

# "SERENA"

SERENA



DNA Test Report

Test Date: December 10th, 2024

[embk.me/serena138](http://embk.me/serena138)

## BREED ANCESTRY



## GENETIC STATS

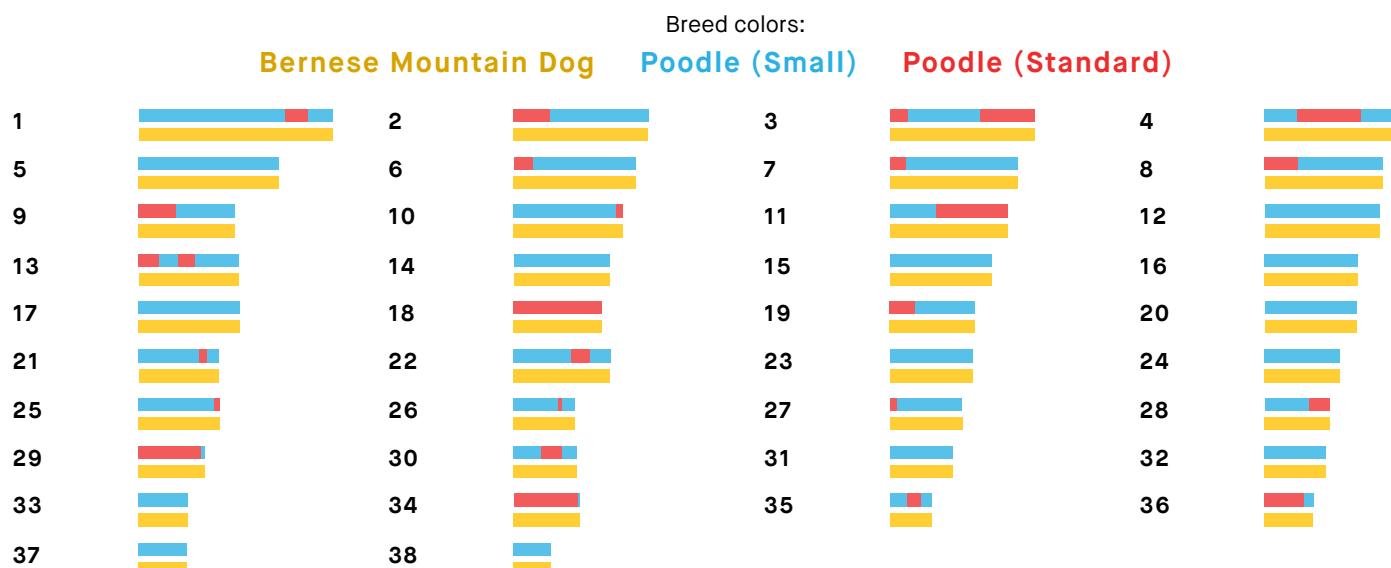
Predicted adult weight: **43 lbs**  
Life stage: **Young adult**  
Based on your dog's date of birth provided.

## TEST DETAILS

Kit number: EM-53824914  
Swab number: 31220710609796

## BREED ANCESTRY BY CHROMOSOME

Our advanced test identifies from where Serena inherited every part of the chromosome pairs in her genome.



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## BERNESE MOUNTAIN DOG



The Bernese Mountain Dog, commonly referred to as a 'Berner', is a versatile working dog that is both visually pleasing and a loyal companion. The Bernese Mountain Dog was bred to herd cattle, pull carts and be a watchdog in the Swiss farmlands. The ancient 'Molosser' breed is considered the main contributor to Mastiff-type dogs, which include the Berner. It is likely that the Molosser bred with farm dogs from the Swiss Alps in the first century B.C., developing a number of Swiss Sennenhund ("mountain dog") breeds, including the Berner Sennenhund. It is thought that the Berner continued working on these Swiss farmlands for over 2,000 years, before their primary purpose switched from herding cattle to appearing as a show dog in the early 20th century. They were first classified as the Bernese Mountain Dog at this time by the Swiss Kennel Club. Following World War I, in which the breed nearly became extinct, Berners were exported to America before being accepted by the AKC as an official breed in 1937. Breed development faltered somewhat during World War II before Berners became an established and popular breed in the mid to late 20th century. This easygoing breed likes to be around their owners, where their calm and intelligent nature makes them a beloved family dog. Berners exhibit their working dog instincts in their willingness to learn and relative ease to be trained. Their heritage also often results in being protective and sometimes shy towards new people and dogs. Early socialization training allows the Bernese Mountain Dog to learn to overcome initial caution around new things. This breed is a large dog, weighing around 100 pounds, and likes to keep busy, so it is important training is conducted while young and manageable. While they are well-tempered dogs, they are slow to mature and often exhibit puppy behavior for a number of years before reaching full maturity. Due to their beautiful and thick double coat, Berners tend to shed generously, requiring frequent brushing to keep under control. Unfortunately, owing to their size and limited gene pool, Bernese Mountain Dogs are prone to health problems and have a life expectancy of between 6-8 years. Nonetheless, this lovable dog

### Fun Fact

Berners can haul up to 1,000 pounds - 10 times their weight!

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### POODLE (SMALL)



Miniature and toy poodles are varieties of the poodle breed which originated in Germany in the 15th century. Unlike the larger standard poodle (>15 inches tall), these small poodles were not developed for hunting---except for truffles!---and were generally used as lap dogs and companions. Small poodles are frequently used to create designer dogs like Schnoodles and Maltipoos with low-shedding, hypoallergenic coats. All poodles are highly intelligent and energetic, and need daily exercise and stimulation. They are overall healthy dogs, although heritable eye disease, epilepsy and allergies are relatively common, and toy poodles also have a heightened risk of accidents/trauma due to their small size.

#### Alternative Names

Toy Poodle, Miniature Poodle

#### Fun Fact

Although Toy Poodles are the most popular dog breed in Japan, Poodles as a group are the eighth most popular breed in the US, with miniature poodles being the most common variety.

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### POODLE (STANDARD)



The Standard Poodle is a popular, water-loving dog used for centuries as a bird dog and popular pet. Poodles were established in Germany by the 15th century. Oddly enough, they are the national dog breed of France, and they were the most popular breed of dog in the United States throughout the 1960s and 70s. They're still quite popular today, owing to their intelligence, trainability, and non-shedding coats. Although well-known for their fancy fur, they're one of the most intelligent breeds of dog and require a lot of exercise and stimulation.

#### Fun Fact

From 1989 to 1991, John Suter raced a team of Poodles in the Iditarod. Although his teams placed in the back half of the pack, he managed to win \$2,000 in prize money before retiring his poodle team. The Iditarod has since changed its rules to specify that only northern dog breeds can compete.

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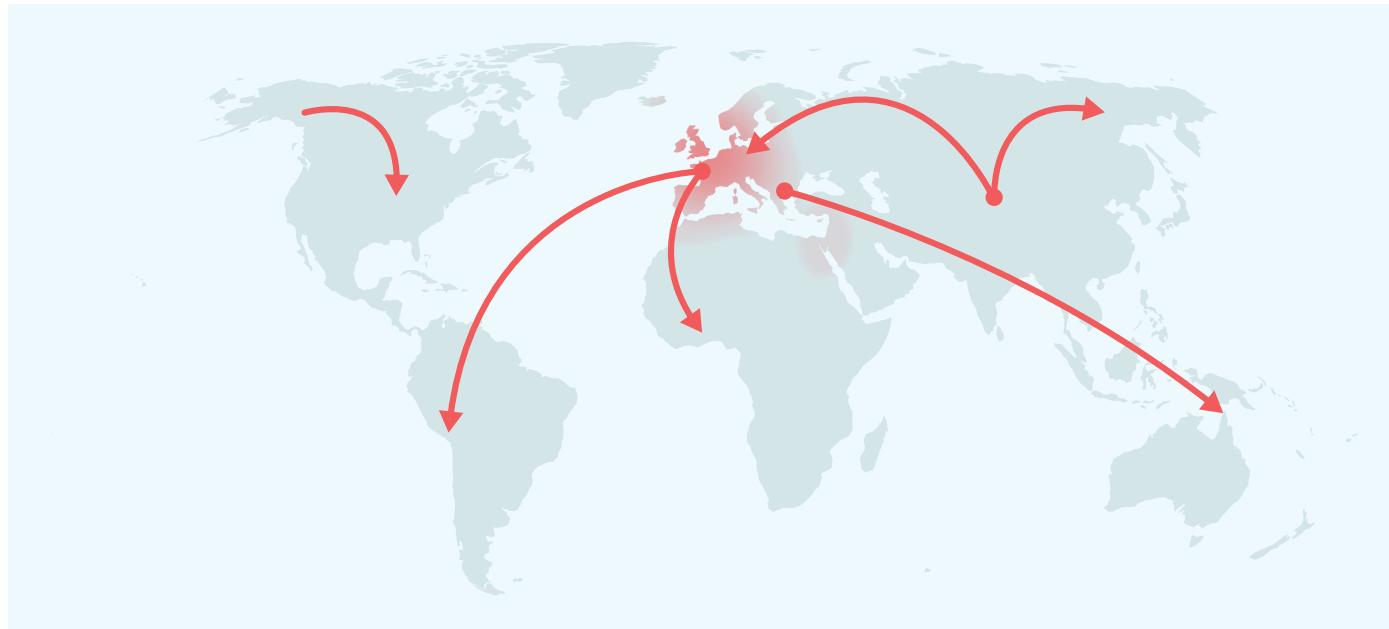


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## MATERNAL LINE



Through Serena's mitochondrial DNA we can trace her mother's ancestry back to where dogs and people first became friends. This map helps you visualize the routes that her ancestors took to your home. Their story is described below the map.

