

AMERICAN KENNEL CLUB

NAME  
SNICKERS XXV

NUMBER  
TS50903702

991003061834044

BREED  
CAVALIER KING CHARLES SPANIEL

SEX  
FEMALE

COLOR  
BLACK & WHITE, TAN MARKINGS

DATE OF BIRTH  
APRIL 16, 2021

SIRE  
ROCKY XXVIII  
TS27472002 01-17 (AKC DNA #V920431)

DAM  
XPRSIONS ONYX  
TS40918605 08-21 (OFA28G)

BREEDER  
KEITH CHUPP

OWNER

WILLARD R HELMUTH  
579 N CR 100 E  
ARTHUR IL 61911-6265



AMERICAN  
KENNEL CLUB®

CERTIFICATE ISSUED  
SEPTEMBER 26, 2023

*This certificate invalidates all previous certificates issued.*

If a date appears after the name and number of the sire and dam, it indicates the issue of the Stud Book Register in which the sire or dam is published.

**For Transfer Instructions, see back of Certificate.**

*This Certificate issued with the right to correct or revoke by the American Kennel Club.*

REGISTRATION CERTIFICATE

## BREED ANCESTRY

 Cavalier King Charles Spaniel : 100.0%

## GENETIC STATS

Predicted adult weight: **19 lbs**

## TEST DETAILS

Kit number: EM-96585875

Swab number: 31220910805313

## CAVALIER KING CHARLES SPANIEL



The Cavalier King Charles Spaniel is one of the most popular dog breeds in the United States, and with good reason. Their affectionate personalities combined with their need to be close to their humans make them a lovely breed of choice for families. They tend to get along well with children and peaceably with other dogs and animals in the home (though as the breed used to be used for hunting, caution around small animals should be exercised). The Cavalier has an interesting history -- their ancestors were dogs of the British monarchy, but over time, the breed began to die out as dogs with shorter muzzles were favored in the 1800s. They were crossed with Pugs and some other breeds to change their appearance. However, Roswell Eldridge sought out King Charles Spaniels that had longer muzzles, and recreated the Cavalier as it used to be from those dogs.

### Fun Fact

The breed experienced two large bursts in popularity. The first is when Queen Victoria revived the dying breed. The second was when Charlotte, a popular character from the popular show *Sex and the City* adopted one on TV.

## MATERNAL LINE



Through Snickers'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: A1d

This female lineage can be traced back about 15,000 years to some of the original Central Asian wolves that were domesticated into modern dogs. The early females that represent this lineage were likely taken into Eurasia, where they spread rapidly. As a result, many modern breed and village dogs from the Americas, Africa, through Asia and down into Oceania belong to this group! This widespread lineage is not limited to a select few breeds, but the majority of Rottweilers, Afghan Hounds and Wirehaired Pointing Griffons belong to it. It is also the most common female lineage among Papillons, Samoyeds and Jack Russell Terriers. Considering its occurrence in breeds as diverse as Afghan Hounds and Samoyeds, some of this is likely ancient variation. But because of its presence in many modern European breeds, much of its diversity likely can be attributed to much more recent breeding.

### HAPLOTYPE: A26a/305

Part of the large A1d haplogroup, we have not yet detected this haplotype in any of our village dogs. Among the 6 breeds we see it in, it appears most frequently in Newfoundlands, Cavalier King Charles Spaniels, and soft coated Wheaten Terriers.

## 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** allele do not produce dark hairs at all, and will be "red" over their entire body. The shade of red, which can range from a deep copper to yellow/gold to cream, is dependent on other genetic factors including the Intensity loci. In addition to determining if a dog can develop dark hairs at all, the E Locus can give a dog a black "mask" or "widow's peak," unless the dog has overriding coat color genetic factors. Dogs with one or two copies of the **Em** allele usually have a melanistic mask (dark facial hair as commonly seen in the German Shepherd and Pug). Dogs with no copies of **Em** but one or two copies of the **Eg** allele usually have a melanistic "widow's peak" (dark forehead hair as commonly seen in the Afghan Hound and Borzoi, where it is called either "grizzle" or "domino").

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

### 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
<p><b>Intensity Loci</b></p> <p>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 <b>Intense Red Pigmentation</b> will likely have deep red hair like an Irish Setter or "apricot" hair like some Poodles, dogs with a result of <b>Intermediate Red Pigmentation</b> will likely have tan or yellow hair like a Soft-Coated Wheaten Terrier, and dogs with <b>Dilute Red Pigmentation</b> 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.</p>	<p><b>Any light hair likely apricot or red (Intense Red Pigmentation)</b></p>
<p><b>A Locus (ASIP)</b></p> <p>The A Locus controls switching between black and red pigment in hair cells, but it will only be expressed in dogs that are not <b>ee</b> at the E Locus and are <b>k<sup>Y</sup>k<sup>Y</sup></b> 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.</p>	<p><b>Black/Brown and tan coat color pattern (a<sup>t</sup>a<sup>t</sup>)</b></p>
<p><b>D Locus (MLPH)</b></p> <p>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 <b>d</b> allele, also known as "<b>d1</b>", and the less common alleles known as "<b>d2</b>" and "<b>d3</b>". Dogs with two <b>d</b> 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 <b>d</b> allele will not be dilute, but can pass the <b>d</b> allele on to their puppies.</p>	<p><b>Dark areas of hair and skin are not lightened (DD)</b></p>

## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
<p><b>Cocoa (HPS3)</b></p> <p>Dogs with the <b>coco</b> genotype will produce dark brown pigment instead of black in both their hair and skin. Dogs with the <b>Nco</b> genotype will produce black pigment, but can pass the <b>co</b> allele on to their puppies. Dogs that have the <b>coco</b> genotype as well as the <b>bb</b> genotype at the B locus are generally a lighter brown than dogs that have the <b>Bb</b> or <b>BB</b> genotypes at the B locus.</p>	<p><b>No co alleles, not expressed (NN)</b></p>
<p><b>B Locus (TYRP1)</b></p> <p>Dogs with two copies of the <b>b</b> allele produce brown pigment instead of black in both their hair and skin. Dogs with one copy of the <b>b</b> allele will produce black pigment, but can pass the <b>b</b> allele on to their puppies. E Locus <b>ee</b> dogs that carry two <b>b</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".</p>	<p><b>Black or gray hair and skin (BB)</b></p>
<p><b>Saddle Tan (RALY)</b></p> <p>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 <b>II</b> 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 <b>a<sup>t</sup></b> allele, so dogs that do not express <b>a<sup>t</sup></b> are not influenced by this gene.</p>	<p><b>Not saddle tan patterned (II)</b></p>
<p><b>S Locus (MITF)</b></p> <p>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.</p>	<p><b>Likely flash, parti, piebald, or extreme white (spsp)</b></p>

## TRAITS: COAT COLOR (CONTINUED)

<b>TRAIT</b>	<b>RESULT</b>
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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)**



## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
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### 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)**

## TRAITS: OTHER COAT TRAITS

TRAIT	RESULT
<b>Furnishings (RSPO2)</b>	
<p>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.</p>	<b>Likely furnished (mustache, beard, and/or eyebrows) (FI)</b>

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## TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
<p><b>Coat Length (FGF5)</b></p> <p>The FGF5 gene affects hair length in many species, including cats, dogs, mice, and humans. In dogs, an <b>Lh</b> allele confers a long, silky hair coat across many breeds, including Yorkshire Terriers, Cocker Spaniels, and Golden Retrievers, while the <b>Sh</b> 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.</p> <p>The most common of these is the <b>Lh1</b> variant (G/T, CanFam3.1, chr32, g.4509367) and the less common ones are <b>Lh2</b> (C/T, CanFam3.1, chr32, g.4528639), <b>Lh3</b> (16bp deletion, CanFam3.1, chr32, g.4528616), and <b>Lh4</b> (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.</p> <p>The <b>Lh</b> alleles have a recessive mode of inheritance, meaning that two copies of the <b>Lh</b> 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 <b>Lh1</b> and <b>Lh2</b> have been found in Samoyeds, one copy each of <b>Lh1</b> and <b>Lh3</b> have been found in Eurasiers, and one copy each of <b>Lh1</b> and <b>Lh4</b> have been found in the Afghan Hounds and Eurasiers.</p> <p>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.</p>	<p><b>Likely long coat (LhLh)</b></p>

## TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
<p><b>Shedding (MC5R)</b></p> <p>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.</p>	<p><b>Likely light shedding (TT)</b></p>
<p><b>Coat Texture (KRT71)</b></p> <p>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.</p>	<p><b>Likely wavy coat (CC)</b></p>
<p><b>Hairlessness (FOXI3)</b></p> <p>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.</p>	<p><b>Very unlikely to be hairless (NN)</b></p>
<p><b>Hairlessness (SGK3)</b></p> <p>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.</p>	<p><b>Very unlikely to be hairless (NN)</b></p>

## TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
<b>Oculocutaneous Albinism Type 2 (SLC45A2)</b>	
<p>Dogs with two copies <b>DD</b> 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 <b>ND</b> 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.</p>	<b>Likely not albino (NN)</b>

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## TRAITS: OTHER BODY FEATURES

TRAIT	RESULT
<p><b>Muzzle Length (BMP3)</b></p> <p>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 <b>C</b> allele. Dogs in many short-length muzzle (brachycephalic) breeds such as the English Bulldog, Pug, and Pekingese have two copies of the derived <b>A</b> 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.</p>	<p><b>Likely medium or long muzzle (CC)</b></p>
<p><b>Tail Length (T)</b></p> <p>Whereas most dogs have two <b>C</b> alleles and a long tail, dogs with one <b>G</b> 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 <b>GG</b> genotypes have not been observed, suggesting that dogs with the <b>GG</b> genotype do not survive to birth. 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.</p>	<p><b>Likely normal-length tail (CC)</b></p>
<p><b>Hind Dewclaws (LMBR1)</b></p> <p>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 <b>T</b> 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 <b>CC</b> or <b>TC</b> dogs will have hind dewclaws.</p>	<p><b>Likely to have hind dew claws (CT)</b></p>

## TRAITS: OTHER BODY FEATURES (CONTINUED)

TRAIT	RESULT
<p><b>Chondrodysplasia (Chr. 18 FGF4 Retrogene)</b></p> <p>Dogs with one or two copies of the <b>I</b> 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 <b>I</b> allele on leg length is additive. Therefore, dogs with the <b>II</b> result display the largest reduction in leg length. Dogs with the <b>NI</b> genotype will have an intermediate leg length, while dogs with the <b>NN</b> 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.</p>	<p><b>Not indicative of chondrodysplasia (normal leg length) (NN)</b></p>
<p><b>Blue Eye Color (ALX4)</b></p> <p>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 (<b>Dup</b>) 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. <b>NN</b> 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.</p>	<p><b>Less likely to have blue eyes (NN)</b></p>
<p><b>Back Muscling &amp; Bulk, Large Breed (ACSL4)</b></p> <p>The <b>T</b> 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" <b>T</b> allele is absent from leaner shaped large breed dogs like the Great Dane, Irish Wolfhound, and Scottish Deerhound, which are fixed for the ancestral <b>C</b> 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.</p>	<p><b>Likely normal muscling (CC)</b></p>

## TRAITS: BODY SIZE

TRAIT	RESULT
<b>Body Size (IGF1)</b> The I allele is associated with smaller body size.	<b>Smaller (II)</b>
<b>Body Size (IGFR1)</b> The A allele is associated with smaller body size.	<b>Larger (GG)</b>
<b>Body Size (STC2)</b> The A allele is associated with smaller body size.	<b>Smaller (AA)</b>
<b>Body Size (GHR - E191K)</b> The A allele is associated with smaller body size.	<b>Smaller (AA)</b>
<b>Body Size (GHR - P177L)</b> The T allele is associated with smaller body size.	<b>Smaller (TT)</b>



## TRAITS: PERFORMANCE

TRAIT	RESULT
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### 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)**

## HEALTH REPORT

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

If Snickers 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 Snickers 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 262 genetic health risks we analyzed, we found 5 results that you should learn about.

#### Increased risk results (1)

**Intervertebral Disc Disease (Type I)**

#### Notable results (4)

**Degenerative Myelopathy, DM**

**Episodic Falling Syndrome**

**Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD**

**Proportionate Dwarfism**

#### Clear results

**Breed-relevant (2)**

**Other (254)**

## BREED-RELEVANT RESULTS

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



















 Intervertebral Disc Disease (Type I) (FGF4 retrogene - CFA12)	Increased risk
 Degenerative Myelopathy, DM (SOD1A)	Notable
 Episodic Falling Syndrome (BCAN)	Notable
 Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD (ACADM, Cavalier King Charles Spaniel Variant)	Notable
 Dry Eye Curly Coat Syndrome (FAM83H Exon 5)	Clear
 Muscular Dystrophy (DMD, Cavalier King Charles Spaniel Variant 1)	Clear

Registration: American Kennel Club (AKC)





















## OTHER RESULTS



















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

 Proportionate Dwarfism (GH1 Exon 5, Chihuahua Variant)	Notable
 2-DHA Kidney & Bladder Stones (APRT)	Clear
 Acral Mutilation Syndrome (GDNF-AS, Spaniel and Pointer Variant)	Clear
 Alaskan Husky Encephalopathy (SLC19A3)	Clear
 Alaskan Malamute Polyneuropathy, AMPN (NDRG1 SNP)	Clear
 Alexander Disease (GFAP)	Clear
 ALT Activity (GPT)	Clear
 Anhidrotic Ectodermal Dysplasia (EDA Intron 8)	Clear
 Autosomal Dominant Progressive Retinal Atrophy (RHO)	Clear
 Bald Thigh Syndrome (IGFBP5)	Clear
 Bernard-Soulier Syndrome, BSS (GP9, Cocker Spaniel Variant)	Clear
 Bully Whippet Syndrome (MSTN)	Clear
 Canine Elliptocytosis (SPTB Exon 30)	Clear
 Canine Fucosidosis (FUCA1)	Clear
 Canine Leukocyte Adhesion Deficiency Type I, CLAD I (ITGB2, Setter Variant)	Clear
 Canine Leukocyte Adhesion Deficiency Type III, CLAD III (FERMT3, German Shepherd Variant)	Clear
 Canine Multifocal Retinopathy, cmr1 (BEST1 Exon 2)	Clear
 Canine Multifocal Retinopathy, cmr2 (BEST1 Exon 5, Coton de Tulear Variant)	Clear



















## OTHER RESULTS

 Canine Multifocal Retinopathy, cmr3 (BEST1 Exon 10 Deletion, Finnish and Swedish Lapphund, Lapponian Herder Variant)	Clear
 Canine Multiple System Degeneration (SERAC1 Exon 4, Chinese Crested Variant)	Clear
 Canine Multiple System Degeneration (SERAC1 Exon 15, Kerry Blue Terrier Variant)	Clear
 Cardiomyopathy and Juvenile Mortality (YARS2)	Clear
 Centronuclear Myopathy, CNM (PTPLA)	Clear
 Cerebellar Hypoplasia (VLDLR, Eurasier Variant)	Clear
 Chondrodystrophy (ITGA10, Norwegian Elkhound and Karelian Bear Dog Variant)	Clear
 Cleft Lip and/or Cleft Palate (ADAMTS20, Nova Scotia Duck Tolling Retriever Variant)	Clear
 Cleft Palate, CP1 (DLX6 intron 2, Nova Scotia Duck Tolling Retriever Variant)	Clear
 Cobalamin Malabsorption (CUBN Exon 8, Beagle Variant)	Clear
 Cobalamin Malabsorption (CUBN Exon 53, Border Collie Variant)	Clear
 Collie Eye Anomaly (NHEJ1)	Clear
 Complement 3 Deficiency, C3 Deficiency (C3)	Clear
 Congenital Cornification Disorder (NSDHL, Chihuahua Variant)	Clear
 Congenital Hypothyroidism (TPO, Rat, Toy, Hairless Terrier Variant)	Clear
 Congenital Hypothyroidism (TPO, Tenterfield Terrier Variant)	Clear
 Congenital Hypothyroidism with Goiter (TPO Intron 13, French Bulldog Variant)	Clear
 Congenital Hypothyroidism with Goiter (SLC5A5, Shih Tzu Variant)	Clear

## OTHER RESULTS

 Congenital Macrothrombocytopenia (TUBB1 Exon 1, Cairn and Norfolk Terrier Variant)	Clear
 Congenital Myasthenic Syndrome, CMS (COLQ, Labrador Retriever Variant)	Clear
 Congenital Myasthenic Syndrome, CMS (COLQ, Golden Retriever Variant)	Clear
 Congenital Myasthenic Syndrome, CMS (CHAT, Old Danish Pointing Dog Variant)	Clear
 Congenital Myasthenic Syndrome, CMS (CHRNE, Jack Russell Terrier Variant)	Clear
 Congenital Stationary Night Blindness (LRIT3, Beagle Variant)	Clear
 Congenital Stationary Night Blindness (RPE65, Briard Variant)	Clear
 Craniomandibular Osteopathy, CMO (SLC37A2)	Clear
 Craniomandibular Osteopathy, CMO (SLC37A2 Intron 16, Basset Hound Variant)	Clear
 Cystinuria Type I-A (SLC3A1, Newfoundland Variant)	Clear
 Cystinuria Type II-A (SLC3A1, Australian Cattle Dog Variant)	Clear
 Cystinuria Type II-B (SLC7A9, Miniature Pinscher Variant)	Clear
 Darier Disease (ATP2A2, Irish Terrier Variant)	Clear
 Day Blindness (CNGB3 Deletion, Alaskan Malamute Variant)	Clear
 Day Blindness (CNGA3 Exon 7, German Shepherd Variant)	Clear
 Day Blindness (CNGA3 Exon 7, Labrador Retriever Variant)	Clear
 Day Blindness (CNGB3 Exon 6, German Shorthaired Pointer Variant)	Clear
 Deafness and Vestibular Syndrome of Dobermans, DVDob, DINGS (MYO7A)	Clear

## OTHER RESULTS

	Demyelinating Polyneuropathy (SBF2/MTRM13)	Clear
	Dental-Skeletal-Retinal Anomaly (MIA3, Cane Corso Variant)	Clear
	Diffuse Cystic Renal Dysplasia and Hepatic Fibrosis (INPP5E Intron 9, Norwich Terrier Variant)	Clear
	Dilated Cardiomyopathy, DCM (RBM20, Schnauzer Variant)	Clear
	Dilated Cardiomyopathy, DCM1 (PDK4, Doberman Pinscher Variant 1)	Clear
	Dilated Cardiomyopathy, DCM2 (TTN, Doberman Pinscher Variant 2)	Clear
	Disproportionate Dwarfism (PRKG2, Dogo Argentino Variant)	Clear
	Dystrophic Epidermolysis Bullosa (COL7A1, Central Asian Shepherd Dog Variant)	Clear
	Dystrophic Epidermolysis Bullosa (COL7A1, Golden Retriever Variant)	Clear
	Early Bilateral Deafness (LOXHD1 Exon 38, Rottweiler Variant)	Clear
	Early Onset Adult Deafness, EOAD (EPS8L2 Deletion, Rhodesian Ridgeback Variant)	Clear
	Early Onset Cerebellar Ataxia (SEL1L, Finnish Hound Variant)	Clear
	Ehlers Danlos (ADAMTS2, Doberman Pinscher Variant)	Clear
	Ehlers-Danlos Syndrome (EDS) (COL5A1, Labrador Retriever Variant)	Clear
	Enamel Hypoplasia (ENAM Deletion, Italian Greyhound Variant)	Clear
	Enamel Hypoplasia (ENAM SNP, Parson Russell Terrier Variant)	Clear
	Exercise-Induced Collapse, EIC (DNM1)	Clear
	Factor VII Deficiency (F7 Exon 5)	Clear

## OTHER RESULTS

✔ Factor XI Deficiency (F11 Exon 7, Kerry Blue Terrier Variant)	Clear
✔ Familial Nephropathy (COL4A4 Exon 3, Cocker Spaniel Variant)	Clear
✔ Familial Nephropathy (COL4A4 Exon 30, English Springer Spaniel Variant)	Clear
✔ Fanconi Syndrome (FAN1, Basenji Variant)	Clear
✔ Fetal-Onset Neonatal Neuroaxonal Dystrophy (MFN2, Giant Schnauzer Variant)	Clear
✔ Glanzmann's Thrombasthenia Type I (ITGA2B Exon 13, Great Pyrenees Variant)	Clear
✔ Glanzmann's Thrombasthenia Type I (ITGA2B Exon 12, Otterhound Variant)	Clear
✔ Globoid Cell Leukodystrophy, Krabbe disease (GALC Exon 5, Terrier Variant)	Clear
✔ Glycogen Storage Disease Type IA, Von Gierke Disease, GSD IA (G6PC, Maltese Variant)	Clear
✔ Glycogen Storage Disease Type IIIA, GSD IIIA (AGL, Curly Coated Retriever Variant)	Clear
✔ Glycogen storage disease Type VII, Phosphofructokinase Deficiency, PFK Deficiency (PFKM, Whippet and English Springer Spaniel Variant)	Clear
✔ Glycogen storage disease Type VII, Phosphofructokinase Deficiency, PFK Deficiency (PFKM, Wachtelhund Variant)	Clear
✔ GM1 Gangliosidosis (GLB1 Exon 2, Portuguese Water Dog Variant)	Clear
✔ GM1 Gangliosidosis (GLB1 Exon 15, Shiba Inu Variant)	Clear
✔ GM1 Gangliosidosis (GLB1 Exon 15, Alaskan Husky Variant)	Clear
✔ GM2 Gangliosidosis (HEXA, Japanese Chin Variant)	Clear
✔ GM2 Gangliosidosis (HEXB, Poodle Variant)	Clear
✔ Golden Retriever Progressive Retinal Atrophy 1, GR-PRA1 (SLC4A3)	Clear



## OTHER RESULTS

<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, 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 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, Acatlasemia (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



















## OTHER RESULTS

<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
<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"/> Late Onset Spinocerebellar Ataxia (CAPN1)	Clear

## OTHER RESULTS

✓ Late-Onset Neuronal Ceroid Lipofuscinosis, NCL 12 (ATP13A2, Australian Cattle Dog Variant)	Clear
✓ Leonberger Polyneuropathy 1 (LPN1, ARHGEF10)	Clear
✓ Leonberger Polyneuropathy 2 (GJA9)	Clear
✓ Lethal Acrodermatitis, LAD (MKLN1)	Clear
✓ Leukodystrophy (TSEN54 Exon 5, Standard Schnauzer Variant)	Clear
✓ Ligneous Membranitis, LM (PLG)	Clear
✓ Limb Girdle Muscular Dystrophy (SGCD, Boston Terrier Variant)	Clear
✓ Limb-Girdle Muscular Dystrophy 2D (SGCA Exon 3, Miniature Dachshund Variant)	Clear
✓ Long QT Syndrome (KCNQ1)	Clear
✓ Lundehund Syndrome (LEPREL1)	Clear
✓ Macular Corneal Dystrophy, MCD (CHST6)	Clear
✓ Malignant Hyperthermia (RYR1)	Clear
✓ May-Hegglin Anomaly (MYH9)	Clear
✓ Methemoglobinemia (CYB5R3, Pit Bull Terrier Variant)	Clear
✓ Methemoglobinemia (CYB5R3)	Clear
✓ Microphthalmia (RBP4 Exon 2, Soft Coated Wheaten Terrier Variant)	Clear
✓ Mucopolysaccharidosis IIIB, Sanfilippo Syndrome Type B, MPS IIIB (NAGLU, Schipperke Variant)	Clear
✓ Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6, Dachshund Variant)	Clear

## OTHER RESULTS

 Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6, New Zealand Huntaway Variant)	Clear
 Mucopolysaccharidosis Type VI, Maroteaux-Lamy Syndrome, MPS VI (ARSB Exon 5, Miniature Pinscher Variant)	Clear
 Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 3, German Shepherd Variant)	Clear
 Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 5, Terrier Brasileiro Variant)	Clear
 Multiple Drug Sensitivity (ABCB1)	Clear
 Muscular Dystrophy (DMD, Golden Retriever Variant)	Clear
 Musladin-Lueke Syndrome, MLS (ADAMTSL2)	Clear
 Myasthenia Gravis-Like Syndrome (CHRNE, Heideterrier Variant)	Clear
 Myotonia Congenita (CLCN1 Exon 23, Australian Cattle Dog Variant)	Clear
 Myotonia Congenita (CLCN1 Exon 19, Labrador Retriever Variant)	Clear
 Myotonia Congenita (CLCN1 Exon 7, Miniature Schnauzer Variant)	Clear
 Narcolepsy (HCRTR2 Exon 1, Dachshund Variant)	Clear
 Narcolepsy (HCRTR2 Intron 4, Doberman Pinscher Variant)	Clear
 Narcolepsy (HCRTR2 Intron 6, Labrador Retriever Variant)	Clear
 Nemaline Myopathy (NEB, American Bulldog Variant)	Clear
 Neonatal Cerebellar Cortical Degeneration (SPTBN2, Beagle Variant)	Clear
 Neonatal Encephalopathy with Seizures, NEWS (ATF2)	Clear
 Neonatal Interstitial Lung Disease (LAMP3)	Clear



















## OTHER RESULTS

✓ Neuroaxonal Dystrophy, NAD (VPS11, Rottweiler Variant)	Clear
✓ Neuroaxonal Dystrophy, NAD (TECPR2, Spanish Water Dog Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 1, NCL 1 (PPT1 Exon 8, Dachshund Variant 1)	Clear
✓ Neuronal Ceroid Lipofuscinosis 10, NCL 10 (CTSD Exon 5, American Bulldog Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 2, NCL 2 (TPP1 Exon 4, Dachshund Variant 2)	Clear
✓ Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 SNP, Border Collie Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 Deletion, Golden Retriever Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 6, NCL 6 (CLN6 Exon 7, Australian Shepherd Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 7, NCL 7 (MFSD8, Chihuahua and Chinese Crested Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8, Australian Shepherd Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8 Exon 2, English Setter Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8 Insertion, Saluki Variant)	Clear
✓ Neuronal Ceroid Lipofuscinosis, Cerebellar Ataxia, NCL4A (ARSG Exon 2, American Staffordshire Terrier Variant)	Clear
✓ Oculocutaneous Albinism, OCA (SLC45A2 Exon 6, Bullmastiff Variant)	Clear
✓ Oculocutaneous Albinism, OCA (SLC45A2, Small Breed Variant)	Clear
✓ Oculoskeletal Dysplasia 2 (COL9A2, Samoyed Variant)	Clear
✓ Osteochondrodysplasia (SLC13A1, Poodle Variant)	Clear
✓ Osteogenesis Imperfecta (COL1A2, Beagle Variant)	Clear

## OTHER RESULTS

<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
<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

## OTHER RESULTS

 Primary Open Angle Glaucoma (ADAMTS10 Exon 9, Norwegian Elkhound Variant)	Clear
 Primary Open Angle Glaucoma and Primary Lens Luxation (ADAMTS17 Exon 2, Chinese Shar-Pei Variant)	Clear
 Progressive Retinal Atrophy (SAG)	Clear
 Progressive Retinal Atrophy (IFT122 Exon 26, Lapponian Herder Variant)	Clear
 Progressive Retinal Atrophy, Bardet-Biedl Syndrome (BBS2 Exon 11, Shetland Sheepdog Variant)	Clear
 Progressive Retinal Atrophy, CNGA (CNGA1 Exon 9)	Clear
 Progressive Retinal Atrophy, crd1 (PDE6B, American Staffordshire Terrier Variant)	Clear
 Progressive Retinal Atrophy, crd4/cord1 (RPGRIP1)	Clear
 Progressive Retinal Atrophy, PRA1 (CNGB1)	Clear
 Progressive Retinal Atrophy, PRA3 (FAM161A)	Clear
 Progressive Retinal Atrophy, prcd (PRCD Exon 1)	Clear
 Progressive Retinal Atrophy, rcd1 (PDE6B Exon 21, Irish Setter Variant)	Clear
 Progressive Retinal Atrophy, rcd3 (PDE6A)	Clear
 Protein Losing Nephropathy, PLN (NPHS1)	Clear
 Pyruvate Dehydrogenase Deficiency (PDP1, Spaniel Variant)	Clear
 Pyruvate Kinase Deficiency (PKLR Exon 5, Basenji Variant)	Clear
 Pyruvate Kinase Deficiency (PKLR Exon 7, Beagle Variant)	Clear
 Pyruvate Kinase Deficiency (PKLR Exon 10, Terrier Variant)	Clear

## OTHER RESULTS

<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, RIPD (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
<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



## OTHER RESULTS

✓ Succinic Semialdehyde Dehydrogenase Deficiency (ALDH5A1 Exon 7, Saluki Variant)	Clear
✓ Thrombopathia (RASGRP1 Exon 5, American Eskimo Dog Variant)	Clear
✓ Thrombopathia (RASGRP1 Exon 5, Basset Hound Variant)	Clear
✓ Thrombopathia (RASGRP1 Exon 8, Landseer Variant)	Clear
✓ Trapped Neutrophil Syndrome, TNS (VPS13B)	Clear
✓ Ullrich-like Congenital Muscular Dystrophy (COL6A3 Exon 10, Labrador Retriever Variant)	Clear
✓ Ullrich-like Congenital Muscular Dystrophy (COL6A1 Exon 3, Landseer Variant)	Clear
✓ Unilateral Deafness and Vestibular Syndrome (PTPRQ Exon 39, Doberman Pinscher)	Clear
✓ Urate Kidney & Bladder Stones (SLC2A9)	Clear
✓ Von Willebrand Disease Type I, Type I vWD (VWF)	Clear
✓ Von Willebrand Disease Type II, Type II vWD (VWF, Pointer Variant)	Clear
✓ Von Willebrand Disease Type III, Type III vWD (VWF Exon 4, Terrier Variant)	Clear
✓ Von Willebrand Disease Type III, Type III vWD (VWF Intron 16, Nederlandse Kooikerhondje Variant)	Clear
✓ Von Willebrand Disease Type III, Type III vWD (VWF Exon 7, Shetland Sheepdog Variant)	Clear
✓ X-Linked Hereditary Nephropathy, XLHN (COL4A5 Exon 35, Samoyed Variant 2)	Clear
✓ X-Linked Myotubular Myopathy (MTM1, Labrador Retriever Variant)	Clear
✓ X-Linked Progressive Retinal Atrophy 1, XL-PRA1 (RPGR)	Clear
✓ X-linked Severe Combined Immunodeficiency, X-SCID (IL2RG Exon 1, Basset Hound Variant)	Clear

## OTHER RESULTS

X-linked Severe Combined Immunodeficiency, X-SCID (IL2RG, Corgi Variant) Clear

Xanthine Urolithiasis (XDH, Mixed Breed Variant) Clear

$\beta$ -Mannosidosis (MANBA Exon 16, Mixed-Breed Variant) Clear

Mast Cell Tumor No result

## HEALTH REPORT

### Increased risk result

#### Intervertebral Disc Disease (Type I)

Snickers inherited both copies of the variant we tested for Chondrodystrophy and Intervertebral Disc Disease, CDDY/IVDD, Type I IVDD

Snickers is at increased risk for Type I IVDD

#### How to interpret this result

Snickers has two copies of an FGF4 retrogene on chromosome 12. In some breeds such as Beagles, Cocker Spaniels, and Dachshunds (among others) this variant is found in nearly all dogs. While those breeds are known to have an elevated risk of IVDD, many dogs in those breeds never develop IVDD. For mixed breed dogs and purebreds of other breeds where this variant is not as common, risk for Type I IVDD is greater for individuals with this variant than for similar dogs.

#### What is Chondrodystrophy and Intervertebral Disc Disease, CDDY/IVDD, Type I IVDD?

Type I Intervertebral Disc Disease (IVDD) is a back/spine issue that refers to a health condition affecting the discs that act as cushions between vertebrae. With Type I IVDD, affected dogs can have a disc event where it ruptures or herniates towards the spinal cord. This pressure on the spinal cord causes neurologic signs which can range from a wobbly gait to impairment of movement. Chondrodystrophy (CDDY) refers to the relative proportion between a dog's legs and body, wherein the legs are shorter and the body longer. There are multiple different variants that can cause a markedly chondrodystrophic appearance as observed in Dachshunds and Corgis. However, this particular variant is the only one known to also increase the risk for IVDD.

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

Signs of CDDY are recognized in puppies as it affects body shape. IVDD is usually first recognized in adult dogs, with breed specific differences in age of onset.

#### Signs & symptoms

Research indicates that dogs with one or two copies of this variant have a similar risk of developing IVDD. However, there are some breeds (e.g. Beagles and Cocker Spaniels, among others) where this variant has been passed down to nearly all dogs of the breed and most do not show overt clinical signs of the disorder. This suggests that there are other genetic and environmental factors (such as weight, mobility, and family history) that contribute to an individual dog's risk of developing clinical IVDD. Signs of IVDD include neck or back pain, a change in your dog's walking pattern (including dragging of the hind limbs), and paralysis. These signs can be mild to severe, and if your dog starts exhibiting these signs, you should schedule an appointment with your veterinarian for a diagnosis.

#### How vets diagnose this condition

For CDDY, dogs with one copy of this variant may have mild proportional differences in their leg length. Dogs with two copies of this variant will often have visually longer bodies and shorter legs. For IVDD, a neurological exam will be performed on any dog showing suspicious signs. Based on the result of this exam, radiographs to detect the presence of calcified discs or advanced imaging (MRI/CT) to detect a disc rupture may be recommended.

#### How this condition is treated

Registration:



## HEALTH REPORT

### Notable result

#### Degenerative Myelopathy, DM

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

#### What does this result mean?

This variant should not impact Snickers'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. Snickers 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?

The dog equivalent of Amyotrophic Lateral Sclerosis, or Lou Gehrig's disease, DM is a progressive degenerative disorder of the spinal cord. Because the nerves that control the hind limbs are the first to degenerate, the most common clinical signs are back muscle wasting and gait abnormalities.

#### 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

- Giving your dog the best quality of life for as long as possible is all you can do after receiving this diagnosis.

## HEALTH REPORT

### Notable result

#### Episodic Falling Syndrome

Snickers inherited one copy of the variant we tested for Episodic Falling Syndrome

#### What does this result mean?

This variant should not impact Snickers'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. Snickers 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 Episodic Falling Syndrome?

This disease causes episodes of spastic muscle contraction in response to stress, excitement, or exercise. EFS is caused by deficiency of a protein called brevicin, which has a role in controlling the speed and rate at which specific neurons in the brain and spinal cord fire. Loss of brevicin leads to abnormal bursts of neuronal activity, leading to the downstream effect of spastic muscle contraction.

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

Signs first appear in puppies.

#### How vets diagnose this condition

Genetic testing, blood work, neurological tests, and clinical signs can be used to diagnose this condition.

#### How this condition is treated

Affected dogs usually recover within an hour of an episode, though the stiff limbs and gait may persist for several hours. However, they may overheat during an episode due to the uncontrollable muscle contractions, which could be life threatening. Medications are available to help control symptoms.

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

- Minimizing exposure to typical triggers may help reduce clinical signs. Please follow the recommendations from your veterinarian.

## HEALTH REPORT

### Notable result

#### Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD

Snickers inherited one copy of the variant we tested for Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD

#### What does this result mean?

This variant should not impact Snickers's health. This variant is inherited in an autosomal recessive manner, meaning a dog needs two copies of the variant to show signs of this condition. Snickers 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 Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD?

Medium-Chain Acyl-CoA Dehydrogenase Deficiency (MCADD) affects the body's ability to break down certain fats for energy. This can lead to lethargy and seizures in affected dogs.

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

The age of diagnosis can vary, but signs typically first appear in young dogs.

#### How vets diagnose this condition

A combination of physical examination, blood tests, and genetic testing can be used to diagnose MCADD.

#### How this condition is treated

Treatment consists of frequent feeding of low-fat diets. Anti-convulsant therapy may be indicated in some cases.

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

- Frequent feedings are required to prevent affected dogs from entering a fasted state where they must rely on their fat storage for energy.

## HEALTH REPORT

### Notable result

#### Proportionate Dwarfism

Snickers inherited one copy of the variant we tested for Proportionate Dwarfism

#### What does this result mean?

This variant should not impact Snickers'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. Snickers 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 Proportionate Dwarfism?

Embark's data suggests that this variant in the GH1 gene may contribute to a smaller body size. The original publication predicts this is due to a growth hormone (GH) deficiency. However, adult body size is influenced by several different genetic variants. Other changes noted by the publication, including retained baby teeth, persistent puppy-like coats, and low blood sugar have been occasionally reported by owners of dogs with two copies of this variant. These changes may or may not be associated with this variant.

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

Dogs with this variant may never show clinical signs. Smaller stature may be noticeable if the puppy grows at a different rate than littermates without this variant. Low blood sugar is a potential issue common to most toy breeds but could persist beyond four months of age. Retained puppy teeth and puppy-like coats can only be noted at more than six months of age.

#### How vets diagnose this condition

Clinical history, genetic testing, and laboratory testing can be used to diagnose this form of Proportionate Dwarfism. Further research is needed to determine the full effects of this variant.

#### How this condition is treated

Our internal data suggests that most dogs with two copies of this variant will not require additional care than other toy breed puppies. If a complication occurs, your veterinarian may recommend various treatments, including correcting blood sugar or extracting retained baby teeth.

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

- Monitor for signs of hypoglycemia, including not eating, lethargy, and inability to stand. Call your veterinarian immediately for advice if you notice these signs.

## INBREEDING AND DIVERSITY

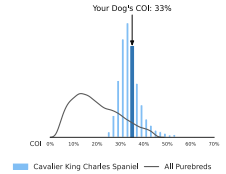
### CATEGORY

### RESULT

#### 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.

**33%**

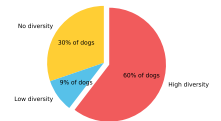


#### MHC Class II - DLA DRB1

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 purebreds:



#### 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 purebreds:

