315	incipient cataract, posterior sutures		0		1	2.0%
100.316	incipient cataract, nucleus		0		1	2.0%
100.321	incomplete cataract, anterior cortex		0		1	2.0%
100.322	incomplete cataract, posterior cortex		0		1	2.0%
100.326	incomplete cataract, nucleus		0		1	2.0%
100.345	*significant cataracts (summary)*		*0*		*12*	*23.5%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	2.0%
RETINA						
120.180	retinal dysplasia, geographic		0		2	3.9%
120.310	generalized progressive retinal atrophy (PRA)		0		3	5.9%
120.960	retinopathy		0		2	3.9%
OTHER						
900.000	other, unspecified		1	4.8%	0	
900.100	other, not inherited		0		1	2.0%
900.110	other. suspect not inherited/significance unknown		0		1	2.0%
NORMAL						
0.000	normal globe		21	100.0%	39	76.5%

PETIT BASSET GRIFFON VENDEEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma – POAG	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17* gene
B.	Corneal dystrophy - endothelial	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/ no strands	Not defined	1	Passes with no notation	
	- all other forms	Not defined	1	NO	
D.	Cataract	Not defined	1	NO	
E.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

Primary Open Angle Glaucoma (POAG) in the Petit Basset Griffon Vendeen is caused by an inversion with a breakpoint disrupting the *ADAMTS17* gene. Pectinate ligament abnormalities are not present on gonioscopy and the iridocorneal angle remains open. The initial clinical features are noted around 3-4 years and include a small rise in intraocular pressure accompanied by lens subluxation. Retinal degeneration and optic nerve cupping noted in late stages when globe enlargement and vision disruption has occurred. A DNA test is available.

B. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from OFA All-Breeds Report, 1991-1998.

2. Forman OP, Pettitt L, Komaromy AM, et al. A Novel Genome-Wide Association Study Approach Using Genotyping by Exome Sequqncing Leads to the Indentification of a Primary Open Angle Glaucoma Association Inversion Disrupting ADAMTS17; PLoS one, 2015: 10(12):e0143546.

3. Bedford, PGC (2017), Open-angle glaucoma in the Petit Basset Griffon Vendeen. Vet Ophthalmol, 20: 98-102. doi.10.1111/vop.12369.

OCULAR DISORDERS REPORT
PETIT BASSET GRIFFON VENDEEN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,398 #	%	2016-2020 220 #	%
GLOBE						
10.000	glaucoma		3	0.1%	1	0.5%
EYELIDS						
21.000	entropion, unspecified		3	0.1%	0	
25.110	distichiasis		11	0.5%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.220	pigmentary keratitis		1	0.0%	0	
70.700	corneal dystrophy		17	0.7%	0	
70.730	corneal endothelial degeneration		26	1.1%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		2	0.1%	0	
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		459	19.1%	47	21.4%
93.720	persistent pupillary membranes, iris to lens		34	1.4%	2	0.9%
93.730	persistent pupillary membranes, iris to cornea		210	8.8%	14	6.4%
93.740	persistent pupillary membranes, iris sheets		15	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		11	0.5%	8	3.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		58	2.4%	15	6.8%
93.999	uveal cysts		4	0.2%	0	
LENS						
100.200	cataract, unspecified		2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		110	4.6%	5	2.3%
100.301	punctate cataract, anterior cortex		24	1.0%	5	2.3%
100.302	punctate cataract, posterior cortex		5	0.2%	0	
100.303	punctate cataract, equatorial cortex		3	0.1%	1	0.5%
100.304	punctate cataract, anterior sutures		4	0.2%	0	
100.305	punctate cataract, posterior sutures		5	0.2%	2	0.9%
100.306	punctate cataract, nucleus		2	0.1%	0	
100.307	punctate cataract, capsular		12	0.5%	5	2.3%
100.311	incipient cataract, anterior cortex		23	1.0%	3	1.4%
100.312	incipient cataract, posterior cortex		7	0.3%	0	
100.313	incipient cataract, equatorial cortex		5	0.2%	0	
100.315	incipient cataract, posterior sutures		6	0.3%	0	
100.316	incipient cataract, nucleus		3	0.1%	0	
100.317	incipient cataract, capsular		12	0.5%	1	0.5%
100.326	incomplete cataract, nucleus		0		1	0.5%
100.328	y-suture tip opacities		1	0.0%	2	0.9%
100.330	generalized/complete cataract		12	0.5%	0	
100.345	*significant cataracts (summary)*		*126*	*5.3%*	*20*	*9.1%*
100.375	*subluxation/luxation, unspecified*		*8*	*0.3%*	*2*	*0.9%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	12	0.5%	1	0.5%
110.320	vitreal degeneration	13	0.5%	0	
RETINA					
120.170	retinal dysplasia, folds	108	4.5%	6	2.7%
120.180	retinal dysplasia, geographic	11	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	0	
120.400	retinal hemorrhage	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	3	0.1%	1	0.5%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	38	1.6%	0	
900.100	other, not inherited	76	3.2%	5	2.3%
900.110	other. suspect not inherited/significance unknown	46	1.9%	4	1.8%
NORMAL					
0.000	normal globe	1,538	64.1%	135	61.4%

PHARAOH HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pharaoh Hound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
PHARAOH HOUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 370 #	 %	2016-2020 142 #	 %
EYELIDS					
25.110	distichiasis	7	1.9%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.3%	0	
CORNEA					
70.700	corneal dystrophy	3	0.8%	1	0.7%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.3%	0	
93.710	persistent pupillary membranes, iris to iris	28	7.6%	12	8.5%
93.720	persistent pupillary membranes, iris to lens	1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	11	3.0%	3	2.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.3%	0	
93.999	uveal cysts	1	0.3%	0	
LENS					
100.200	cataract, unspecified	1	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	21	5.7%	9	6.3%
100.301	punctate cataract, anterior cortex	2	0.5%	1	0.7%
100.302	punctate cataract, posterior cortex	1	0.3%	0	
100.305	punctate cataract, posterior sutures	2	0.5%	0	
100.306	punctate cataract, nucleus	1	0.3%	0	
100.307	punctate cataract, capsular	1	0.3%	0	
100.311	incipient cataract, anterior cortex	1	0.3%	0	
100.312	incipient cataract, posterior cortex	2	0.5%	1	0.7%
100.313	incipient cataract, equatorial cortex	2	0.5%	0	
100.315	incipient cataract, posterior sutures	3	0.8%	1	0.7%
100.316	incipient cataract, nucleus	1	0.3%	0	
100.328	y-suture tip opacities	1	0.3%	0	
100.330	generalized/complete cataract	1	0.3%	0	
100.345	*significant cataracts (summary)*	*19*	*5.1%*	*3*	*2.1%*
VITREOUS					
110.320	vitreal degeneration	0		1	0.7%
RETINA					
120.170	retinal dysplasia, folds	3	0.8%	1	0.7%
120.180	retinal dysplasia, geographic	2	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.8%	0	
120.960	retinopathy	0		3	2.1%
OTHER					
900.000	other, unspecified	4	1.1%	0	
900.100	other, not inherited	7	1.9%	0	
900.110	other. suspect not inherited/significance unknown	3	0.8%	2	1.4%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	303 81.9%	107 75.4%

PLOTT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 2	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Plott is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Plott. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl, B., et al. (2006). "Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans." Genomics **88**(5): 551-563. PMID: 16938425

OCULAR DISORDERS REPORT
PLOTT

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 0 #	 %	2016-2020 9 #	 %
NORMAL					
0.000 normal globe		0		9	100.0%

POINTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pointer breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 686 #	%	2016-2020 146 #	%
EYELIDS					
21.000	entropion, unspecified	5	0.7%	0	
22.000	ectropion, unspecified	1	0.1%	0	
25.110	distichiasis	4	0.6%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	0	
CORNEA					
70.700	corneal dystrophy	6	0.9%	6	4.1%
UVEA					
93.710	persistent pupillary membranes, iris to iris	11	1.6%	1	0.7%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	18	2.6%	3	2.1%
100.302	punctate cataract, posterior cortex	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	0	
100.305	punctate cataract, posterior sutures	0		1	0.7%
100.306	punctate cataract, nucleus	1	0.1%	1	0.7%
100.312	incipient cataract, posterior cortex	3	0.4%	0	
100.313	incipient cataract, equatorial cortex	1	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.1%	0	
100.317	incipient cataract, capsular	0		1	0.7%
100.321	incomplete cataract, anterior cortex	0		1	0.7%
100.322	incomplete cataract, posterior cortex	0		2	1.4%
100.326	incomplete cataract, nucleus	0		2	1.4%
100.345	*significant cataracts (summary)*	*8*	*1.2%*	*8*	*5.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	7	1.0%	0	
120.180	retinal dysplasia, geographic	3	0.4%	1	0.7%
120.310	generalized progressive retinal atrophy (PRA)	2	0.3%	0	
OPTIC NERVE					
130.110	micropapilla	4	0.6%	1	0.7%
130.120	optic nerve hypoplasia	1	0.1%	0	
OTHER					
900.000	other, unspecified	7	1.0%	0	
900.100	other, not inherited	6	0.9%	0	
900.110	other. suspect not inherited/significance unknown	9	1.3%	10	6.8%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	620 90.4%	122 83.6%

POLISH LOWLAND SHEEPDOG
(Polski Owczarek Nizinny)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Retinal atrophy - rod-cone dysplasia type 1 (*rcd4*)	Autosomal recessive	2	NO	Mutation in the *C2orf71* or *C17H2orf71* genes
E.	Ceroid lipofuscinosis	Not defined	3	NO	

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available.

A form of PRA, similar to that found in Gordon and Irish setters, has also been found in the the Polish Lowland Sheepdog. This form of PRA has been referred to as late-onset, slowly progressive PRA (LOPRA). Slight vascular attenuation, first seen between 4.5 -6 years of age precedes tapetal hyperreflectivity. All fundic changes were bilaterally symmetric and progressed slowly eventually causing clinical blindness, bilateral complete vascular attenuation, and tapetal hyperreflectivity by 12 years of age, on average. Almost all affected dogs were homozygous for the rcd4 mutation in *C17H2orf71* gene. A DNA test is available.

E. Ceroid lipofuscinosis

A systemic metabolic disorder that affects the retina and retinal pigment epithelium with accumulation of lipopigments resulting in retinal degeneration.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Downs LM, Bell JS, Freeman J, et al. Late-onset progressive retinal atrophy in the Gordon and Irish Setter breeds is associated with a frameshift mutation in C2orf71. *Anim Genet*. 2012;44:169-177.

3. Narfstrom K, Wrigstad A, Ekesten B, et al. Neuronal ceroid lipofuscinosis: clinical and morphologic findings in nine affected Polish Owczarek Nizinny (PON) dogs. *Vet Ophthalmol*. 2007;10:111-120.

OCULAR DISORDERS REPORT
POLISH LOWLAND SHEEPDOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 1,067 #	 %	2016-2020 179 #	 %
EYELIDS					
25.110	distichiasis	17	1.6%	4	2.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.1%	1	0.6%
CORNEA					
70.700	corneal dystrophy	30	2.8%	6	3.4%
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	70	6.6%	20	11.2%
93.999	uveal cysts	2	0.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	46	4.3%	7	3.9%
100.301	punctate cataract, anterior cortex	5	0.5%	7	3.9%
100.302	punctate cataract, posterior cortex	8	0.7%	2	1.1%
100.303	punctate cataract, equatorial cortex	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.306	punctate cataract, nucleus	0		1	0.6%
100.307	punctate cataract, capsular	1	0.1%	1	0.6%
100.311	incipient cataract, anterior cortex	4	0.4%	1	0.6%
100.312	incipient cataract, posterior cortex	3	0.3%	0	
100.313	incipient cataract, equatorial cortex	1	0.1%	2	1.1%
100.315	incipient cataract, posterior sutures	3	0.3%	0	
100.316	incipient cataract, nucleus	1	0.1%	1	0.6%
100.317	incipient cataract, capsular	2	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		2	1.1%
100.330	generalized/complete cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*31*	*2.9%*	*17*	*9.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.320	vitreal degeneration	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	10	0.9%	0	
120.310	generalized progressive retinal atrophy (PRA)	16	1.5%	5	2.8%
120.960	retinopathy	1	0.1%	0	
OTHER					
900.000	other, unspecified	5	0.5%	0	
900.100	other, not inherited	24	2.2%	1	0.6%
900.110	other. suspect not inherited/significance unknown	0		7	3.9%
NORMAL					
0.000	normal globe	905	84.8%	121	67.6%

POMERANIAN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Entropion	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)	Autosomal recessive	1	NO	Mutation in the *PDE6A* gene
F.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward head conformation that minimizes or eliminates the likelihood of the defect.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest

threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

F. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Pomeranian is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pomeranian breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
POMERANIAN

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,092**		**738**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.2%	4	0.5%
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	3	0.3%	23	3.1%
22.000	ectropion, unspecified	1	0.1%	0	
25.110	distichiasis	52	4.8%	21	2.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.1%	1	0.1%
40.910	keratoconjunctivitis sicca	1	0.1%	0	
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	2	0.2%	0	
70.700	corneal dystrophy	3	0.3%	1	0.1%
70.730	corneal endothelial degeneration	2	0.2%	0	
UVEA					
93.110	iris hypoplasia	0		1	0.1%
93.150	iris coloboma	0		2	0.3%
93.710	persistent pupillary membranes, iris to iris	62	5.7%	71	9.6%
93.720	persistent pupillary membranes, iris to lens	3	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	4	0.4%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.5%	6	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	3	0.4%
93.810	uveal melanoma	1	0.1%	0	
97.150	chorioretinal coloboma, congenital	0		1	0.1%
LENS					
100.200	cataract, unspecified	1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	28	2.6%	8	1.1%
100.301	punctate cataract, anterior cortex	2	0.2%	2	0.3%
100.302	punctate cataract, posterior cortex	2	0.2%	2	0.3%
100.303	punctate cataract, equatorial cortex	1	0.1%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	3	0.3%	0	
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	1	0.1%	1	0.1%
100.311	incipient cataract, anterior cortex	9	0.8%	3	0.4%
100.312	incipient cataract, posterior cortex	6	0.5%	2	0.3%
100.313	incipient cataract, equatorial cortex	3	0.3%	2	0.3%
100.315	incipient cataract, posterior sutures	0		1	0.1%
100.316	incipient cataract, nucleus	2	0.2%	1	0.1%
100.317	incipient cataract, capsular	0		3	0.4%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.330	generalized/complete cataract	11	1.0%	1	0.1%
100.340	resorbing/hypermature cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*44*	*4.0%*	*19*	*2.6%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.3%	1	0.1%
110.135	PHPV/PTVL	1	0.1%	0	
110.200	vitreous degeneration-anterior chamber	3	0.3%	3	0.4%
110.320	vitreal degeneration	14	1.3%	3	0.4%
RETINA					
120.170	retinal dysplasia, folds	2	0.2%	5	0.7%
120.180	retinal dysplasia, geographic	3	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	16	1.5%	1	0.1%
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	2	0.2%	0	
120.920	retinal detachment with dialysis	0		1	0.1%
120.960	retinopathy	0		2	0.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.2%	0	
130.150	optic disc coloboma	2	0.2%	1	0.1%
OTHER					
900.000	other, unspecified	10	0.9%	0	
900.100	other, not inherited	27	2.5%	2	0.3%
900.110	other. suspect not inherited/significance unknown	11	1.0%	21	2.8%
NORMAL					
0.000	normal globe	902	82.6%	563	76.3%

POODLE

(Toy, Miniature, and Standard varieties)

* All varieties of the Poodle are basically the same genetic makeup, having their size governed by differences in an "insulin-like growth factor." (See Reference 2.)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 1	 Breeder option Passes with no notation	
D.	Cataract	Not defined	1, 2-4	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Vitreous degeneration	Not defined	1	Breeder option	
G.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 10-20	NO	Mutation in the *prcd* gene
H.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*)	Autosomal recessive	1	NO	Mutation in the *C2orf71* gene *only in Standards & Miniatures
I.	Cone degeneration (achromatopsia)	Autosomal recessive	4, 21	NO	Mutation has not been published *only in Standards
J.	Micropapilla	Not defined	1	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

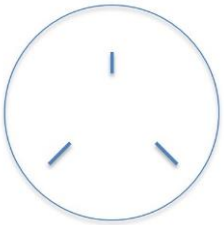
D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The Poodle cataract can involve the lens cortex and lens nucleus. The rate and degree of progression are variable. A familial form of cataract has been described in the Standard Poodle, beginning with an equatorial opacity initially observed in dogs prior to 2 years of age.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment and/or glaucoma. Either condition may cause blindness.

G. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that PRA in the Poodle is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available. It is important to note that in all breeds in which a molecular diagnostic test for the disease is available, it is possible to have dogs diagnosed clinically as affected, yet the DNA test results are normal. This suggests that other genetic causes of PRA exist or that the diagnosed affected dog has an acquired disease that mimics the inherited disorder.

H. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

I. Cone degeneration: Day Blindness/Retinal degeneration:

An autosomal recessive disorder of standard poodles and ‘Doodles’ (where the mix-bred dogs are backcrossed to standard poodles that carry the genetic defect); the disease also has been referred to as achromatopsia. The salient clinical findings is profound visual difficulty in bright light, day blindness, with subjective normal night vision. In the early stages of the disease, fundus examination is normal with some dogs showing focal hyperreflectivity of the cone-rich fovea like region of the retina; the photopic ERG is not recordable. In some older dogs, there is progression resulting in poor/absent vision under both dim and bright light conditions, markedly abnormal or non-recordable ERG, and a fundus appearance indicative of late stage retinal degeneration and indistinguishable from progressive retinal atrophy.

J. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

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OCULAR DISORDERS REPORT
POODLE

		1991-2015 47,985		2016-2020 10,591	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	21	0.0%	6	0.1%
10.000	glaucoma	6	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	34	0.1%	10	0.1%
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	122	0.3%	26	0.2%
22.000	ectropion, unspecified	5	0.0%	2	0.0%
25.110	distichiasis	2,967	6.2%	566	5.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	8	0.0%	11	0.1%
40.910	keratoconjunctivitis sicca	10	0.0%	3	0.0%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	0	
51.100	third eyelid cartilage anomaly	40	0.1%	5	0.0%
52.110	prolapsed gland of the third eyelid	18	0.0%	1	0.0%
CORNEA					
70.210	corneal pannus	39	0.1%	0	
70.220	pigmentary keratitis	27	0.1%	8	0.1%
70.700	corneal dystrophy	263	0.5%	57	0.5%
70.730	corneal endothelial degeneration	12	0.0%	0	
UVEA					
90.250	pigmentary uveitis	2	0.0%	1	0.0%
93.110	iris hypoplasia	1	0.0%	3	0.0%
93.140	corneal endothelial pigment without PPM	5	0.0%	0	
93.150	iris coloboma	6	0.0%	0	
93.180	Iiris sphincter dysplasia	0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	1,483	3.1%	590	5.6%
93.720	persistent pupillary membranes, iris to lens	83	0.2%	22	0.2%
93.730	persistent pupillary membranes, iris to cornea	33	0.1%	5	0.0%
93.740	persistent pupillary membranes, iris sheets	38	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	167	0.3%	215	2.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	6	0.1%
93.810	uveal melanoma	4	0.0%	0	
93.999	uveal cysts	8	0.0%	4	0.0%
97.150	chorioretinal coloboma, congenital	1	0.0%	1	0.0%
LENS					
100.110	microphakia, congenital	0		1	0.0%
100.200	cataract, unspecified	384	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown	2,576	5.4%	450	4.2%
100.301	punctate cataract, anterior cortex	441	0.9%	69	0.7%
100.302	punctate cataract, posterior cortex	193	0.4%	27	0.3%
100.303	punctate cataract, equatorial cortex	120	0.3%	21	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.304	punctate cataract, anterior sutures	53	0.1%	12	0.1%
100.305	punctate cataract, posterior sutures	119	0.2%	43	0.4%
100.306	punctate cataract, nucleus	38	0.1%	18	0.2%
100.307	punctate cataract, capsular	41	0.1%	42	0.4%
100.311	incipient cataract, anterior cortex	482	1.0%	57	0.5%
100.312	incipient cataract, posterior cortex	400	0.8%	49	0.5%
100.313	incipient cataract, equatorial cortex	258	0.5%	32	0.3%
100.314	incipient cataract, anterior sutures	37	0.1%	3	0.0%
100.315	incipient cataract, posterior sutures	89	0.2%	16	0.2%
100.316	incipient cataract, nucleus	65	0.1%	17	0.2%
100.317	incipient cataract, capsular	39	0.1%	10	0.1%
100.320	incomplete cataract, unspecified	0		2	0.0%
100.321	incomplete cataract, anterior cortex	9	0.0%	20	0.2%
100.322	incomplete cataract, posterior cortex	14	0.0%	15	0.1%
100.323	incomplete cataract, equatorial cortex	7	0.0%	10	0.1%
100.324	incomplete cataract, anterior sutures	0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		2	0.0%
100.326	incomplete cataract, nucleus	3	0.0%	5	0.0%
100.327	incomplete cataract, capsular	0		2	0.0%
100.328	y-suture tip opacities	18	0.0%	60	0.6%
100.330	generalized/complete cataract	429	0.9%	11	0.1%
100.340	resorbing/hypermature cataract	2	0.0%	4	0.0%
100.345	*significant cataracts (summary)*	*3,241*	*6.8%*	*548*	*5.2%*
100.375	*subluxation/luxation, unspecified*	*29*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	77	0.2%	40	0.4%
110.135	PHPV/PTVL	24	0.1%	9	0.1%
110.200	vitreous degeneration-anterior chamber	11	0.0%	10	0.1%
110.320	vitreal degeneration	312	0.7%	53	0.5%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
97.120	coloboma	11	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	127	0.3%	33	0.3%
120.180	retinal dysplasia, geographic	21	0.0%	2	0.0%
120.190	retinal dysplasia, detached	9	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	582	1.2%	16	0.2%
120.400	retinal hemorrhage	3	0.0%	0	
120.910	retinal detachment without dialysis	27	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	4	0.0%
120.960	retinopathy	12	0.0%	12	0.1%
OPTIC NERVE					
130.110	micropapilla	161	0.3%	51	0.5%
130.120	optic nerve hypoplasia	210	0.4%	41	0.4%
130.150	optic disc coloboma	49	0.1%	6	0.1%
OTHER					
900.000	other, unspecified	433	0.9%	0	
900.100	other, not inherited	897	1.9%	19	0.2%

OTHER CONTINUED	1991-2015	2016-2020
900.110 other. suspect not inherited/significance unknown	458 1.0%	419 4.0%
NORMAL		
0.000 normal globe	38,825 80.9%	7,931 74.9%

PORTUGUESE PODENGO PEQUENO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Vitreous degeneration	Not defined	1	Breeder option	
E.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)	Autosomal recessive	1	NO	Mutation in the *PDE6A* gene
F.	Retinal atrophy (*prcd*)	Autosomal recessive	2	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataracts

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary

membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Protuguese Podengo Pequeno is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

F. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Other forms of retinal degeneration that are not *prcd* are recognized in the Portuguese Podengo Pequeno. The currently available genetic test will not detect these other forms of PRA.

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2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
PORTUGUESE PODENGO PEQUENO

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 158 #	 %	2016-2020 244 #	 %
EYELIDS					
20.140	ectopic cilia	0		1	0.4%
25.110	distichiasis	8	5.1%	13	5.3%
CORNEA					
70.700	corneal dystrophy	0		4	1.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	8	5.1%	15	6.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	6	3.8%	10	4.1%
100.301	punctate cataract, anterior cortex	1	0.6%	0	
100.302	punctate cataract, posterior cortex	0		1	0.4%
100.303	punctate cataract, equatorial cortex	0		2	0.8%
100.306	punctate cataract, nucleus	0		1	0.4%
100.311	incipient cataract, anterior cortex	1	0.6%	4	1.6%
100.312	incipient cataract, posterior cortex	2	1.3%	1	0.4%
100.313	incipient cataract, equatorial cortex	0		1	0.4%
100.315	incipient cataract, posterior sutures	0		2	0.8%
100.316	incipient cataract, nucleus	0		3	1.2%
100.317	incipient cataract, capsular	1	0.6%	0	
100.325	incomplete cataract, posterior sutures	0		1	0.4%
100.330	generalized/complete cataract	1	0.6%	0	
100.340	resorbing/hypermature cataract	1	0.6%	0	
100.345	*significant cataracts (summary)*	*7*	*4.4%*	*16*	*6.6%*
100.375	*subluxation/luxation, unspecified*	*2*	*1.3%*	*1*	*0.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.6%	1	0.4%
110.200	vitreous degeneration-anterior chamber	2	1.3%	4	1.6%
110.320	vitreal degeneration	8	5.1%	4	1.6%
RETINA					
120.180	retinal dysplasia, geographic	0		1	0.4%
120.310	generalized progressive retinal atrophy (PRA)	2	1.3%	3	1.2%
120.960	retinopathy	2	1.3%	1	0.4%
OTHER					
900.100	other, not inherited	0		1	0.4%
900.110	other. suspect not inherited/significance unknown	4	2.5%	10	4.1%
NORMAL					
0.000	normal globe	121	76.6%	178	73.0%

PORTUGUESE WATER DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Autosomal recessive	1-3	NO	Mutation is not yet published
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1 1	Breeder option Passes with no notation	
E.	Cataract	Not defined	1	NO	
F.	Y-suture tip opacity	Not defined	1	Breeder option	
G.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 4, 5	NO	Mutation in the *prcd* gene
H.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

This is a congenital abnormality present bilaterally and characterized by a small globe and associated ocular defects which can affect the cornea, anterior chamber, lens and/or retina. These associated defects may be variable in severity. Several cases have been identified, all of which appeared to have a common ancestry. All affected animals so far identified have been the progeny of dogs that were phenotypically normal, suggesting that the defect is not dominantly inherited.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds.

Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

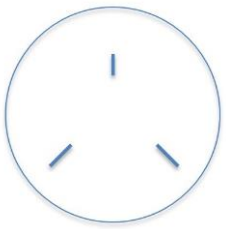
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which

should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

G. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Portuguese Water Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

A second, earlier onset form of PRA has also been identified recently in the Portuguese Water Dog. The onset of visual deficits occurs at 2-3 years of age, and, dogs show advanced retinal degeneration at the time visual deficits are recognized. The condition appears inherited as autosomal recessive. A DNA test is available.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Case records (1986-1994), Section of Medical Genetics, School of Veterinary Medicine, University of Pennsylvania.

3. Shaw, G. C., et al. (2019). "Microphthalmia With Multiple Anterior Segment Defects in Portuguese Water Dogs." Vet Pathol **56**(2): 269-273. PMID: 30131012

4. Miyadera K, Aguirre G. A new form of early-onset pra in Portuguese Water Dogs - ECVO 2014 Abstract #65. *Vet Ophthalmol*. 2014;17:E25.

5. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. Epub 2006/08/30. PMID: 16938425

OCULAR DISORDERS REPORT
PORTUGUESE WATER DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 28,970 #	%	2016-2020 8,500 #	%
GLOBE						
0.110	microphthalmia		15	0.1%	18	0.2%
10.000	glaucoma		6	0.0%	0	
EYELIDS						
20.140	ectopic cilia		3	0.0%	0	
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		53	0.2%	17	0.2%
22.000	ectropion, unspecified		3	0.0%	0	
25.110	distichiasis		1,066	3.7%	274	3.2%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		2	0.0%
40.910	keratoconjunctivitis sicca		6	0.0%	5	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		0		1	0.0%
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		4	0.0%	0	
70.220	pigmentary keratitis		4	0.0%	3	0.0%
70.700	corneal dystrophy		189	0.7%	140	1.6%
70.730	corneal endothelial degeneration		4	0.0%	3	0.0%
UVEA						
93.110	iris hypoplasia		2	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM		2	0.0%	0	
93.150	iris coloboma		1	0.0%	0	
93.180	liris sphincter dysplasia		0		1	0.0%
93.710	persistent pupillary membranes, iris to iris		1,755	6.1%	686	8.1%
93.720	persistent pupillary membranes, iris to lens		39	0.1%	14	0.2%
93.730	persistent pupillary membranes, iris to cornea		32	0.1%	4	0.0%
93.740	persistent pupillary membranes, iris sheets		43	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		33	0.1%	53	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		8	0.0%	4	0.0%
93.810	uveal melanoma		6	0.0%	1	0.0%
93.999	uveal cysts		13	0.0%	2	0.0%
LENS						
100.200	cataract, unspecified		69	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		1,901	6.6%	559	6.6%
100.301	punctate cataract, anterior cortex		146	0.5%	44	0.5%
100.302	punctate cataract, posterior cortex		57	0.2%	20	0.2%
100.303	punctate cataract, equatorial cortex		54	0.2%	8	0.1%
100.304	punctate cataract, anterior sutures		22	0.1%	2	0.0%
100.305	punctate cataract, posterior sutures		30	0.1%	14	0.2%
100.306	punctate cataract, nucleus		14	0.0%	6	0.1%
100.307	punctate cataract, capsular		21	0.1%	11	0.1%
100.311	incipient cataract, anterior cortex		97	0.3%	23	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.312	incipient cataract, posterior cortex	86	0.3%	21	0.2%
100.313	incipient cataract, equatorial cortex	82	0.3%	17	0.2%
100.314	incipient cataract, anterior sutures	12	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	15	0.1%	3	0.0%
100.316	incipient cataract, nucleus	21	0.1%	3	0.0%
100.317	incipient cataract, capsular	21	0.1%	8	0.1%
100.321	incomplete cataract, anterior cortex	6	0.0%	9	0.1%
100.322	incomplete cataract, posterior cortex	7	0.0%	8	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	5	0.1%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.326	incomplete cataract, nucleus	1	0.0%	1	0.0%
100.328	y-suture tip opacities	16	0.1%	31	0.4%
100.330	generalized/complete cataract	70	0.2%	12	0.1%
100.340	resorbing/hypermature cataract	1	0.0%	1	0.0%
100.345	*significant cataracts (summary)*	*850*	*2.9%*	*248*	*2.9%*
100.375	*subluxation/luxation, unspecified*	*11*	*0.0%*	*3*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	43	0.1%	20	0.2%
110.135	PHPV/PTVL	16	0.1%	3	0.0%
110.200	vitreous degeneration-anterior chamber	2	0.0%	6	0.1%
110.320	vitreal degeneration	44	0.2%	7	0.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	224	0.8%	89	1.0%
120.180	retinal dysplasia, geographic	19	0.1%	1	0.0%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	173	0.6%	5	0.1%
120.400	retinal hemorrhage	8	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	2	0.0%	1	0.0%
120.960	retinopathy	1	0.0%	5	0.1%
OPTIC NERVE					
130.110	micropapilla	14	0.0%	6	0.1%
130.120	optic nerve hypoplasia	11	0.0%	0	
130.150	optic disc coloboma	6	0.0%	0	
OTHER					
900.000	other, unspecified	313	1.1%	0	
900.100	other, not inherited	535	1.8%	5	0.1%
900.110	other. suspect not inherited/significance unknown	279	1.0%	307	3.6%
NORMAL					
0.000	normal globe	24,389	84.2%	6,371	75.0%

PUG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Pigmentary Keratitis/Pigmentary Keratopathy	Not defined	1-3	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1, 4	NO
F.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Pug, entropion usually involves the medial canthal margin of the lower eyelid(s).

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Exposure/Pigmentary keratitis/Pigmentary keratopathy

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

The breed standard indicates the Pug should have a "large massive round head with very large, bold and prominent eyes." These characteristics give rise to the ocular exposure and irritative problems common in the breed.

Pigmentary keratopathy is a condition reported in Pugs in which the cornea becomes pigmented, often resulting in vision impairment. Development of pigmentary keratopathy is associated with congenital uveal pathology - iris hypoplasia and the presence of persistent pupillary membranes - but not with other factors such as Schirmer tear test values or medial canthal entropion.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Labelle AL, Dresser CB, Hamor RE, et al. Characteristics of, prevalence of, and risk factors for corneal pigmentation (pigmentary keratopathy) in Pugs. *J Am Vet Med Assoc*. 2013;243:667-674.

3. Maini, S., et al. (2019). "Pigmentary keratitis in pugs in the United Kingdom: prevalence and associated features." BMC Vet Res **15**(1): 384. PMID: 31666065

4. Gelatt KN, Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005;8:101-111.

OCULAR DISORDERS REPORT
PUG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 2,564 #	%	2016-2020 694 #	%
GLOBE					
0.110	microphthalmia	3	0.1%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	14	0.5%	1	0.1%
20.160	macropalpebral fissure	67	2.6%	0	
21.000	entropion, unspecified	482	18.8%	108	15.6%
22.000	ectropion, unspecified	11	0.4%	0	
25.110	distichiasis	228	8.9%	50	7.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.1%
40.910	keratoconjunctivitis sicca	7	0.3%	2	0.3%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	80	3.1%	0	
70.220	pigmentary keratitis	787	30.7%	348	50.1%
70.700	corneal dystrophy	14	0.5%	1	0.1%
70.730	corneal endothelial degeneration	4	0.2%	0	
UVEA					
90.250	pigmentary uveitis	0		1	0.1%
93.150	iris coloboma	2	0.1%	1	0.1%
93.710	persistent pupillary membranes, iris to iris	264	10.3%	87	12.5%
93.720	persistent pupillary membranes, iris to lens	8	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	16	0.6%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	5	0.2%	3	0.4%
93.999	uveal cysts	2	0.1%	0	
LENS					
100.200	cataract, unspecified	4	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	52	2.0%	14	2.0%
100.301	punctate cataract, anterior cortex	4	0.2%	1	0.1%
100.302	punctate cataract, posterior cortex	4	0.2%	2	0.3%
100.303	punctate cataract, equatorial cortex	5	0.2%	0	
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	6	0.2%	0	
100.306	punctate cataract, nucleus	4	0.2%	0	
100.307	punctate cataract, capsular	3	0.1%	1	0.1%
100.311	incipient cataract, anterior cortex	18	0.7%	3	0.4%
100.312	incipient cataract, posterior cortex	16	0.6%	4	0.6%
100.313	incipient cataract, equatorial cortex	8	0.3%	0	
100.315	incipient cataract, posterior sutures	8	0.3%	1	0.1%
100.316	incipient cataract, nucleus	4	0.2%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.317	incipient cataract, capsular	5	0.2%	0	
100.321	incomplete cataract, anterior cortex	3	0.1%	1	0.1%
100.322	incomplete cataract, posterior cortex	3	0.1%	0	
100.324	incomplete cataract, anterior sutures	0		1	0.1%
100.325	incomplete cataract, posterior sutures	1	0.0%	1	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	0	
100.330	generalized/complete cataract	13	0.5%	0	
100.345	*significant cataracts (summary)*	*112*	*4.4%*	*15*	*2.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	13	0.5%	3	0.4%
110.135	PHPV/PTVL	3	0.1%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	0	
110.320	vitreal degeneration	28	1.1%	2	0.3%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	19	0.7%	2	0.3%
120.180	retinal dysplasia, geographic	11	0.4%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	36	1.4%	0	
900.100	other, not inherited	162	6.3%	7	1.0%
900.110	other. suspect not inherited/significance unknown	90	3.5%	37	5.3%
NORMAL					
0.000	normal globe	1,050	41.0%	222	32.0%

PULI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Lens luxation	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene
D.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene
E.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation may result in blinding retinal detachment and/or elevated intraocular pressure (glaucoma) causing vision impairment, pain, and blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

D. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Puli is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
PULI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,084 #	%	2016-2020 168 #	%
EYELIDS						
20.110	eyelid dermoid		1	0.1%	0	
20.140	ectopic cilia		1	0.1%	0	
20.160	macropalpebral fissure		1	0.1%	0	
21.000	entropion, unspecified		8	0.7%	0	
25.110	distichiasis		7	0.6%	0	
CORNEA						
70.220	pigmentary keratitis		5	0.5%	0	
70.700	corneal dystrophy		18	1.7%	0	
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		244	22.5%	35	20.8%
93.720	persistent pupillary membranes, iris to lens		14	1.3%	0	
93.730	persistent pupillary membranes, iris to cornea		8	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		5	0.5%	3	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.999	uveal cysts		1	0.1%	0	
LENS						
100.200	cataract, unspecified		3	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		63	5.8%	6	3.6%
100.301	punctate cataract, anterior cortex		5	0.5%	4	2.4%
100.302	punctate cataract, posterior cortex		2	0.2%	2	1.2%
100.305	punctate cataract, posterior sutures		6	0.6%	2	1.2%
100.306	punctate cataract, nucleus		3	0.3%	0	
100.307	punctate cataract, capsular		2	0.2%	0	
100.311	incipient cataract, anterior cortex		8	0.7%	4	2.4%
100.312	incipient cataract, posterior cortex		4	0.4%	2	1.2%
100.313	incipient cataract, equatorial cortex		7	0.6%	0	
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		3	0.3%	0	
100.317	incipient cataract, capsular		1	0.1%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.6%
100.322	incomplete cataract, posterior cortex		0		2	1.2%
100.328	y-suture tip opacities		0		2	1.2%
100.330	generalized/complete cataract		7	0.6%	0	
100.345	*significant cataracts (summary)*		*52*	*4.8%*	*19*	*11.3%*
100.375	*subluxation/luxation, unspecified*		*1*	*0.1%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.2%	0	
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitreous degeneration-anterior chamber		0		1	0.6%
110.320	vitreal degeneration		1	0.1%	0	
RETINA						
120.170	retinal dysplasia, folds		45	4.2%	6	3.6%
120.180	retinal dysplasia, geographic		3	0.3%	0	

RETINA CONTINUED		1991-2015		2016-2020	
120.310	generalized progressive retinal atrophy (PRA)	4	0.4%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	2	0.2%	0	
OPTIC NERVE					
130.110	micropapilla	2	0.2%	0	
130.120	optic nerve hypoplasia	3	0.3%	0	
OTHER					
900.000	other, unspecified	13	1.2%	0	
900.100	other, not inherited	46	4.2%	0	
900.110	other. suspect not inherited/significance unknown	7	0.6%	5	3.0%
NORMAL					
0.000	normal globe	735	67.8%	108	64.3%

PYRENEAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Choroidal hypoplasia	Not defined	1	NO
D.	Retinal dysplasia – folds	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is more commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

D. Retinal dysplasia – folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pyrenean Shepherd. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
PYRENEAN SHEPHERD

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**421**		**276**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	0		2	0.7%
EYELIDS					
21.000	entropion, unspecified	0		1	0.4%
25.110	distichiasis	0		2	0.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.2%	1	0.4%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
CORNEA					
70.700	corneal dystrophy	1	0.2%	2	0.7%
UVEA					
93.110	iris hypoplasia	1	0.2%	2	0.7%
93.150	iris coloboma	1	0.2%	1	0.4%
93.710	persistent pupillary membranes, iris to iris	26	6.2%	6	2.2%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	12	2.9%	4	1.4%
100.301	punctate cataract, anterior cortex	2	0.5%	1	0.4%
100.302	punctate cataract, posterior cortex	1	0.2%	1	0.4%
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.2%	2	0.7%
100.311	incipient cataract, anterior cortex	5	1.2%	0	
100.312	incipient cataract, posterior cortex	1	0.2%	1	0.4%
100.313	incipient cataract, equatorial cortex	2	0.5%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	3	0.7%	4	1.4%
100.322	incomplete cataract, posterior cortex	3	0.7%	1	0.4%
100.326	incomplete cataract, nucleus	1	0.2%	1	0.4%
100.328	y-suture tip opacities	0		1	0.4%
100.345	*significant cataracts (summary)*	*21*	*5.0%*	*12*	*4.3%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	1.0%	2	0.7%
110.135	PHPV/PTVL	0		3	1.1%
110.320	vitreal degeneration	1	0.2%	0	
FUNDUS					
97.110	choroidal hypoplasia	17	4.0%	6	2.2%
RETINA					
120.170	retinal dysplasia, folds	9	2.1%	6	2.2%
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	0	

RETINA CONTINUED	1991-2015		2016-2020	
120.920 retinal detachment with dialysis	0		1	0.4%
OPTIC NERVE				
130.110 micropapilla	0		2	0.7%
130.120 optic nerve hypoplasia	0		1	0.4%
OTHER				
900.000 other, unspecified	9	2.1%	0	
900.100 other, not inherited	11	2.6%	0	
900.110 other. suspect not inherited/significance unknown	4	1.0%	16	5.8%
NORMAL				
0.000 normal globe	351	83.4%	222	80.4%

RAT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene
B.	Lens luxation	Autosomal recessive	2, 3	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
RAT TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 267 #	 %	2016-2020 67 #	 %
EYELIDS						
25.110	distichiasis		4	1.5%	2	3.0%
UVEA						
93.710	persistent pupillary membranes, iris to iris		7	2.6%	2	3.0%
93.730	persistent pupillary membranes, iris to cornea		1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.7%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		5	1.9%	0	
100.303	punctate cataract, equatorial cortex		1	0.4%	0	
100.311	incipient cataract, anterior cortex		3	1.1%	0	
100.312	incipient cataract, posterior cortex		3	1.1%	0	
100.313	incipient cataract, equatorial cortex		2	0.7%	0	
100.315	incipient cataract, posterior sutures		1	0.4%	0	
100.316	incipient cataract, nucleus		1	0.4%	0	
100.330	generalized/complete cataract		4	1.5%	0	
100.345	*significant cataracts (summary)*		*15*	*5.6%*	*0*	
100.375	*subluxation/luxation, unspecified*		*3*	*1.1%*	*0*	
VITREOUS						
110.200	vitreous degeneration-anterior chamber		1	0.4%	1	1.5%
110.320	vitreal degeneration		3	1.1%	0	
RETINA						
120.190	retinal dysplasia, detached		1	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.4%	0	
OTHER						
900.000	other, unspecified		3	1.1%	0	
900.110	other. suspect not inherited/significance unknown		1	0.4%	2	3.0%
NORMAL						
0.000	normal globe		242	90.6%	60	89.6%

OCULAR DISORDERS REPORT
REDBONE COONHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the REDBONE COONHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
REDBONE COONHOUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 20 #	 %	2016-2020 38 #	 %
EYELIDS					
21.000	entropion, unspecified	0		2	5.3%
25.110	distichiasis	0		1	2.6%
NICTITANS					
52.110	prolapsed gland of the third eyelid	0		1	2.6%
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	5.0%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		2	5.3%
RETINA					
120.170	retinal dysplasia, folds	0		1	2.6%
120.310	generalized progressive retinal atrophy (PRA)	1	5.0%	0	
120.960	retinopathy	0		1	2.6%
OTHER					
900.110	other. suspect not inherited/significance unknown	1	5.0%	1	2.6%
NORMAL					
0.000	normal globe	18	90.0%	30	78.9%

RHODESIAN RIDGEBACK

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Y-suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

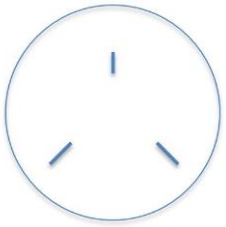
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Rhodesian Ridgeback breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Breed club request to ACVO Genetics Committee, 2008.

OCULAR DISORDERS REPORT
RHODESIAN RIDGEBACK

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 4,441 #	%	2016-2020 1,443 #	%
GLOBE						
0.110	microphthalmia		2	0.0%	0	
EYELIDS						
20.140	ectopic cilia		0		1	0.1%
21.000	entropion, unspecified		15	0.3%	2	0.1%
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		129	2.9%	27	1.9%
NICTITANS						
51.100	third eyelid cartilage anomaly		5	0.1%	1	0.1%
52.110	prolapsed gland of the third eyelid		3	0.1%	0	
CORNEA						
70.210	corneal pannus		6	0.1%	0	
70.700	corneal dystrophy		24	0.5%	7	0.5%
UVEA						
93.110	iris hypoplasia		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		4	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		266	6.0%	74	5.1%
93.720	persistent pupillary membranes, iris to lens		6	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		2	0.0%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		63	1.4%	51	3.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands		5	0.1%	0	
93.810	uveal melanoma		2	0.0%	1	0.1%
93.999	uveal cysts		5	0.1%	1	0.1%
97.150	chorioretinal coloboma, congenital		1	0.0%	1	0.1%
LENS						
100.200	cataract, unspecified		4	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		214	4.8%	51	3.5%
100.301	punctate cataract, anterior cortex		11	0.2%	3	0.2%
100.302	punctate cataract, posterior cortex		44	1.0%	13	0.9%
100.303	punctate cataract, equatorial cortex		2	0.0%	0	
100.304	punctate cataract, anterior sutures		0		2	0.1%
100.305	punctate cataract, posterior sutures		21	0.5%	6	0.4%
100.307	punctate cataract, capsular		9	0.2%	5	0.3%
100.311	incipient cataract, anterior cortex		6	0.1%	4	0.3%
100.312	incipient cataract, posterior cortex		82	1.8%	21	1.5%
100.313	incipient cataract, equatorial cortex		9	0.2%	2	0.1%
100.315	incipient cataract, posterior sutures		14	0.3%	5	0.3%
100.316	incipient cataract, nucleus		5	0.1%	0	
100.317	incipient cataract, capsular		15	0.3%	6	0.4%
100.322	incomplete cataract, posterior cortex		1	0.0%	5	0.3%
100.324	incomplete cataract, anterior sutures		1	0.0%	0	
100.325	incomplete cataract, posterior sutures		1	0.0%	1	0.1%
100.328	y-suture tip opacities		6	0.1%	10	0.7%
100.330	generalized/complete cataract		3	0.1%	0	

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*234*	*5.3%*	*83*	*5.8%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.0%	6	0.4%
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	4	0.3%
110.320	vitreal degeneration	11	0.2%	3	0.2%
RETINA					
120.170	retinal dysplasia, folds	6	0.1%	4	0.3%
120.180	retinal dysplasia, geographic	1	0.0%	1	0.1%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	0.1%	3	0.2%
120.910	retinal detachment without dialysis	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	5	0.1%	0	
OTHER					
900.000	other, unspecified	51	1.1%	0	
900.100	other, not inherited	90	2.0%	2	0.1%
900.110	other. suspect not inherited/significance unknown	45	1.0%	36	2.5%
NORMAL					
0.000	normal globe	3,715	83.7%	1,142	79.1%

ROTTWEILER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Uveal cysts	Not defined	1-3	Breeder option
C.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1, 2	NO
E.	Retinal atrophy - generalized	Not defined	1	NO

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are

complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

A variety of cataracts have been observed in this breed ranging from the posterior polar cataract similar to that in the Golden Retriever and cataracts involving multiple areas of the nucleus and cortex. Further studies need to be performed as to the exact mode of inheritance, but it is our recommendation that the individually afflicted dog should not be bred.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Bjerkas E. Progressive retinal atrophy in dogs in Norway. *Norsk Veterinaertidsskrift.* 1991;103:601-610.

OCULAR DISORDERS REPORT
ROTTWEILER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 14,699 #	%	2016-2020 2,990 #	%
GLOBE						
0.110	microphthalmia		3	0.0%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
20.160	macropalpebral fissure		10	0.1%	0	
21.000	entropion, unspecified		115	0.8%	23	0.8%
22.000	ectropion, unspecified		29	0.2%	2	0.1%
25.110	distichiasis		85	0.6%	20	0.7%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.0%
40.910	keratoconjunctivitis sicca		3	0.0%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		4	0.0%	0	
52.110	prolapsed gland of the third eyelid		15	0.1%	2	0.1%
CORNEA						
70.210	corneal pannus		3	0.0%	0	
70.220	pigmentary keratitis		2	0.0%	0	
70.700	corneal dystrophy		134	0.9%	27	0.9%
70.730	corneal endothelial degeneration		7	0.0%	0	
UVEA						
93.110	iris hypoplasia		11	0.1%	4	0.1%
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		49	0.3%	9	0.3%
93.710	persistent pupillary membranes, iris to iris		119	0.8%	21	0.7%
93.720	persistent pupillary membranes, iris to lens		38	0.3%	4	0.1%
93.730	persistent pupillary membranes, iris to cornea		51	0.3%	10	0.3%
93.740	persistent pupillary membranes, iris sheets		8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		113	0.8%	150	5.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		10	0.1%	6	0.2%
93.810	uveal melanoma		3	0.0%	1	0.0%
93.999	uveal cysts		264	1.8%	115	3.8%
LENS						
100.200	cataract, unspecified		229	1.6%	0	
100.210	cataract. suspect not inherited/significance unknown		875	6.0%	200	6.7%
100.301	punctate cataract, anterior cortex		101	0.7%	54	1.8%
100.302	punctate cataract, posterior cortex		260	1.8%	42	1.4%
100.303	punctate cataract, equatorial cortex		9	0.1%	3	0.1%
100.304	punctate cataract, anterior sutures		13	0.1%	6	0.2%
100.305	punctate cataract, posterior sutures		82	0.6%	12	0.4%
100.306	punctate cataract, nucleus		28	0.2%	5	0.2%
100.307	punctate cataract, capsular		42	0.3%	25	0.8%
100.311	incipient cataract, anterior cortex		105	0.7%	21	0.7%
100.312	incipient cataract, posterior cortex		512	3.5%	87	2.9%
100.313	incipient cataract, equatorial cortex		37	0.3%	6	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.314	incipient cataract, anterior sutures	11	0.1%	3	0.1%
100.315	incipient cataract, posterior sutures	72	0.5%	15	0.5%
100.316	incipient cataract, nucleus	54	0.4%	6	0.2%
100.317	incipient cataract, capsular	42	0.3%	7	0.2%
100.321	incomplete cataract, anterior cortex	2	0.0%	5	0.2%
100.322	incomplete cataract, posterior cortex	6	0.0%	10	0.3%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	0		2	0.1%
100.327	incomplete cataract, capsular	3	0.0%	2	0.1%
100.328	y-suture tip opacities	6	0.0%	21	0.7%
100.330	generalized/complete cataract	48	0.3%	2	0.1%
100.345	*significant cataracts (summary)*	*1,663*	*11.3%*	*335*	*11.2%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	21	0.1%	12	0.4%
110.135	PHPV/PTVL	7	0.0%	1	0.0%
110.200	vitreous degeneration-anterior chamber	2	0.0%	4	0.1%
110.320	vitreal degeneration	66	0.4%	7	0.2%
RETINA					
120.170	retinal dysplasia, folds	124	0.8%	27	0.9%
120.180	retinal dysplasia, geographic	43	0.3%	11	0.4%
120.190	retinal dysplasia, detached	1	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	174	1.2%	9	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	16	0.1%	13	0.4%
OPTIC NERVE					
130.110	micropapilla	15	0.1%	4	0.1%
130.120	optic nerve hypoplasia	17	0.1%	1	0.0%
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	137	0.9%	0	
900.100	other, not inherited	330	2.2%	11	0.4%
900.110	other. suspect not inherited/significance unknown	227	1.5%	163	5.5%
NORMAL					
0.000	normal globe	11,699	79.6%	2,065	69.1%

RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing

vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
RUSSELL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 267 #	 %	2016-2020 284 #	 %
EYELIDS						
25.110	distichiasis		10	3.7%	8	2.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.4%
40.910	keratoconjunctivitis sicca		1	0.4%	0	
CORNEA						
70.700	corneal dystrophy		0		1	0.4%
UVEA						
93.150	iris coloboma		1	0.4%	0	
93.180	liris sphincter dysplasia		1	0.4%	0	
93.710	persistent pupillary membranes, iris to iris		10	3.7%	20	7.0%
93.720	persistent pupillary membranes, iris to lens		0		1	0.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.4%	1	0.4%
93.999	uveal cysts		1	0.4%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		8	3.0%	22	7.7%
100.305	punctate cataract, posterior sutures		0		1	0.4%
100.306	punctate cataract, nucleus		0		1	0.4%
100.307	punctate cataract, capsular		0		1	0.4%
100.321	incomplete cataract, anterior cortex		0		1	0.4%
100.322	incomplete cataract, posterior cortex		2	0.7%	2	0.7%
100.323	incomplete cataract, equatorial cortex		0		1	0.4%
100.325	incomplete cataract, posterior sutures		0		1	0.4%
100.328	y-suture tip opacities		0		1	0.4%
100.345	*significant cataracts (summary)*		*2*	*0.7%*	*9*	*3.2%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		2	0.7%
RETINA						
120.170	retinal dysplasia, folds		2	0.7%	1	0.4%
120.180	retinal dysplasia, geographic		1	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.4%	0	
OPTIC NERVE						
130.110	micropapilla		1	0.4%	0	
OTHER						
900.000	other, unspecified		2	0.7%	0	
900.110	other. suspect not inherited/significance unknown		7	2.6%	14	4.9%
NORMAL						
0.000	normal globe		230	86.1%	220	77.5%

RUSSIAN TOY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
RUSSIAN TOY

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 52 #	%	2016-2020 53 #	%
EYELIDS					
25.110	distichiasis	1	1.9%	0	
CORNEA					
70.700	corneal dystrophy	1	1.9%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	1.9%	5	9.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	1.9%	7	13.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	1.9%	0	
97.150	chorioretinal coloboma, congenital	1	1.9%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	1.9%	2	3.8%
100.301	punctate cataract, anterior cortex	3	5.8%	0	
100.303	punctate cataract, equatorial cortex	1	1.9%	0	
100.305	punctate cataract, posterior sutures	0		1	1.9%
100.307	punctate cataract, capsular	0		2	3.8%
100.328	y-suture tip opacities	0		1	1.9%
100.345	*significant cataracts (summary)*	*4*	*7.7%*	*4*	*7.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	1.9%	0	
110.200	vitreous degeneration-anterior chamber	0		1	1.9%
110.320	vitreal degeneration	4	7.7%	2	3.8%
RETINA					
120.180	retinal dysplasia, geographic	0		1	1.9%
120.190	retinal dysplasia, detached	0		1	1.9%
120.960	retinopathy	1	1.9%	0	
OTHER					
900.000	other, unspecified	2	3.8%	0	
900.110	other. suspect not inherited/significance unknown	3	5.8%	0	
NORMAL					
0.000	normal globe	41	78.8%	35	66.0%

Russian Tsvetnaya Bolonka
(Bolonka Zwetna)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST
A.	Cataract	Not defined	1	NO	
B.	Retinal atrophy (*prcd*)	Autosomal recessive	2	NO	Mutation in *prcd* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Russian Tsvetnaya Bolonka is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
RUSSIAN TSVETNAYA BOLONKA

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 90 #	 %	2016-2020 33 #	 %
EYELIDS					
25.110	distichiasis	1	1.1%	0	
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	1.1%	0	
CORNEA					
70.220	pigmentary keratitis	2	2.2%	0	
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	1.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	4	4.4%	1	3.0%
100.301	punctate cataract, anterior cortex	0		2	6.1%
100.313	incipient cataract, equatorial cortex	1	1.1%	0	
100.315	incipient cataract, posterior sutures	0		3	9.1%
100.317	incipient cataract, capsular	0		1	3.0%
100.328	y-suture tip opacities	0		3	9.1%
100.345	*significant cataracts (summary)*	*1*	*1.1%*	*9*	*27.3%*
100.375	*subluxation/luxation, unspecified*	*1*	*1.1%*	*0*	
VITREOUS					
110.135	PHPV/PTVL	1	1.1%	0	
110.200	vitreous degeneration-anterior chamber	2	2.2%	2	6.1%
110.320	vitreal degeneration	10	11.1%	3	9.1%
OTHER					
900.000	other, unspecified	1	1.1%	0	
900.100	other, not inherited	2	2.2%	0	
900.110	other. suspect not inherited/significance unknown	0		4	12.1%
NORMAL					
0.000	normal globe	77	85.6%	19	57.6%

RUSSO-EUROPEAN LAIKA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Russo-European Laika is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Russo-European Laika. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl, B., et al. (2006). "Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans." Genomics **88**(5): 551-563. PMID: 16938425

SAMOYED

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-7	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1, 8	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy (*RPGR)*	X-linked recessive	1, 9, 10	NO	Mutation in the *RPGR* gene
G.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 11, 12	NO (Breeder option with Normal DNA test for folds)	Mutation in the *COL9A2* gene
H.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive with incomplete dominance for the eyes	1, 11-14	NO	Mutation in the *COL9A2* gene
I.	Uveodermatologic syndrome	Not defined	1, 15, 16	NO	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Samoyed, many of the PPMs identified on routine screening examinations bridge from the iris to the cornea where they may be associated with corneal opacity and vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - *RPGR*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In the Samoyed, one form of PRA, known as XLPRA1, is due to a mutation in the *RPGR* gene and is inherited as a recessive, sex-linked trait. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.
In the Samoyed, the presence of retinal folds may be seen in the heterozygous state described in "I" below. Thus the recommendation against breeding. The breeding advice for

Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog showing that it is not a carrier of the *COL9A2* mutation.

H. Retinal dysplasia - folds with skeletal defects in homozygous affected dogs

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 2 (DRD2) in the Samoyed. A similar condition, DRD1, occurs in the Labrador Retriever. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs ("downhill" conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1,267 bp deletion of *COL9A2.* A DNA test is available.

I. Uveodermatologic syndrome

Uveodermatologic syndrome in the Samoyed bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechiae) and the peripheral iris and cornea (peripheral anterior synechiae) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. Some veterinary ophthalmologists feel there is a prevalence of this entity in the Samoyed. Additional studies are needed to validate this experience and explore the possibility of a genetic basis.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Ekesten B, Narfstrom K. Correlation of morphologic features of the iridocorneal angle to intraocular pressure in Samoyeds. *Am J Vet Res*. 1991;52:1875-1878.

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16. Halliwell RE. Autoimmune diseases in domestic animals. *J Am Vet Med Assoc*. 1982;181:1088-1096.

OCULAR DISORDERS REPORT
SAMOYED

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 23,045 #	%	2016-2020 5,526 #	%
GLOBE						
0.110	microphthalmia		20	0.1%	3	0.1%
10.000	glaucoma		10	0.0%	1	0.0%
EYELIDS						
20.140	ectopic cilia		7	0.0%	2	0.0%
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		6	0.0%	0	
22.000	ectropion, unspecified		3	0.0%	1	0.0%
25.110	distichiasis		1,331	5.8%	226	4.1%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		10	0.0%	15	0.3%
40.910	keratoconjunctivitis sicca		14	0.1%	3	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		4	0.0%	1	0.0%
CORNEA						
70.210	corneal pannus		4	0.0%	0	
70.220	pigmentary keratitis		1	0.0%	1	0.0%
70.700	corneal dystrophy		793	3.4%	235	4.3%
70.730	corneal endothelial degeneration		15	0.1%	2	0.0%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		456	2.0%	126	2.3%
93.720	persistent pupillary membranes, iris to lens		24	0.1%	9	0.2%
93.730	persistent pupillary membranes, iris to cornea		35	0.2%	8	0.1%
93.740	persistent pupillary membranes, iris sheets		16	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		10	0.0%	6	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		12	0.1%	2	0.0%
93.810	uveal melanoma		1	0.0%	0	
93.999	uveal cysts		12	0.1%	4	0.1%
97.150	chorioretinal coloboma, congenital		0		3	0.1%
LENS						
100.200	cataract, unspecified		100	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown		771	3.3%	158	2.9%
100.301	punctate cataract, anterior cortex		66	0.3%	25	0.5%
100.302	punctate cataract, posterior cortex		147	0.6%	21	0.4%
100.303	punctate cataract, equatorial cortex		14	0.1%	2	0.0%
100.304	punctate cataract, anterior sutures		8	0.0%	3	0.1%
100.305	punctate cataract, posterior sutures		58	0.3%	12	0.2%
100.306	punctate cataract, nucleus		17	0.1%	3	0.1%
100.307	punctate cataract, capsular		22	0.1%	20	0.4%
100.311	incipient cataract, anterior cortex		76	0.3%	28	0.5%
100.312	incipient cataract, posterior cortex		251	1.1%	46	0.8%
100.313	incipient cataract, equatorial cortex		23	0.1%	7	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.314	incipient cataract, anterior sutures	7	0.0%	0	
100.315	incipient cataract, posterior sutures	51	0.2%	7	0.1%
100.316	incipient cataract, nucleus	33	0.1%	5	0.1%
100.317	incipient cataract, capsular	28	0.1%	15	0.3%
100.321	incomplete cataract, anterior cortex	0		2	0.0%
100.322	incomplete cataract, posterior cortex	8	0.0%	16	0.3%
100.325	incomplete cataract, posterior sutures	1	0.0%	2	0.0%
100.326	incomplete cataract, nucleus	1	0.0%	1	0.0%
100.327	incomplete cataract, capsular	3	0.0%	4	0.1%
100.328	y-suture tip opacities	5	0.0%	14	0.3%
100.330	generalized/complete cataract	66	0.3%	0	
100.340	resorbing/hypermature cataract	1	0.0%	2	0.0%
100.345	*significant cataracts (summary)*	*986*	*4.3%*	*235*	*4.3%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.0%*	*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	22	0.1%	7	0.1%
110.135	PHPV/PTVL	11	0.0%	3	0.1%
110.200	vitreous degeneration-anterior chamber	0		2	0.0%
110.320	vitreal degeneration	94	0.4%	7	0.1%
FUNDUS					
97.110	choroidal hypoplasia	4	0.0%	0	
97.120	coloboma	7	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	483	2.1%	82	1.5%
120.180	retinal dysplasia, geographic	168	0.7%	47	0.9%
120.190	retinal dysplasia, detached	26	0.1%	6	0.1%
120.310	generalized progressive retinal atrophy (PRA)	56	0.2%	0	
120.400	retinal hemorrhage	2	0.0%	0	
120.910	retinal detachment without dialysis	10	0.0%	0	
120.920	retinal detachment with dialysis	0		2	0.0%
120.960	retinopathy	2	0.0%	8	0.1%
OPTIC NERVE					
130.110	micropapilla	18	0.1%	1	0.0%
130.120	optic nerve hypoplasia	13	0.1%	2	0.0%
130.150	optic disc coloboma	70	0.3%	5	0.1%
OTHER					
900.000	other, unspecified	176	0.8%	0	
900.100	other, not inherited	447	1.9%	9	0.2%
900.110	other. suspect not inherited/significance unknown	225	1.0%	201	3.6%
NORMAL					
0.000	normal globe	18,959	82.3%	4,344	78.6%

SCHAPENDOES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*CCDC66)*	Autosomal recessive	1, 2	NO	Mutation in the *CCDC66* gene

Description and Comments

A. Retinal atrophy - *CCDC66*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

In the Schapendoes the age of onset is between 2-5 years of age. The causal mutation is a single base pair insertion in exon 6 of the gene coiled-coil domain containing 66 (*CCDC66)* that leads to a stop codon. The mutation is inherited as an autosomal recessive trait. A DNA test is available.

References

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OCULAR DISORDERS REPORT
SCHAPENDOES

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 76 #	 %	2016-2020 47 #	 %
EYELIDS						
25.110	distichiasis		1	1.3%	1	2.1%
CORNEA						
70.700	corneal dystrophy		0		1	2.1%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		1	2.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	1.3%	1	2.1%
LENS						
100.210	cataract. suspect not inherited/significance unknown		3	3.9%	4	8.5%
100.301	punctate cataract, anterior cortex		1	1.3%	1	2.1%
100.311	incipient cataract, anterior cortex		0		2	4.3%
100.312	incipient cataract, posterior cortex		0		2	4.3%
100.315	incipient cataract, posterior sutures		1	1.3%	1	2.1%
100.328	y-suture tip opacities		1	1.3%	2	4.3%
100.345	*significant cataracts (summary)*		*3*	*3.9%*	*8*	*17.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	2.6%	1	2.1%
110.320	vitreal degeneration		1	1.3%	0	
RETINA						
120.180	retinal dysplasia, geographic		1	1.3%	0	
OTHER						
900.100	other, not inherited		6	7.9%	0	
900.110	other. suspect not inherited/significance unknown		0		2	4.3%
NORMAL						
0.000	normal globe		65	85.5%	30	63.8%

SCHIPPERKE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Vitreous degeneration	Not defined	1	Breeder option	
E.	Retinal atrophy - generalized (*prcd*)	Presumed autosomal recessive	1, 2	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Schipperke is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Zangerl, B., et al. (2006). "Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans." Genomics **88**(5): 551-563. PMID: 16938425

OCULAR DISORDERS REPORT
SCHIPPERKE

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,458**		**241**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
25.110	distichiasis	46	3.2%	5	2.1%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	0		1	0.4%
70.700	corneal dystrophy	3	0.2%	0	
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	126	8.6%	21	8.7%
93.720	persistent pupillary membranes, iris to lens	6	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	10	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.5%	1	0.4%
LENS					
100.200	cataract, unspecified	4	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	62	4.3%	13	5.4%
100.301	punctate cataract, anterior cortex	13	0.9%	2	0.8%
100.302	punctate cataract, posterior cortex	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	5	0.3%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.306	punctate cataract, nucleus	7	0.5%	1	0.4%
100.311	incipient cataract, anterior cortex	20	1.4%	2	0.8%
100.312	incipient cataract, posterior cortex	10	0.7%	0	
100.313	incipient cataract, equatorial cortex	8	0.5%	1	0.4%
100.315	incipient cataract, posterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	5	0.3%	1	0.4%
100.317	incipient cataract, capsular	1	0.1%	1	0.4%
100.321	incomplete cataract, anterior cortex	1	0.1%	0	
100.322	incomplete cataract, posterior cortex	0		1	0.4%
100.330	generalized/complete cataract	8	0.5%	0	
100.345	*significant cataracts (summary)*	*86*	*5.9%*	*9*	*3.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.135	PHPV/PTVL	1	0.1%	0	
110.200	vitreous degeneration-anterior chamber	1	0.1%	0	
110.320	vitreal degeneration	18	1.2%	5	2.1%
RETINA					
120.170	retinal dysplasia, folds	9	0.6%	2	0.8%
120.180	retinal dysplasia, geographic	4	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	16	1.1%	1	0.4%
120.920	retinal detachment with dialysis	0		1	0.4%
120.960	retinopathy	2	0.1%	0	

		1991-2015		2016-2020	
OTHER					
900.000	other, unspecified	16	1.1%	0	
900.100	other, not inherited	51	3.5%	0	
900.110	other. suspect not inherited/significance unknown	16	1.1%	18	7.5%
NORMAL					
0.000	normal globe	1,170	80.2%	182	75.5%

SCOTTISH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- iris to lens	Not defined	1	NO
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
	- endothelial opacity/no strands	Not defined	1	NO
B.	Cataract	Not defined	1	NO
C.	Ligneous conjunctivitis	Not defined	2, 3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire Terrier.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Ramsey DT, Ketring K, Glaze MB, et al. Ligneous conjunctivitis in four Doberman Pinschers. *J Am Anim Hosp Assoc*. 1996; 32: 439-447.

3. Mason SL, McElroy P, Nuttall T. Ligneous membranitis in Scottish Terriers. Vet Rec. 2012; 171: 160.

OCULAR DISORDERS REPORT
SCOTTISH TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 756 #	%	2016-2020 185 #	%
EYELIDS						
25.110	distichiasis		3	0.4%	0	
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.1%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.3%	0	
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		2	0.3%	0	
70.700	corneal dystrophy		5	0.7%	1	0.5%
70.730	corneal endothelial degeneration		2	0.3%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		3	0.4%	0	
93.710	persistent pupillary membranes, iris to iris		227	30.0%	49	26.5%
93.720	persistent pupillary membranes, iris to lens		38	5.0%	5	2.7%
93.730	persistent pupillary membranes, iris to cornea		9	1.2%	2	1.1%
93.740	persistent pupillary membranes, iris sheets		3	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		57	7.5%	71	38.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.5%	6	3.2%
LENS						
100.210	cataract. suspect not inherited/significance unknown		73	9.7%	10	5.4%
100.301	punctate cataract, anterior cortex		7	0.9%	0	
100.302	punctate cataract, posterior cortex		2	0.3%	0	
100.303	punctate cataract, equatorial cortex		2	0.3%	0	
100.304	punctate cataract, anterior sutures		2	0.3%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.306	punctate cataract, nucleus		3	0.4%	0	
100.307	punctate cataract, capsular		2	0.3%	1	0.5%
100.311	incipient cataract, anterior cortex		6	0.8%	1	0.5%
100.312	incipient cataract, posterior cortex		5	0.7%	1	0.5%
100.313	incipient cataract, equatorial cortex		3	0.4%	0	
100.314	incipient cataract, anterior sutures		1	0.1%	0	
100.315	incipient cataract, posterior sutures		1	0.1%	1	0.5%
100.316	incipient cataract, nucleus		9	1.2%	0	
100.317	incipient cataract, capsular		2	0.3%	1	0.5%
100.321	incomplete cataract, anterior cortex		0		1	0.5%
100.322	incomplete cataract, posterior cortex		0		1	0.5%
100.326	incomplete cataract, nucleus		0		1	0.5%
100.327	incomplete cataract, capsular		0		1	0.5%
100.330	generalized/complete cataract		4	0.5%	1	0.5%
100.345	*significant cataracts (summary)*		*50*	*6.6%*	*10*	*5.4%*
100.375	*subluxation/luxation, unspecified*		*1*	*0.1%*	*0*	

	1991-2015		2016-2020	
VITREOUS				
110.120 persistent hyaloid artery/remnant	1	0.1%	0	
110.320 vitreal degeneration	5	0.7%	0	
RETINA				
120.170 retinal dysplasia, folds	5	0.7%	0	
120.310 generalized progressive retinal atrophy (PRA)	8	1.1%	0	
OPTIC NERVE				
130.150 optic disc coloboma	2	0.3%	0	
OTHER				
900.000 other, unspecified	13	1.7%	0	
900.100 other, not inherited	60	7.9%	0	
900.110 other. suspect not inherited/significance unknown	19	2.5%	9	4.9%
NORMAL				
0.000 normal globe	398	52.6%	71	38.4%

SEALYHAM TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	1-5	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to

be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Formston C. Observations on subluxation and luxation of the crystalline lens in the dog. *J Comp Pathol*. 1945;55:168-186.

3. Hodgman SFJ. Abnormalities and defects in pedigree dogs: I. An investigation into the existence of abnormalities in pedigree dogs in British Isles. *J Small Anim Pract*. 1963;4:447-456.

4. Curtis R, Barnett KC. Primary lens luxation in the dog. *J Small Anim Pract*. 1980;21:657-668.

5. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
SEALYHAM TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 487 #	%	2016-2020 37 #	%
EYELIDS					
25.110	distichiasis	27	5.5%	1	2.7%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	31	6.4%	6	16.2%
93.720	persistent pupillary membranes, iris to lens	2	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.2%	2	5.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
LENS					
100.200	cataract, unspecified	2	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	20	4.1%	1	2.7%
100.301	punctate cataract, anterior cortex	4	0.8%	0	
100.302	punctate cataract, posterior cortex	3	0.6%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	2	0.4%	0	
100.307	punctate cataract, capsular	3	0.6%	2	5.4%
100.311	incipient cataract, anterior cortex	3	0.6%	0	
100.312	incipient cataract, posterior cortex	8	1.6%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	2	0.4%	0	
100.317	incipient cataract, capsular	2	0.4%	0	
100.330	generalized/complete cataract	7	1.4%	0	
100.345	*significant cataracts (summary)*	*39*	*8.0%*	*2*	*5.4%*
100.375	*subluxation/luxation, unspecified*	*5*	*1.0%*	*0*	
VITREOUS					
110.135	PHPV/PTVL	2	0.4%	0	
110.320	vitreal degeneration	6	1.2%	0	
FUNDUS					
97.120	coloboma	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	9	1.8%	0	
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.190	retinal dysplasia, detached	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	2.3%	0	
120.910	retinal detachment without dialysis	1	0.2%	0	
120.960	retinopathy	0		1	2.7%
OPTIC NERVE					
130.110	micropapilla	0		1	2.7%
130.120	optic nerve hypoplasia	1	0.2%	0	

	1991-2015		2016-2020	
OTHER				
900.000 other, unspecified	4	0.8%	0	
900.100 other, not inherited	10	2.1%	0	
900.110 other. suspect not inherited/significance unknown	2	0.4%	2	5.4%
NORMAL				
0.000 normal globe	408	83.8%	25	67.6%

SERBIAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy – *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Serbian Hound is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Serbian Hound. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl, B., et al. (2006). "Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans." Genomics **88**(5): 551-563. PMID: 16938425

SHETLAND SHEEPDOG
(Sheltie)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	1. Corneal dystrophy	Not defined	1, 2	Breeder option	
	2. Sheltie corneal dystrophy	Not defined	1, 2	NO	
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 3	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy (*CNGA1*)	Autosomal recessive	1, 4	NO	Mutation in the *CNGA1* gene
F.	Slowly progressing retinopathy	Not defined	5	NO	
G.	Choroidal hypoplasia (Collie eye anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	1, 6, 7	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

Distichiasis in the Shetland Sheepdog usually involves stiff lashes which require permanent epilation.

B. 1. Corneal dystrophy

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

2. Sheltie corneal dystrophy

The corneal changes in the Shetland Sheepdog are characterized grossly by multifocal, central, subepithelial and superficial stromal, grey-white, circular or irregular rings. Some affected animals develop corneal erosions. The preocular tear film in the majority of dogs is unstable and requires symptomatic therapy to keep the patients comfortable. Further studies are necessary to define this disorder.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms are seen in the Shetland sheepdog and pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - *CNGA1*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

One form of PRA in the Shetland Sheepdog is caused by a 4bp exonic deletion in *CNGA1.* However multiple forms of PRA exist in the breed and slowly progressive retinopathy is also not genetically linked to this mutation. A DNA test is available; however it will only detect this mutation.

F. Slowly progressing retinopathy

A syndrome as yet not well defined. May be a variant of PRA.

G. Choroidal hypoplasia (Collie eye anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie eye anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Crispin SM, Barnett KC. Dystrophy, degeneration and infiltration of the canine cornea. *J Small Anim Pract*. 1983;24:63-83.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Wiik AC, Ropstad EO, Ekesten B, et al. Progressive retinal atrophy in Shetland Sheepdog is associated with a mutation in the CNGA1 gene. *Anim Genet*. 2015;46:515-521.

5. Karlstam L, Hertil E, Zeiss C, et al. A slowly progressive retinopathy in the Shetland Sheepdog. *Vet Ophthalmol*. 2011;14:227-238.

6. Barnett KC, Stades FC. Collie eye anomaly in the Shetland Sheepdog in the Netherlands. *J Small Anim Pract*. 1979;20:321-329.

7. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

8. Fredholm M, Larsen RC, Jönsson M, Söderlund MA, Hardon T, Proschowsky HF. Discrepancy in compliance between the clinical and genetic diagnosis of choroidal hypoplasia in Danish Rough Collies and Shetland Sheepdogs. Anim Genet. 2016 Apr; 47(2): 250-2.

OCULAR DISORDERS REPORT
SHETLAND SHEEPDOG

	TOTAL DOGS EXAMINED	1991-2015 38,374		2016-2020 5,067	
	Diagnostic Name	**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	64	0.2%	6	0.1%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	9	0.0%	0	
21.000	entropion, unspecified	7	0.0%	1	0.0%
22.000	ectropion, unspecified	10	0.0%	0	
25.110	distichiasis	2,491	6.5%	251	5.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	5	0.0%	2	0.0%
40.910	keratoconjunctivitis sicca	7	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	7	0.0%	0	
52.110	prolapsed gland of the third eyelid	4	0.0%	0	
CORNEA					
70.210	corneal pannus	9	0.0%	0	
70.220	pigmentary keratitis	4	0.0%	0	
70.700	corneal dystrophy	1,047	2.7%	123	2.4%
70.730	corneal endothelial degeneration	35	0.1%	1	0.0%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	5	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM	5	0.0%	0	
93.150	iris coloboma	26	0.1%	2	0.0%
93.710	persistent pupillary membranes, iris to iris	1,599	4.2%	273	5.4%
93.720	persistent pupillary membranes, iris to lens	119	0.3%	9	0.2%
93.730	persistent pupillary membranes, iris to cornea	192	0.5%	16	0.3%
93.740	persistent pupillary membranes, iris sheets	29	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	11	0.0%	9	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	18	0.0%	9	0.2%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	24	0.1%	5	0.1%
97.150	chorioretinal coloboma, congenital	5	0.0%	6	0.1%
LENS					
100.200	cataract, unspecified	73	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	593	1.5%	111	2.2%
100.301	punctate cataract, anterior cortex	71	0.2%	17	0.3%
100.302	punctate cataract, posterior cortex	61	0.2%	11	0.2%
100.303	punctate cataract, equatorial cortex	28	0.1%	3	0.1%
100.304	punctate cataract, anterior sutures	4	0.0%	2	0.0%
100.305	punctate cataract, posterior sutures	8	0.0%	3	0.1%
100.306	punctate cataract, nucleus	22	0.1%	2	0.0%
100.307	punctate cataract, capsular	20	0.1%	6	0.1%
100.311	incipient cataract, anterior cortex	138	0.4%	17	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.312	incipient cataract, posterior cortex	92	0.2%	14	0.3%
100.313	incipient cataract, equatorial cortex	55	0.1%	3	0.1%
100.314	incipient cataract, anterior sutures	5	0.0%	0	
100.315	incipient cataract, posterior sutures	13	0.0%	0	
100.316	incipient cataract, nucleus	35	0.1%	2	0.0%
100.317	incipient cataract, capsular	28	0.1%	6	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	6	0.1%
100.322	incomplete cataract, posterior cortex	2	0.0%	5	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	3	0.1%
100.327	incomplete cataract, capsular	1	0.0%	2	0.0%
100.328	y-suture tip opacities	2	0.0%	4	0.1%
100.330	generalized/complete cataract	44	0.1%	3	0.1%
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*705*	*1.8%*	*109*	*2.2%*
100.375	*subluxation/luxation, unspecified*	*6*	*0.0%*	*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	90	0.2%	8	0.2%
110.135	PHPV/PTVL	17	0.0%	5	0.1%
110.200	vitreous degeneration-anterior chamber	1	0.0%	1	0.0%
110.320	vitreal degeneration	133	0.3%	23	0.5%
FUNDUS					
97.110	choroidal hypoplasia	125	0.3%	25	0.5%
97.120	coloboma	82	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	86	0.2%	16	0.3%
120.180	retinal dysplasia, geographic	16	0.0%	6	0.1%
120.190	retinal dysplasia, detached	5	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	215	0.6%	8	0.2%
120.910	retinal detachment without dialysis	18	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	19	0.0%	5	0.1%
OPTIC NERVE					
130.110	micropapilla	17	0.0%	3	0.1%
130.120	optic nerve hypoplasia	25	0.1%	0	
130.150	optic disc coloboma	191	0.5%	11	0.2%
OTHER					
900.000	other, unspecified	243	0.6%	0	
900.100	other, not inherited	570	1.5%	10	0.2%
900.110	other. suspect not inherited/significance unknown	279	0.7%	164	3.2%
NORMAL					
0.000	normal globe	32,486	84.7%	4,018	79.3%

SHIBA INU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	3	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
D.	Cataract	Not defined	3	NO
E.	Y-suture tip opacity	Not defined	3	Breeder option

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

A recent study found that a *SRBD1* polymorphism in exon 4 plays an important role in the development of glaucoma in the Shiba Inu. A genetic test is not yet available.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

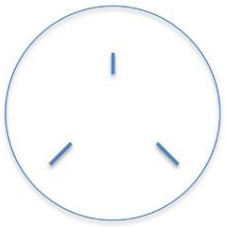
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or "highlighted" or "more dense") distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a "peace sign" as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the "Lens" section of the CAER form. The newest version of the form (3/16/21) has boxes that say, "posterior Y-suture tip opacities" which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures" AND ALSO MARK "suspect not inherited/significance unknown" (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: "E2" or "posterior suture tip opacities." This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

1. ACVO Genetics Committee and Data from OFA All-Breeds Report.

2. Kanemaki N, Tchedre KT, Imayasu M, et al. Dogs and humans share a common susceptibility gene SRBD1 for glaucoma risk. *PloS one*. 2013;8:e74372.

3. Kato K, Sasaki N, Matsunaga S, et al. Possible association of glaucoma with pectinate ligament dysplasia and narrowing of the iridocorneal angle in Shiba Inu dogs in Japan. *Vet Ophthalmol*. 2006;9:71-75.

OCULAR DISORDERS REPORT
SHIBA INU

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 4,408 #	%	2016-2020 1,085 #	%
GLOBE						
10.000	glaucoma		2	0.0%	0	
EYELIDS						
20.140	ectopic cilia		4	0.1%	0	
20.160	macropalpebral fissure		6	0.1%	0	
21.000	entropion, unspecified		12	0.3%	0	
25.110	distichiasis		105	2.4%	19	1.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		2	0.0%	0	
40.910	keratoconjunctivitis sicca		1	0.0%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.0%	0	
CORNEA						
70.210	corneal pannus		4	0.1%	0	
70.220	pigmentary keratitis		10	0.2%	1	0.1%
70.700	corneal dystrophy		32	0.7%	4	0.4%
70.730	corneal endothelial degeneration		10	0.2%	1	0.1%
UVEA						
93.710	persistent pupillary membranes, iris to iris		175	4.0%	45	4.1%
93.720	persistent pupillary membranes, iris to lens		15	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		21	0.5%	43	4.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	0	
93.999	uveal cysts		0		2	0.2%
LENS						
100.200	cataract, unspecified		10	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		187	4.2%	65	6.0%
100.301	punctate cataract, anterior cortex		6	0.1%	3	0.3%
100.302	punctate cataract, posterior cortex		15	0.3%	4	0.4%
100.303	punctate cataract, equatorial cortex		3	0.1%	0	
100.304	punctate cataract, anterior sutures		3	0.1%	0	
100.305	punctate cataract, posterior sutures		23	0.5%	19	1.8%
100.306	punctate cataract, nucleus		1	0.0%	0	
100.307	punctate cataract, capsular		1	0.0%	3	0.3%
100.311	incipient cataract, anterior cortex		32	0.7%	4	0.4%
100.312	incipient cataract, posterior cortex		24	0.5%	2	0.2%
100.313	incipient cataract, equatorial cortex		12	0.3%	1	0.1%
100.314	incipient cataract, anterior sutures		2	0.0%	0	
100.315	incipient cataract, posterior sutures		11	0.2%	6	0.6%
100.316	incipient cataract, nucleus		4	0.1%	2	0.2%
100.317	incipient cataract, capsular		2	0.0%	0	
100.322	incomplete cataract, posterior cortex		0		2	0.2%
100.328	y-suture tip opacities		3	0.1%	20	1.8%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	19	0.4%	0	
100.345	*significant cataracts (summary)*	*171*	*3.9%*	*66*	*6.1%*
100.375	*subluxation/luxation, unspecified*	*3*	*0.1%*	*1*	*0.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	19	0.4%	5	0.5%
110.135	PHPV/PTVL	4	0.1%	0	
110.320	vitreal degeneration	32	0.7%	0	
RETINA					
120.170	retinal dysplasia, folds	7	0.2%	4	0.4%
120.180	retinal dysplasia, geographic	2	0.0%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	28	0.6%	1	0.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.120	optic nerve hypoplasia	7	0.2%	1	0.1%
OTHER					
900.000	other, unspecified	31	0.7%	0	
900.100	other, not inherited	95	2.2%	1	0.1%
900.110	other. suspect not inherited/significance unknown	39	0.9%	45	4.1%
NORMAL					
0.000	normal globe	3,714	84.3%	834	76.9%

SHIH TZU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
B.	Glaucoma	Not defined	3	NO
C.	Entropion	Not defined	1	Breeder option
D.	Distichiasis	Not defined	1	Breeder option
E.	Ectopic cilia	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
G.	Pigmentary keratitis	Not defined	1	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
I.	Cataract	Not defined	1	NO
J.	Vitreous degeneration	Not defined	1, 4, 5	Breeder option
K.	Retinal detachment	Not defined	4, 6	NO
L.	Retinal atrophy - generalized	Not defined	1	NO
M.	Optic nerve hypoplasia	Not defined	1, 7	NO
N.	Retinal degeneration	Not defined	5	NO

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

A recent study found that a *SRBD1* polymorphism in intron 1 plays an important role in the development of glaucoma in the Shih Tzu. A genetic test is not yet available.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

E. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

F. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

G. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

J. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal detachment

A separation of the sensory retina from the underlying tissue. It results in blindness when complete.

L. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

M. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

N. Retinal degeneration

A unilateral or bilateral retinal disease which can be progressive. When bilateral, the ophthalmoscopic lesions are sometimes asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited. An intriguing aspect of the disease has been the preponderance of affected males compared to females. This has been confirmed in a recent unpublished survey.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Sanchez RF, Innocent G, Mould J, et al. Canine keratoconjunctivitis sicca: disease trends in a review of 229 cases. *J Small Anim Pract*. 2007;48:211-217.

3. Kanemaki N, Tchedre KT, Imayasu M, et al. Dogs and humans share a common susceptibility gene SRBD1 for glaucoma risk. *PloS one*. 2013;8:e74372.

4. Hendrix DV, Nasisse MP, Cowen P, et al. Clinical signs, concurrent diseases and risk factors associated with retinal detachment in dogs. *Prog Vet Comp Ophthal*. 1993;3:87-91.

5. Krishnan, H., et al. (2020). "Vitreous degeneration and associated ocular abnormalities in the dog." Vet Ophthalmol **23**(2): 219-224. PMID: 31464365

6. Itoh Y, Maehara S, Yamasaki A, et al. Investigation of fellow eye of unilateral retinal detachment in Shih-Tzu. *Vet Ophthalmol*. 2010;13:289-293.

7. da Silva EG, Dubielzig R, Zarfoss MK, et al. Distinctive histopathologic features of canine optic nerve hypoplasia and aplasia: a retrospective review of 13 cases. *Vet Ophthalmol*. 2008;11:23-29.

OCULAR DISORDERS REPORT
SHIH TZU

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	2,537		847	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	6	0.2%	0	
EYELIDS					
20.140	ectopic cilia	41	1.6%	4	0.5%
20.160	macropalpebral fissure	57	2.2%	0	
21.000	entropion, unspecified	171	6.7%	97	11.5%
22.000	ectropion, unspecified	4	0.2%	0	
25.110	distichiasis	478	18.8%	103	12.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	4	0.2%	3	0.4%
40.910	keratoconjunctivitis sicca	17	0.7%	12	1.4%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
CORNEA					
70.210	corneal pannus	25	1.0%	0	
70.220	pigmentary keratitis	145	5.7%	55	6.5%
70.700	corneal dystrophy	32	1.3%	3	0.4%
70.730	corneal endothelial degeneration	4	0.2%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	4	0.2%	1	0.1%
93.710	persistent pupillary membranes, iris to iris	36	1.4%	20	2.4%
93.720	persistent pupillary membranes, iris to lens	4	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	2	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	2	0.2%
93.999	uveal cysts	5	0.2%	0	
LENS					
100.200	cataract, unspecified	16	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	58	2.3%	16	1.9%
100.301	punctate cataract, anterior cortex	14	0.6%	2	0.2%
100.302	punctate cataract, posterior cortex	7	0.3%	2	0.2%
100.303	punctate cataract, equatorial cortex	1	0.0%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	9	0.4%	2	0.2%
100.306	punctate cataract, nucleus	1	0.0%	1	0.1%
100.307	punctate cataract, capsular	2	0.1%	3	0.4%
100.311	incipient cataract, anterior cortex	21	0.8%	3	0.4%
100.312	incipient cataract, posterior cortex	20	0.8%	2	0.2%
100.313	incipient cataract, equatorial cortex	13	0.5%	1	0.1%
100.314	incipient cataract, anterior sutures	1	0.0%	0	
100.315	incipient cataract, posterior sutures	6	0.2%	3	0.4%
100.316	incipient cataract, nucleus	8	0.3%	0	
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.2%
100.322	incomplete cataract, posterior cortex	1	0.0%	1	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.323	incomplete cataract, equatorial cortex	0		2	0.2%
100.326	incomplete cataract, nucleus	0		2	0.2%
100.328	y-suture tip opacities	0		3	0.4%
100.330	generalized/complete cataract	23	0.9%	3	0.4%
100.345	*significant cataracts (summary)*	*147*	*5.8%*	*32*	*3.8%*
100.375	*subluxation/luxation, unspecified*	*4*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	13	0.5%	7	0.8%
110.200	vitreous degeneration-anterior chamber	10	0.4%	10	1.2%
110.320	vitreal degeneration	158	6.2%	20	2.4%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	11	0.4%	1	0.1%
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.190	retinal dysplasia, detached	0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	41	1.6%	1	0.1%
120.910	retinal detachment without dialysis	9	0.4%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.1%
120.960	retinopathy	2	0.1%	2	0.2%
OPTIC NERVE					
130.120	optic nerve hypoplasia	10	0.4%	1	0.1%
130.150	optic disc coloboma	4	0.2%	0	
OTHER					
900.000	other, unspecified	43	1.7%	0	
900.100	other, not inherited	97	3.8%	5	0.6%
900.110	other. suspect not inherited/significance unknown	89	3.5%	81	9.6%
NORMAL					
0.000	normal globe	1,505	59.3%	490	57.9%

SHIKOKU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Shikoku breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
SHIKOKU

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 11 #	 %	2016-2020 48 #	 %
EYELIDS					
25.110	distichiasis	0		1	2.1%
UVEA					
93.710	persistent pupillary membranes, iris to iris	3	27.3%	22	45.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		5	10.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	9.1%	3	6.2%
100.307	punctate cataract, capsular	1	9.1%	0	
100.345	*significant cataracts (summary)*	*1*	*9.1%*	*0*	
OTHER					
900.110	other. suspect not inherited/significance unknown	0		4	8.3%
NORMAL					
0.000	normal globe	4	36.4%	20	41.7%

SHILOH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Shiloh Shepherd breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
SHILOH SHEPHERD

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 243 #	 %	2016-2020 76 #	 %
EYELIDS					
25.110	distichiasis	2	0.8%	1	1.3%
NICTITANS					
50.210	pannus of third eyelid	0		1	1.3%
CORNEA					
70.210	corneal pannus	0		3	3.9%
70.700	corneal dystrophy	29	11.9%	8	10.5%
70.730	corneal endothelial degeneration	1	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	3	1.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	1.3%
93.999	uveal cysts	1	0.4%	1	1.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	11	4.5%	2	2.6%
100.302	punctate cataract, posterior cortex	1	0.4%	0	
100.307	punctate cataract, capsular	1	0.4%	0	
100.312	incipient cataract, posterior cortex	1	0.4%	0	
100.314	incipient cataract, anterior sutures	1	0.4%	0	
100.330	generalized/complete cataract	1	0.4%	0	
100.345	*significant cataracts (summary)*	*5*	*2.1%*	*0*	
RETINA					
120.180	retinal dysplasia, geographic	2	0.8%	0	
OTHER					
900.000	other, unspecified	1	0.4%	0	
900.100	other, not inherited	4	1.6%	0	
900.110	other. suspect not inherited/significance unknown	1	0.4%	2	2.6%
NORMAL					
0.000	normal globe	208	85.6%	60	78.9%

SIBERIAN HUSKY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-4	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Presumed autosomal recessive	1, 5-8	NO	
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
E.	Cataract	Not defined	1, 4	NO	
F.	Retinal atrophy (*RPGR*)	X-linked	1, 9, 10	NO	Mutation in the *RPGR* gene
G.	Cone degeneration - (achromatopsia)	Autosomal recessive	10	NO	Mutation in the *CNGB3* gene
H.	Uveodermatologic syndrome	Not defined	1, 11-14	NO	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds.

Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In the Siberian Husky, the opacities are bilaterally symmetrical, round to oval and ring shaped. They occur early in life (0.5-2 years) and may progress to cause significant vision loss. When seen, it may be beneficial to feed a low fat diet and recheck the eyes the following year to see if the opacities resolve, ruling out inherited corneal dystrophy.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Siberian Husky, cataracts begin in the axial posterior cortex at approximately one year of age. Progression is variable and vision impairment may occur. In cases with rapid progression, secondary lens-induced uveitis and glaucoma may be associated with partial cataract resorption.

F. Retinal atrophy – (*RPGR*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In the Siberian Husky, one form of PRA, known as XLPRA1, is due to a mutation in the *RPGR* gene and is inherited as a recessive, sex-linked trait. A DNA test is available.

G. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A missense mutation in the same gene (*CNGB3*) that has been identified in CD-affected Alaskan Malamute-derived dogs has been detected in German Shorthaired Pointers affected with a clinically identical allelic disorder. A DNA test is available.

H. Uveodermatologic syndrome

Uveodermatologic syndrome in the Siberian Husky bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Siberian Huskies compared with other dog breeds. Affected dogs are generally young, ranging in age between 1-1/2 to 4 years.

References

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OCULAR DISORDERS REPORT
SIBERIAN HUSKY

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**37,828**		**5,862**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	7	0.0%	0	
10.000	glaucoma	12	0.0%	3	0.1%
EYELIDS					
20.110	eyelid dermoid	4	0.0%	0	
20.140	ectopic cilia	3	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	19	0.1%	1	0.0%
22.000	ectropion, unspecified	4	0.0%	0	
25.110	distichiasis	396	1.0%	61	1.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	3	0.1%
40.910	keratoconjunctivitis sicca	3	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.0%	0	
52.110	prolapsed gland of the third eyelid	2	0.0%	0	
CORNEA					
70.210	corneal pannus	21	0.1%	1	0.0%
70.220	pigmentary keratitis	3	0.0%	0	
70.700	corneal dystrophy	997	2.6%	100	1.7%
70.730	corneal endothelial degeneration	37	0.1%	1	0.0%
UVEA					
93.110	iris hypoplasia	3	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	8	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	891	2.4%	186	3.2%
93.720	persistent pupillary membranes, iris to lens	26	0.1%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	50	0.1%	7	0.1%
93.740	persistent pupillary membranes, iris sheets	5	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	14	0.0%	12	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	17	0.0%	2	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	20	0.1%	3	0.1%
97.150	chorioretinal coloboma, congenital	3	0.0%	1	0.0%
LENS					
100.200	cataract, unspecified	576	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown	688	1.8%	138	2.4%
100.301	punctate cataract, anterior cortex	67	0.2%	19	0.3%
100.302	punctate cataract, posterior cortex	199	0.5%	21	0.4%
100.303	punctate cataract, equatorial cortex	36	0.1%	5	0.1%
100.304	punctate cataract, anterior sutures	10	0.0%	3	0.1%
100.305	punctate cataract, posterior sutures	103	0.3%	9	0.2%
100.306	punctate cataract, nucleus	23	0.1%	10	0.2%
100.307	punctate cataract, capsular	29	0.1%	15	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.311	incipient cataract, anterior cortex	131	0.3%	22	0.4%
100.312	incipient cataract, posterior cortex	1,281	3.4%	104	1.8%
100.313	incipient cataract, equatorial cortex	63	0.2%	10	0.2%
100.314	incipient cataract, anterior sutures	18	0.0%	0	
100.315	incipient cataract, posterior sutures	260	0.7%	5	0.1%
100.316	incipient cataract, nucleus	91	0.2%	11	0.2%
100.317	incipient cataract, capsular	87	0.2%	19	0.3%
100.321	incomplete cataract, anterior cortex	5	0.0%	8	0.1%
100.322	incomplete cataract, posterior cortex	58	0.2%	85	1.5%
100.323	incomplete cataract, equatorial cortex	1	0.0%	9	0.2%
100.324	incomplete cataract, anterior sutures	1	0.0%	2	0.0%
100.325	incomplete cataract, posterior sutures	6	0.0%	3	0.1%
100.326	incomplete cataract, nucleus	10	0.0%	16	0.3%
100.327	incomplete cataract, capsular	7	0.0%	7	0.1%
100.328	y-suture tip opacities	6	0.0%	10	0.2%
100.330	generalized/complete cataract	463	1.2%	14	0.2%
100.340	resorbing/hypermature cataract	1	0.0%	1	0.0%
100.345	*significant cataracts (summary)*	*3,532*	*9.3%*	*408*	*7.0%*
100.375	*subluxation/luxation, unspecified*	*13*	*0.0%*	*2*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	47	0.1%	17	0.3%
110.135	PHPV/PTVL	6	0.0%	1	0.0%
110.200	vitreous degeneration-anterior chamber	0		1	0.0%
110.320	vitreal degeneration	37	0.1%	4	0.1%
FUNDUS					
97.110	choroidal hypoplasia	47	0.1%	16	0.3%
97.120	coloboma	16	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	91	0.2%	10	0.2%
120.180	retinal dysplasia, geographic	50	0.1%	10	0.2%
120.190	retinal dysplasia, detached	13	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	162	0.4%	11	0.2%
120.400	retinal hemorrhage	7	0.0%	0	
120.910	retinal detachment without dialysis	27	0.1%	0	
120.920	retinal detachment with dialysis	2	0.0%	1	0.0%
120.960	retinopathy	21	0.1%	27	0.5%
OPTIC NERVE					
130.110	micropapilla	3	0.0%	0	
130.120	optic nerve hypoplasia	7	0.0%	0	
130.150	optic disc coloboma	3	0.0%	0	
OTHER					
900.000	other, unspecified	354	0.9%	0	
900.100	other, not inherited	753	2.0%	11	0.2%
900.110	other. suspect not inherited/significance unknown	478	1.3%	324	5.5%
NORMAL					
0.000	normal globe	31,998	84.6%	4,689	80.0%

SILKEN WINDHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Vitreous degeneration	Not defined	1	Breeder option	
C.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1, 2	NO	Mutation in the *NHEJ1* gene
D.	Y-suture tip opacity	Not defined	1	Breeder option	
E.	Retinopathy	Not defined	1	Breeder option	

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

C. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

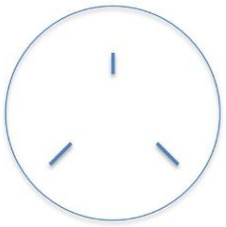
A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a

recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

OCULAR DISORDERS REPORT
SILKEN WINDHOUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 280 #	 %	2016-2020 405 #	 %
GLOBE					
0.110	microphthalmia	0		1	0.2%
EYELIDS					
25.110	distichiasis	3	1.1%	4	1.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	0.4%	3	0.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	16	5.7%	9	2.2%
100.302	punctate cataract, posterior cortex	1	0.4%	0	
100.305	punctate cataract, posterior sutures	1	0.4%	0	
100.307	punctate cataract, capsular	2	0.7%	0	
100.311	incipient cataract, anterior cortex	1	0.4%	4	1.0%
100.312	incipient cataract, posterior cortex	0		1	0.2%
100.315	incipient cataract, posterior sutures	1	0.4%	3	0.7%
100.317	incipient cataract, capsular	1	0.4%	0	
100.328	y-suture tip opacities	1	0.4%	2	0.5%
100.345	*significant cataracts (summary)*	*8*	*2.9%*	*10*	*2.5%*
VITREOUS					
110.200	vitreous degeneration-anterior chamber	0		3	0.7%
110.320	vitreal degeneration	5	1.8%	4	1.0%
FUNDUS					
97.110	choroidal hypoplasia	1	0.4%	0	
RETINA					
120.180	retinal dysplasia, geographic	3	1.1%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	1	0.4%	0	
120.960	retinopathy	0		5	1.2%
OTHER					
900.000	other, unspecified	2	0.7%	0	
900.100	other, not inherited	0		1	0.2%
900.110	other. suspect not inherited/significance unknown	7	2.5%	20	4.9%
NORMAL					
0.000	normal globe	255	91.1%	351	86.7%

SILKY TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1-3	NO	
D.	Vitreous degeneration	Not defined	1, 2, 4	Breeder option	
E.	Retinal atrophy (*prcd)*	Autosomal recessive	5	NO	Mutation in the *prcd* gene

Description and Comments

A. Entropion

A conformational defect resulting in an "in rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Silky Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gelatt KN, Samuelson DA, Barrie KP, et al. Biometry and clinical characteristics of congenital cataracts and microphthalmia in the Miniature Schnauzer. *J Am Vet Med Assoc*. 1983;183:99-102.

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OCULAR DISORDERS REPORT
SILKY TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**690**		**234**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
21.000	entropion, unspecified	1	0.1%	8	3.4%
25.110	distichiasis	3	0.4%	0	
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.9%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.4%
70.700	corneal dystrophy	8	1.2%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	45	6.5%	16	6.8%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	1	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	1	0.4%
LENS					
100.200	cataract, unspecified	4	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	35	5.1%	16	6.8%
100.301	punctate cataract, anterior cortex	9	1.3%	2	0.9%
100.302	punctate cataract, posterior cortex	4	0.6%	3	1.3%
100.303	punctate cataract, equatorial cortex	6	0.9%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	0		3	1.3%
100.306	punctate cataract, nucleus	1	0.1%	3	1.3%
100.307	punctate cataract, capsular	0		1	0.4%
100.311	incipient cataract, anterior cortex	12	1.7%	4	1.7%
100.312	incipient cataract, posterior cortex	18	2.6%	5	2.1%
100.313	incipient cataract, equatorial cortex	9	1.3%	1	0.4%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	2	0.3%	1	0.4%
100.316	incipient cataract, nucleus	0		1	0.4%
100.317	incipient cataract, capsular	1	0.1%	1	0.4%
100.321	incomplete cataract, anterior cortex	1	0.1%	1	0.4%
100.322	incomplete cataract, posterior cortex	1	0.1%	1	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.4%
100.328	y-suture tip opacities	0		4	1.7%
100.330	generalized/complete cataract	22	3.2%	1	0.4%
100.345	*significant cataracts (summary)*	*92*	*13.3%*	*33*	*14.1%*
VITREOUS					
110.135	PHPV/PTVL	0		1	0.4%
110.200	vitreous degeneration-anterior chamber	0		4	1.7%
110.320	vitreal degeneration	29	4.2%	14	6.0%

		1991-2015		2016-2020	
FUNDUS					
97.110	choroidal hypoplasia	2	0.3%	1	0.4%
RETINA					
120.170	retinal dysplasia, folds	4	0.6%	1	0.4%
120.180	retinal dysplasia, geographic	1	0.1%	1	0.4%
120.310	generalized progressive retinal atrophy (PRA)	8	1.2%	1	0.4%
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	0		1	0.4%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	1	0.4%
OTHER					
900.000	other, unspecified	12	1.7%	0	
900.100	other, not inherited	24	3.5%	0	
900.110	other. suspect not inherited/significance unknown	9	1.3%	10	4.3%
NORMAL					
0.000	normal globe	519	75.2%	160	68.4%

SLOUGHI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*rcd1a*)	Autosomal recessive	1	NO	Mutation in the *PDE6B* gene

Description and Comments

A. Retinal atrophy - *rcd1a*

A later onset degenerative disease of the retinal visual cells with visual deficits detectable at 2 to 3 years of age and which progresses to blindness. This abnormality may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. It is inherited as an autosomal recessive trait.

In the Sloughi, the disease is due to an 8-bp insertion in exon 21 of the *PDE6B* gene causing the *rcd1a* form of PRA. The disease is genetically distinct from that in the Irish Setter and has a later age of onset. A DNA test is available.

References

1. Dekomien G, Runte M, Godde R, et al. Generalized progressive retinal atrophy of Sloughi dogs is due to an 8-bp insertion in exon 21 of the PDE6B gene. *Cytogenet Cell Gene*t. 2000;90:261-267.

OCULAR DISORDERS REPORT
SLOUGHI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 32 #	 %	2016-2020 40 #	 %
EYELIDS					
25.110	distichiasis	0		2	5.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	3.1%	0	
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	6.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	3.1%	3	7.5%
VITREOUS					
110.320	vitreal degeneration	1	3.1%	0	
OTHER					
900.000	other, unspecified	1	3.1%	0	
NORMAL					
0.000	normal globe	31	96.9%	35	87.5%

SMOOTH FOX TERRIER*

*The Smooth Fox Terrier and the Wire Fox Terrier were originally considered two varieties of the same breed. They became separate breeds in 1985. It is likely that the same genetic diseases exist in both breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1, 2	NO	
B.	Lens luxation	Autosomal recessive	1, 3-7	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Martin CL and Wyman M. Primary glaucoma in the dog. *Vet Clin North Am*. 1978 May;8:257-286.

3. Lawson DD. Luxation of the crystalline lens in the dog. *J Small Anim Pract.* 1969;10:461.

4. Curtis R and Barnett KC. Primary lens luxation in the dog. *J Small Anim Pract*. 1980 Dec;21:657-668.

5. Hodgman SFJ. Abnormalities and defects in pedigree dogs: I. An investigation into the existence of abnormalities in pedigree dogs in British Isles. *J Small Anim Pract*. 1963;4:447.

6. Formston C. Observations on subluxation and luxation of the crystalline lens in the dog. *Journal of Comparative Pathology*. 1945;55:168.

7. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Vet Ophthalmol. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
SMOOTH FOX TERRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 270 #	 %	2016-2020 67 #	 %
CORNEA					
70.700	corneal dystrophy	0		1	1.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	13	4.8%	1	1.5%
93.720	persistent pupillary membranes, iris to lens	0		1	1.5%
93.730	persistent pupillary membranes, iris to cornea	0		1	1.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.4%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.4%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	1.1%	0	
100.311	incipient cataract, anterior cortex	1	0.4%	0	
100.312	incipient cataract, posterior cortex	2	0.7%	0	
100.330	generalized/complete cataract	2	0.7%	0	
100.345	*significant cataracts (summary)*	*5*	*1.9%*	*0*	
VITREOUS					
110.320	vitreal degeneration	3	1.1%	1	1.5%
RETINA					
120.170	retinal dysplasia, folds	1	0.4%	2	3.0%
120.310	generalized progressive retinal atrophy (PRA)	2	0.7%	1	1.5%
120.960	retinopathy	0		1	1.5%
OTHER					
900.000	other, unspecified	1	0.4%	0	
900.100	other, not inherited	6	2.2%	0	
900.110	other. suspect not inherited/significance unknown	3	1.1%	3	4.5%
NORMAL					
0.000	normal globe	240	88.9%	56	83.6%

SOFT-COATED WHEATEN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	1, 2	NO
D.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Van der Woerdt A. Multiple ocular anomalies in two related litters of Soft-Coated Wheaten Terriers. *Prog Vet Comp Ophthal*. 1995;5:78.

OCULAR DISORDERS REPORT
SOFT COATED WHEATEN TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**7,291**		**1,235**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	130	1.8%	38	3.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.1%	4	0.3%
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.0%	0	
CORNEA					
70.700	corneal dystrophy	54	0.7%	6	0.5%
UVEA					
93.140	corneal endothelial pigment without PPM	3	0.0%	0	
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	240	3.3%	67	5.4%
93.720	persistent pupillary membranes, iris to lens	18	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	3	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	42	0.6%	55	4.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.1%	4	0.3%
93.999	uveal cysts	15	0.2%	5	0.4%
LENS					
100.200	cataract, unspecified	24	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	341	4.7%	69	5.6%
100.301	punctate cataract, anterior cortex	27	0.4%	13	1.1%
100.302	punctate cataract, posterior cortex	9	0.1%	3	0.2%
100.303	punctate cataract, equatorial cortex	13	0.2%	2	0.2%
100.304	punctate cataract, anterior sutures	4	0.1%	4	0.3%
100.305	punctate cataract, posterior sutures	4	0.1%	1	0.1%
100.306	punctate cataract, nucleus	4	0.1%	0	
100.307	punctate cataract, capsular	12	0.2%	6	0.5%
100.311	incipient cataract, anterior cortex	29	0.4%	9	0.7%
100.312	incipient cataract, posterior cortex	29	0.4%	4	0.3%
100.313	incipient cataract, equatorial cortex	17	0.2%	2	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures	11	0.2%	2	0.2%
100.316	incipient cataract, nucleus	17	0.2%	1	0.1%
100.317	incipient cataract, capsular	12	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		2	0.2%
100.322	incomplete cataract, posterior cortex	0		3	0.2%
100.328	y-suture tip opacities	1	0.0%	3	0.2%
100.330	generalized/complete cataract	35	0.5%	0	
100.340	resorbing/hypermature cataract	0		1	0.1%
100.345	*significant cataracts (summary)*	*250*	*3.4%*	*57*	*4.6%*

LENS CONTINUED		1991-2015		2016-2020	
100.375	subluxation/luxation, unspecified	4	0.1%	1	0.1%
VITREOUS					
110.120	persistent hyaloid artery/remnant	68	0.9%	8	0.6%
110.135	PHPV/PTVL	6	0.1%	0	
110.320	vitreal degeneration	13	0.2%	2	0.2%
FUNDUS					
97.110	choroidal hypoplasia	17	0.2%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	70	1.0%	4	0.3%
120.180	retinal dysplasia, geographic	3	0.0%	1	0.1%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	0.2%	1	0.1%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	14	0.2%	0	
130.120	optic nerve hypoplasia	5	0.1%	0	
130.150	optic disc coloboma	9	0.1%	0	
OTHER					
900.000	other, unspecified	49	0.7%	0	
900.100	other, not inherited	183	2.5%	2	0.2%
900.110	other. suspect not inherited/significance unknown	58	0.8%	57	4.6%
NORMAL					
0.000	normal globe	6,330	86.8%	930	75.3%

SPANISH WATER DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 2	NO	Mutation in the *prcd* gene
C.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Spanish Water Dog is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in

their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and Data from OFA All-Breeds Report.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
SPANISH WATER DOG

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 215 #	 %	2016-2020 213 #	 %
EYELIDS					
25.110	distichiasis	2	0.9%	2	0.9%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.5%	0	
CORNEA					
70.700	corneal dystrophy	2	0.9%	1	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	7	3.3%	6	2.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.5%	0	
93.999	uveal cysts	0		1	0.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	15	7.0%	10	4.7%
100.302	punctate cataract, posterior cortex	1	0.5%	0	
100.305	punctate cataract, posterior sutures	0		1	0.5%
100.306	punctate cataract, nucleus	2	0.9%	1	0.5%
100.313	incipient cataract, equatorial cortex	1	0.5%	1	0.5%
100.316	incipient cataract, nucleus	1	0.5%	0	
100.317	incipient cataract, capsular	1	0.5%	0	
100.345	*significant cataracts (summary)*	*6*	*2.8%*	*3*	*1.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.5%	0	
110.320	vitreal degeneration	0		2	0.9%
RETINA					
120.170	retinal dysplasia, folds	5	2.3%	3	1.4%
120.180	retinal dysplasia, geographic	1	0.5%	3	1.4%
120.190	retinal dysplasia, detached	1	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	2.3%	3	1.4%
OPTIC NERVE					
130.110	micropapilla	0		1	0.5%
OTHER					
900.000	other, unspecified	4	1.9%	0	
900.100	other, not inherited	7	3.3%	0	
900.110	other. suspect not inherited/significance unknown	2	0.9%	16	7.5%
NORMAL					
0.000	normal globe	181	84.2%	172	80.8%

SPINONE ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder options
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Y-suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

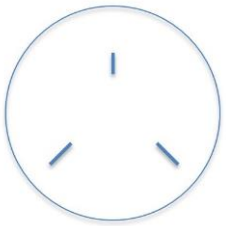
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Spinone Italiano breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
SPINONE ITALIANO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,060 #	 %	2016-2020 407 #	 %
GLOBE						
0.110	microphthalmia		1	0.0%	0	
EYELIDS						
20.160	macropalpebral fissure		3	0.1%	0	
21.000	entropion, unspecified		30	1.5%	2	0.5%
22.000	ectropion, unspecified		12	0.6%	6	1.5%
25.110	distichiasis		25	1.2%	8	2.0%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.0%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		3	0.1%	0	
52.110	prolapsed gland of the third eyelid		3	0.1%	0	
UVEA						
90.250	pigmentary uveitis		1	0.0%	0	
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		86	4.2%	34	8.4%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	2	0.5%
93.730	persistent pupillary membranes, iris to cornea		1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.1%	1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	0.3%	2	0.5%
93.999	uveal cysts		3	0.1%	0	
LENS						
100.200	cataract, unspecified		2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		107	5.2%	23	5.7%
100.301	punctate cataract, anterior cortex		6	0.3%	0	
100.302	punctate cataract, posterior cortex		3	0.1%	0	
100.303	punctate cataract, equatorial cortex		1	0.0%	1	0.2%
100.304	punctate cataract, anterior sutures		3	0.1%	0	
100.305	punctate cataract, posterior sutures		2	0.1%	3	0.7%
100.306	punctate cataract, nucleus		14	0.7%	0	
100.307	punctate cataract, capsular		3	0.1%	1	0.2%
100.311	incipient cataract, anterior cortex		13	0.6%	3	0.7%
100.312	incipient cataract, posterior cortex		6	0.3%	0	
100.313	incipient cataract, equatorial cortex		5	0.2%	0	
100.314	incipient cataract, anterior sutures		1	0.0%	0	
100.315	incipient cataract, posterior sutures		5	0.2%	1	0.2%
100.316	incipient cataract, nucleus		7	0.3%	5	1.2%
100.317	incipient cataract, capsular		0		2	0.5%
100.322	incomplete cataract, posterior cortex		0		1	0.2%
100.328	y-suture tip opacities		0		3	0.7%
100.330	generalized/complete cataract		5	0.2%	0	
100.345	*significant cataracts (summary)*		*76*	*3.7%*	*20*	*4.9%*
100.375	*subluxation/luxation, unspecified*		*3*	*0.1%*	*0*	

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	0	
110.200	vitreous degeneration-anterior chamber	2	0.1%	1	0.2%
110.320	vitreal degeneration	19	0.9%	0	
RETINA					
120.170	retinal dysplasia, folds	10	0.5%	0	
120.180	retinal dysplasia, geographic	0		1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	0.2%
OTHER					
900.000	other, unspecified	22	1.1%	0	
900.100	other, not inherited	62	3.0%	0	
900.110	other. suspect not inherited/significance unknown	15	0.7%	17	4.2%
NORMAL					
0.000	normal globe	1,801	87.4%	306	75.2%

ST. BERNARD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Entropion	Not defined	1, 2	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Persistent pupillary membrane - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In this breed, entropion is associated with an exceptionally large palpebral fissure.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest

threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Priester WA. Congenital ocular defects in cattle, horses, cats, and dogs. *J Am Vet Med Assoc*. 1972 Jun 1;160:1504-1511.

OCULAR DISORDERS REPORT
ST. BERNARD

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**213**		**128**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.160	macropalpebral fissure	21	9.9%	0	
21.000	entropion, unspecified	47	22.1%	33	25.8%
22.000	ectropion, unspecified	73	34.3%	34	26.6%
25.110	distichiasis	14	6.6%	5	3.9%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.5%	0	
52.110	prolapsed gland of the third eyelid	1	0.5%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.8%
70.700	corneal dystrophy	2	0.9%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	20	9.4%	13	10.2%
93.720	persistent pupillary membranes, iris to lens	0		1	0.8%
93.730	persistent pupillary membranes, iris to cornea	0		2	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.8%
93.999	uveal cysts	1	0.5%	1	0.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	12	5.6%	5	3.9%
100.302	punctate cataract, posterior cortex	2	0.9%	1	0.8%
100.303	punctate cataract, equatorial cortex	1	0.5%	0	
100.305	punctate cataract, posterior sutures	1	0.5%	0	
100.306	punctate cataract, nucleus	1	0.5%	0	
100.307	punctate cataract, capsular	1	0.5%	0	
100.311	incipient cataract, anterior cortex	2	0.9%	2	1.6%
100.312	incipient cataract, posterior cortex	3	1.4%	1	0.8%
100.313	incipient cataract, equatorial cortex	5	2.3%	1	0.8%
100.316	incipient cataract, nucleus	4	1.9%	0	
100.317	incipient cataract, capsular	0		1	0.8%
100.321	incomplete cataract, anterior cortex	1	0.5%	0	
100.326	incomplete cataract, nucleus	1	0.5%	0	
100.328	y-suture tip opacities	1	0.5%	0	
100.330	generalized/complete cataract	8	3.8%	0	
100.345	*significant cataracts (summary)*	*31*	*14.6%*	*6*	*4.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	1.4%	0	
110.135	PHPV/PTVL	1	0.5%	0	
RETINA					
120.170	retinal dysplasia, folds	5	2.3%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.5%	0	
130.120	optic nerve hypoplasia	1	0.5%	0	

	1991-2015	2016-2020
OTHER		
900.000 other, unspecified	3 1.4%	0
900.100 other, not inherited	6 2.8%	4 3.1%
900.110 other. suspect not inherited/significance unknown	9 4.2%	8 6.2%
NORMAL		
0.000 normal globe	84 39.4%	57 44.5%

STAFFORDSHIRE BULL TERRIER*

* Please note that since 1972 the AKC considers the Staffordshire Bull Terrier a different breed from the American Staffordshire Terrier.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
C.	Cataract	Autosomal recessive	1-4	NO	Mutation in the *HSF4* gene
D.	Persistent hyperplastic primary vitreous (PHPV)	Not defined	1, 5, 6	NO	
E.	Vitreous degeneration	Not defined	1	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Staffordshire Bull Terrier, cataracts usually develop by one year of age. There is initial opacification of the suture lines progressing to nuclear and cortical cataract formation; complete cataracts and blindness develop by three years of age. The condition is inherited as an autosomal recessive mutation in the *HSF4* gene (*HSF4-1*). A DNA test is available.

D. Persistent hyperplastic primary vitreous (PHPV)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent tunica vasculosa lentis (PTVL) which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result. The disease is an inherited disorder in the breed, but the mode of inheritance has not been defined. The results of current studies cannot rule out autosomal recessive or a dominant trait with incomplete penetrance.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978;19:109-120.

3. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305-316.

4. Mellersh CS, McLaughlin B, Ahonen S, et al. Mutation in HSF4 is associated with hereditary cataract in the Australian Shepherd. *Vet Ophthalmol*. 2009;12:372-378.

5. Curtis R, Barnett KC, Leon A. Persistent hyperplastic primary vitreous in the Staffordshire Bull Terrier. *Vet Rec*. 1984;115:385.

6. Leon A, Curtis R, Barnett K. Hereditary persistent hyperplastic primary vitreous in the Staffordshire Bull Terrier. *J Am Anim Hosp Assoc*. 1986;22:765-774.

OCULAR DISORDERS REPORT
STAFFORDSHIRE BULL TERRIER

	TOTAL DOGS EXAMINED	1991-2015 846		2016-2020 484	
	Diagnostic Name	**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	73	8.6%	29	6.0%
CORNEA					
70.700	corneal dystrophy	1	0.1%	3	0.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	20	2.4%	16	3.3%
93.720	persistent pupillary membranes, iris to lens	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.4%	13	2.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	6	0.7%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	32	3.8%	17	3.5%
100.301	punctate cataract, anterior cortex	5	0.6%	5	1.0%
100.302	punctate cataract, posterior cortex	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.2%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	0		4	0.8%
100.307	punctate cataract, capsular	2	0.2%	1	0.2%
100.311	incipient cataract, anterior cortex	2	0.2%	4	0.8%
100.312	incipient cataract, posterior cortex	6	0.7%	3	0.6%
100.313	incipient cataract, equatorial cortex	4	0.5%	1	0.2%
100.314	incipient cataract, anterior sutures	0		1	0.2%
100.315	incipient cataract, posterior sutures	1	0.1%	2	0.4%
100.317	incipient cataract, capsular	2	0.2%	1	0.2%
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.328	y-suture tip opacities	0		3	0.6%
100.330	generalized/complete cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*26*	*3.1%*	*27*	*5.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.5%	2	0.4%
110.200	vitreous degeneration-anterior chamber	0		1	0.2%
110.320	vitreal degeneration	18	2.1%	5	1.0%
RETINA					
120.170	retinal dysplasia, folds	5	0.6%	3	0.6%
120.180	retinal dysplasia, geographic	4	0.5%	2	0.4%
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	2	0.4%
OTHER					
900.000	other, unspecified	9	1.1%	0	
900.100	other, not inherited	20	2.4%	0	
900.110	other. suspect not inherited/significance unknown	15	1.8%	13	2.7%
NORMAL					
0.000	normal globe	695	82.2%	375	77.5%

STANDARD SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Y-suture tip opacity	Not defined	1	Breeder option
D.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

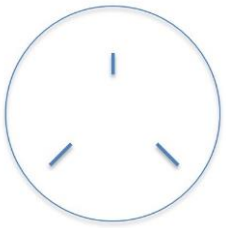
B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

There are apparently several forms of cataracts in the Standard Schnauzer: 1) posterior cortex and posterior/total nucleus involvement, with slow progression; 2) dense posterior polar opacity near the sub-capsular region which progresses rapidly to very dense posterior polar plaques in young animals; 3) dense posterior polar opacity like that reported in young animals but found in older animals with variable progression.

C. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Standard Schnauzer breed. The conditions listed are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
STANDARD SCHNAUZER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 3,074 #	%	2016-2020 587 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	0	
10.000	glaucoma		2	0.1%	0	
EYELIDS						
20.140	ectopic cilia		0		1	0.2%
25.110	distichiasis		64	2.1%	6	1.0%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.0%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		2	0.1%	1	0.2%
52.110	prolapsed gland of the third eyelid		2	0.1%	0	
CORNEA						
70.700	corneal dystrophy		21	0.7%	6	1.0%
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		14	0.5%	2	0.3%
93.720	persistent pupillary membranes, iris to lens		3	0.1%	2	0.3%
93.730	persistent pupillary membranes, iris to cornea		3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		7	0.2%	7	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	0	
93.999	uveal cysts		2	0.1%	0	
LENS						
100.200	cataract, unspecified		2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		113	3.7%	31	5.3%
100.301	punctate cataract, anterior cortex		10	0.3%	6	1.0%
100.302	punctate cataract, posterior cortex		5	0.2%	4	0.7%
100.303	punctate cataract, equatorial cortex		5	0.2%	0	
100.304	punctate cataract, anterior sutures		1	0.0%	1	0.2%
100.305	punctate cataract, posterior sutures		10	0.3%	4	0.7%
100.306	punctate cataract, nucleus		4	0.1%	3	0.5%
100.307	punctate cataract, capsular		11	0.4%	2	0.3%
100.311	incipient cataract, anterior cortex		11	0.4%	4	0.7%
100.312	incipient cataract, posterior cortex		12	0.4%	2	0.3%
100.313	incipient cataract, equatorial cortex		16	0.5%	1	0.2%
100.314	incipient cataract, anterior sutures		2	0.1%	0	
100.315	incipient cataract, posterior sutures		1	0.0%	1	0.2%
100.316	incipient cataract, nucleus		9	0.3%	0	
100.317	incipient cataract, capsular		4	0.1%	1	0.2%
100.321	incomplete cataract, anterior cortex		0		1	0.2%
100.322	incomplete cataract, posterior cortex		0		1	0.2%
100.323	incomplete cataract, equatorial cortex		0		1	0.2%
100.328	y-suture tip opacities		1	0.0%	8	1.4%
100.330	generalized/complete cataract		13	0.4%	1	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.345	*significant cataracts (summary)*	*117*	*3.8%*	*41*	*7.0%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	1	0.2%
110.320	vitreal degeneration	18	0.6%	1	0.2%
RETINA					
120.170	retinal dysplasia, folds	30	1.0%	2	0.3%
120.180	retinal dysplasia, geographic	4	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	23	0.7%	1	0.2%
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	5	0.2%	1	0.2%
130.120	optic nerve hypoplasia	3	0.1%	1	0.2%
130.150	optic disc coloboma	0		1	0.2%
OTHER					
900.000	other, unspecified	31	1.0%	0	
900.100	other, not inherited	71	2.3%	1	0.2%
900.110	other. suspect not inherited/significance unknown	22	0.7%	42	7.2%
NORMAL					
0.000	normal globe	2,745	89.3%	471	80.2%

SUSSEX SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO
D.	Persistent hyaloid artery	Not defined	1	Breeder option
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular

strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Sussex Spaniel breed. The conditions listed are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
SUSSEX SPANIEL

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**423**		**67**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.160	macropalpebral fissure	23	5.4%	0	
21.000	entropion, unspecified	1	0.2%	0	
22.000	ectropion, unspecified	30	7.1%	3	4.5%
25.110	distichiasis	24	5.7%	5	7.5%
NICTITANS					
52.110	prolapsed gland of the third eyelid	0		1	1.5%
CORNEA					
70.700	corneal dystrophy	2	0.5%	0	
UVEA					
93.110	iris hypoplasia	2	0.5%	1	1.5%
93.150	iris coloboma	7	1.7%	1	1.5%
93.710	persistent pupillary membranes, iris to iris	2	0.5%	3	4.5%
93.720	persistent pupillary membranes, iris to lens	6	1.4%	1	1.5%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.5%	1	1.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	15	3.5%	2	3.0%
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	0		1	1.5%
100.307	punctate cataract, capsular	1	0.2%	0	
100.312	incipient cataract, posterior cortex	2	0.5%	0	
100.315	incipient cataract, posterior sutures	2	0.5%	0	
100.316	incipient cataract, nucleus	2	0.5%	0	
100.317	incipient cataract, capsular	4	0.9%	1	1.5%
100.322	incomplete cataract, posterior cortex	0		1	1.5%
100.328	y-suture tip opacities	0		1	1.5%
100.330	generalized/complete cataract	2	0.5%	0	
100.345	*significant cataracts (summary)*	*14*	*3.3%*	*4*	*6.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	36	8.5%	4	6.0%
110.135	PHPV/PTVL	4	0.9%	0	
110.320	vitreal degeneration	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	42	9.9%	3	4.5%
120.180	retinal dysplasia, geographic	2	0.5%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.2%	0	
130.120	optic nerve hypoplasia	1	0.2%	0	
130.150	optic disc coloboma	3	0.7%	0	
OTHER					
900.000	other, unspecified	10	2.4%	0	
900.100	other, not inherited	20	4.7%	0	

OTHER CONTINUED	1991-2015	2016-2020
900.110 other. suspect not inherited/significance unknown	5 1.2%	4 6.0%
NORMAL		
0.000 normal globe	265 62.6%	48 71.6%

SWEDISH LAPPHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Swedish Lapphund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Swedish Lapphund. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563. PMID: 16938425

OCULAR DISORDERS REPORT
SWEDISH LAPPHUND

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 3 # %	2016-2020 9 # %
UVEA			
93.750	persistent pupillary membranes, lens pigment foci/no strands	0	1 11.1%
LENS			
100.210	cataract. suspect not inherited/significance unknown	1 33.3%	0
100.305	punctate cataract, posterior sutures	1 33.3%	0
100.315	incipient cataract, posterior sutures	1 33.3%	0
100.328	y-suture tip opacities	1 33.3%	0
100.345	*significant cataracts (summary)*	*3 100.0%*	*0*
RETINA			
120.310	generalized progressive retinal atrophy (PRA)	1 33.3%	0
NORMAL			
0.000	normal globe	0	8 88.9%

SWEDISH VALLHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to lens	Not defined	1	NO	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Vitreous degeneration	Not defined	1	Breeder option	
G.	Retinopathy	Presumed autosomal recessive	1-4	NO	Mutation in the *MERTK* gene
H.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Swedish Vallhund, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear

between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

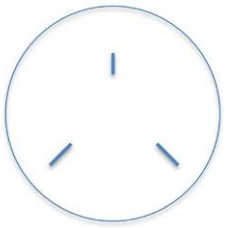
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinopathy

Swedish Vallhunds have a unique form of retinal degeneration compared to most forms of PRA. The condition is multifocal rather than diffuse and the age of onset and rate of progression vary dramatically, even between littermates. The clinical signs progress in three stages. (A. Komaromy, personal communication 2016)

- Stage one usually occurs between 2-3 years of age and is characterized by mottling or multifocal brown discoloration of the tapetal fundus – this should be marked as retinopathy even though visual deficits are not yet noted.

- In stage two, geographic thinning of the retina can be seen and subtle night vision deficits are observed.

- In stage three, the retinal thinning becomes more generalized with small islands of retinal sparing and deficits are noted in both photopic and scotopic vision. The disease has been associated with a mutation in the *MERTK* gene on canine chromosome 17. Dogs homozogous for the mutation have an 18 fold increased risk of developing the retinopathy. However, the actual causative mutation has not yet been identified.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Cooper AE, Ahonen S, Rowlan JS, et al. A novel form of progressive retinal atrophy in Swedish Vallhund dogs. *PloS one*. 2014;9:e106610.

3. Ahonen SJ, Arumilli M, Seppala E, et al. Increased expression of MERTK is associated with a unique form of canine retinopathy. *PloS one*. 2014;9:e114552.

4. Everson R, Pettitt L, Forman OP, et al. An intronic LINE-1 insertion in MRTK is strongly associated with retinopathy in Swedish Vallhund Dogs. PLoS one. 2017; 12(8):e0183021

OCULAR DISORDERS REPORT
SWEDISH VALLHUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,398 #	%	2016-2020 343 #	%
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
25.110	distichiasis		36	2.6%	2	0.6%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.1%	0	
CORNEA						
70.700	corneal dystrophy		16	1.1%	7	2.0%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		238	17.0%	77	22.4%
93.720	persistent pupillary membranes, iris to lens		7	0.5%	3	0.9%
93.730	persistent pupillary membranes, iris to cornea		2	0.1%	1	0.3%
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		5	0.4%	7	2.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.810	uveal melanoma		2	0.1%	0	
93.999	uveal cysts		5	0.4%	1	0.3%
LENS						
100.210	cataract. suspect not inherited/significance unknown		209	14.9%	33	9.6%
100.301	punctate cataract, anterior cortex		8	0.6%	1	0.3%
100.302	punctate cataract, posterior cortex		3	0.2%	0	
100.303	punctate cataract, equatorial cortex		2	0.1%	2	0.6%
100.305	punctate cataract, posterior sutures		10	0.7%	3	0.9%
100.306	punctate cataract, nucleus		10	0.7%	6	1.7%
100.307	punctate cataract, capsular		1	0.1%	2	0.6%
100.311	incipient cataract, anterior cortex		14	1.0%	7	2.0%
100.312	incipient cataract, posterior cortex		3	0.2%	1	0.3%
100.313	incipient cataract, equatorial cortex		7	0.5%	0	
100.314	incipient cataract, anterior sutures		2	0.1%	2	0.6%
100.315	incipient cataract, posterior sutures		6	0.4%	0	
100.316	incipient cataract, nucleus		13	0.9%	2	0.6%
100.321	incomplete cataract, anterior cortex		1	0.1%	1	0.3%
100.322	incomplete cataract, posterior cortex		0		1	0.3%
100.323	incomplete cataract, equatorial cortex		1	0.1%	0	
100.328	y-suture tip opacities		0		4	1.2%
100.330	generalized/complete cataract		7	0.5%	0	
100.345	*significant cataracts (summary)*		*88*	*6.3%*	*32*	*9.3%*
VITREOUS						
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitreous degeneration-anterior chamber		1	0.1%	1	0.3%
110.320	vitreal degeneration		45	3.2%	8	2.3%
FUNDUS						
97.110	choroidal hypoplasia		0		1	0.3%

		1991-2015		2016-2020	
RETINA					
120.170	retinal dysplasia, folds	23	1.6%	3	0.9%
120.180	retinal dysplasia, geographic	4	0.3%	2	0.6%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	45	3.2%	2	0.6%
120.960	retinopathy	40	2.9%	15	4.4%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	4	1.2%
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	47	3.4%	0	
900.100	other, not inherited	71	5.1%	2	0.6%
900.110	other. suspect not inherited/significance unknown	50	3.6%	31	9.0%
NORMAL					
0.000	normal globe	897	64.2%	167	48.7%

TEDDY ROOSEVELT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Teddy Roosevelt Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
TEDDY ROOSEVELT TERRIER

Diagnostic Name	1991-2015 TOTAL DOGS EXAMINED 4 # %	2016-2020 2 # %
LENS		
100.311 incipient cataract, anterior cortex	1 25.0%	0
100.312 incipient cataract, posterior cortex	1 25.0%	0
100.313 incipient cataract, equatorial cortex	1 25.0%	0
100.345 significant cataracts (summary)	*3 75.0%*	*0*
VITREOUS		
110.200 vitreous degeneration-anterior chamber	0	1 50.0%
OTHER		
900.110 other. suspect not inherited/significance unknown	2 50.0%	0
NORMAL		
0.000 normal globe	1 25.0%	1 50.0%

TENTERFIELD TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Tenterfield Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

TIBETAN MASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Tibetan Mastiff breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
TIBETAN MASTIFF

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 44 #	 %	2016-2020 46 #	 %
EYELIDS					
21.000	entropion, unspecified	3	6.8%	0	
22.000	ectropion, unspecified	0		1	2.2%
25.110	distichiasis	1	2.3%	4	8.7%
CORNEA					
70.700	corneal dystrophy	1	2.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	4	9.1%	7	15.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	11.4%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	2.3%	2	4.3%
100.301	punctate cataract, anterior cortex	1	2.3%	0	
100.302	punctate cataract, posterior cortex	0		1	2.2%
100.307	punctate cataract, capsular	0		1	2.2%
100.315	incipient cataract, posterior sutures	0		1	2.2%
100.317	incipient cataract, capsular	0		2	4.3%
100.345	*significant cataracts (summary)*	*1*	*2.3%*	*5*	*10.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	2.2%
OTHER					
900.000	other, unspecified	2	4.5%	0	
900.110	other. suspect not inherited/significance unknown	0		3	6.5%
NORMAL					
0.000	normal globe	32	72.7%	31	67.4%

TIBETAN SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Y-suture tip opacity	Not defined	1	Breeder option	
F.	Retinal atrophy *FAM161A*	Autosomal recessive	1-3	NO	Mutation in the *FAM161A* gene

Descriptions and Comments

A. Entropion

A conformational defect resulting in an "in rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

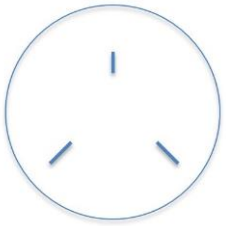
Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

F. Retinal atrophy - *FAM161A*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In most breeds PRA is inherited as an autosomal recessive trait.

In the Tibetan Spaniel, a mutation in *FAM161A* causes a later onset (4-5 years) of PRA. This form is being called progressive retinal atrophy 3 (PRA3) and appears to be the causative mutation in about 60% of Tibetan Spaniels with PRA. This form is inherited as an autosomal recessive trait. A DNA test for PRA3 is available. This test will not detect PRA caused by other genetic mutations. At least one other form of PRA appears to be present in the Tibetan

Spaniel.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Bjerkas E. Progressive retinal atrophy in dogs in Norway. *Norsk Veterinaertidsskrift*. 1991;103:601-610.

3. Downs LM, Mellersh CS. An Intronic SINE insertion in FAM161A that causes exon-skipping is associated with progressive retinal atrophy in Tibetan Spaniels and Tibetan Terriers. *PLoS One*. 2014;9:e93990.

OCULAR DISORDERS REPORT
TIBETAN SPANIEL

		1991-2015 3,208		2016-2020 362	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
20.140	ectopic cilia	4	0.1%	0	
20.160	macropalpebral fissure	5	0.2%	0	
21.000	entropion, unspecified	89	2.8%	3	0.8%
22.000	ectropion, unspecified	2	0.1%	0	
25.110	distichiasis	278	8.7%	22	6.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
40.910	keratoconjunctivitis sicca	2	0.1%	1	0.3%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	0	
52.110	prolapsed gland of the third eyelid	6	0.2%	1	0.3%
CORNEA					
70.210	corneal pannus	8	0.2%	0	
70.220	pigmentary keratitis	18	0.6%	3	0.8%
70.700	corneal dystrophy	10	0.3%	0	
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	1	0.0%	0	
93.150	iris coloboma	4	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	58	1.8%	11	3.0%
93.720	persistent pupillary membranes, iris to lens	4	0.1%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	6	1.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.810	uveal melanoma	2	0.1%	0	
93.999	uveal cysts	2	0.1%	1	0.3%
LENS					
100.200	cataract, unspecified	9	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	80	2.5%	8	2.2%
100.301	punctate cataract, anterior cortex	4	0.1%	3	0.8%
100.302	punctate cataract, posterior cortex	2	0.1%	0	
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	9	0.3%	2	0.6%
100.306	punctate cataract, nucleus	1	0.0%	0	
100.307	punctate cataract, capsular	1	0.0%	0	
100.311	incipient cataract, anterior cortex	21	0.7%	0	
100.312	incipient cataract, posterior cortex	12	0.4%	0	
100.313	incipient cataract, equatorial cortex	6	0.2%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.1%	1	0.3%

LENS CONTINUED		1991-2015		2016-2020	
100.316	incipient cataract, nucleus	7	0.2%	0	
100.317	incipient cataract, capsular	2	0.1%	0	
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.328	y-suture tip opacities	5	0.2%	7	1.9%
100.330	generalized/complete cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*90*	*2.8%*	*13*	*3.6%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.2%	1	0.3%
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitreous degeneration-anterior chamber	1	0.0%	1	0.3%
110.320	vitreal degeneration	13	0.4%	2	0.6%
RETINA					
120.170	retinal dysplasia, folds	9	0.3%	0	
120.180	retinal dysplasia, geographic	1	0.0%	3	0.8%
120.190	retinal dysplasia, detached	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	28	0.9%	1	0.3%
120.960	retinopathy	1	0.0%	4	1.1%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.1%	0	
130.150	optic disc coloboma	7	0.2%	0	
OTHER					
900.000	other, unspecified	32	1.0%	0	
900.100	other, not inherited	75	2.3%	2	0.6%
900.110	other. suspect not inherited/significance unknown	32	1.0%	21	5.8%
NORMAL					
0.000	normal globe	2,612	81.4%	280	77.3%

TIBETAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Lens luxation	Autosomal recessive	1, 2-7	NO	Mutation in the *ADAMTS17* gene
F.	Retinal atrophy *FAM161A*	Autosomal recessive	1, 3, 8-11	NO	Mutation in the *FAM161A* gene
G.	Retinal atrophy - Rod-cone dysplasia (*rcd4*)	Autosomal recessive	14	NO	Mutation in the *C2orf71* gene
H.	Ceroid lipofuscinosis	Not defined	13, 14	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Retinal atrophy - *FAM161A*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky and Samoyed, in most breeds studied to date, PRA is inherited as an autosomal recessive trait.

There are ERG studies to indicate that there is depression of the B wave at 10-12 weeks of age in the second variety and slower depression in the first variety. Some may have no obvious signs at 5-6 years of age, only to develop clinical signs at 6-7 years of age. It is logical that any animal found with signs of bilateral atrophy should not be bred. Members of the family of the affected animal should be carefully screened. Perhaps, ERG in animals less than 4 years of age is logical, especially if the animal is intended for breed foundation.

In the Tibetan Terrier a mutation in *FAM161A* causes a later onset (4-5 years) of PRA. This form is being called progressive retinal atrophy 3 (PRA3). This form is inherited as an autosomal recessive trait. A DNA test for PRA3 is available. This test will not detect PRA caused by other genetic mutations. At least one other form of PRA appears to be present in the Tibetan Terrier.

G. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA initially identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A mutation-based gene test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and is of no value in identifying other forms of PRA.

H. Ceroid Lipofuscinosis

An inherited disease of man and animal characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease. In the Tibetan Terrier, moderate visual impairment can occur in low-light conditions.

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OCULAR DISORDERS REPORT
TIBETAN TERRIER

	TOTAL DOGS EXAMINED	1991-2015 8,299		2016-2020 1,093	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	4	0.0%	0	
10.000	glaucoma	3	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	120	1.4%	5	0.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	4	0.4%
NICTITANS					
52.110	prolapsed gland of the third eyelid	4	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	3	0.0%	1	0.1%
70.700	corneal dystrophy	88	1.1%	8	0.7%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	487	5.9%	63	5.8%
93.720	persistent pupillary membranes, iris to lens	21	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	40	0.5%	0	
93.740	persistent pupillary membranes, iris sheets	10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	34	0.4%	37	3.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	11	0.1%	4	0.4%
93.810	uveal melanoma	0		1	0.1%
93.999	uveal cysts	0		1	0.1%
LENS					
100.200	cataract, unspecified	34	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	380	4.6%	64	5.9%
100.301	punctate cataract, anterior cortex	71	0.9%	9	0.8%
100.302	punctate cataract, posterior cortex	36	0.4%	3	0.3%
100.303	punctate cataract, equatorial cortex	11	0.1%	5	0.5%
100.304	punctate cataract, anterior sutures	12	0.1%	0	
100.305	punctate cataract, posterior sutures	6	0.1%	2	0.2%
100.306	punctate cataract, nucleus	9	0.1%	1	0.1%
100.307	punctate cataract, capsular	12	0.1%	5	0.5%
100.311	incipient cataract, anterior cortex	62	0.7%	8	0.7%
100.312	incipient cataract, posterior cortex	67	0.8%	7	0.6%
100.313	incipient cataract, equatorial cortex	36	0.4%	2	0.2%
100.314	incipient cataract, anterior sutures	12	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	13	0.2%	1	0.1%
100.316	incipient cataract, nucleus	9	0.1%	2	0.2%
100.317	incipient cataract, capsular	5	0.1%	0	
100.321	incomplete cataract, anterior cortex	5	0.1%	6	0.5%
100.322	incomplete cataract, posterior cortex	3	0.0%	3	0.3%
100.323	incomplete cataract, equatorial cortex	2	0.0%	3	0.3%
100.326	incomplete cataract, nucleus	0		1	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	38	0.5%	3	0.3%
100.340	resorbing/hypermature cataract	1	0.0%	1	0.1%
100.345	*significant cataracts (summary)*	*444*	*5.4%*	*63*	*5.8%*
100.375	*subluxation/luxation, unspecified*	*17*	*0.2%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.0%	2	0.2%
110.135	PHPV/PTVL	2	0.0%	0	
110.320	vitreal degeneration	39	0.5%	2	0.2%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	10	0.1%	2	0.2%
120.180	retinal dysplasia, geographic	4	0.0%	1	0.1%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	124	1.5%	0	
120.400	retinal hemorrhage	3	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.1%
120.960	retinopathy	3	0.0%	7	0.6%
OPTIC NERVE					
130.110	micropapilla	2	0.0%	0	
130.120	optic nerve hypoplasia	4	0.0%	1	0.1%
OTHER					
900.000	other, unspecified	82	1.0%	0	
900.100	other, not inherited	147	1.8%	2	0.2%
900.110	other. suspect not inherited/significance unknown	61	0.7%	43	3.9%
NORMAL					
0.000	normal globe	7,077	85.3%	860	78.7%

TOY AUSTRALIAN SHEPHERD

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Iris coloboma	Not defined	1	NO	
D.	Iris hypoplasia	Not defined	1	Breeder option	
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
F.	Cataract	Autosomal co-dominant	1, 7, 8	NO	Mutation in the *HSF4-2* gene
G.	Retinal atrophy (*prcd*)	Autosomal recessive	1, 9	NO	Mutation in the *prcd* gene
H.	Cone degeneration - day blindness	Autosomal recessive	10	NO	Mutation in the *CNGB3* gene
I.	Multifocal retinopathy - *cmr1*	Autosomal recessive	11	Breeder option	Mutation in the *BEST1* gene
J.	Choroidal hypoplasia (Collie Eye Anomaly) - Optic nerve coloboma - Retinal detachment - Retinal hemorrhage - Staphyloma/coloboma	Autosomal recessive	1, 12	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merled coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

D. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the *HSF4-2* mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

G. Retinal atrophy - *prcd*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Toy Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

H. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

I. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene

(*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

J. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

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OCULAR DISORDERS REPORT
TOY AUSTRALIAN SHEPHERD

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**923**		**156**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	4	0.4%	0	
EYELIDS					
25.110	distichiasis	41	4.4%	9	5.8%
CORNEA					
70.700	corneal dystrophy	1	0.1%	3	1.9%
UVEA					
93.110	iris hypoplasia	15	1.6%	7	4.5%
93.150	iris coloboma	18	2.0%	1	0.6%
93.180	Iiris sphincter dysplasia	3	0.3%	0	
93.710	persistent pupillary membranes, iris to iris	103	11.2%	13	8.3%
93.720	persistent pupillary membranes, iris to lens	7	0.8%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.2%	1	0.6%
93.740	persistent pupillary membranes, iris sheets	0		1	0.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	12	1.3%	3	1.9%
100.302	punctate cataract, posterior cortex	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.6%
100.306	punctate cataract, nucleus	0		1	0.6%
100.311	incipient cataract, anterior cortex	4	0.4%	0	
100.312	incipient cataract, posterior cortex	1	0.1%	0	
100.313	incipient cataract, equatorial cortex	2	0.2%	0	
100.317	incipient cataract, capsular	2	0.2%	0	
100.330	generalized/complete cataract	1	0.1%	0	
100.345	*significant cataracts (summary)*	*13*	*1.4%*	*2*	*1.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.5%	0	
110.135	PHPV/PTVL	2	0.2%	0	
110.320	vitreal degeneration	2	0.2%	1	0.6%
RETINA					
120.170	retinal dysplasia, folds	3	0.3%	0	
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	10	1.1%	1	0.6%
130.120	optic nerve hypoplasia	2	0.2%	0	
OTHER					
900.000	other, unspecified	6	0.7%	0	
900.100	other, not inherited	8	0.9%	0	

OTHER CONTINUED	1991-2015	2016-2020
900.110 other. suspect not inherited/significance unknown	6 0.7%	5 3.2%
NORMAL		
0.000 normal globe	786 85.2%	115 73.7%

TOY FOX TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Lens luxation	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011 Nov;14:378-384.

OCULAR DISORDERS REPORT
TOY FOX TERRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 193 #	 %	2016-2020 32 #	 %
EYELIDS					
25.110	distichiasis	2	1.0%	0	
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	3.1%
CORNEA					
70.700	corneal dystrophy	0		1	3.1%
70.730	corneal endothelial degeneration	1	0.5%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	19	9.8%	1	3.1%
93.720	persistent pupillary membranes, iris to lens	2	1.0%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.5%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	1.6%	1	3.1%
100.311	incipient cataract, anterior cortex	5	2.6%	1	3.1%
100.312	incipient cataract, posterior cortex	1	0.5%	1	3.1%
100.313	incipient cataract, equatorial cortex	0		1	3.1%
100.316	incipient cataract, nucleus	0		1	3.1%
100.321	incomplete cataract, anterior cortex	0		1	3.1%
100.345	*significant cataracts (summary)*	*6*	*3.1%*	*5*	*15.6%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.5%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.5%	0	
110.320	vitreal degeneration	3	1.6%	1	3.1%
RETINA					
120.170	retinal dysplasia, folds	7	3.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	1.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	1.0%	0	
OTHER					
900.000	other, unspecified	2	1.0%	0	
900.100	other, not inherited	3	1.6%	0	
900.110	other. suspect not inherited/significance unknown	4	2.1%	3	9.4%
NORMAL					
0.000	normal globe	155	80.3%	25	78.1%

VIZSLA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2	NO
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract	Not defined	1	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation,

specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Strom AR, Hassig M, Iburg TM, et al. Epidemiology of canine glaucoma presented to University of Zurich from 1995 to 2009. Part 1: Congenital and primary glaucoma (4 and 123 cases). *Vet Ophthalmol*. 2011 Mar;14:121-126.

OCULAR DISORDERS REPORT
VIZSLA

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 2,890 #	%	2016-2020 1,286 #	%
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
21.000	entropion, unspecified		3	0.1%	0	
22.000	ectropion, unspecified		3	0.1%	0	
25.110	distichiasis		25	0.9%	10	0.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.1%
40.910	keratoconjunctivitis sicca		1	0.0%	1	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		4	0.1%	0	
52.110	prolapsed gland of the third eyelid		7	0.2%	0	
CORNEA						
70.700	corneal dystrophy		38	1.3%	17	1.3%
70.730	corneal endothelial degeneration		2	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		58	2.0%	27	2.1%
93.720	persistent pupillary membranes, iris to lens		12	0.4%	2	0.2%
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		89	3.1%	100	7.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	2	0.2%
93.999	uveal cysts		2	0.1%	0	
LENS						
100.200	cataract, unspecified		4	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		105	3.6%	34	2.6%
100.301	punctate cataract, anterior cortex		10	0.3%	2	0.2%
100.302	punctate cataract, posterior cortex		15	0.5%	6	0.5%
100.303	punctate cataract, equatorial cortex		2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		4	0.1%	1	0.1%
100.307	punctate cataract, capsular		8	0.3%	6	0.5%
100.311	incipient cataract, anterior cortex		16	0.6%	4	0.3%
100.312	incipient cataract, posterior cortex		19	0.7%	16	1.2%
100.313	incipient cataract, equatorial cortex		19	0.7%	1	0.1%
100.314	incipient cataract, anterior sutures		1	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures		4	0.1%	0	
100.316	incipient cataract, nucleus		2	0.1%	1	0.1%
100.317	incipient cataract, capsular		6	0.2%	3	0.2%
100.326	incomplete cataract, nucleus		0		1	0.1%
100.328	y-suture tip opacities		2	0.1%	1	0.1%
100.330	generalized/complete cataract		2	0.1%	0	
100.345	*significant cataracts (summary)*		*114*	*3.9%*	*44*	*3.4%*
100.375	*subluxation/luxation, unspecified*		*2*	*0.1%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		3	0.1%	2	0.2%
110.135	PHPV/PTVL		1	0.0%	0	

VITREOUS CONTINUED		1991-2015		2016-2020	
110.200	vitreous degeneration-anterior chamber	1	0.0%	6	0.5%
110.320	vitreal degeneration	13	0.4%	5	0.4%
RETINA					
120.170	retinal dysplasia, folds	3	0.1%	2	0.2%
120.310	generalized progressive retinal atrophy (PRA)	5	0.2%	0	
120.960	retinopathy	2	0.1%	4	0.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.0%	1	0.1%
OTHER					
900.000	other, unspecified	51	1.8%	0	
900.100	other, not inherited	73	2.5%	1	0.1%
900.110	other. suspect not inherited/significance unknown	50	1.7%	58	4.5%
NORMAL					
0.000	normal globe	2,520	87.2%	1,023	79.5%

VOLPINO ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Volpino Italiano. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
VOLPINO ITALIANO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2015 1 # %	2016-2020 0 # %
NORMAL			
0.000 normal globe		1 100.0%	0

WEIMARANER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy - generalized	X-linked	1, 2	NO	Mutation in the *RPGR* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

In the Weimaraner, because there is significant clinical disease associated with the abnormal hairs, breeding should be discouraged.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted

on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Kropatsch R, Akkad D, Frank M, et al. A large deletion in RPGR causes XLPRA in Weimarener dogs. Canine Genetics and Epidemiol. 2016; 3:7.

OCULAR DISORDERS REPORT
WEIMARANER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 1,654 #	 %	2016-2020 509 #	 %
EYELIDS					
21.000	entropion, unspecified	3	0.2%	0	
25.110	distichiasis	492	29.7%	131	25.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.4%
NICTITANS					
51.100	third eyelid cartilage anomaly	13	0.8%	4	0.8%
CORNEA					
70.700	corneal dystrophy	29	1.8%	7	1.4%
70.730	corneal endothelial degeneration	5	0.3%	1	0.2%
UVEA					
93.150	iris coloboma	2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	15	0.9%	3	0.6%
93.720	persistent pupillary membranes, iris to lens	3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		9	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.1%	0	
93.810	uveal melanoma	1	0.1%	0	
93.999	uveal cysts	5	0.3%	3	0.6%
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	92	5.6%	39	7.7%
100.301	punctate cataract, anterior cortex	10	0.6%	7	1.4%
100.302	punctate cataract, posterior cortex	5	0.3%	1	0.2%
100.303	punctate cataract, equatorial cortex	8	0.5%	2	0.4%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.2%
100.306	punctate cataract, nucleus	7	0.4%	4	0.8%
100.307	punctate cataract, capsular	1	0.1%	2	0.4%
100.311	incipient cataract, anterior cortex	40	2.4%	8	1.6%
100.312	incipient cataract, posterior cortex	11	0.7%	5	1.0%
100.313	incipient cataract, equatorial cortex	12	0.7%	8	1.6%
100.314	incipient cataract, anterior sutures	2	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures	2	0.1%	0	
100.316	incipient cataract, nucleus	4	0.2%	4	0.8%
100.317	incipient cataract, capsular	1	0.1%	4	0.8%
100.321	incomplete cataract, anterior cortex	1	0.1%	2	0.4%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.326	incomplete cataract, nucleus	0		1	0.2%
100.330	generalized/complete cataract	5	0.3%	0	
100.345	*significant cataracts (summary)*	*113*	*6.8%*	*52*	*10.2%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*1*	*0.2%*

		1991-2015		2016-2020	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.2%	1	0.2%
110.135	PHPV/PTVL	0		2	0.4%
110.200	vitreous degeneration-anterior chamber	1	0.1%	2	0.4%
110.320	vitreal degeneration	2	0.1%	1	0.2%
RETINA					
120.170	retinal dysplasia, folds	2	0.1%	0	
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	0.4%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.960	retinopathy	1	0.1%	0	
OTHER					
900.000	other, unspecified	12	0.7%	0	
900.100	other, not inherited	50	3.0%	5	1.0%
900.110	other. suspect not inherited/significance unknown	16	1.0%	25	4.9%
NORMAL					
0.000	normal globe	1,066	64.4%	290	57.0%

WELSH SPRINGER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Presumed autosomal dominant	1-4	NO
B.	Entropion	Not defined	1	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
F.	Cataract	Presumed autosomal recessive	1, 5, 6	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam. Due to the increased incidence of PLD in the breed and the increased progression observed with age, it may be prudent to perform repeated gonioscopy examinations over time.

Primary angle closure glaucoma has been reported in the Welsh Springer Spaniel. Females are affected more than males. Onset ranges from 10 weeks to 10 years. At the iridocorneal angle, the pectinate ligaments appear sparse and wispy in contrast to the sturdy fibers seen in other breeds. A dominant mode of inheritance is reported.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic),

defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Welsh Springer Spaniel, lesions may be seen as early as 8-12 weeks of age and progress rapidly to complete cataract, impairing vision. A recessive mode of inheritance is reported.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Cottrell B, Barnett K. Primary glaucoma in the Welsh Springer Spaniel. *J Small Anim Pract*. 1988;29:185-199.

3. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111. Epub 2004/02/26.

4. Oliver JA, Ekiri A, Mellersh. Prevalence and Progression of Pectinate Ligament Dysplasia in the Welsh Springer Spaniel. J Sm Anim Pract. 2016;57: 416-421.

5. Barnett KC. Hereditary cataract in the Welsh Springer Spaniel. *J Small Anim Pract*. 1980;21:621-625. Epub 1980/11/01.

6. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305.

OCULAR DISORDERS REPORT
WELSH SPRINGER SPANIEL

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**2,576**		**644**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	39	1.5%	16	2.5%
22.000	ectropion, unspecified	3	0.1%	0	
25.110	distichiasis	299	11.6%	108	16.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	2	0.3%
CORNEA					
70.700	corneal dystrophy	43	1.7%	18	2.8%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	579	22.5%	170	26.4%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	2	0.3%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.2%	6	0.9%
93.999	uveal cysts	2	0.1%	2	0.3%
97.150	chorioretinal coloboma, congenital	0		1	0.2%
LENS					
100.200	cataract, unspecified	6	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	130	5.0%	28	4.3%
100.301	punctate cataract, anterior cortex	11	0.4%	7	1.1%
100.302	punctate cataract, posterior cortex	3	0.1%	3	0.5%
100.303	punctate cataract, equatorial cortex	1	0.0%	1	0.2%
100.304	punctate cataract, anterior sutures	2	0.1%	1	0.2%
100.306	punctate cataract, nucleus	1	0.0%	2	0.3%
100.307	punctate cataract, capsular	1	0.0%	3	0.5%
100.311	incipient cataract, anterior cortex	4	0.2%	0	
100.312	incipient cataract, posterior cortex	2	0.1%	2	0.3%
100.313	incipient cataract, equatorial cortex	2	0.1%	2	0.3%
100.316	incipient cataract, nucleus	2	0.1%	0	
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.330	generalized/complete cataract	1	0.0%	0	
100.345	*significant cataracts (summary)*	*38*	*1.5%*	*22*	*3.4%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.0%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	10	0.4%	1	0.2%
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	5	0.2%	0	

		1991-2015		2016-2020	
FUNDUS					
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	29	1.1%	5	0.8%
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	8	0.3%	1	0.2%
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	6	0.2%	1	0.2%
130.150	optic disc coloboma	4	0.2%	0	
OTHER					
900.000	other, unspecified	19	0.7%	0	
900.100	other, not inherited	50	1.9%	4	0.6%
900.110	other. suspect not inherited/significance unknown	20	0.8%	25	3.9%
NORMAL					
0.000	normal globe	1,718	66.7%	332	51.6%

WELSH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Lens luxation	Autosomal recessive	1, 2	NO	Mutation in the *ADAMTS17* gene

Description and Comment

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011 Nov;14:378-384.

OCULAR DISORDERS REPORT
WELSH TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 359 #	 %	2016-2020 40 #	 %
GLOBE						
10.000	glaucoma		1	0.3%	0	
EYELIDS						
20.140	ectopic cilia		1	0.3%	0	
25.110	distichiasis		12	3.3%	1	2.5%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.3%	0	
CORNEA						
70.700	corneal dystrophy		4	1.1%	0	
70.730	corneal endothelial degeneration		3	0.8%	1	2.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		30	8.4%	1	2.5%
93.720	persistent pupillary membranes, iris to lens		2	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.8%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		4	1.1%	7	17.5%
LENS						
100.200	cataract, unspecified		1	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		22	6.1%	0	
100.301	punctate cataract, anterior cortex		2	0.6%	0	
100.302	punctate cataract, posterior cortex		2	0.6%	0	
100.307	punctate cataract, capsular		1	0.3%	0	
100.311	incipient cataract, anterior cortex		3	0.8%	0	
100.312	incipient cataract, posterior cortex		2	0.6%	0	
100.313	incipient cataract, equatorial cortex		1	0.3%	0	
100.317	incipient cataract, capsular		2	0.6%	0	
100.328	y-suture tip opacities		0		3	7.5%
100.345	*significant cataracts (summary)*		*14*	*3.9%*	*3*	*7.5%*
100.375	*subluxation/luxation, unspecified*		*3*	*0.8%*	*0*	
RETINA						
120.170	retinal dysplasia, folds		1	0.3%	0	
OTHER						
900.000	other, unspecified		6	1.7%	0	
900.100	other, not inherited		13	3.6%	0	
900.110	other. suspect not inherited/significance unknown		1	0.3%	4	10.0%
NORMAL						
0.000	normal globe		291	81.1%	28	70.0%

WEST HIGHLAND WHITE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1-4	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 5	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Presumed autosomal recessive	1, 5	NO
D.	Y-suture tip opacity	Not defined	1	Breeder option
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

In the West Highland White Terrier, this disease has been reported more commonly in females than males.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the West Highland White Terrier, these membranes, when present, often bridge from the iris to the lens and may result in cataract with vision impairment.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

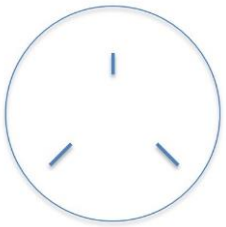
C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The cataract described in the West Highland White Terrier initially involves the posterior Y sutures and may infrequently progress, resulting in vision impairment. The age of onset is less than 6 months of age. A recessive mode of inheritance is suggested by the pedigrees which have been studied.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Sansom J, Barnett KC, Neumann W, et al. Treatment of keratoconjunctivitis sicca in dogs with cyclosporine ophthalmic ointment: a European clinical field trial. *Vet Rec*. 1995; 137: 504-507.

3. Baker GJ, Formston C. An evaluation of transplantation of the parotid duct in the treatment of kerato-conjunctivitis sicca in the dog. *J Small Anim Pract*. 1968; 9: 261-268.

4. Kaswan RL, Martin CL, Chapman WL, Jr. Keratoconjunctivitis sicca: histopathologic study of nictitating membrane and lacrimal glands from 28 dogs. *Am J Vet Res*. 1984; 45: 112-118.

5. Narfstrom K. Cataract in the West Highland White Terrier. *J Small Anim Pract*. 1981; 22: 467-471.

OCULAR DISORDERS REPORT
WEST HIGHLAND WHITE TERRIER

		1991-2015		2016-2020	
	TOTAL DOGS EXAMINED	**1,379**		**392**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	5	0.4%	0	
EYELIDS					
25.110	distichiasis	2	0.1%	1	0.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.5%
40.910	keratoconjunctivitis sicca	3	0.2%	0	
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.700	corneal dystrophy	1	0.1%	0	
70.730	corneal endothelial degeneration	3	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	117	8.5%	29	7.4%
93.720	persistent pupillary membranes, iris to lens	21	1.5%	3	0.8%
93.730	persistent pupillary membranes, iris to cornea	5	0.4%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	16	1.2%	7	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.3%	0	
LENS					
100.200	cataract, unspecified	21	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown	112	8.1%	34	8.7%
100.301	punctate cataract, anterior cortex	18	1.3%	4	1.0%
100.302	punctate cataract, posterior cortex	9	0.7%	2	0.5%
100.303	punctate cataract, equatorial cortex	3	0.2%	2	0.5%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	17	1.2%	5	1.3%
100.306	punctate cataract, nucleus	9	0.7%	2	0.5%
100.307	punctate cataract, capsular	9	0.7%	3	0.8%
100.311	incipient cataract, anterior cortex	35	2.5%	2	0.5%
100.312	incipient cataract, posterior cortex	22	1.6%	4	1.0%
100.313	incipient cataract, equatorial cortex	5	0.4%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	5	0.4%	0	
100.316	incipient cataract, nucleus	14	1.0%	1	0.3%
100.317	incipient cataract, capsular	9	0.7%	4	1.0%
100.321	incomplete cataract, anterior cortex	1	0.1%	2	0.5%
100.322	incomplete cataract, posterior cortex	2	0.1%	1	0.3%
100.325	incomplete cataract, posterior sutures	4	0.3%	0	
100.326	incomplete cataract, nucleus	0		1	0.3%
100.328	y-suture tip opacities	11	0.8%	7	1.8%
100.330	generalized/complete cataract	30	2.2%	0	
100.345	*significant cataracts (summary)*	*227*	*16.5%*	*40*	*10.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	0	
110.200	vitreous degeneration-anterior chamber	0		1	0.3%

VITREOUS CONTINUED		1991-2015		2016-2020	
110.320	vitreal degeneration	11	0.8%	1	0.3%
RETINA					
120.170	retinal dysplasia, folds	45	3.3%	11	2.8%
120.180	retinal dysplasia, geographic	3	0.2%	0	
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	1.0%	2	0.5%
120.910	retinal detachment without dialysis	1	0.1%	0	
120.920	retinal detachment with dialysis	2	0.1%	0	
120.960	retinopathy	1	0.1%	0	
OPTIC NERVE					
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	33	2.4%	0	
900.100	other, not inherited	17	1.2%	1	0.3%
900.110	other. suspect not inherited/significance unknown	31	2.2%	17	4.3%
NORMAL					
0.000	normal globe	1,001	72.6%	274	69.9%

WHIPPET

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Vitreous degeneration	Not defined	1, 2	Breeder option	
D.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	3	NO	Mutation in the *NHEJ1* gene
E.	Retinal atrophy – generalized	Not defined	4	NO	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment. This is a significant problem in the Whippet.

D. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly" and has been identified in the longhaired Whippet. The choroidal hypoplasia component is caused by a 7799 base pairs deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Krishnan, H., et al. (2020). "Vitreous degeneration and associated ocular abnormalities in the dog." Vet Ophthalmol **23**(2): 219-224. PMID: 31464365

3. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Genome research*. 2007;17:1562-1571. Epub 2007/10/06.

4. Somma A, Moreno J, Sato M, et al. Characterization of a novel form of Progressive Retinal Atrophy in Whippet dogs: a clinical, electroretinographic, and breeding study. Vet Ophth. 2016: 1-10.

OCULAR DISORDERS REPORT
WHIPPET

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 10,890 #	%	2016-2020 2,894 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	0	
EYELIDS						
20.140	ectopic cilia		2	0.0%	0	
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		7	0.1%	6	0.2%
NICTITANS						
50.210	pannus of third eyelid		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		5	0.0%	0	
70.700	corneal dystrophy		37	0.3%	10	0.3%
70.730	corneal endothelial degeneration		5	0.0%	1	0.0%
UVEA						
93.110	iris hypoplasia		0		2	0.1%
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.180	Iiris sphincter dysplasia		2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		100	0.9%	44	1.5%
93.720	persistent pupillary membranes, iris to lens		10	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		11	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		16	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		9	0.1%	4	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.0%	4	0.1%
93.810	uveal melanoma		0		1	0.0%
93.999	uveal cysts		18	0.2%	6	0.2%
LENS						
100.200	cataract, unspecified		11	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		410	3.8%	106	3.7%
100.301	punctate cataract, anterior cortex		44	0.4%	16	0.6%
100.302	punctate cataract, posterior cortex		21	0.2%	4	0.1%
100.303	punctate cataract, equatorial cortex		18	0.2%	9	0.3%
100.304	punctate cataract, anterior sutures		4	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures		5	0.0%	10	0.3%
100.306	punctate cataract, nucleus		16	0.1%	2	0.1%
100.307	punctate cataract, capsular		2	0.0%	2	0.1%
100.311	incipient cataract, anterior cortex		51	0.5%	13	0.4%
100.312	incipient cataract, posterior cortex		36	0.3%	4	0.1%
100.313	incipient cataract, equatorial cortex		53	0.5%	12	0.4%
100.314	incipient cataract, anterior sutures		1	0.0%	2	0.1%
100.315	incipient cataract, posterior sutures		9	0.1%	0	
100.316	incipient cataract, nucleus		13	0.1%	2	0.1%
100.317	incipient cataract, capsular		17	0.2%	2	0.1%
100.321	incomplete cataract, anterior cortex		0		4	0.1%
100.322	incomplete cataract, posterior cortex		1	0.0%	4	0.1%
100.323	incomplete cataract, equatorial cortex		0		3	0.1%

LENS CONTINUED		1991-2015		2016-2020	
100.326	incomplete cataract, nucleus	0		1	0.0%
100.328	y-suture tip opacities	1	0.0%	13	0.4%
100.330	generalized/complete cataract	16	0.1%	2	0.1%
100.345	*significant cataracts (summary)*	*319*	*2.9%*	*107*	*3.7%*
100.375	*subluxation/luxation, unspecified*	*33*	*0.3%*	*1*	*0.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	16	0.1%	16	0.6%
110.135	PHPV/PTVL	11	0.1%	1	0.0%
110.200	vitreous degeneration-anterior chamber	30	0.3%	43	1.5%
110.320	vitreal degeneration	588	5.4%	68	2.3%
FUNDUS					
97.110	choroidal hypoplasia	19	0.2%	0	
97.120	coloboma	4	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	31	0.3%	9	0.3%
120.180	retinal dysplasia, geographic	4	0.0%	5	0.2%
120.190	retinal dysplasia, detached	4	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	40	0.4%	8	0.3%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	4	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	6	0.1%	5	0.2%
OPTIC NERVE					
130.110	micropapilla	3	0.0%	1	0.0%
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	14	0.1%	0	
OTHER					
900.000	other, unspecified	114	1.0%	0	
900.100	other, not inherited	233	2.1%	2	0.1%
900.110	other. suspect not inherited/significance unknown	117	1.1%	124	4.3%
NORMAL					
0.000	normal globe	9,622	88.4%	2,442	84.4%

WHITE SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Mi-Ki, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the White Shepherd breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
WHITE SHEPHERD

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 17 #	 %	2016-2020 47 #	 %
CORNEA					
70.210	corneal pannus	0		2	4.3%
70.700	corneal dystrophy	2	11.8%	4	8.5%
UVEA					
93.720	persistent pupillary membranes, iris to lens	1	5.9%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	5.9%	3	6.4%
100.305	punctate cataract, posterior sutures	0		1	2.1%
100.317	incipient cataract, capsular	1	5.9%	0	
100.328	y-suture tip opacities	0		1	2.1%
100.345	*significant cataracts (summary)*	*1*	*5.9%*	*2*	*4.3%*
RETINA					
120.170	retinal dysplasia, folds	1	5.9%	0	
OPTIC NERVE					
130.110	micropapilla	1	5.9%	1	2.1%
130.120	optic nerve hypoplasia	1	5.9%	0	
OTHER					
900.100	other, not inherited	0		1	2.1%
900.110	other. suspect not inherited/significance unknown	0		5	10.6%
NORMAL					
0.000	normal globe	10	58.8%	32	68.1%

WIRE FOX TERRIER*

*The Wire Fox Terrier and the Smooth Fox Terrier were originally considered two varieties of the same breed. They became separate breeds in 1985. It is likely that the same genetic diseases xist in both breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1, 2	NO	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	3	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The cataracts observed in Wire Fox Terrier begin in the posterior subcapsular region and are progressive.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Martin CL, Wyman M. Primary glaucoma in the dog. *Vet Clin North Am*. 1978;8:257-286.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
WIRE FOX TERRIER

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 297 #	 %	2016-2020 41 #	 %
GLOBE					
0.110	microphthalmia	1	0.3%	0	
EYELIDS					
25.110	distichiasis	8	2.7%	1	2.4%
CORNEA					
70.700	corneal dystrophy	3	1.0%	0	
70.730	corneal endothelial degeneration	1	0.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	92	31.0%	26	63.4%
93.720	persistent pupillary membranes, iris to lens	3	1.0%	2	4.9%
93.730	persistent pupillary membranes, iris to cornea	5	1.7%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	2.4%
LENS					
100.200	cataract, unspecified	4	1.3%	0	
100.210	cataract. suspect not inherited/significance unknown	2	0.7%	0	
100.301	punctate cataract, anterior cortex	3	1.0%	0	
100.311	incipient cataract, anterior cortex	5	1.7%	0	
100.312	incipient cataract, posterior cortex	5	1.7%	0	
100.313	incipient cataract, equatorial cortex	2	0.7%	0	
100.314	incipient cataract, anterior sutures	1	0.3%	0	
100.321	incomplete cataract, anterior cortex	1	0.3%	0	
100.322	incomplete cataract, posterior cortex	1	0.3%	0	
100.326	incomplete cataract, nucleus	1	0.3%	0	
100.330	generalized/complete cataract	8	2.7%	0	
100.345	*significant cataracts (summary)*	*31*	*10.4%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.3%	0	
110.320	vitreal degeneration	1	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	1.3%	0	
OTHER					
900.000	other, unspecified	3	1.0%	0	
900.100	other, not inherited	12	4.0%	0	
900.110	other. suspect not inherited/significance unknown	1	0.3%	0	
NORMAL					
0.000	normal globe	179	60.3%	14	34.1%

WIREHAIRED POINTING GRIFFON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO
D.	Y-suture tip opacity	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

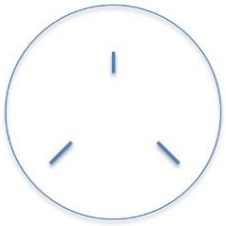
Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Y-suture tip opacity

These are prominent (or “highlighted” or “more dense”) distal portions of the posterior sutures that may occur in the posterior cortex to occasionally on the posterior lens capsule. This is not a true cataract, so there is no lens fiber disruption (no feathering or bulbous tips). It may be in the shape of a “peace sign” as diagrammed here, but occasionally a patient may have 4-5 suture lines and therefore more suture tip opacities. They may be present only at one suture tip of one eye or up to all three (or more, as stated above) suture tips in both eyes in a given dog. They are more commonly found in multiples or at least bilaterally symmetrical. They may be visible only with biomicroscopy or sometimes with retroillumination. They do not appear to progress (unless mis-diagnosed) and are considered essentially a variation of normal or possibly familial, as they are seen more commonly in certain breeds.



These should be marked under the “Lens” section of the CAER form. The newest version of the form (3/16/21) has boxes that say, “posterior Y-suture tip opacities” which should be marked. If working with an older version of the form, there are 2 places to mark within the lens section as cataract bubbles: "punctate posterior sutures” AND ALSO MARK "suspect not inherited/significance unknown” (without which they technically fail or at least require further information before coding). This diagnosis should ALSO be accompanied by drawings (like below) and/or have comments such as: “E2” or “posterior suture tip opacities.” This helps differentiate them from 1) prominent but otherwise normal full suture lines – which should just be commented on and are treated as normal, and 2) true sutural cataracts - which would either be breeder option or failing.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Wirehaired Pointing Griffon breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
WIREHAIRED POINTING GRIFFON

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 472 #	 %	2016-2020 360 #	 %
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
21.000	entropion, unspecified	3	0.6%	1	0.3%
25.110	distichiasis	3	0.6%	6	1.7%
NICTITANS					
51.100	third eyelid cartilage anomaly	0		1	0.3%
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
CORNEA					
70.210	corneal pannus	0		1	0.3%
70.700	corneal dystrophy	1	0.2%	0	
70.730	corneal endothelial degeneration	3	0.6%	0	
UVEA					
93.110	iris hypoplasia	0		2	0.6%
93.710	persistent pupillary membranes, iris to iris	7	1.5%	7	1.9%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.2%	2	0.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	34	7.2%	29	8.1%
100.301	punctate cataract, anterior cortex	0		1	0.3%
100.302	punctate cataract, posterior cortex	1	0.2%	2	0.6%
100.303	punctate cataract, equatorial cortex	0		1	0.3%
100.305	punctate cataract, posterior sutures	0		1	0.3%
100.306	punctate cataract, nucleus	2	0.4%	1	0.3%
100.307	punctate cataract, capsular	0		1	0.3%
100.311	incipient cataract, anterior cortex	2	0.4%	1	0.3%
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.316	incipient cataract, nucleus	2	0.4%	1	0.3%
100.328	y-suture tip opacities	1	0.2%	2	0.6%
100.345	*significant cataracts (summary)*	*9*	*1.9%*	*11*	*3.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		2	0.6%
110.200	vitreous degeneration-anterior chamber	0		1	0.3%
110.320	vitreal degeneration	7	1.5%	1	0.3%
RETINA					
120.170	retinal dysplasia, folds	4	0.8%	1	0.3%
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.400	retinal hemorrhage	1	0.2%	0	
120.960	retinopathy	0		1	0.3%
OTHER					
900.000	other, unspecified	6	1.3%	0	
900.100	other, not inherited	2	0.4%	1	0.3%
900.110	other. suspect not inherited/significance unknown	8	1.7%	12	3.3%

	1991-2015	2016-2020
NORMAL		
0.000 normal globe	411 87.1%	295 81.9%

WIREHAIRED VIZSLA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary conditions of the Wirehaired Vizsla breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
WIREHAIRED VIZSLA

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 119 #	1991-2015 119 %	2016-2020 105 #	2016-2020 105 %
EYELIDS						
25.110	distichiasis		0		1	1.0%
NICTITANS						
52.110	prolapsed gland of the third eyelid		3	2.5%	0	
CORNEA						
70.700	corneal dystrophy		0		1	1.0%
UVEA						
93.710	persistent pupillary membranes, iris to iris		10	8.4%	4	3.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands		11	9.2%	5	4.8%
LENS						
100.210	cataract. suspect not inherited/significance unknown		18	15.1%	7	6.7%
100.312	incipient cataract, posterior cortex		0		1	1.0%
100.322	incomplete cataract, posterior cortex		0		1	1.0%
100.345	*significant cataracts (summary)*		*0*		*2*	*1.9%*
VITREOUS						
110.320	vitreal degeneration		2	1.7%	0	
RETINA						
120.910	retinal detachment without dialysis		1	0.8%	0	
OTHER						
900.000	other, unspecified		4	3.4%	0	
900.100	other, not inherited		0		1	1.0%
900.110	other. suspect not inherited/significance unknown		3	2.5%	6	5.7%
NORMAL						
0.000	normal globe		90	75.6%	82	78.1%

XOLOITZCUINTLI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Xoloitzcuintli breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

OCULAR DISORDERS REPORT
XOLOITZCUINTLI

Diagnostic Name		1991-2015 TOTAL DOGS EXAMINED 53 #	 %	2016-2020 102 #	 %
EYELIDS					
25.110	distichiasis	1	1.9%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	1.9%	2	2.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	2.9%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		3	2.9%
100.305	punctate cataract, posterior sutures	0		1	1.0%
100.311	incipient cataract, anterior cortex	2	3.8%	1	1.0%
100.312	incipient cataract, posterior cortex	5	9.4%	3	2.9%
100.313	incipient cataract, equatorial cortex	2	3.8%	1	1.0%
100.317	incipient cataract, capsular	2	3.8%	1	1.0%
100.345	*significant cataracts (summary)*	*11*	*20.8%*	*7*	*6.9%*
VITREOUS					
110.320	vitreal degeneration	0		1	1.0%
RETINA					
120.180	retinal dysplasia, geographic	1	1.9%	0	
OTHER					
900.100	other, not inherited	0		1	1.0%
900.110	other. suspect not inherited/significance unknown	0		4	3.9%
NORMAL					
0.000	normal globe	46	86.8%	86	84.3%

YORKSHIRE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	3	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Lens luxation	Autosomal recessive	3-5	NO	Mutation in the *ADAMTS17* gene
F.	Vitreous degeneration	Not defined	1	Breeder option	
G.	Retinal atrophy - generalized	Not defined	1	NO	

Description and Comment

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment. There is evidence that Yorkshire Terriers sometimes present with severe, congenital, unilateral keratoconjunctivitis sicca (KCS) and it is suspected this is due to hypoplasia or aplasia of the gland.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

References

1. ACVO Genetics Committee and/or Data from OFA All-Breeds Report.

2. Herrera HD, Weichsler N, Gomez JR, et al. Severe, unilateral, unresponsive keratoconjunctivitis sicca in 16 juvenile Yorkshire Terriers. *Vet Ophthalmol.* 2007;10:285-288.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol.* 2011;14:378-384.

4. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

5. Walde I. Retinal and corneal dysplasias in the Yorkshire Terrier and other breeds in Austria. *Tiereztliche Praxix*. 1997;25:62.

OCULAR DISORDERS REPORT
YORKSHIRE TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2015 1,573 #	 %	2016-2020 641 #	 %
GLOBE						
0.110	microphthalmia		3	0.2%	3	0.5%
10.000	glaucoma		1	0.1%	0	
EYELIDS						
21.000	entropion, unspecified		0		1	0.2%
25.110	distichiasis		33	2.1%	6	0.9%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		5	0.3%	2	0.3%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.210	corneal pannus		4	0.3%	0	
70.220	pigmentary keratitis		4	0.3%	0	
70.700	corneal dystrophy		12	0.8%	4	0.6%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.110	iris hypoplasia		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		154	9.8%	49	7.6%
93.720	persistent pupillary membranes, iris to lens		4	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		4	0.3%	2	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		12	0.8%	14	2.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.1%	0	
LENS						
100.200	cataract, unspecified		23	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown		51	3.2%	10	1.6%
100.301	punctate cataract, anterior cortex		27	1.7%	9	1.4%
100.302	punctate cataract, posterior cortex		11	0.7%	2	0.3%
100.303	punctate cataract, equatorial cortex		6	0.4%	0	
100.304	punctate cataract, anterior sutures		3	0.2%	0	
100.305	punctate cataract, posterior sutures		4	0.3%	2	0.3%
100.306	punctate cataract, nucleus		1	0.1%	2	0.3%
100.307	punctate cataract, capsular		0		3	0.5%
100.311	incipient cataract, anterior cortex		24	1.5%	12	1.9%
100.312	incipient cataract, posterior cortex		16	1.0%	7	1.1%
100.313	incipient cataract, equatorial cortex		15	1.0%	4	0.6%
100.314	incipient cataract, anterior sutures		2	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures		3	0.2%	1	0.2%
100.316	incipient cataract, nucleus		3	0.2%	0	
100.317	incipient cataract, capsular		1	0.1%	1	0.2%
100.321	incomplete cataract, anterior cortex		2	0.1%	5	0.8%
100.322	incomplete cataract, posterior cortex		0		3	0.5%
100.323	incomplete cataract, equatorial cortex		0		1	0.2%
100.326	incomplete cataract, nucleus		1	0.1%	1	0.2%
100.328	y-suture tip opacities		1	0.1%	1	0.2%

LENS CONTINUED		1991-2015		2016-2020	
100.330	generalized/complete cataract	28	1.8%	1	0.2%
100.345	*significant cataracts (summary)*	*171*	*10.9%*	*56*	*8.7%*
100.375	*subluxation/luxation, unspecified*	*1*	*0.1%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	3	0.5%
110.135	PHPV/PTVL	4	0.3%	1	0.2%
110.200	vitreous degeneration-anterior chamber	1	0.1%	5	0.8%
110.320	vitreal degeneration	19	1.2%	7	1.1%
RETINA					
120.170	retinal dysplasia, folds	7	0.4%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	53	3.4%	4	0.6%
120.920	retinal detachment with dialysis	0		2	0.3%
120.960	retinopathy	4	0.3%	1	0.2%
OPTIC NERVE					
130.110	micropapilla	0		1	0.2%
130.120	optic nerve hypoplasia	3	0.2%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	19	1.2%	0	
900.100	other, not inherited	26	1.7%	2	0.3%
900.110	other. suspect not inherited/significance unknown	22	1.4%	24	3.7%
NORMAL					
0.000	normal globe	1,195	76.0%	476	74.3%