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

Coat Color and Trait Certificate

Call Name:	Grandpa	**Laboratory #:**	252674
Registered Name:	-	**Registration #:**	-
Breed:	Poodle	**Certificate Date:**	Aug. 23, 2021
Sex:	Male		
DOB:	July 2021		

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

Coat Color/Trait Test	Gene	Genotype	Interpretation
A Locus (Agouti)	*ASIP*	A^y/a^t	Sable/fawn (carries tricolor/black and tan)
A^S Locus (Saddle Tan)	*RALY*	N/A^s	Saddle tan/creeping tan (non saddle tan carrier)
B Locus (Brown)	*TYRP1*	B/b or b/b	Black or brown coat, nose and foot pads (carries at least one copy 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 (Apricot/Yellow/Red) - e (Common Variant Found in Many Breeds)	*MC1R*	E/e	Black (carries yellow/red)
E^m Locus (Melanistic Mask)	*MC1R*	E^m/N	Melanistic mask (carrier)
I Locus (Intensity)	*MFSD12*	I/I	Normal intensity
K Locus (Dominant Black)	*CBD103*	K^B/k^y	No agouti expression allowed (carrier)
M Locus (Merle)	*PMEL*	m/m	Non merle
S Locus (White Spotting, Parti, or Piebald)	*MITF*	s^p/s^p	Nearly solid white, parti, or piebald

Interpretation:

This dog carries one copy of **A^y** and one copy of **a^t** which results in a sable/fawn coat color. However, this dog's coat color is also dependent on the E, K, and B genes. The sable/fawn coat color is only expressed if the dog is also E/E or E/e at the E locus and k^y/k^y at the K locus which allows for agouti gene expression. This dog will pass on **A^y** to 50% of its offspring and **a^t** to 50% of its offspring.

This dog carries one copy of an **A^s** allele and one copy of **N**, the wildtype sequence. This combination of alleles is also found in dogs with a saddle tan coat color. However, this dog's coat color is also dependent on the E, A, and K loci. Saddle tan is found only in dogs that are also E/E or E/e at the E locus, k^y/k^y at the K locus, and a^t/a^t or a^t/a at the A locus. This dog will pass the **N** allele to 50% of its offspring and the **A^s** allele to 50% of its offspring, which can produce saddle tan dogs.

This dog carries one or more copies of the four possible b mutations and has a B locus genotype of **B/b** or **b/b** that cannot be distinguished without additional testing of parental samples or by examining the coat, nose and footpad color of the dog. Dogs inherit two copies of the B locus, one from each parent. Because there are four different B locus mutations that can potentially be identified, as well as some limitations inherent to genetic testing methodologies currently available, a result of "B/b or b/b" means that it cannot be determined if the b

mutations identified in this dog are present on the same copy of the B locus inherited from one parent or if they occur on separate copies of the B locus inherited from each of the parents. If the mutations identified are all present on the same copy of the B locus, this dog will have a **B/b** genotype and typically will have a black coat, nose and footpads. If the mutations identified are present on different copies of the B locus, this dog will have a **b/b** genotype and may have a brown coat, and will typically have a brown nose and footpads. 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. The B locus genotype for this dog can be inferred without the need for parental testing by evaluating the color of this dog's nose. If this dog's nose is brown, the B locus genotype of this dog must be **b/b** and this dog will pass one copy of **b** to 100% of its offspring. If this dog's nose is black, the final B locus genotype of this dog must be **B/b** and this dog will pass one copy of **B** to 50% of its offspring and one copy of **b** to 50% of its offspring. In either case, this dog carries at least one copy of **b** and 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 one copy of **E** and one copy 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 50% of its offspring and **e** to 50% of its offspring, which can produce a yellow/red coat (including shades of white, cream, yellow, apricot or red) if inherited with another copy of **e**.

This dog carries one copy of $\mathbf{E^m}$ and one copy of **N** which results in a melanistic mask on the muzzle of the dog. However, a melanistic mask may be unrecognizable on a dog with a dark coat color. This dog will pass on $\mathbf{E^m}$ to 50% of its offspring and **N** to 50% of its offspring.

This dog does not carry a copy of the i mutation and has an I locus genotype of **I/I** which does not result in the lightening of the light, phaeomelanin pigments that produce the dog's coat color in an e/e dog. This dog will pass one copy of **I** to 100% of its offspring and cannot produce i/i dogs.

This dog carries one copy of $\mathbf{K^B}$ and one copy of $\mathbf{k^y}$ 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 genes. This dog will pass on $\mathbf{K^B}$ to 50% of its offspring and $\mathbf{k^y}$ to 50% of its offspring.

This dog carries two copies of **m**, the non-merle, wild-type allele of the *PMEL* gene, and, therefore, does not have a merle coat color/pattern. This dog will pass on one copy of the **m** allele to 100% of its offspring.

This dog carries two copies of $\mathbf{s^p}$ which results in a nearly solid white, parti, or piebald coat color. This dog will pass on one copy of $\mathbf{s^p}$ 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.

Blake C Ballif, PhD
Laboratory & Scientific Director

Casey R Carl, DVM
Associate Medical Director

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. These tests were developed and their performance determined by Paw Print Genetics®. This laboratory has established and verified the tests' accuracy and precision. 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.