### HAPLOGROUP: A1e

This female lineage likely stems from some of the original Central Asian wolves that were domesticated into modern dogs starting about 15,000 years ago. It seemed to be a fairly rare dog line for most of dog history until the past 300 years, when the lineage seemed to "explode" out and spread quickly. What really separates this group from the pack is its presence in Alaskan village dogs and Samoyeds. It is possible that this was an indigenous lineage brought to the Americas from Siberia when people were first starting to make that trip themselves! We see this lineage pop up in overwhelming numbers of Irish Wolfhounds, and it also occurs frequently in popular large breeds like Bernese Mountain Dogs, Saint Bernards and Great Danes. Shetland Sheepdogs are also common members of this maternal line, and we see it a lot in Boxers, too. Though it may be all mixed up with European dogs thanks to recent breeding events, its origins in the Americas makes it a very exciting lineage for sure!

### HAPLOTYPE: A22

Part of the large A1e haplogroup, we see this haplotype in Bernese Mountain Dogs, German Shepherd Dogs, Great Danes, and village dogs in the Democratic Republic of the Congo.

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## TRAITS: COAT COLOR

TRAIT	RESULT
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### E Locus (MC1R)

The E Locus determines if and where a dog can produce dark (black or brown) hair. Dogs with two copies of the recessive **e** variant do not produce dark hairs and will express a red pigment called pheomelanin over their entire body. The shade of red, which can range from a deep copper to white, depends on other genetic factors, including the Intensity loci. In addition to determining if a dog can develop dark hairs, the E Locus can give a dog a black "mask" or "widow's peak" unless the dog has overriding coat color genetic factors.

**No dark mask or grizzle (Ee)**

Dogs with one or two copies of the **E<sup>m</sup>** variant may have a melanistic mask (dark facial hair as commonly seen in the German Shepherd Dog and Pug). In the absence of **E<sup>m</sup>**, dogs with the **E<sup>g</sup>** variant can have a "grizzle" phenotype (darker color on the head and top with a melanistic "widow's peak" and a lighter underside, commonly seen in the Afghan Hound and Borzoi and also referred to as "domino"). In the absence of both **E<sup>m</sup>** and **E** variants, dogs with the **E<sup>a</sup>** or **E<sup>h</sup>** variants can express the grizzle phenotype. Additionally, a dog with any combination of two of the **E<sup>g</sup>**, **E<sup>a</sup>**, or **E<sup>h</sup>** variants (example: **E<sup>g</sup>E<sup>a</sup>**) is also expected to express the grizzle phenotype.

### K Locus (CBD103)

The K Locus **K<sup>B</sup>** allele "overrides" the A Locus, meaning that it prevents the A Locus genotype from affecting coat color. For this reason, the **K<sup>B</sup>** allele is referred to as the "dominant black" allele. As a result, dogs with at least one **K<sup>B</sup>** allele will usually have solid black or brown coats (or red/cream coats if they are **ee** at the E Locus) regardless of their genotype at the A Locus, although several other genes could impact the dog's coat and cause other patterns, such as white spotting. Dogs with the **k<sup>Y</sup>k<sup>Y</sup>** genotype will show a coat color pattern based on the genotype they have at the A Locus. Dogs who test as **K<sup>B</sup>k<sup>Y</sup>** may be brindle rather than black or brown.

**More likely to have a patterned haircoat (k<sup>Y</sup>k<sup>Y</sup>)**

## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
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### Intensity Loci

Areas of a dog's coat where dark (black or brown) pigment is not expressed either contain red/yellow pigment, or no pigment at all. Five locations across five chromosomes explain approximately 70% of red pigmentation "intensity" variation across all dogs. Dogs with a result of **Intense Red Pigmentation** will likely have deep red hair like an Irish Setter or "apricot" hair like some Poodles, dogs with a result of **Intermediate Red Pigmentation** will likely have tan or yellow hair like a Soft-Coated Wheaten Terrier, and dogs with **Dilute Red Pigmentation** will likely have cream or white hair like a Samoyed. Because the mutations we test may not directly cause differences in red pigmentation intensity, we consider this to be a linkage test.

**Any light hair likely yellow or tan (Intermediate Red Pigmentation)**

### A Locus (ASIP)

The A Locus controls switching between black and red pigment in hair cells, but it will only be expressed in dogs that are **ee** at the E Locus and are **k<sup>y</sup>k<sup>y</sup>** at the K Locus. Sable (also called "Fawn") dogs have a mostly or entirely red coat with some interspersed black hairs. Agouti (also called "Wolf Sable") dogs have red hairs with black tips, mostly on their head and back. Black and tan dogs are mostly black or brown with lighter patches on their cheeks, eyebrows, chest, and legs. Recessive black dogs have solid-colored black or brown coats.

**Black/Brown and tan coat color pattern (a<sup>t</sup>a<sup>t</sup>)**

### D Locus (MLPH)

The D locus result that we report is determined by three different genetic variants that can work together to cause diluted pigmentation. These are the common **d** allele, also known as "**d1**", and the less common alleles known as "**d2**" and "**d3**". Dogs with two **d** alleles, regardless of which variant, will have all black pigment lightened ("diluted") to gray, or brown pigment lightened to lighter brown in their hair, skin, and sometimes eyes. There are many breed-specific names for these dilute colors, such as "blue", "charcoal", "fawn", "silver", and "Isabella". Note that in certain breeds, dilute dogs have a higher incidence of Color Dilution Alopecia. Dogs with one **d** allele will not be dilute, but can pass the **d** allele on to their puppies.

**Dark areas of hair and skin are not lightened (DD)**

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## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
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### Cocoa (HPS3)

Dogs with the **coco** genotype will produce dark brown pigment instead of black in both their hair and skin.

Dogs with the **Nco** genotype will produce black pigment, but can pass the **co** allele on to their puppies.

Dogs that have the **coco** genotype as well as the **bb** genotype at the B locus are generally a lighter brown than dogs that have the **Bb** or **BB** genotypes at the B locus.

**No co alleles, not expressed (NN)**

### B Locus (TYRP1)

Dogs with two copies of the **b** allele produce brown pigment instead of black in both their hair and skin.

Dogs with one copy of the **b** allele will produce black pigment, but can pass the **b** allele on to their puppies.

E Locus **ee** dogs that carry two **b** alleles will have red or cream coats, but have brown noses, eye rims, and footpads (sometimes referred to as "Dudley Nose" in Labrador Retrievers). "Liver" or "chocolate" is the preferred color term for brown in most breeds; in the Doberman Pinscher it is referred to as "red".

**Black or gray hair and skin (BB)**

### Saddle Tan (RALY)

The "Saddle Tan" pattern causes the black hairs to recede into a "saddle" shape on the back, leaving a tan face, legs, and belly, as a dog ages. The Saddle Tan pattern is characteristic of breeds like the Corgi, Beagle, and German Shepherd. Dogs that have the **II** genotype at this locus are more likely to be mostly black with tan points on the eyebrows, muzzle, and legs as commonly seen in the Doberman Pinscher and the Rottweiler. This gene modifies the A Locus **a<sup>t</sup>** allele, so dogs that do not express **a<sup>t</sup>** are not influenced by this gene.

**Likely saddle tan patterned (NI)**

### S Locus (MITF)

The S Locus determines white spotting and pigment distribution. MITF controls where pigment is produced, and an insertion in the MITF gene causes a loss of pigment in the coat and skin, resulting in white hair and/or pink skin. Dogs with two copies of this variant will likely have breed-dependent white patterning, with a nearly white, parti, or piebald coat. Dogs with one copy of this variant will have more limited white spotting and may be considered flash, parti or piebald. This MITF variant does not explain all white spotting patterns in dogs and other variants are currently being researched. Some dogs may have small amounts of white on the paws, chest, face, or tail regardless of their S Locus genotype.

**Likely solid colored, but may have small amounts of white (Ssp)**

## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
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### M Locus (PMEL)

Merle coat patterning is common to several dog breeds including the Australian Shepherd, Catahoula Leopard Dog, and Shetland Sheepdog, among many others. Merle arises from an unstable SINE insertion (which we term the "M\*" allele) that disrupts activity of the pigmentary gene PMEL, leading to mottled or patchy coat color. Dogs with an **M\*m** result are likely to be phenotypically merle or could be "non-expressing" merle, meaning that the merle pattern is very subtle or not at all evident in their coat. Dogs with an **M\*M\*** result are likely to be phenotypically merle or double merle. Dogs with an **mm** result have no merle alleles and are unlikely to have a merle coat pattern.

**No merle alleles (mm)**

Note that Embark does not currently distinguish between the recently described cryptic, atypical, atypical+, classic, and harlequin merle alleles. Our merle test only detects the presence, but not the length of the SINE insertion. We do not recommend making breeding decisions on this result alone. Please pursue further testing for allelic distinction prior to breeding decisions.

