



Coat Color and Trait Certificate

Call Name: Luna
Registered Name: Sandstone Spirit In The Night
Breed: Labrador Retriever
Sex: Female
DOB: Nov. 2023

Laboratory #: 453689
Registration #: SS44685003
Microchip #: 992000002760870
Certificate Date: June 18, 2024

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

Coat Color/Trait Test	Gene	Genotype	Interpretation
D Locus (Dilute)	<i>MLPH</i>	D/D	Non-dilute (does not carry dilute)
E Locus	<i>MC1R</i>	E/E	Black
L Locus (Long Hair/Fluffy)	<i>FGF5</i>	Sh/Sh	Shorthaired (does not carry long hair)

Interpretation:

This dog does not carry any copies of the d^1 , d^2 , or d^3 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 E on to 100% of its offspring.

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 **E** on 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.

Paw Print Genetics® performed the testing on the dog listed on this certificate. The genes/traits reported here were selected by the client. Normal results do not exclude inherited mutations not tested in these or other genes that may cause variation in traits, 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 any 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.

Laboratory Report

Laboratory #:	453689	Call Name:	Luna
Order #:	204795	Registered Name:	Sandstone Spirit In The Night
Ordered By:	Susan Leonard	Breed:	Labrador Retriever
(Co-)Owner:	Carly Leonard	Sex:	Female
Ordered:	May 23, 2024	DOB:	Nov. 2023
Received:	June 3, 2024	Registration #:	SS44685003
Reported:	June 18, 2024	Microchip #:	992000002760870

Results:

Disease	Gene	Genotype	Interpretation
Copper Toxicosis (Labrador Retriever Type) ATP7A	<i>ATP7A</i>	WT/M	X-Linked Female Carrier
Copper Toxicosis (Labrador Retriever Type) ATP7B	<i>ATP7B</i>	WT/M	At-Risk
Exercise-Induced Collapse	<i>DNM1</i>	WT/WT	Normal (Clear)
Hereditary Nasal Parakeratosis (Labrador Retriever Type)	<i>SUV39H2</i>	WT/WT	Normal (Clear)
Macular Corneal Dystrophy (Labrador Retriever Type)	<i>CHST6</i>	WT/WT	Normal (Clear)
Progressive Retinal Atrophy, Progressive Rod-Cone Degeneration	<i>PRCD</i>	WT/WT	Normal (Clear)

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

Interpretation:

Molecular genetic analysis was performed for six specific mutations reported to be associated with disease in dogs. We identified two normal copies of the DNA sequences in four of the mutations tested. Thus, this dog is not at an increased risk for the diseases associated with these four mutations. However, we identified one normal copy and one mutant copy of the DNA sequences for *ATP7B*. Thus, this dog is at risk of Copper Toxicosis (Labrador Retriever Type) ATP7B.

In addition, we identified one normal copy and one mutant copy of the DNA sequences for *ATP7A*. Thus, this dog carries one copy of the protective mutation for Copper Toxicosis (Labrador Retriever Type) ATP7A.

Recommendations:

Copper Toxicosis (Labrador Retriever Type) is inherited in an autosomal incomplete dominant fashion. Based on this, and the fact that this dog showed a mutation in one copy of the *ATP7B* gene, this dog is at risk for this disease. Though Copper Toxicosis is more commonly seen in dogs having two copies of the mutated gene, dogs inheriting a single copy of the mutation also have an increased, though lesser, risk of developing Copper Toxicosis. In addition, this disease appears to be sex-influenced in that female dogs inheriting one or two copies of the *ATP7B* mutation are at an increased risk of developing clinical disease compared to their male counterparts. Dogs with Copper Toxicosis have a decreased ability to excrete dietary copper from the body resulting in excessive copper storage in tissues and organs, including the liver, which can result in liver damage and subsequent cirrhosis. Though the age of onset and progression of the disease are variable, most affected dogs will present during middle age with non-specific signs of liver dysfunction including weight loss, lethargy, weakness, vomiting, diarrhea, and abdominal pain. In late stages of disease, affected dogs may develop signs of liver failure which include abdominal swelling, jaundice, and neurological dysfunction. Dogs found to have one or

two copies of the mutation may benefit from certain preventative therapies. When a dog with a single copy of the *ATP7B* mutation (WT/M) is bred with another dog with a single copy of the same mutation (WT/M), there is risk of having affected pups. For each pup born to this pairing, there is a 25% chance the puppy will inherit two copies of the mutation (M/M) and a 50% chance the puppy will inherit one copy of the mutation (WT/M) and, in either case, may be susceptible to developing Copper Toxicosis. Dogs related to this dog have an increased risk to be affected by the mutated gene. Additional testing for this mutation is indicated for related dogs.

This dog was tested for a genetic mutation of the canine *ATP7A* gene which partially protects against copper toxicosis in dogs that have inherited the *ATP7B* mutation described above. This dog carries one copy of the *ATP7A* gene mutation. Therefore, this dog may have a lesser risk of copper toxicosis than the risk associated with the inheritance of the *ATP7B* gene mutation alone. The *ATP7A* gene mutation is more effective at decreasing the risk of copper toxicosis in male dogs than females. However, since multiple factors (both genetic and environmental) play a role in causing copper toxicosis, the *ATP7A* mutation is not completely protective in either sex. Dogs that did not inherit the *ATP7B* gene mutation are not affected positively or negatively when they inherit one or two copies of the *ATP7A* gene mutation. Note: The *ATP7A* mutation is located on the X chromosome. Since males only have a single X chromosome they can only inherit a single copy of this mutation.

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