Paw Print Genetics
A division of Genetic Veterinary Sciences, Inc.

Canine Genetic Health Certificate™

Call Name:	Orsa	**Laboratory #:**	319627
Registered Name:	Scarlett South Lamanis		
Breed:	Labrador Retriever		
Sex:	Female	**Certificate Date:**	Sept. 19, 2022
DOB:	Oct. 2021		

This canine's DNA showed the following genotype(s):

Disease	Gene	Genotype	Interpretation
Centronuclear Myopathy	*PTPLA*	WT/WT	Normal (clear)
Chondrodystrophy with Intervertebral Disc Disease Risk Factor (CDDY with IVDD)	*CFA12 FGF4*	WT/WT	Normal (Clear) - No CDDY or Increased IVDD Risk
Cone Degeneration (Labrador Retriever Type)	*CNGA3*	WT/WT	Normal (clear)
Congenital Myasthenic Syndrome (Labrador Retriever Type)	*COLQ*	WT/WT	Normal (clear)
Copper Toxicosis (Labrador Retriever Type) ATP7A	*ATP7A*	WT/WT	Normal/Clear Female
Copper Toxicosis (Labrador Retriever Type) ATP7B	*ATP7B*	WT/WT	Normal (clear)
Cystinuria (Labrador Retriever Type)	*SLC3A1*	WT/WT	Normal (clear)
Degenerative Myelopathy	*SOD1*	WT/WT	Normal (clear)
Elliptocytosis	*SPTB*	WT/WT	Normal (clear)
Exercise-Induced Collapse	*DNM1*	WT/WT	Normal (clear)
Hereditary Nasal Parakeratosis	*SUV39H2*	WT/WT	Normal (clear)
Hyperuricosuria	*SLC2A9*	WT/WT	Normal (clear)

WT, wild type (normal); M, mutant; Y, Y chromosome (male)

Blake C Ballif, PhD
Laboratory & Scientific Director

Christina J Ramirez, PhD, DVM, DACVP
Medical Director

Paw Print Genetics® performed the testing on the dog listed on this certificate. See the Laboratory Report for interpretation and recommendations based on these findings. The genes/diseases reported here were selected by the client. Normal results do not exclude inherited mutations not tested in these or other genes that may cause medical problems or may be passed on to offspring. The results included in this report relate only to the items tested using the sample provided. These tests were developed and their performance determined by Paw Print Genetics. This laboratory has established and verified the test(s)' accuracy and precision with >99.9% sensitivity and specificity. The presence of mosaicism may not be detected by this test. Non-paternity may lead to unexpected results. This is not a breed identification test. Because all tests performed are DNA-based, rare genomic variations may interfere with the performance of some tests producing false results. If you think these results are in error, please contact the laboratory immediately for further evaluation. In the event of a valid dispute of results claim, Paw Print Genetics will do its best to resolve such a claim to the customer's satisfaction. If no resolution is possible after investigation by Paw Print Genetics with the cooperation of the customer, the extent of the customer's sole remedy is a refund of the fee paid. In no event shall Paw Print Genetics be liable for indirect, consequential or incidental damages of any kind. Any claim must be asserted within 60 days of the report of the test results. Genetic counseling is

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available at Paw Print Genetics.

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This canine's DNA showed the following genotype(s):

Disease	Gene	Genotype	Interpretation
Ichthyosis (Golden Retriever Type 1)	*PNPLA1*	WT/WT	Normal (clear)
Macular Corneal Dystrophy (Labrador Retriever Type)	*CHST6*	WT/WT	Normal (clear)
Myotubular Myopathy 1	*MTM1*	WT/WT	Normal/Clear Female
Narcolepsy (Labrador Retriever Type)	*HCRTR2*	WT/WT	Normal (clear)
Progressive Retinal Atrophy, Cone-Rod Dystrophy 4	*RPGRIP1*	WT/WT	Normal (clear)
Progressive Retinal Atrophy, Golden Retriever 2	*TTC8*	WT/WT	Normal (clear)
Progressive Retinal Atrophy, Progressive Rod-Cone Degeneration	*PRCD*	WT/WT	Normal (clear)
Pyruvate Kinase Deficiency (Labrador Retriever Type)	*PKLR*	WT/WT	Normal (clear)
Retinal Dysplasia/Oculoskeletal Dysplasia 1	*COL9A3*	WT/WT	Normal (clear)
Skeletal Dysplasia 2	*COL11A2*	WT/WT	Normal (clear)
Stargardt Disease	*ABCA4*	WT/WT	Normal (clear)

WT, wild type (normal); M, mutant; Y, Y chromosome (male)

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Coat Color and Trait Certificate

Call Name: Orsa
Registered Name: Scarlett South Lamanis
Breed: Labrador Retriever
Sex: Female
DOB: Oct. 2021

Laboratory #: 319627

Certificate Date: Sept. 19, 2022

This canine's DNA showed the following genotype(s):

Coat Color/Trait Test	Gene	Genotype	Interpretation
B Locus (Brown)	*TYRP1*	b/b	Brown coat, nose and foot pads (carries two copies of brown)
Chondrodysplasia (CDPA)	*CFA18 FGF4*	cd/cd	No Leg Shortening Associated with CDPA
D Locus (Dilute)	*MLPH*	D/D	Non-dilute (does not carry dilute)
E Locus - e (Apricot/Cream/Red/Yellow, Common Variant Found in Many Breeds)	*MC1R*	E/E	Black
K Locus (Dominant Black)	*CBD103*	KB/KB	No agouti expression allowed
L Locus (Long Hair/Fluffy) - Lh1 (Common Variant Found in Many Breeds)	*FGF5*	Sh/Sh	Shorthaired (does not carry long hair)

Interpretation:

This dog carries two copies of one of the b mutations and has a B locus genotype of **b/b**. Thus, this dog typically will have a brown coat, nose and foot pads. Depending on the breed, b/b dogs may be referred to as brown, chocolate, liver or red. However, this dog's coat color is dependent on the genotypes of many other genes. This dog will pass one copy of **b** to 100% of its offspring. This dog can produce b/b offspring if bred to a dog that is also a carrier of a b mutation (B/b or b/b).

Two genetic mutations are associated with shortened legs in dogs. Both mutations consist of copied sections (duplication) of the canine *FGF4* gene (called an *FGF4*-retrogene) that have been inserted into two aberrant locations in the genome; one in chromosome 12 (*CFA12 FGF4*; associated with CDDY and IVDD risk) and one in chromosome 18 (*CFA18 FGF4*; associated with chondrodysplasia [CDPA], but not associated with IVDD). Appropriate breeding decisions regarding dogs which have inherited the *CFA12 FGF4* mutation (WT/M or M/M) need to address both the potential loss of genetic diversity in a population which would occur if dogs with this mutation were prohibited from breeding as well as the loss of the short-legged appearance that is a defining physical characteristic for some breeds. In breeds which inherit both mutations, breeders may use genetic testing results to selectively breed for the CDPA (*CFA18 FGF4*) mutation while breeding away from the CDDY and IVDD risk (*CFA12 FGF4*) mutation to reduce IVDD risk and retain the short-legged appearance. However, the frequency of each mutation varies between breeds and, in some cases, may not be conducive to such a breeding strategy. For example, breeds with extreme limb shortening (e.g. Basset hound, Dachshund, Corgi) typically develop their appearance due to inheritance of both the *CFA12 FGF4* and *CFA18 FGF4* mutations. In addition, depending on the breed, offspring born without either the *CFA12 FGF4* or *CFA18 FGF4* mutations may display longer limbs than cohorts and, therefore, not meet specific breed standards.

This dog carries two copies of the **cd** allele which does not result in leg shortening. However, the actual leg length of the dog is a result of a combination of factors including the mutation associated with CDDY and IVDD risk (*CFA12 FGF4*) as well as variants in other genes. This dog will pass one copy of **cd** to 100% of its offspring.

This dog does not carry any copies of the d_1 or d_2 mutations and has a D locus genotype of **D/D** which does not result in the "dilution" or lightening of the pigments that produce the dog's coat color. This dog will pass one copy of **D** to 100% of its offspring and cannot produce d/d dogs.

This dog carries two copies of **E** which allows for the production of black pigment. However, this dog's coat color is also dependent on the K, A, and B genes. This dog will pass on **E** to 100% of its offspring.

The K locus genotype for this dog is **K^B/K^B** which prevents expression of the agouti gene (A locus) and allows for solid eumelanin (black pigment) production in pigmented areas of the dog. However, this dog's coat color is also dependent on its genotypes at the E and B loci. This dog will pass on **K^B** to 100% of its offspring.

This dog carries two copies of **Sh** which results in short hair. This dog will pass on **Sh** to 100% of its offspring.

Paw Print Genetics® has genetic counseling available to you at no additional charge to answer any questions about these test results, their implications and potential outcomes in breeding this dog.

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