### R Locus (USH2A)

The R Locus regulates the presence or absence of the roan coat color pattern. Partial duplication of the USH2A gene is strongly associated with this coat pattern. Dogs with at least one **R** allele will likely have roaning on otherwise uniformly unpigmented white areas. Roan appears in white areas controlled by the S Locus but not in other white or cream areas created by other loci, such as the E Locus with **ee** along with Dilute Red Pigmentation by I Locus (for example, in Samoyeds). Mechanisms for controlling the extent of roaning are currently unknown, and roaning can appear in a uniform or non-uniform pattern. Further, non-uniform roaning may appear as ticked, and not obviously roan. The roan pattern can appear with or without ticking.

**Likely no impact on coat pattern (rr)**

### H Locus (Harlequin)

This pattern is recognized in Great Danes and causes dogs to have a white coat with patches of darker pigment. A dog with an **Hh** result will be harlequin if they are also **M\*m** or **M\*M\*** at the M Locus and are not **ee** at the E locus. Dogs with a result of **hh** will not be harlequin. This trait is thought to be homozygous lethal; a living dog with an **HH** genotype has never been found.

**No harlequin alleles (hh)**

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## TRAITS: COAT COLOR (CONTINUED)

### TRAIT

### RESULT

#### Panda White Spotting

Panda White Spotting originated in a line of German Shepherd Dogs and causes a mostly symmetrical white spotting of the head and/or body. This is a dominant variant of the KIT gene, which has a role in pigmentation.

Dogs with one copy of the I allele will exhibit this white spotting. Dogs with two copies of the I allele have never been observed, as two copies of the variant is suspected to be lethal to the developing embryo. Dogs with the NN result will not exhibit white spotting due to this variant.

**Not expected to display Panda pattern (NN)**

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### TRAITS: OTHER COAT TRAITS

TRAIT	RESULT	
<b>Furnishings (RSPO2)</b>	Dogs with one or two copies of the <b>F</b> allele have "furnishings": the mustache, beard, and eyebrows characteristic of breeds like the Schnauzer, Scottish Terrier, and Wire Haired Dachshund. A dog with two <b>I</b> alleles will not have furnishings, which is sometimes called an "improper coat" in breeds where furnishings are part of the breed standard. The mutation is a genetic insertion which we measure indirectly using a linkage test highly correlated with the insertion.	<b>Likely furnished (mustache, beard, and/or eyebrows) (FI)</b>

## TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
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### Coat Length (FGF5)

The FGF5 gene affects hair length in many species, including cats, dogs, mice, and humans. In dogs, an **Lh** allele confers a long, silky hair coat across many breeds, including Yorkshire Terriers, Cocker Spaniels, and Golden Retrievers, while the **Sh** allele causes a shorter coat, as seen in the Boxer or the American Staffordshire Terrier. In certain breeds, such as the Pembroke Welsh Corgi and French Bulldog, the long haircoat is described as "fluffy". The coat length determined by FGF5, as reported by us, is influenced by four genetic variants that work together to promote long hair.

The most common of these is the **Lh1** variant (G/T, CanFam3.1, chr32, g.4509367) and the less common ones are **Lh2** (C/T, CanFam3.1, chr32, g.4528639), **Lh3** (16bp deletion, CanFam3.1, chr32, g.4528616), and **Lh4** (GG insertion, CanFam3.1, chr32, g.4528621). The FGF5\_Lh1 variant is found across many dog breeds. The less common alleles, FGF5\_Lh2, have been found in the Akita, Samoyed, and Siberian Husky, FGF5\_Lh3 have been found in the Eurasier, and FGF5\_Lh4 have been found in the Afghan Hound, Eurasier, and French Bulldog.

**Likely long coat (LhLh)**

The **Lh** alleles have a recessive mode of inheritance, meaning that two copies of the **Lh** alleles are required to have long hair. The presence of two Lh alleles at any of these FGF5 loci is expected to result in long hair. One copy each of **Lh1** and **Lh2** have been found in Samoyeds, one copy each of **Lh1** and **Lh3** have been found in Eurasiers, and one copy each of **Lh1** and **Lh4** have been found in the Afghan Hounds and Eurasiers.

Interestingly, the Lh3 variant, a 16 base pair deletion, encompasses the Lh4 variant (GG insertion). The presence of one or two copies of Lh3 influences the outcome at the Lh4 locus. When two copies of Lh3 are present, there will be no reportable result for the FGF5\_Lh4 locus. With one copy of Lh3, Lh4 can have either one copy of the variant allele or the normal allele. The overall FGF5 result remains unaffected by this.

## TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
<b>Shedding (MC5R)</b>	<b>Likely light shedding (CT)</b>
Dogs with at least one copy of the ancestral <b>C</b> allele, like many Labradors and German Shepherd Dogs, are heavy or seasonal shedders, while those with two copies of the <b>T</b> allele, including many Boxers, Shih Tzus and Chihuahuas, tend to be lighter shedders. Dogs with furnished/wire-haired coats caused by RSPO2 (the furnishings gene) tend to be low shedders regardless of their genotype at this gene.	
<b>Coat Texture (KRT71)</b>	<b>Likely wavy coat (CT)</b>
Dogs with a long coat and at least one copy of the <b>T</b> allele have a wavy or curly coat characteristic of Poodles and Bichon Frises. Dogs with two copies of the ancestral <b>C</b> allele are likely to have a straight coat, but there are other factors that can cause a curly coat, for example if they at least one <b>F</b> allele for the Furnishings (RSPO2) gene then they are likely to have a curly coat. Dogs with short coats may carry one or two copies of the <b>T</b> allele but still have straight coats.	
<b>Hairlessness (FOXI3)</b>	<b>Very unlikely to be hairless (NN)</b>
A duplication in the FOXI3 gene causes hairlessness over most of the body as well as changes in tooth shape and number. This mutation occurs in Peruvian Inca Orchid, Xoloitzcuintli (Mexican Hairless), and Chinese Crested (other hairless breeds have different mutations). Dogs with the <b>NDup</b> genotype are likely to be hairless while dogs with the <b>NN</b> genotype are likely to have a normal coat. The <b>DupDup</b> genotype has never been observed, suggesting that dogs with that genotype cannot survive to birth. Please note that this is a linkage test, so it may not be as predictive as direct tests of the mutation in some lines.	
<b>Hairlessness (SGK3)</b>	<b>Very unlikely to be hairless (NN)</b>
Hairlessness in the American Hairless Terrier arises from a mutation in the SGK3 gene. Dogs with the <b>DD</b> result are likely to be hairless. Dogs with the <b>ND</b> genotype will have a normal coat, but can pass the <b>D</b> variant on to their offspring.	

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### TRAITS: OTHER COAT TRAITS (CONTINUED)

#### TRAIT

#### RESULT

##### Oculocutaneous Albinism Type 2 (SLC45A2)

Dogs with two copies **DD** of this deletion in the SLC45A2 gene have oculocutaneous albinism (OCA), also known as Doberman Z Factor Albinism, a recessive condition characterized by severely reduced or absent pigment in the eyes, skin, and hair. Affected dogs sometimes suffer from vision problems due to lack of eye pigment (which helps direct and absorb ambient light) and are prone to sunburn. Dogs with a single copy of the deletion **ND** will not be affected but can pass the mutation on to their offspring. This particular mutation can be traced back to a single white Doberman Pinscher born in 1976, and it has only been observed in dogs descended from this individual. Please note that this is a linkage test, so it may not be as predictive as direct tests of the mutation in some lines.

**Likely not albino (NN)**

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## TRAITS: OTHER BODY FEATURES

TRAIT	RESULT
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### Muzzle Length (BMP3)

Dogs in medium-length muzzle (mesocephalic) breeds like Staffordshire Terriers and Labradors, and long muzzle (dolichocephalic) breeds like Whippet and Collie have one, or more commonly two, copies of the ancestral **C** allele. Dogs in many short-length muzzle (brachycephalic) breeds such as the English Bulldog, Pug, and Pekingese have two copies of the derived **A** allele. At least five different genes affect muzzle length in dogs, with BMP3 being the only one with a known causal mutation. For example, the skull shape of some breeds, including the dolichocephalic Scottish Terrier or the brachycephalic Japanese Chin, appear to be caused by other genes. Thus, dogs may have short or long muzzles due to other genetic factors that are not yet known to science.

**Likely medium or long muzzle (CC)**

### Tail Length (T)

Whereas most dogs have two **C** alleles and a long tail, dogs with one **G** allele are likely to have a bobtail, which is an unusually short or absent tail. This mutation causes natural bobtail in many breeds including the Pembroke Welsh Corgi, the Australian Shepherd, and the Brittany Spaniel. Dogs with **GG** genotypes have not been observed, suggesting that dogs with the **GG** genotype do not survive to birth.

**Likely normal-length tail (CC)**

Please note that this mutation does not explain every natural bobtail! While certain lineages of Boston Terrier, English Bulldog, Rottweiler, Miniature Schnauzer, Cavalier King Charles Spaniel, and Parson Russell Terrier, and Dobermans are born with a natural bobtail, these breeds do not have this mutation. This suggests that other unknown genetic mutations can also lead to a natural bobtail.

### Hind Dewclaws (LMBR1)

Common in certain breeds such as the Saint Bernard, hind dewclaws are extra, nonfunctional digits located midway between a dog's paw and hock. Dogs with at least one copy of the **T** allele have about a 50% chance of having hind dewclaws. Note that other (currently unknown to science) mutations can also cause hind dewclaws, so some **CC** or **TC** dogs will have hind dewclaws.

**Likely to have hind dew claws (CT)**

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## TRAITS: OTHER BODY FEATURES (CONTINUED)

TRAIT	RESULT
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### Chondrodysplasia (Chr. 18 FGF4 Retrogene)

Dogs with one or two copies of the **I** allele will exhibit a short-legged trait known as chondrodysplasia (CDPA). CDPA is a breed-defining characteristic of many breeds exhibiting the "short-legged, long-bodied" appearance known as disproportionate dwarfism, including the corgi, dachshund and basset hound. The impact of the **I** allele on leg length is additive. Therefore, dogs with the **II** result display the largest reduction in leg length. Dogs with the **NI** genotype will have an intermediate leg length, while dogs with the **NN** result will not exhibit leg shortening due to this variant. Breeds that display disproportionate dwarfism also frequently inherit a genetic variant known as the chondrodystrophy (CDDY) variant. The CDDY variant also shortens legs (in a less significant amount than CDPA) but, secondarily, increases the risk of Type I Intervertebral Disc Disease (IVDD). Test results for CDDY are listed in this dog's health testing results under "Intervertebral Disc Disease (Type I)". In contrast, the CDPA variant has NOT been shown to increase the risk of IVDD.

Not indicative of chondrodysplasia (normal leg length) (NN)

### Blue Eye Color (ALX4)

Embark researchers discovered this large duplication associated with blue eyes in Arctic breeds like Siberian Husky as well as tri-colored (non-merle) Australian Shepherds. Dogs with at least one copy of the duplication (**Dup**) are more likely to have at least one blue eye. Some dogs with the duplication may have only one blue eye (complete heterochromia) or may not have blue eyes at all; nevertheless, they can still pass the duplication and the trait to their offspring. **NN** dogs do not carry this duplication, but may have blue eyes due to other factors, such as merle. Please note that this is a linkage test, so it may not be as predictive as direct tests of the mutation in some lines.

Less likely to have blue eyes (NN)

### Back Muscling & Bulk, Large Breed (ACSL4)

The **T** allele is associated with heavy muscling along the back and trunk in characteristically "bulky" large-breed dogs including the Saint Bernard, Bernese Mountain Dog, Greater Swiss Mountain Dog, and Rottweiler. The "bulky" **T** allele is absent from leaner shaped large breed dogs like the Great Dane, Irish Wolfhound, and Scottish Deerhound, which are fixed for the ancestral **C** allele. Note that this mutation does not seem to affect muscling in small or even mid-sized dog breeds with notable back muscling, including the American Staffordshire Terrier, Boston Terrier, and the English Bulldog.

Likely normal muscling (CC)

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### TRAITS: BODY SIZE

TRAIT	RESULT
<b>Body Size (IGF1)</b> The <b>I</b> allele is associated with smaller body size.	<b>Intermediate (NI)</b>
<b>Body Size (IGFR1)</b> The <b>A</b> allele is associated with smaller body size.	<b>Intermediate (GA)</b>
<b>Body Size (STC2)</b> The <b>A</b> allele is associated with smaller body size.	<b>Intermediate (TA)</b>
<b>Body Size (GHR - E191K)</b> The <b>A</b> allele is associated with smaller body size.	<b>Larger (GG)</b>
<b>Body Size (GHR - P177L)</b> The <b>T</b> allele is associated with smaller body size.	<b>Larger (CC)</b>

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## TRAITS: PERFORMANCE

### TRAIT

### RESULT

#### Altitude Adaptation (EPAS1)

This mutation causes dogs to be especially tolerant of low oxygen environments (hypoxia), such as those found at high elevations. Dogs with at least one **A** allele are less susceptible to "altitude sickness." This mutation was originally identified in breeds from high altitude areas such as the Tibetan Mastiff.

**Normal altitude tolerance (GG)**

#### Appetite (POMC)

This mutation in the POMC gene is found primarily in Labrador and Flat Coated Retrievers. Compared to dogs with no copies of the mutation (**NN**), dogs with one (**ND**) or two (**DD**) copies of the mutation are more likely to have high food motivation, which can cause them to eat excessively, have higher body fat percentage, and be more prone to obesity. Read more about the genetics of POMC, and learn how you can contribute to research, in our blog post (<https://embarkvet.com/resources/blog/pomc-dogs/>). We measure this result using a linkage test.

**Normal food motivation (NN)**

# "SERENA"

## SERENA



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## HEALTH REPORT

### How to interpret Serena's genetic health results:

If Serena inherited any of the variants that we tested, they will be listed at the top of the Health Report section, along with a description of how to interpret this result. We also include all of the variants that we tested Serena for that we did not detect the risk variant for.

### A genetic test is not a diagnosis

This genetic test does not diagnose a disease. Please talk to your vet about your dog's genetic results, or if you think that your pet may have a health condition or disease.

### Summary

Of the 274 genetic health risks we analyzed, we found 3 results that you should learn about.

#### **Notable results** (3)

##### **ALT Activity**

##### **Copper Toxicosis (Attenuating)**

##### **Degenerative Myelopathy, DM**

#### **Clear results**

##### **Breed-relevant** (6)

##### **Other** (264)

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## BREED-RELEVANT RESULTS

Research studies indicate that these results are more relevant to dogs like Serena, and may influence her chances of developing certain health conditions.

<input type="checkbox"/> -	Degenerative Myelopathy, DM (SOD1A)	Notable
<input checked="" type="checkbox"/>	GM2 Gangliosidosis (HEXB, Poodle Variant)	Clear
<input checked="" type="checkbox"/>	Intervertebral Disc Disease (Type I) (FGF4 retrogene - CFA12)	Clear
<input checked="" type="checkbox"/>	Neonatal Encephalopathy with Seizures, NEWS (ATF2)	Clear
<input checked="" type="checkbox"/>	Osteochondrodysplasia (SLC13A1, Poodle Variant)	Clear
<input checked="" type="checkbox"/>	Progressive Retinal Atrophy, prcd (PRCD Exon 1)	Clear
<input checked="" type="checkbox"/>	Von Willebrand Disease Type I, Type I vWD (VWF)	Clear



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## OTHER RESULTS

Research has not yet linked these conditions to dogs with similar breeds to Serena. Review any increased risk or notable results to understand her potential risk and recommendations.

<input checked="" type="checkbox"/> ALT Activity (GPT)	Notable
<input checked="" type="checkbox"/> Copper Toxicosis (Attenuating) (ATP7A, Labrador Retriever)	Notable
<input checked="" type="checkbox"/> 2-DHA Kidney & Bladder Stones (APRT)	Clear
<input checked="" type="checkbox"/> Acral Mutilation Syndrome (GDNF-AS, Spaniel and Pointer Variant)	Clear
<input checked="" type="checkbox"/> Alaskan Husky Encephalopathy (SLC19A3)	Clear
<input checked="" type="checkbox"/> Alaskan Malamute Polyneuropathy, AMPN (NDRG1 SNP)	Clear
<input checked="" type="checkbox"/> Alexander Disease (GFAP)	Clear
<input checked="" type="checkbox"/> Anhidrotic Ectodermal Dysplasia (EDA Intron 8)	Clear
<input checked="" type="checkbox"/> Autosomal Dominant Progressive Retinal Atrophy (RHO)	Clear
<input checked="" type="checkbox"/> Bald Thigh Syndrome (IGFBP5)	Clear
<input checked="" type="checkbox"/> Bernard-Soulier Syndrome, BSS (GP9, Cocker Spaniel Variant)	Clear
<input checked="" type="checkbox"/> Bully Whippet Syndrome (MSTN)	Clear
<input checked="" type="checkbox"/> Canine Elliptocytosis (SPTB Exon 30)	Clear
<input checked="" type="checkbox"/> Canine Fucosidosis (FUCA1)	Clear
<input checked="" type="checkbox"/> Canine Leukocyte Adhesion Deficiency Type I, CLAD I (ITGB2, Setter Variant)	Clear
<input checked="" type="checkbox"/> Canine Leukocyte Adhesion Deficiency Type III, CLAD III (FERMT3, German Shepherd Variant)	Clear
<input checked="" type="checkbox"/> Canine Multifocal Retinopathy, cmr1 (BEST1 Exon 2)	Clear
<input checked="" type="checkbox"/> Canine Multifocal Retinopathy, cmr2 (BEST1 Exon 5, Coton de Tulear Variant)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/> Canine Multifocal Retinopathy, cmr3 (BEST1 Exon 10 Deletion, Finnish and Swedish Lapphund, Lapponian Herder Variant)	Clear
<input checked="" type="checkbox"/> Canine Multiple System Degeneration (SERAC1 Exon 4, Chinese Crested Variant)	Clear
<input checked="" type="checkbox"/> Canine Multiple System Degeneration (SERAC1 Exon 15, Kerry Blue Terrier Variant)	Clear
<input checked="" type="checkbox"/> Cardiomyopathy and Juvenile Mortality (YARS2)	Clear
<input checked="" type="checkbox"/> Centronuclear Myopathy, CNM (PTPLA)	Clear
<input checked="" type="checkbox"/> Cerebellar Hypoplasia (VLDLR, Eurasier Variant)	Clear
<input checked="" type="checkbox"/> Chondrodysplasia (ITGA10, Norwegian Elkhound and Karelian Bear Dog Variant)	Clear
<input checked="" type="checkbox"/> Cleft Lip and/or Cleft Palate (ADAMTS20, Nova Scotia Duck Tolling Retriever Variant)	Clear
<input checked="" type="checkbox"/> Cleft Palate, CP1 (DLX6 intron 2, Nova Scotia Duck Tolling Retriever Variant)	Clear
<input checked="" type="checkbox"/> Cobalamin Malabsorption (CUBN Exon 8, Beagle Variant)	Clear
<input checked="" type="checkbox"/> Cobalamin Malabsorption (CUBN Exon 53, Border Collie Variant)	Clear
<input checked="" type="checkbox"/> Collie Eye Anomaly (NHEJ1)	Clear
<input checked="" type="checkbox"/> Complement 3 Deficiency, C3 Deficiency (C3)	Clear
<input checked="" type="checkbox"/> Congenital Cornification Disorder (NSDHL, Chihuahua Variant)	Clear
<input checked="" type="checkbox"/> Congenital Dyserythropoietic Anemia and Polymyopathy (EHPB1L1, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> Congenital Hypothyroidism (TPO, Rat, Toy, Hairless Terrier Variant)	Clear
<input checked="" type="checkbox"/> Congenital Hypothyroidism (TPO, Tenterfield Terrier Variant)	Clear
<input checked="" type="checkbox"/> Congenital Hypothyroidism with Goiter (TPO Intron 13, French Bulldog Variant)	Clear



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## OTHER RESULTS

<input checked="" type="checkbox"/>	Congenital Hypothyroidism with Goiter (SLC5A5, Shih Tzu Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Macrothrombocytopenia (TUBB1 Exon 1, Cairn and Norfolk Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Muscular Dystrophy (LAMA2, Italian Greyhound)	Clear
<input checked="" type="checkbox"/>	Congenital Myasthenic Syndrome, CMS (COLQ, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Myasthenic Syndrome, CMS (COLQ, Golden Retriever Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Myasthenic Syndrome, CMS (CHAT, Old Danish Pointing Dog Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Myasthenic Syndrome, CMS (CHRNE, Jack Russell Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Stationary Night Blindness (LRIT3, Beagle Variant)	Clear
<input checked="" type="checkbox"/>	Congenital Stationary Night Blindness (RPE65, Briard Variant)	Clear
<input checked="" type="checkbox"/>	Copper Toxicosis (Accumulating) (ATP7B)	Clear
<input checked="" type="checkbox"/>	Copper Toxicosis (Attenuating) (RETN, Labrador Retriever)	Clear
<input checked="" type="checkbox"/>	Craniomandibular Osteopathy, CMO (SLC37A2)	Clear
<input checked="" type="checkbox"/>	Craniomandibular Osteopathy, CMO (SLC37A2 Intron 16, Basset Hound Variant)	Clear
<input checked="" type="checkbox"/>	Cystinuria Type I-A (SLC3A1, Newfoundland Variant)	Clear
<input checked="" type="checkbox"/>	Cystinuria Type II-A (SLC3A1, Australian Cattle Dog Variant)	Clear
<input checked="" type="checkbox"/>	Cystinuria Type II-B (SLC7A9, Miniature Pinscher Variant)	Clear
<input checked="" type="checkbox"/>	Darier Disease (ATP2A2, Irish Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Day Blindness (CNGB3 Deletion, Alaskan Malamute Variant)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/> Day Blindness (CNGA3 Exon 7, German Shepherd Variant)	Clear
<input checked="" type="checkbox"/> Day Blindness (CNGA3 Exon 7, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> Day Blindness (CNGB3 Exon 6, German Shorthaired Pointer Variant)	Clear
<input checked="" type="checkbox"/> Deafness and Vestibular Syndrome of Dobermans, DVDOB, DINGS (MYO7A)	Clear
<input checked="" type="checkbox"/> Demyelinating Polyneuropathy (SBF2/MTRM13)	Clear
<input checked="" type="checkbox"/> Dental-Skeletal-Retinal Anomaly (MIA3, Cane Corso Variant)	Clear
<input checked="" type="checkbox"/> Diffuse Cystic Renal Dysplasia and Hepatic Fibrosis (INPP5E Intron 9, Norwich Terrier Variant)	Clear
<input checked="" type="checkbox"/> Dilated Cardiomyopathy, DCM (RBM20, Schnauzer Variant)	Clear
<input checked="" type="checkbox"/> Dilated Cardiomyopathy, DCM1 (PDK4, Doberman Pinscher Variant 1)	Clear
<input checked="" type="checkbox"/> Dilated Cardiomyopathy, DCM2 (TTN, Doberman Pinscher Variant 2)	Clear
<input checked="" type="checkbox"/> Disproportionate Dwarfism (PRKG2, Dogo Argentino Variant)	Clear
<input checked="" type="checkbox"/> Dry Eye Curly Coat Syndrome (FAM83H Exon 5)	Clear
<input checked="" type="checkbox"/> Dystrophic Epidermolysis Bullosa (COL7A1, Central Asian Shepherd Dog Variant)	Clear
<input checked="" type="checkbox"/> Dystrophic Epidermolysis Bullosa (COL7A1, Golden Retriever Variant)	Clear
<input checked="" type="checkbox"/> Early Bilateral Deafness (LOXHD1 Exon 38, Rottweiler Variant)	Clear
<input checked="" type="checkbox"/> Early Onset Adult Deafness, EOAD (EPS8L2 Deletion, Rhodesian Ridgeback Variant)	Clear
<input checked="" type="checkbox"/> Early Onset Cerebellar Ataxia (SEL1L, Finnish Hound Variant)	Clear
<input checked="" type="checkbox"/> Ehlers Danlos (ADAMTS2, Doberman Pinscher Variant)	Clear



## OTHER RESULTS

<input checked="" type="checkbox"/> Ehlers-Danlos Syndrome (EDS) (COL5A1, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> Enamel Hypoplasia (ENAM Deletion, Italian Greyhound Variant)	Clear
<input checked="" type="checkbox"/> Enamel Hypoplasia (ENAM SNP, Parson Russell Terrier Variant)	Clear
<input checked="" type="checkbox"/> Episodic Falling Syndrome (BCAN)	Clear
<input checked="" type="checkbox"/> Exercise-Induced Collapse, EIC (DNM1)	Clear
<input checked="" type="checkbox"/> Factor VII Deficiency (F7 Exon 5)	Clear
<input checked="" type="checkbox"/> Factor XI Deficiency (F11 Exon 7, Kerry Blue Terrier Variant)	Clear
<input checked="" type="checkbox"/> Familial Nephropathy (COL4A4 Exon 3, Cocker Spaniel Variant)	Clear
<input checked="" type="checkbox"/> Familial Nephropathy (COL4A4 Exon 30, English Springer Spaniel Variant)	Clear
<input checked="" type="checkbox"/> Fanconi Syndrome (FAN1, Basenji Variant)	Clear
<input checked="" type="checkbox"/> Fetal-Onset Neonatal Neuroaxonal Dystrophy (MFN2, Giant Schnauzer Variant)	Clear
<input checked="" type="checkbox"/> Glanzmann's Thrombasthenia Type I (ITGA2B Exon 13, Great Pyrenees Variant)	Clear
<input checked="" type="checkbox"/> Glanzmann's Thrombasthenia Type I (ITGA2B Exon 12, Otterhound Variant)	Clear
<input checked="" type="checkbox"/> Globoid Cell Leukodystrophy, Krabbe disease (GALC Exon 5, Terrier Variant)	Clear
<input checked="" type="checkbox"/> Glycogen Storage Disease Type IA, Von Gierke Disease, GSD IA (G6PC1, German Pinscher Variant)	Clear
<input checked="" type="checkbox"/> Glycogen Storage Disease Type IA, Von Gierke Disease, GSD IA (G6PC, Maltese Variant)	Clear
<input checked="" type="checkbox"/> Glycogen Storage Disease Type IIIA, GSD IIIA (AGL, Curly Coated Retriever Variant)	Clear
<input checked="" type="checkbox"/> Glycogen storage disease Type VII, Phosphofructokinase Deficiency, PFK Deficiency (PFKM, Whippet and English Springer Spaniel Variant)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/>	Glycogen storage disease Type VII, Phosphofructokinase Deficiency, PFK Deficiency (PFKM, Wachtelhund Variant)	Clear
<input checked="" type="checkbox"/>	GM1 Gangliosidosis (GLB1 Exon 2, Portuguese Water Dog Variant)	Clear
<input checked="" type="checkbox"/>	GM1 Gangliosidosis (GLB1 Exon 15, Shiba Inu Variant)	Clear
<input checked="" type="checkbox"/>	GM1 Gangliosidosis (GLB1 Exon 15, Alaskan Husky Variant)	Clear
<input checked="" type="checkbox"/>	GM2 Gangliosidosis (HEXA, Japanese Chin Variant)	Clear
<input checked="" type="checkbox"/>	Golden Retriever Progressive Retinal Atrophy 1, GR-PRA1 (SLC4A3)	Clear
<input checked="" type="checkbox"/>	Golden Retriever Progressive Retinal Atrophy 2, GR-PRA2 (TTC8)	Clear
<input checked="" type="checkbox"/>	Goniodysgenesis and Glaucoma, Pectinate Ligament Dysplasia, PLD (OLFM3)	Clear
<input checked="" type="checkbox"/>	Hemophilia A (F8 Exon 11, German Shepherd Variant 1)	Clear
<input checked="" type="checkbox"/>	Hemophilia A (F8 Exon 1, German Shepherd Variant 2)	Clear
<input checked="" type="checkbox"/>	Hemophilia A (F8 Exon 10, Boxer Variant)	Clear
<input checked="" type="checkbox"/>	Hemophilia B (F9 Exon 7, Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Hemophilia B (F9 Exon 7, Rhodesian Ridgeback Variant)	Clear
<input checked="" type="checkbox"/>	Hereditary Ataxia (PNPLA8, Australian Shepherd Variant)	Clear
<input checked="" type="checkbox"/>	Hereditary Ataxia, Cerebellar Degeneration (RAB24, Old English Sheepdog and Gordon Setter Variant)	Clear
<input checked="" type="checkbox"/>	Hereditary Cataracts (HSF4 Exon 9, Australian Shepherd Variant)	Clear
<input checked="" type="checkbox"/>	Hereditary Cataracts (FYCO1, Wirehaired Pointing Griffon Variant)	Clear
<input checked="" type="checkbox"/>	Hereditary Cerebellar Ataxia (SELENOP, Belgian Shepherd Variant)	Clear

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<input checked="" type="checkbox"/> Hereditary Footpad Hyperkeratosis (FAM83G, Terrier and Kromfohrlander Variant)	Clear
<input checked="" type="checkbox"/> Hereditary Footpad Hyperkeratosis (DSG1, Rottweiler Variant)	Clear
<input checked="" type="checkbox"/> Hereditary Nasal Parakeratosis (SUV39H2 Intron 4, Greyhound Variant)	Clear
<input checked="" type="checkbox"/> Hereditary Nasal Parakeratosis, HNPK (SUV39H2)	Clear
<input checked="" type="checkbox"/> Hereditary Vitamin D-Resistant Rickets (VDR)	Clear
<input checked="" type="checkbox"/> Hypocatalasia, Acatalasemia (CAT)	Clear
<input checked="" type="checkbox"/> Hypomyelination and Tremors (FNIP2, Weimaraner Variant)	Clear
<input checked="" type="checkbox"/> Hypophosphatasia (ALPL Exon 9, Karelian Bear Dog Variant)	Clear
<input checked="" type="checkbox"/> Ichthyosis (NIPAL4, American Bulldog Variant)	Clear
<input checked="" type="checkbox"/> Ichthyosis (ASPRV1 Exon 2, German Shepherd Variant)	Clear
<input checked="" type="checkbox"/> Ichthyosis (SLC27A4, Great Dane Variant)	Clear
<input checked="" type="checkbox"/> Ichthyosis, Epidermolytic Hyperkeratosis (KRT10, Terrier Variant)	Clear
<input checked="" type="checkbox"/> Ichthyosis, ICH1 (PNPLA1, Golden Retriever Variant)	Clear
<input checked="" type="checkbox"/> Ichthyosis, ICH2 (ABHD5, Golden Retriever Variant)	Clear
<input checked="" type="checkbox"/> Inflammatory Myopathy (SLC25A12)	Clear
<input checked="" type="checkbox"/> Inherited Myopathy of Great Danes (BIN1)	Clear
<input checked="" type="checkbox"/> Inherited Selected Cobalamin Malabsorption with Proteinuria (CUBN, Komondor Variant)	Clear
<input checked="" type="checkbox"/> Intestinal Lipid Malabsorption (ACSL5, Australian Kelpie)	Clear

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<input checked="" type="checkbox"/>	Junctional Epidermolysis Bullosa (LAMA3 Exon 66, Australian Cattle Dog Variant)	Clear
<input checked="" type="checkbox"/>	Junctional Epidermolysis Bullosa (LAMB3 Exon 11, Australian Shepherd Variant)	Clear
<input checked="" type="checkbox"/>	Juvenile Epilepsy (LGI2)	Clear
<input checked="" type="checkbox"/>	Juvenile Laryngeal Paralysis and Polyneuropathy (RAB3GAP1, Rottweiler Variant)	Clear
<input checked="" type="checkbox"/>	Juvenile Myoclonic Epilepsy (DIRAS1)	Clear
<input checked="" type="checkbox"/>	L-2-Hydroxyglutaricaciduria, L2HGA (L2HGDH, Staffordshire Bull Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Lagotto Storage Disease (ATG4D)	Clear
<input checked="" type="checkbox"/>	Laryngeal Paralysis (RAPGEF6, Miniature Bull Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Laryngeal Paralysis and Polyneuropathy (CNTNAP1, Leonberger, Saint Bernard, and Labrador Retriever variant)	Clear
<input checked="" type="checkbox"/>	Late Onset Spinocerebellar Ataxia (CAPN1)	Clear
<input checked="" type="checkbox"/>	Late-Onset Neuronal Ceroid Lipofuscinosis, NCL 12 (ATP13A2, Australian Cattle Dog Variant)	Clear
<input checked="" type="checkbox"/>	Leonberger Polyneuropathy 1 (LPN1, ARHGEF10)	Clear
<input checked="" type="checkbox"/>	Leonberger Polyneuropathy 2 (GJA9)	Clear
<input checked="" type="checkbox"/>	Lethal Acrodermatitis, LAD (MKLN1)	Clear
<input checked="" type="checkbox"/>	Leukodystrophy (TSEN54 Exon 5, Standard Schnauzer Variant)	Clear
<input checked="" type="checkbox"/>	Ligneous Membranitis, LM (PLG)	Clear
<input checked="" type="checkbox"/>	Limb Girdle Muscular Dystrophy (SGCD, Boston Terrier Variant)	Clear
<input checked="" type="checkbox"/>	Limb-Girdle Muscular Dystrophy 2D (SGCA Exon 3, Miniature Dachshund Variant)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/> Long QT Syndrome (KCNQ1)	Clear
<input checked="" type="checkbox"/> Lundehund Syndrome (LEPREL1)	Clear
<input checked="" type="checkbox"/> Macular Corneal Dystrophy, MCD (CHST6)	Clear
<input checked="" type="checkbox"/> Malignant Hyperthermia (RYR1)	Clear
<input checked="" type="checkbox"/> May-Hegglin Anomaly (MYH9)	Clear
<input checked="" type="checkbox"/> MDR1 Drug Sensitivity (ABCB1)	Clear
<input checked="" type="checkbox"/> Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD (ACADM, Cavalier King Charles Spaniel Variant)	Clear
<input checked="" type="checkbox"/> Methemoglobinemia (CYB5R3, Pit Bull Terrier Variant)	Clear
<input checked="" type="checkbox"/> Methemoglobinemia (CYB5R3)	Clear
<input checked="" type="checkbox"/> Microphthalmia (RBP4 Exon 2, Soft Coated Wheaten Terrier Variant)	Clear
<input checked="" type="checkbox"/> Mucopolysaccharidosis IIIB, Sanfilippo Syndrome Type B, MPS IIIB (NAGLU, Schipperke Variant)	Clear
<input checked="" type="checkbox"/> Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6, Dachshund Variant)	Clear
<input checked="" type="checkbox"/> Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6, New Zealand Huntaway Variant)	Clear
<input checked="" type="checkbox"/> Mucopolysaccharidosis Type VI, Maroteaux-Lamy Syndrome, MPS VI (ARSB Exon 5, Miniature Pinscher Variant)	Clear
<input checked="" type="checkbox"/> Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 3, German Shepherd Variant)	Clear
<input checked="" type="checkbox"/> Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 5, Terrier Brasileiro Variant)	Clear
<input checked="" type="checkbox"/> Muscular Dystrophy (DMD, Cavalier King Charles Spaniel Variant 1)	Clear
<input checked="" type="checkbox"/> Muscular Dystrophy (DMD, Golden Retriever Variant)	Clear

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<input checked="" type="checkbox"/>	Muscular Dystrophy-Dystroglycanopathy (LARGE1, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/>	Musladin-Lueke Syndrome, MLS (ADAMTSL2)	Clear
<input checked="" type="checkbox"/>	Myasthenia Gravis-Like Syndrome (CHRNE, Heideterrier Variant)	Clear
<input checked="" type="checkbox"/>	Myotonia Congenita (CLCN1 Exon 23, Australian Cattle Dog Variant)	Clear
<input checked="" type="checkbox"/>	Myotonia Congenita (CLCN1 Exon 19, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/>	Myotonia Congenita (CLCN1 Exon 7, Miniature Schnauzer Variant)	Clear
<input checked="" type="checkbox"/>	Narcolepsy (HCRTR2 Exon 1, Dachshund Variant)	Clear
<input checked="" type="checkbox"/>	Narcolepsy (HCRTR2 Intron 4, Doberman Pinscher Variant)	Clear
<input checked="" type="checkbox"/>	Narcolepsy (HCRTR2 Intron 6, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/>	Nemaline Myopathy (NEB, American Bulldog Variant)	Clear
<input checked="" type="checkbox"/>	Neonatal Cerebellar Cortical Degeneration (SPTBN2, Beagle Variant)	Clear
<input checked="" type="checkbox"/>	Neonatal Interstitial Lung Disease (LAMP3)	Clear
<input checked="" type="checkbox"/>	Neuroaxonal Dystrophy, NAD (VPS11, Rottweiler Variant)	Clear
<input checked="" type="checkbox"/>	Neuroaxonal Dystrophy, NAD (TECPR2, Spanish Water Dog Variant)	Clear
<input checked="" type="checkbox"/>	Neuronal Ceroid Lipofuscinosis 1, NCL 1 (PPT1 Exon 8, Dachshund Variant 1)	Clear
<input checked="" type="checkbox"/>	Neuronal Ceroid Lipofuscinosis 10, NCL 10 (CTSD Exon 5, American Bulldog Variant)	Clear
<input checked="" type="checkbox"/>	Neuronal Ceroid Lipofuscinosis 2, NCL 2 (TPP1 Exon 4, Dachshund Variant 2)	Clear
<input checked="" type="checkbox"/>	Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 SNP, Border Collie Variant)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 Deletion, Golden Retriever Variant)	Clear
<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis 6, NCL 6 (CLN6 Exon 7, Australian Shepherd Variant)	Clear
<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis 7, NCL 7 (MFSD8, Chihuahua and Chinese Crested Variant)	Clear
<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8, Australian Shepherd Variant)	Clear
<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8 Exon 2, English Setter Variant)	Clear
<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8 Insertion, Saluki Variant)	Clear
<input checked="" type="checkbox"/> Neuronal Ceroid Lipofuscinosis, Cerebellar Ataxia, NCL4A (ARSG Exon 2, American Staffordshire Terrier Variant)	Clear
<input checked="" type="checkbox"/> Oculocutaneous Albinism, OCA (SLC45A2 Exon 6, Bullmastiff Variant)	Clear
<input checked="" type="checkbox"/> Oculocutaneous Albinism, OCA (SLC45A2, Small Breed Variant)	Clear
<input checked="" type="checkbox"/> Oculoskeletal Dysplasia 2 (COL9A2, Samoyed Variant)	Clear
<input checked="" type="checkbox"/> Osteogenesis Imperfecta (COL1A2, Beagle Variant)	Clear
<input checked="" type="checkbox"/> Osteogenesis Imperfecta (SERPINH1, Dachshund Variant)	Clear
<input checked="" type="checkbox"/> Osteogenesis Imperfecta (COL1A1, Golden Retriever Variant)	Clear
<input checked="" type="checkbox"/> P2Y12 Receptor Platelet Disorder (P2Y12)	Clear
<input checked="" type="checkbox"/> Pachyonychia Congenita (KRT16, Dogue de Bordeaux Variant)	Clear
<input checked="" type="checkbox"/> Paroxysmal Dyskinesia, PxD (PIGN)	Clear
<input checked="" type="checkbox"/> Persistent Mullerian Duct Syndrome, PMDS (AMHR2)	Clear
<input checked="" type="checkbox"/> Pituitary Dwarfism (POU1F1 Intron 4, Karelian Bear Dog Variant)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/>	Platelet Factor X Receptor Deficiency, Scott Syndrome (TMEM16F)	Clear
<input checked="" type="checkbox"/>	Polycystic Kidney Disease, PKD (PKD1)	Clear
<input checked="" type="checkbox"/>	Pompe's Disease (GAA, Finnish and Swedish Lapphund, Lapponian Herder Variant)	Clear
<input checked="" type="checkbox"/>	Prekallikrein Deficiency (KLKB1 Exon 8)	Clear
<input checked="" type="checkbox"/>	Primary Ciliary Dyskinesia, PCD (NME5, Alaskan Malamute Variant)	Clear
<input checked="" type="checkbox"/>	Primary Ciliary Dyskinesia, PCD (STK36, Australian Shepherd Variant)	Clear
<input checked="" type="checkbox"/>	Primary Ciliary Dyskinesia, PCD (CCDC39 Exon 3, Old English Sheepdog Variant)	Clear
<input checked="" type="checkbox"/>	Primary Hyperoxaluria (AGXT)	Clear
<input checked="" type="checkbox"/>	Primary Lens Luxation (ADAMTS17)	Clear
<input checked="" type="checkbox"/>	Primary Open Angle Glaucoma (ADAMTS17 Exon 11, Basset Fauve de Bretagne Variant)	Clear
<input checked="" type="checkbox"/>	Primary Open Angle Glaucoma (ADAMTS10 Exon 17, Beagle Variant)	Clear
<input checked="" type="checkbox"/>	Primary Open Angle Glaucoma (ADAMTS10 Exon 9, Norwegian Elkhound Variant)	Clear
<input checked="" type="checkbox"/>	Primary Open Angle Glaucoma and Primary Lens Luxation (ADAMTS17 Exon 2, Chinese Shar-Pei Variant)	Clear
<input checked="" type="checkbox"/>	Progressive Retinal Atrophy (SAG)	Clear
<input checked="" type="checkbox"/>	Progressive Retinal Atrophy (IFT122 Exon 26, Lapponian Herder Variant)	Clear
<input checked="" type="checkbox"/>	Progressive Retinal Atrophy 5, PRA5 (NECAP1 Exon 6, Giant Schnauzer Variant)	Clear
<input checked="" type="checkbox"/>	Progressive Retinal Atrophy, Bardet-Biedl Syndrome (BBS2 Exon 11, Shetland Sheepdog Variant)	Clear
<input checked="" type="checkbox"/>	Progressive Retinal Atrophy, CNGA (CNGA1 Exon 9)	Clear

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## OTHER RESULTS

<input checked="" type="checkbox"/> Progressive Retinal Atrophy, crd1 (PDE6B, American Staffordshire Terrier Variant)	Clear
<input checked="" type="checkbox"/> Progressive Retinal Atrophy, crd4/cord1 (RPGRIP1)	Clear
<input checked="" type="checkbox"/> Progressive Retinal Atrophy, PRA1 (CNGB1)	Clear
<input checked="" type="checkbox"/> Progressive Retinal Atrophy, PRA3 (FAM161A)	Clear
<input checked="" type="checkbox"/> Progressive Retinal Atrophy, rcd1 (PDE6B Exon 21, Irish Setter Variant)	Clear
<input checked="" type="checkbox"/> Progressive Retinal Atrophy, rcd3 (PDE6A)	Clear
<input checked="" type="checkbox"/> Proportionate Dwarfism (GH1 Exon 5, Chihuahua Variant)	Clear
<input checked="" type="checkbox"/> Protein Losing Nephropathy, PLN (NPHS1)	Clear
<input checked="" type="checkbox"/> Pyruvate Dehydrogenase Deficiency (PDP1, Spaniel Variant)	Clear
<input checked="" type="checkbox"/> Pyruvate Kinase Deficiency (PKLR Exon 5, Basenji Variant)	Clear
<input checked="" type="checkbox"/> Pyruvate Kinase Deficiency (PKLR Exon 7, Beagle Variant)	Clear
<input checked="" type="checkbox"/> Pyruvate Kinase Deficiency (PKLR Exon 10, Terrier Variant)	Clear
<input checked="" type="checkbox"/> Pyruvate Kinase Deficiency (PKLR Exon 7, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> Pyruvate Kinase Deficiency (PKLR Exon 7, Pug Variant)	Clear
<input checked="" type="checkbox"/> Raine Syndrome (FAM20C)	Clear
<input checked="" type="checkbox"/> Recurrent Inflammatory Pulmonary Disease, RILD (AKNA, Rough Collie Variant)	Clear
<input checked="" type="checkbox"/> Renal Cystadenocarcinoma and Nodular Dermatofibrosis (FLCN Exon 7)	Clear
<input checked="" type="checkbox"/> Retina Dysplasia and/or Optic Nerve Hypoplasia (SIX6 Exon 1, Golden Retriever Variant)	Clear

## OTHER RESULTS

<input checked="" type="checkbox"/> Sensory Neuropathy (FAM134B, Border Collie Variant)	Clear
<input checked="" type="checkbox"/> Severe Combined Immunodeficiency, SCID (PRKDC, Terrier Variant)	Clear
<input checked="" type="checkbox"/> Severe Combined Immunodeficiency, SCID (RAG1, Wetterhoun Variant)	Clear
<input checked="" type="checkbox"/> Shaking Puppy Syndrome (PLP1, English Springer Spaniel Variant)	Clear
<input checked="" type="checkbox"/> Shar-Pei Autoinflammatory Disease, SPAID, Shar-Pei Fever (MTBP)	Clear
<input checked="" type="checkbox"/> Skeletal Dysplasia 2, SD2 (COL11A2, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> Skin Fragility Syndrome (PKP1, Chesapeake Bay Retriever Variant)	Clear
<input checked="" type="checkbox"/> Spinocerebellar Ataxia (SCN8A, Alpine Dachsbracke Variant)	Clear
<input checked="" type="checkbox"/> Spinocerebellar Ataxia with Myokymia and/or Seizures (KCNJ10)	Clear
<input checked="" type="checkbox"/> Spongy Degeneration with Cerebellar Ataxia 1 (KCNJ10)	Clear
<input checked="" type="checkbox"/> Spongy Degeneration with Cerebellar Ataxia 2 (ATP1B2)	Clear
<input checked="" type="checkbox"/> Stargardt Disease (ABCA4 Exon 28, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> Succinic Semialdehyde Dehydrogenase Deficiency (ALDH5A1 Exon 7, Saluki Variant)	Clear
<input checked="" type="checkbox"/> Thrombopathia (RASGRP1 Exon 5, American Eskimo Dog Variant)	Clear
<input checked="" type="checkbox"/> Thrombopathia (RASGRP1 Exon 5, Basset Hound Variant)	Clear
<input checked="" type="checkbox"/> Thrombopathia (RASGRP1 Exon 8, Landseer Variant)	Clear
<input checked="" type="checkbox"/> Trapped Neutrophil Syndrome, TNS (VPS13B)	Clear
<input checked="" type="checkbox"/> Ullrich-like Congenital Muscular Dystrophy (COL6A3 Exon 10, Labrador Retriever Variant)	Clear

# "SERENA"



## SERENA

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## OTHER RESULTS

<input checked="" type="checkbox"/> Ulrich-like Congenital Muscular Dystrophy (COL6A1 Exon 3, Landseer Variant)	Clear
<input checked="" type="checkbox"/> Unilateral Deafness and Vestibular Syndrome (PTPRQ Exon 39, Doberman Pinscher)	Clear
<input checked="" type="checkbox"/> Urate Kidney & Bladder Stones (SLC2A9)	Clear
<input checked="" type="checkbox"/> Von Willebrand Disease Type II, Type II vWD (VWF, Pointer Variant)	Clear
<input checked="" type="checkbox"/> Von Willebrand Disease Type III, Type III vWD (VWF Exon 4, Terrier Variant)	Clear
<input checked="" type="checkbox"/> Von Willebrand Disease Type III, Type III vWD (VWF Intron 16, Nederlandse Kooikerhondje Variant)	Clear
<input checked="" type="checkbox"/> Von Willebrand Disease Type III, Type III vWD (VWF Exon 7, Shetland Sheepdog Variant)	Clear
<input checked="" type="checkbox"/> X-Linked Hereditary Nephropathy, XLHN (COL4A5 Exon 35, Samoyed Variant 2)	Clear
<input checked="" type="checkbox"/> X-Linked Myotubular Myopathy (MTM1, Labrador Retriever Variant)	Clear
<input checked="" type="checkbox"/> X-Linked Progressive Retinal Atrophy 1, XL-PRA1 (RPGR)	Clear
<input checked="" type="checkbox"/> X-linked Severe Combined Immunodeficiency, X-SCID (IL2RG Exon 1, Basset Hound Variant)	Clear
<input checked="" type="checkbox"/> X-linked Severe Combined Immunodeficiency, X-SCID (IL2RG, Corgi Variant)	Clear
<input checked="" type="checkbox"/> Xanthine Urolithiasis (XDH, Mixed Breed Variant)	Clear
<input checked="" type="checkbox"/> β-Mannosidosis (MANBA Exon 16, Mixed-Breed Variant)	Clear
Mast Cell Tumor	No result



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## HEALTH REPORT

### Notable result

#### ALT Activity

Serena inherited one copy of the variant we tested for Alanine Aminotransferase Activity

##### **Why is this important to your vet?**

Serena has one copy of a variant associated with reduced ALT activity as measured on veterinary blood chemistry panels. Please inform your veterinarian that Serena has this genotype, as ALT is often used as an indicator of liver health and Serena is likely to have a lower than average resting ALT activity. As such, an increase in Serena's ALT activity could be evidence of liver damage, even if it is within normal limits by standard ALT reference ranges.

##### **What is Alanine Aminotransferase Activity?**

ALT is a liver enzyme that vets measure to monitor liver health. With this result, your dog may naturally have a lower ALT baseline. Knowing this helps your veterinarian interpret future bloodwork results more accurately.

##### **How vets diagnose this condition**

Genetic testing is the only way to provide your veterinarian with this clinical tool.

##### **How this condition is treated**

Veterinarians may recommend blood work to establish a baseline ALT value for healthy dogs with one or two copies of this variant.

##### **Actions to take if your dog is affected**

- Talk to your vet about your dog's ALT result, as it may help them better interpret your dog's blood work.
- Dogs with this result do not exhibit symptoms or develop health issues associated with this variant.

## HEALTH REPORT

### Notable result

#### **Copper Toxicosis (Attenuating)**

Serena inherited one copy of the variant we tested for Copper Toxicosis (Attenuating)

##### **Why is this important to your vet?**

Serena has a genotype at the ATP7A gene that modifies and may help mitigate some of the symptoms from dogs with variants at ATP7B (<https://my.embarkvet.com/members/results/health/condition/140102?i=35>). This variant is not associated with an increased risk of any disease. As this variant resides on the X- chromosome, male dogs with one copy of the variant are better protected from copper accumulation due to the ATP7B variant than female dogs with one copy of the variant.

##### **What is Copper Toxicosis (Attenuating)?**

This genetic variant may help lessen the effects of copper buildup in dogs that also carry the copper toxicosis risk variant ATP7B (<https://my.embarkvet.com/members/results/health/condition/140102?i=35>). On its own, it is not known to cause health problems.

##### **When signs & symptoms develop in affected dogs**

A variant in this gene may delay or have no effect on the onset of clinical signs of copper toxicosis in dogs with the ATP7B (<https://my.embarkvet.com/members/results/health/condition/140102?i=35>) variant. If your dog has the ATP7B variant, please read more about the age of onset on the ATP7B page.

##### **How vets diagnose this condition**

No diagnostics are required for this variant. If your dog has the ATP7B (<https://my.embarkvet.com/members/results/health/condition/140102?i=35>) variant, please read what diagnostics may be considered on the ATP7B page.

##### **How this condition is treated**

No treatment is required for this variant. If your dog has the ATP7B (<https://my.embarkvet.com/members/results/health/condition/140102?i=35>) variant, please read the available treatment on the ATP7B page.

##### **Actions to take if your dog is affected**

- No specific action is needed for dogs with this variant alone.
- If your dog also has the ATP7B variant, please review what actions you can take on the ATP7B page (<https://my.embarkvet.com/members/results/health/condition/140102?i=35>).
- Routine veterinary care and a balanced diet are appropriate for most dogs with this result.

# "SERENA"

## SERENA



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## HEALTH REPORT

### Notable result

#### **Degenerative Myelopathy, DM**

Serena inherited one copy of the variant we tested for Degenerative Myelopathy, DM

##### **What does this result mean?**

This variant should not impact Serena's health. This variant is inherited in an autosomal recessive manner, meaning that a dog needs two copies of the variant to show signs of this condition. Serena is unlikely to develop this condition due to this variant because she only has one copy of the variant.

##### **Impact on Breeding**

Your dog carries this variant and will pass it on to ~50% of her offspring. You can email [breeders@embarkvet.com](mailto:breeders@embarkvet.com) to discuss with a genetic counselor how the genotype results should be applied to a breeding program.

##### **What is Degenerative Myelopathy, DM?**

This condition affects the spinal cord nerves involved in movement, most noticeably in the hind limbs. It is progressive, meaning symptoms worsen over time, including weakness, muscle loss, and changes in walking.

##### **When signs & symptoms develop in affected dogs**

Affected dogs do not usually show signs of DM until they are at least 8 years old.

##### **How vets diagnose this condition**

Definitive diagnosis requires microscopic analysis of the spinal cord after death. However, veterinarians use clues such as genetic testing, breed, age, and other diagnostics to determine if DM is the most likely cause of your dog's clinical signs.

##### **How this condition is treated**

As dogs are seniors at the time of onset, the treatment for DM is aimed towards increasing their comfort through a combination of lifestyle changes, medication, and physical therapy.

##### **Actions to take if your dog is affected**

- Talk to your vet about your dog's degenerative myelopathy result, as it may influence how they monitor your dog's mobility and overall health, especially in their senior years.
- Keep your dog active with regular, low-impact exercise to help them maintain a healthy weight and support their mobility.
- Watch for changes in movement, such as wobbling, reluctance to jump, or dragging their back paws, and consult your vet if you notice any of these signs.
- Provide good traction in your home with rugs or mats to help prevent slipping as your dog ages. If mobility becomes difficult, ask your vet about supportive devices such as harnesses or wheelchairs.

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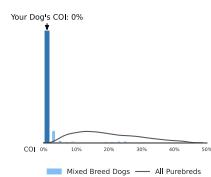
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## INBREEDING AND DIVERSITY

CATEGORY	RESULT
Coefficient Of Inbreeding	0%

### Coefficient Of Inbreeding

Our genetic COI measures the proportion of your dog's genome where the genes on the mother's side are identical by descent to those on the father's side.

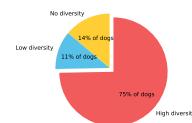


### MHC Class II - DLA DRB1

A Dog Leukocyte Antigen (DLA) gene, DRB1 encodes a major histocompatibility complex (MHC) protein involved in the immune response. Some studies have shown associations between certain DRB1 haplotypes and autoimmune diseases such as Addison's disease (hypoadrenocorticism) in certain dog breeds, but these findings have yet to be scientifically validated.

### High Diversity

How common is this amount of diversity in mixed breed dogs:



### MHC Class II - DLA DQA1 and DQB1

DQA1 and DQB1 are two tightly linked DLA genes that code for MHC proteins involved in the immune response. A number of studies have shown correlations of DQA-DQB1 haplotypes and certain autoimmune diseases; however, these have not yet been scientifically validated.

### High Diversity

How common is this amount of diversity in mixed breed dogs:

