



ROCKO

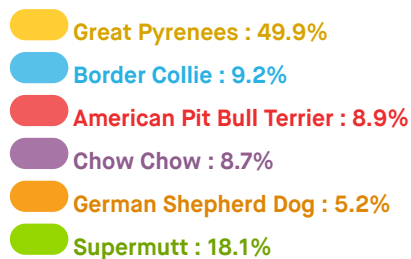


DNA Test Report

Test Date: February 18th, 2025

embk.me/rocko628

BREED MIX



GENETIC STATS

Wolfiness: 0.9 % **MEDIUM**
Predicted adult weight: **68 lbs**

TEST DETAILS

Kit number: EM-26184598
Swab number: 31240111202388

BREED MIX BY CHROMOSOME

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

Breed colors:

Great Pyrenees Border Collie American Pit Bull Terrier Chow Chow
German Shepherd Dog Supermutt





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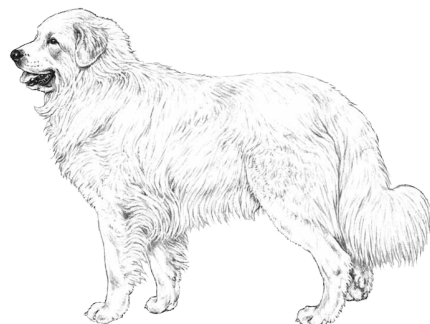
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FAMILY TREE





GREAT PYRENEES



Fun Fact

The dog named Belle from Cécile Aubry's immensely popular children's book "Belle et Sébastien" is a Great Pyrenees.

Great Pyrenees are impressive European livestock guardian dogs. Originally from the Pyrenees Mountains in Western Europe, these dogs have been appreciated for hundreds of years for their solid temperaments, exceptional guarding abilities, and gentle natures. They have been used all over the world as guardians of livestock, and they are still primarily used for this purpose today. Great Pyrenees have been around a very long time. In fact, the first written record that mentions them dates back to a Roman author from the first century BCE; however, more detailed descriptions of Great Pyrenees date back to the 1400s. Because there was not much of a homogenous breeding program then, the breed varied a lot and was not standardized until much later in the 1800s. Until then, they were bred primarily by individuals who used them as guard dogs on farms. They slowly began making their way down the Pyrenees Mountains in the 19th century, though it is possible that some of them made it to the New World alongside Spanish conquistadors in the 16th century. Once they left their native mountainous regions, Great Pyrenees became popular in certain aristocratic circles, including the French and Spanish aristocracy. Their brilliant white coats and imposing features made them the favorite dogs of many livestock owners in the higher echelons of society. Great Pyrenees are not really apartment dogs. Their large size and history as working dogs make them ill-suited to city or apartment life. They will thrive in the suburbs or, even better, a rural setting where they will have plenty of space to roam and plenty of jobs to do. Great Pyrenees will excel as livestock guard dogs—they'll take their jobs very seriously. They are wonderful with children and other animals, and they are exceptional "caretakers." Great Pyrenees are gentle dogs. While they will react with intensity and aggression if they feel their family or their flock is in danger, they are very good at regulating their reactions—they will only act that way if they really perceive danger. In most other instances, Great Pyrenees are mild-mannered and sweet dogs that are very loyal with their family and those they love.



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BORDER COLLIE



Fun Fact

Border Collies are known for possessing an incredibly intense stare used to intimidate livestock.

The Border Collie was bred in the border country between England and Scotland as a herding dog to control sheep. They were highly sought after dogs by local shepherds, who were fond of their energetic and intelligent nature. Sheepdog trials began in the late 1800s, in which this breed of sheepdog impressed and was bred further, developing the Border Collie we recognize today. Today the Border Collie is considered one of, if not the, best sheepherding dogs. The AKC recognized the Border Collie as an official breed in 1995. Border Collies have a high stamina level, matched by their desire to be kept busy. While being a loyal companion dog, the Border Collie mainly thrives on activity. If not given sufficient exercise, Border Collies can be difficult house dogs, directing their energy on less productive activities such as chasing anything that moves or digging. This work-oriented breed requires a high level of both physical and mental stimulation. Border Collies generally have a black and white double coat that sheds moderately. As you can imagine, this breed excels at many sports including obedience, agility and tracking. The Border Collie ranks as the 38th most popular breed.



AMERICAN PIT BULL TERRIER



Fun Fact

One of the most famous American Pit Bull Terriers is Pal, the dog who played the beloved Petey in *The Little Rascals*.

Few dogs are more recognizable than the American Pit Bull Terrier. While they originated in the British Isles and are descendants of the Mastiff-type dogs introduced to England in antiquity, the American Pit Bull Terrier was brought over to the United States by English immigrants in the 1800s. They quickly became one of the most popular and widespread breeds there. Though they are descended from the bull-fighting breeds of England and still have a scary sounding name, the American Pit Bull Terrier is a sweet, talented, and affectionate dog. American Pit Bull Terriers have been subject to a significant amount of controversy due to their tendency to fall prey to dog fighting rings and unscrupulous owners. Because of their high energy, strength, and eagerness to please, they have sometimes become popular for the wrong reasons. The truth is that American Pit Bull Terriers are best as family dogs—they tend to get along very well with children and enjoy the company of their family members. American Pit Bull Terriers can be tricky with other dogs, male or female, so it is best to do a lot of research before bringing an American Pit Bull Terrier into a home with other dogs. It will be a matter of personality and the individual dogs involved, so be sure to consult the shelter or breeder. However, it is much easier to introduce an American Pit Bull Terrier to other dogs when they are puppies. American Pit Bull Terriers have proven themselves to be multifaceted and multitalented dogs. They have served as search and rescue dogs and therapy dogs, and they excel at dog sports such as weight pulling and agility. They are working dogs, so they do require a decent amount of physical activity and thus are not always well-suited to apartment living. They prefer a suburban or rural home, but they can still thrive in the city. As long as they are given enough opportunity to run around, whether at a park or jogging with their beloved master, American Pit Bull Terriers can be very adaptable dogs. Due to some breed specific legislation, American Pit Bull Terriers are not allowed in certain countries and certain cities. It's important to check the local laws before welcoming one of these dogs into a home. If adopted responsibly, treated correctly, and properly



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CHOW CHOW



The Chow Chow (sometimes simply Chow) is an ancient dog breed that probably originated in Mongolia or Siberia before traveling to northern China thousands of years ago. It may have appeared in art there over 2000 years ago as a hunting dog. In China, it is referred to as Songshi Quan, which means "puffy-lion dog". The breed has also been called the Tang Quan, "Dog of the Tang Empire," perhaps because one Emperor owned over 5000 Chows. It is believed that the Chow Chow is one of the native dogs used as the model for the Foo dog, the traditional stone guardians found in front of Buddhist temples and palaces. It is one of the few ancient dog breeds still in existence in the world today.

Fun Fact

A blue tongue and lips aren't the only unique things about the Chow Chow's appearance. Did you know that the blue-coated Chow usually has a blue or gray nose?



ROCKO

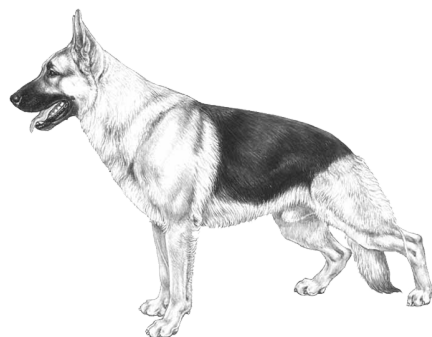


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GERMAN SHEPHERD DOG



The German Shepherd dog is the second most popular dog breed in the United States, and the fourth most popular in the United Kingdom (where it is known as the Alsatian). This breed was standardized in Germany at the end of the 19th century from local dogs used for herding and livestock guarding. Their confidence, courageousness and keen sense of smell coupled with their notable intelligence make them highly suited to police work, military roles, and search and rescue. German Shepherds require regular physical and mental exercise and have a heavy shedding coat that comes in both short and long varieties. They were first recognized by the AKC in 1908 and later became fashionable as soldiers returning from WWI spoke highly of the German dogs and Hollywood popularized the breed with stars like Strongheart and Rin Tin Tin.

Fun Fact

Despite being sometimes called the "Alsatian wolf dog", German Shepherds are not true wolf dogs— they are 100% dog. Nevertheless, German shepherds were crossed with wolves in the past to form the Czechoslovakian and Saarloos wolfdog breeds. German Shepherds, along with other breeds and sled dogs, were also used in the creation of the Chinook breed.



ROCKO

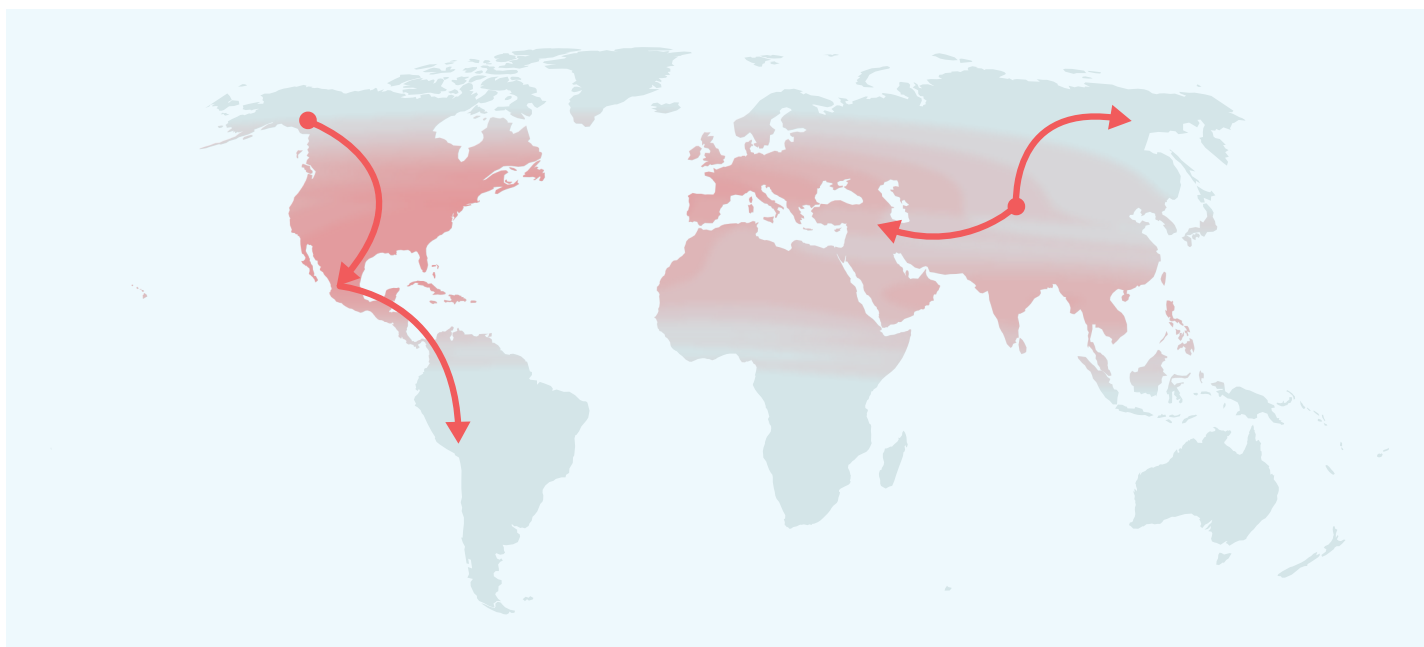


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MATERNAL LINE



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

HAPLOGROUP: A5

A5 is a rare maternal lineage. It is most numerous among the village dogs of Vietnam, though it is also present in the Chow Chow breed. Additionally, it is found in the Carolina Dog, and attests to this population's origins among the indigenous native dog.

HAPLOTYPE: A201

Part of the A5 haplogroup, this haplotype occurs most commonly in Carolina dogs. It's a rare find!



PATERNAL LINE



Through Rocko's Y chromosome we can trace his father's ancestry back to where dogs and people first became friends. This map helps you visualize the routes that his ancestors took to your home. Their story is described below the map.

HAPLOGROUP: A1a

Some of the wolves that became the original dogs in Central Asia around 15,000 years ago came from this long and distinguished line of male dogs. After domestication, they followed their humans from Asia to Europe and then didn't stop there. They took root in Europe, eventually becoming the dogs that founded the Vizsla breed 1,000 years ago. The Vizsla is a Central European hunting dog, and all male Vizslas descend from this line. During the Age of Exploration, like their owners, these pooches went by the philosophy, "Have sail, will travel!" From the windy plains of Patagonia to the snug and homey towns of the American Midwest, the beaches of a Pacific paradise, and the broad expanse of the Australian outback, these dogs followed their masters to the outposts of empires. Whether through good fortune or superior genetics, dogs from the A1a lineage traveled the globe and took root across the world. Now you find village dogs from this line frolicking on Polynesian beaches, hanging out in villages across the

HAPLOTYPE: H1a.11

Part of the large A1a haplogroup, this haplotype occurs most commonly in Great Pyrenees and Newfoundlands.



ROCKO



DNA Test Report

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TRAITS: BASE COAT COLOR

TRAIT	RESULT
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Dark or Light Fur | *E (Extension) Locus* | *Gene: Melanocortin Receptor 1 (MC1R)* | Genetic Result: **Ee**

This gene helps determine whether a dog can produce dark (black or brown) hairs or lighter yellow or red hairs. Any result except for **ee** means that the dog can produce dark hairs. An **ee** result means that the dog does not produce dark hairs and will have lighter yellow or red hairs all over its entire body.

The overall MC1R genetic result is influenced by more subloci than those presented in this section. Additional MC1R subloci results can be found under the **Coat Color Modifiers > Facial Fur Pattern** section below.

Can have dark fur

Did You Know? If a dog has an **ee** result, then the fur's actual shade can range from a deep copper to white - the exact color cannot be predicted solely from this result and will depend on other genetic factors, including the red pigment intensity test.

Dark brown pigment | *Cocoa* | *Gene: HPS3* | Genetic Result: **NN**

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** variant 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 impact on fur and skin color

Did You Know? The **co** variant and the dark brown "cocoa" coat color have only been documented in French Bulldogs. Dogs with the cocoa coat color are sometimes born with light brown coats that darken as they reach maturity.

Red Pigment Intensity | *I (Intensity) Loci* | Genetic Result: **Intermediate Red Pigmentation**

Intensity refers to the concentration of red pigment in the coat. Dogs with more densely concentrated (intense) pigment will be a deeper red, while dogs with less concentrated (dilute) pigment will be tan, yellow, cream, or white. Five locations in the dog genome explain approximately 70% of red pigmentation intensity variation across all dogs. Because the locations we test may not directly cause differences in red pigmentation intensity, we consider this to be a linkage test.

No impact on coat pattern

Did You Know? One of the genes that influences pigment intensity in dogs, TYR, is also responsible for intensity variation in domestic mice, cats, cattle, rabbits, and llamas. In dogs and humans, more genes are involved.



ROCKO



DNA Test Report

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TRAITS: BASE COAT COLOR (CONTINUED)

TRAIT	RESULT
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Brown or Black Pigment | *B (Brown) Locus* | *Gene: Tyrosinase Related Protein 1 (TYRP1)* | Genetic Result: **BB**

This gene helps determine whether a dog produces brown or black pigments. Dogs with a **bb** result produce brown pigment instead of black in both their hair and skin, while dogs with a **Bb** or **BB** result produce black pigment. Dogs that have **ee** at the E (Extension) Locus and **bb** at this B (Brown) Locus are likely to have red or cream coats and brown noses, eye rims, and footpads, which is sometimes referred to as "Dudley Nose" in Labrador Retrievers.

Black or gray fur and skin

Did You Know? "Liver" or "chocolate" is the preferred color term for brown in most breeds; in the Doberman Pinscher it is referred to as "red".

Color Dilution | *D (Dilute) Locus* | *Gene: Melanophilin (MLPH)* | Genetic Result: **DD**

This gene helps determine whether a dog has lighter "diluted" pigment. A dog with a **Dd** or **DD** result will not be dilute. A dog with a **dd** result will have all their black or brown pigment lightened ("diluted") to gray or light brown, and may lighten red pigment to cream. This affects their fur, skin, and sometimes eye color. 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, are typically dilute.

Dark (non-dilute) fur and skin

Did You Know? There are many breed-specific names for these dilute colors, such as "blue", "charcoal", "fawn", "silver", and "Isabella". Dilute dogs, especially in certain breeds, have a higher incidence of Color Dilution Alopecia which causes hair loss in some patches.



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TRAITS: COAT COLOR MODIFIERS

TRAIT	RESULT
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Hidden Patterning | *K (Dominant Black) Locus* | Gene: Canine Beta-Defensin 103 (CBD103) | Genetic Result: $K^B k^Y$

This gene helps determine whether the dog has a black coat. Dogs with a $k^Y k^Y$ result will show a coat color pattern based on the result they have at the A (Agouti) Locus. A $K^B K^B$ or $K^B k^Y$ result means the dog is dominant black, which overrides the fur pattern that would otherwise be determined by the A (Agouti) Locus. These dogs will usually have solid black or brown coats, or if they have **ee** at the E (Extension) Locus then red/cream coats, regardless of their result at the A (Agouti) Locus. Dogs who test as $K^B k^Y$ may be brindle rather than black or brown.

More likely to have a mostly solid black or brown fur coat

Did You Know? Even if a dog is "dominant black" several other genes could still impact the dog's fur and cause other patterns, such as white spotting.

Body Pattern | *A (Agouti) Locus* | Gene: Agouti Signalling Protein (ASIP) | Genetic Result: $a^Y a^t$

This gene is responsible for causing different coat patterns. It only affects the fur of dogs that do not have **ee** at the E (Extension) Locus and do have $k^Y k^Y$ at the K (Dominant Black) Locus. It controls switching between black and red pigment in hair cells, which means that it can cause a dog to have hairs that have sections of black and sections of red/cream, or hairs with different colors on different parts of the dog's body. Sable or Fawn dogs have a mostly or entirely red coat with some interspersed black hairs. Agouti or 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.

No impact on coat pattern

Did You Know? The ASIP gene causes interesting coat patterns in many other species of animals as well as dogs.



TRAITS: COAT COLOR MODIFIERS (CONTINUED)

TRAIT	RESULT
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Facial Fur Pattern | *E (Extension) Locus* | *Gene: Melanocortin Receptor 1 (MC1R)* | Genetic Result: **Ee**

This gene determines whether a dog can have dark hair and can give it a black "mask" or "widow's peak," unless the dog has overriding coat color genetic factors. Dogs with one or two copies of **E^m** in their result may have a mask, which is dark facial fur as seen in the German Shepherd Dog and Pug. Dogs with no **E^m** in their result but one or two copies of the **E^g**, **E^a**, or **E^h** variants can instead have a "widow's peak", which is dark forehead fur.

No dark mask or grizzle facial fur patterns

Did You Know?

The "widow's peak" is seen in the Afghan Hound and Borzoi, and is called either "grizzle" or "domino."

In the absence of **E^m**, dogs with the **E^g** variant can have a "widow's peak" phenotype. In the absence of both **E^m** and **E** variants, dogs with the **E^a** or **E^h** variants can express the "widow's peak" phenotype. Additionally, a dog with any combination of two of the **E^g**, **E^a**, or **E^h** variants (example: **E^gE^a**) is also expected to express the grizzle phenotype.

Saddle Tan | *Gene: RALY* | Genetic Result: **NI**

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^t** allele, so dogs that do not express **a^t** are not influenced by this gene.

No impact on coat pattern

Did You Know? The Saddle Tan pattern is characteristic of breeds like the Corgi, Beagle, and German Shepherd.



TRAITS: COAT COLOR MODIFIERS (CONTINUED)

TRAIT	RESULT
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White Spotting | *S (White Spotting) Locus* | *Gene: MITF* | Genetic Result: **Ssp**

This gene is responsible for most of the white spotting observed in dogs. Dogs with a result of **spsp** will have a nearly white coat or large patches of white in their coat. Dogs with a result of **Ssp** will have more limited white spotting that is breed-dependent. A result of **SS** means that a dog likely has no white or minimal white in their coat. The S Locus does not explain all white spotting patterns in dogs and other causes are currently being researched. Some dogs may have small amounts of white on the paws, chest, face, or tail regardless of their result at this gene.

Likely to have some white areas in coat

Did You Know? Any dog can have white spotting regardless of coat color. The colored sections of the coat will reflect the dog's other genetic coat color results.

Roan | *R (Roan) Locus* | *Gene: USH2A* | Genetic Result: **rr**

This gene, along with the S Locus, regulates whether a dog will have roaning. Dogs with at least one copy of **R** will likely have roaning on otherwise uniformly unpigmented white areas created by the S Locus. Roan may not be visible if white spotting is limited to small areas, such as the paws, chest, face, or tail. The extent of roaning varies from uniform roaning to non-uniform roaning, and patchy, non-uniform roaning may look similar to ticking. Roan does not appear in white areas created by other genes, such as a combination of the E Locus and I Locus (for example, Samoyeds). The roan pattern can appear with or without ticking.

Likely no impact on coat pattern

Did You Know? Roan, tick, and Dalmatians' spots become visible a few weeks after birth. The R Locus is probably involved in the development of Dalmatians' spots.

Merle | *M (Merle) Locus* | *Gene: PMEL* | Genetic Result: **mm**

This gene is responsible for mottled or patchy coat color in some dogs. Dogs with an **M*m** result are likely to appear 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 have merle or double merle coat patterning. Dogs with an **mm** result are unlikely to have a merle coat pattern.

Unlikely to have merle pattern

Did You Know? Merle coat patterning is common to several dog breeds including the Australian Shepherd, Catahoula Leopard Dog, and Shetland Sheepdog.



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TRAITS: COAT COLOR MODIFIERS (CONTINUED)

TRAIT	RESULT
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Harlequin | Gene: *PSMB* | Genetic Result: **hh**

This gene, along with the M Locus, determines whether a dog will have harlequin patterning. 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.

No impact on coat pattern

Did You Know? While many harlequin dogs are white with black patches, some dogs have grey, sable, or brindle patches of color, depending on their genotypes at other coat color genes.

Panda White Spotting | Gene: *KIT* | Genetic Result: **NN**

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

Did You Know? A de novo mutation (a genetic mutation not inherited from the parents) occurred in a female German Shepherd Dog named Lewcinka's Franka von Phenom. She was born in 2000, and all Panda Shepherds can trace their bloodline back to her.



TRAITS: OTHER COAT TRAITS

TRAIT	RESULT
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Furnishings | Gene: *RSP02* | Genetic Result: **II**

This gene is responsible for "furnishings", which is another name for the mustache, beard, and eyebrows that are characteristic of breeds like the Schnauzer, Scottish Terrier, and Wire Haired Dachshund. A dog with an **FF** or **FI** result is likely to have furnishings. A dog with an **II** result will not have furnishings. We measure this result using a linkage test.

Likely unfurnished (no mustache, beard, and/or eyebrows)

Did You Know? In breeds that are expected to have furnishings, dogs without furnishings are the exception - this is sometimes called an "improper coat".

Coat Length | Gene: *FGF5* | Genetic Result: **ShLh**

This 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. An **ShSh** or **ShLh** result is likely to mean a shorter coat, like in the Boxer or the American Staffordshire Terrier. 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 variants, 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 short or mid-length coat

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 Afghan Hounds and Eurasiers.

Did You Know? In certain breeds, such as Pembroke Welsh Corgi and French Bulldog, the long coat is described as "fluffy."



TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
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Shedding | Gene: *MC5R* | Genetic Result: **CC**

This gene affects how much a dog sheds. Dogs with furnishings or wire-haired coats tend to be low shedders regardless of their result for this gene. In other dogs, a **CC** or **CT** result indicates heavy or seasonal shedding, like many Labradors and German Shepherd Dogs. Dogs with a **TT** result tend to be lighter shedders, like Boxers, Shih Tzus and Chihuahuas.

Likely heavy/seasonal shedding

Coat Texture | Gene: *KRT71* | Genetic Result: **CC**

For dogs with long fur, dogs with a **TT** or **CT** result will likely have a wavy or curly coat like the coat of Poodles and Bichon Frises. Dogs with a **CC** result will likely have a straight coat—unless the dog has a "Likely Furnished" result for the Furnishings trait, since this can also make the coat more curly.

Likely straight coat

Did You Know? Dogs with short coats may have straight coats, whatever result they have for this gene.

Hairlessness (Xolo type) | Gene: *FOXI3* | Genetic Result: **NN**

This gene can cause hairlessness over most of the body as well as changes in tooth shape and number. This particular gene occurs in Peruvian Inca Orchid, Xoloitzcuintli (Mexican Hairless), and Chinese Crested; other hairless breeds are due to different genes. Dogs with the **NDup** result are likely to be hairless while dogs with the **NN** result are likely to have a normal coat. We measure this result using a linkage test.

Very unlikely to be hairless

Did You Know? The **DupDup** result has never been observed, suggesting that dogs with that genotype cannot survive to birth.

Hairlessness (Terrier type) | Gene: *SGK3* | Genetic Result: **NN**

This gene is responsible for Hairlessness in the American Hairless Terrier. Dogs with the **DD** result are likely to be hairless. Dogs with the **ND** genotype will have a normal coat, but can pass the **D** variant on to their offspring.

Very unlikely to be hairless

Oculocutaneous Albinism Type 2 | Gene: *SLC45A2* | Genetic Result: **NN**

This gene causes oculocutaneous albinism (OCA), also known as Doberman Z Factor Albinism. Dogs with a **DD** result will have OCA. Effects include severely reduced or absent pigment in the eyes, skin, and hair and



TRAITS: OTHER BODY FEATURES

TRAIT	RESULT
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Muzzle Length | Gene: *BMP3* | Genetic Result: **CC**

This gene affects muzzle length. A dog with a **AC** or **CC** result is likely to have a medium-length muzzle like a Staffordshire Terrier or Labrador, or a long muzzle like a Whippet or Collie. A dog with a **AA** result is likely to have a short muzzle, like an English Bulldog, Pug, or Pekingese.

Likely medium or long muzzle

Did You Know? At least five different genes affect snout length in dogs, with *BMP3* being the only one with a known causal mutation. For example, the muzzle length of some breeds, including the long-snouted Scottish Terrier or the short-snouted Japanese Chin, appear to be caused by other genes. This means your dog may have a long or short snout due to other genetic factors. Embark is working to figure out what these might be.

Tail Length | Gene: *T* | Genetic Result: **CC**

This is one of the genes that can cause a short bobtail. Most dogs have a **CC** result and a long tail. Dogs with a **CG** result are likely to have a bobtail, which is an unusually short or absent tail. This can be seen in many "natural bobtail" 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 such a result do not survive to birth.

Likely normal-length tail

Did You Know? 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, it is not always caused by this gene. This suggests that other unknown genetic effects can also lead to a natural bobtail.

Hind Dew Claws | Gene: *LMBR1* | Genetic Result: **TT**

This is one of the genes that can cause hind dew claws, which are extra, nonfunctional digits located midway between a dog's paw and hock. Dogs with a **CT** or **TT** result have about a 50% chance of having hind dewclaws. Hind dew claws can also be caused by other, still unknown, genes. Embark is working to figure those out.

Likely to have hind dew claws

Did You Know? Hind dew claws are commonly found in certain breeds such as the Saint Bernard.



TRAITS: OTHER BODY FEATURES (CONTINUED)

TRAIT	RESULT
-------	--------

Back Muscling & Bulk (Large Breed) | Gene: *ACSL4* | Genetic Result: **CC**

This gene can cause 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. A dog with the **TT** result is likely to have heavy muscling. Leaner-shaped large breed dogs like the Great Dane, Irish Wolfhound, and Scottish Deerhound generally have a **CC** result. The **TC** result also indicates likely normal muscling.

Likely normal muscling

Did You Know? This gene does not seem to affect muscling in small or even mid-sized dog breeds with lots of back muscling, including the American Staffordshire Terrier, Boston Terrier, and the English Bulldog.

Eye Color | Gene: *ALX4* | Genetic Result: **NN**

This gene is associated with blue eyes in Arctic breeds like Siberian Husky as well as tri-colored (non-merle) Australian Shepherds. Dogs with a **DupDup** or **NDup** result are more likely to have blue eyes, although some dogs may have only one blue eye or may not have blue eyes at all; nevertheless, they can still pass blue eyes to their offspring. Dogs with a **NN** result may have blue eyes due to other factors, such as merle or white spotting. We measure this result using a linkage test.

Less likely to have blue eyes

Did You Know? Embark researchers discovered this gene by studying data from dogs like yours. Who knows what we will be able to discover next? Answer the questions on our research surveys to contribute to future discoveries!

Chondrodysplasia (Leg Length) | Gene: *Chr. 18 FGF4 Retrogene* | Genetic Result: **NN**

This variant is associated with a type of disproportionate dwarfism known as chondrodysplasia (CDPA). CDPA is a breed-defining characteristic of many breeds exhibiting a "short-legged, long-bodied" appearance, such as Corgis, Dachshunds, Basset Hounds, and others. 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.

Likely to have normal leg length

Did You Know? A similar genetic variant called the chondrodystrophy (CDDY) variant also plays an important role in shortening the leg length of many breeds. Dog breeds with the shortest legs, like the Corgi, Dachshund, and Basset Hound generally have one or two copies of the CDDY and CDPA variants. CDDY (but not CDPA) is also associated with an increased risk of Type I Intervertebral Disc Disease (IVDD). You can see the CDDY result in the health test results under "Intervertebral Disc Disease Type I".



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TRAITS: BODY SIZE

TRAIT	RESULT
-------	--------

Body Size 1 | Gene: *IGF1* | Genetic Result: **NI**

This is one of several genes that influence the size of a dog. A result of **II** for this gene is associated with smaller body size. A result of **NN** is associated with larger body size.

Intermediate

Body Size 2 | Gene: *IGFR1* | Genetic Result: **GG**

This is one of several genes that influence the size of a dog. A result of **AA** for this gene is associated with smaller body size. A result of **GG** is associated with larger body size.

Larger

Body Size 3 | Gene: *STC2* | Genetic Result: **TT**

This is one of several genes that influence the size of a dog. A result of **AA** for this gene is associated with smaller body size. A result of **TT** is associated with larger body size.

Larger

Body Size 4 | Gene: *GHR - E191K* | Genetic Result: **GG**

This is one of several genes that influence the size of a dog. A result of **AA** for this gene is associated with smaller body size. A result of **GG** is associated with larger body size.

Larger

Body Size 5 | Gene: *GHR - P177L* | Genetic Result: **CC**

This is one of several genes that influence the size of a dog. A result of **TT** for this gene is associated with smaller body size. A result of **CC** is associated with larger body size.

Larger



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TRAITS: PERFORMANCE

TRAIT	RESULT
-------	--------

Altitude Adaptation | Gene: *EPAS1* | Genetic Result: **GG**

This gene causes dogs to be especially tolerant of low oxygen environments, such as those found at high elevations. Dogs with a **AA** or **GA** result will be less susceptible to "altitude sickness."

**Normal altitude
tolerance**

Did You Know? This gene was originally identified in breeds from high altitude areas such as the Tibetan Mastiff.

Appetite | Gene: *POMC* | Genetic Result: **NN**

This gene influences eating behavior. An **ND** or **DD** result would predict higher food motivation compared to **NN** result, increasing the likelihood 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**

Did You Know? POMC is actually short for "proopiomelanocortin," and is a large protein that is broken up into several smaller proteins that have biological activity. The smaller proteins generated from POMC control, among other things, distribution of pigment to the hair and skin cells, appetite, and energy expenditure.



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HEALTH REPORT

How to interpret Rocko's genetic health results:

If Rocko 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 Rocko 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 2 results that you should learn about.

Notable results (2)

ALT Activity

Canine Multifocal Retinopathy, *cmr1*

Clear results

Breed-relevant (28)

Other (243)



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BREED-RELEVANT RESULTS

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

 Canine Multifocal Retinopathy, cmr1 (BEST1 Exon 2)	Notable
 Anhidrotic Ectodermal Dysplasia (EDA Intron 8)	Clear
 Canine Leukocyte Adhesion Deficiency Type III, CLAD III (FERMT3, German Shepherd Variant)	Clear
 Cobalamin Malabsorption (CUBN Exon 53, Border Collie Variant)	Clear
 Collie Eye Anomaly (NHEJ1)	Clear
 Day Blindness (CNGA3 Exon 7, German Shepherd Variant)	Clear
 Degenerative Myelopathy, DM (SOD1A)	Clear
 Glanzmann's Thrombasthenia Type I (ITGA2B Exon 13, Great Pyrenees Variant)	Clear
 Goniodysgenesis and Glaucoma, Pectinate Ligament Dysplasia, PLD (OLFM3)	Clear
 Hemophilia A (F8 Exon 11, German Shepherd Variant 1)	Clear
 Hemophilia A (F8 Exon 1, German Shepherd Variant 2)	Clear
 Ichthyosis (ASPRV1 Exon 2, German Shepherd Variant)	Clear
 L-2-Hydroxyglutaricaciduria, L2HGA (L2HGDH, Staffordshire Bull Terrier Variant)	Clear
 Methemoglobinemia (CYB5R3, Pit Bull Terrier Variant)	Clear
 Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 3, German Shepherd Variant)	Clear
 Multiple Drug Sensitivity (ABCB1)	Clear
 Myotonia Congenita (CLCN1 Exon 23, Australian Cattle Dog Variant)	Clear
 Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 SNP, Border Collie Variant)	Clear





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BREED-RELEVANT RESULTS

✓ Neuronal Ceroid Lipofuscinosis, Cerebellar Ataxia, NCL4A (ARSG Exon 2, American Staffordshire Terrier Variant)	Clear
✓ Platelet Factor X Receptor Deficiency, Scott Syndrome (TMEM16F)	Clear
✓ Primary Lens Luxation (ADAMTS17)	Clear
✓ Progressive Retinal Atrophy, crd1 (PDE6B, American Staffordshire Terrier Variant)	Clear
✓ Raine Syndrome (FAM20C)	Clear
✓ Renal Cystadenocarcinoma and Nodular Dermatofibrosis (FLCN Exon 7)	Clear
✓ Sensory Neuropathy (FAM134B, Border Collie Variant)	Clear
✓ Trapped Neutrophil Syndrome, TNS (VPS13B)	Clear
✓ Urate Kidney & Bladder Stones (SLC2A9)	Clear
✓ Xanthine Urolithiasis (XDH, Mixed Breed Variant)	Clear
✓ β -Mannosidosis (MANBA Exon 16, Mixed-Breed Variant)	Clear
Mast Cell Tumor	No result





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OTHER RESULTS

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

⊖ ALT Activity (GPT)	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
✓ 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 Multifocal Retinopathy, cmr2 (BEST1 Exon 5, Coton de Tulear Variant)	Clear
✓ 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



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OTHER RESULTS

✓ Centronuclear Myopathy, CNM (PTPLA)	Clear
✓ Cerebellar Hypoplasia (VLDLR, Eurasier Variant)	Clear
✓ Chondrodysplasia (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
✓ Complement 3 Deficiency, C3 Deficiency (C3)	Clear
✓ Congenital Cornification Disorder (NSDHL, Chihuahua Variant)	Clear
✓ Congenital Dyserythropoietic Anemia and Polymyopathy (EHPB1L1, Labrador Retriever 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
✓ Congenital Macrothrombocytopenia (TUBB1 Exon 1, Cairn and Norfolk Terrier Variant)	Clear
✓ Congenital Muscular Dystrophy (LAMA2, Italian Greyhound)	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



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OTHER RESULTS

✓ 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
✓ Copper Toxicosis (Accumulating) (ATP7B)	Clear
✓ Copper Toxicosis (Attenuating) (ATP7A, Labrador Retriever)	Clear
✓ Copper Toxicosis (Attenuating) (RETN, Labrador Retriever)	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, Labrador Retriever Variant)	Clear
✓ Day Blindness (CNGB3 Exon 6, German Shorthaired Pointer Variant)	Clear
✓ Deafness and Vestibular Syndrome of Dobermans, DVDob, DINGS (MYO7A)	Clear
✓ Demyelinating Polyneuropathy (SBF2/MTRM13)	Clear
✓ Dental-Skeletal-Retinal Anomaly (MIA3, Cane Corso Variant)	Clear



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OTHER RESULTS

✓ 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
✓ Dry Eye Curly Coat Syndrome (FAM83H Exon 5)	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
✓ Episodic Falling Syndrome (BCAN)	Clear
✓ Exercise-Induced Collapse, EIC (DNM1)	Clear
✓ Factor VII Deficiency (F7 Exon 5)	Clear



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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 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 (G6PC1, German Pinscher 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





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OTHER RESULTS

✓ Golden Retriever Progressive Retinal Atrophy 2, GR-PRA2 (TTC8)	Clear
✓ Hemophilia A (F8 Exon 10, Boxer Variant)	Clear
✓ Hemophilia B (F9 Exon 7, Terrier Variant)	Clear
✓ Hemophilia B (F9 Exon 7, Rhodesian Ridgeback Variant)	Clear
✓ Hereditary Ataxia (PNPLA8, Australian Shepherd Variant)	Clear
✓ Hereditary Ataxia, Cerebellar Degeneration (RAB24, Old English Sheepdog and Gordon Setter Variant)	Clear
✓ Hereditary Cataracts (HSF4 Exon 9, Australian Shepherd Variant)	Clear
✓ Hereditary Cataracts (FYCO1, Wirehaired Pointing Griffon Variant)	Clear
✓ Hereditary Cerebellar Ataxia (SELENOP, Belgian Shepherd Variant)	Clear
✓ Hereditary Footpad Hyperkeratosis (FAM83G, Terrier and Kromfohrlander Variant)	Clear
✓ Hereditary Footpad Hyperkeratosis (DSG1, Rottweiler Variant)	Clear
✓ Hereditary Nasal Parakeratosis (SUV39H2 Intron 4, Greyhound Variant)	Clear
✓ Hereditary Nasal Parakeratosis, HNPk (SUV39H2)	Clear
✓ Hereditary Vitamin D-Resistant Rickets (VDR)	Clear
✓ Hypocatalasia, Acatalasemia (CAT)	Clear
✓ Hypomyelination and Tremors (FNIP2, Weimaraner Variant)	Clear
✓ Hypophosphatasia (ALPL Exon 9, Karelian Bear Dog Variant)	Clear
✓ Ichthyosis (NIPAL4, American Bulldog Variant)	Clear





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OTHER RESULTS

✓ Ichthyosis (SLC27A4, Great Dane Variant)	Clear
✓ Ichthyosis, Epidermolytic Hyperkeratosis (KRT10, Terrier Variant)	Clear
✓ Ichthyosis, ICH1 (PNPLA1, Golden Retriever Variant)	Clear
✓ Ichthyosis, ICH2 (ABHD5, Golden Retriever Variant)	Clear
✓ Inflammatory Myopathy (SLC25A12)	Clear
✓ Inherited Myopathy of Great Danes (BIN1)	Clear
✓ Inherited Selected Cobalamin Malabsorption with Proteinuria (CUBN, Komondor Variant)	Clear
✓ Intervertebral Disc Disease (Type I) (FGF4 retrogene - CFA12)	Clear
✓ Intestinal Lipid Malabsorption (ACSL5, Australian Kelpie)	Clear
✓ Junctional Epidermolysis Bullosa (LAMA3 Exon 66, Australian Cattle Dog Variant)	Clear
✓ Junctional Epidermolysis Bullosa (LAMB3 Exon 11, Australian Shepherd Variant)	Clear
✓ Juvenile Epilepsy (LGI2)	Clear
✓ Juvenile Laryngeal Paralysis and Polyneuropathy (RAB3GAP1, Rottweiler Variant)	Clear
✓ Juvenile Myoclonic Epilepsy (DIRAS1)	Clear
✓ Lagotto Storage Disease (ATG4D)	Clear
✓ Laryngeal Paralysis (RAPGEF6, Miniature Bull Terrier Variant)	Clear
✓ Laryngeal Paralysis and Polyneuropathy (CNTNAP1, Leonberger, Saint Bernard, and Labrador Retriever variant)	Clear
✓ Late Onset Spinocerebellar Ataxia (CAPN1)	Clear





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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
✓ Medium-Chain Acyl-CoA Dehydrogenase Deficiency, MCADD (ACADM, Cavalier King Charles Spaniel 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





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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 5, Terrier Brasileiro Variant)	Clear
✓ Muscular Dystrophy (DMD, Cavalier King Charles Spaniel Variant 1)	Clear
✓ Muscular Dystrophy (DMD, Golden Retriever Variant)	Clear
✓ Muscular Dystrophy-Dystroglycanopathy (LARGE1, Labrador Retriever Variant)	Clear
✓ Musladin-Lueke Syndrome, MLS (ADAMTSL2)	Clear
✓ Myasthenia Gravis-Like Syndrome (CHRNE, Heideterrier Variant)	Clear
✓ Myotonia Congenita (CLCN1 Exon 19, Labrador Retriever Variant)	Clear
✓ Myotonia Congenita (CLCN1 Exon 7, Miniature Schnauzer Variant)	Clear
✓ Narcolepsy (HCRT2 Exon 1, Dachshund Variant)	Clear
✓ Narcolepsy (HCRT2 Intron 4, Doberman Pinscher Variant)	Clear
✓ Narcolepsy (HCRT2 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
✓ Neuroaxonal Dystrophy, NAD (VPS11, Rottweiler Variant)	Clear





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OTHER RESULTS

✓ 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 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
✓ 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
✓ Osteogenesis Imperfecta (SERPINH1, Dachshund Variant)	Clear
✓ Osteogenesis Imperfecta (COL1A1, Golden Retriever Variant)	Clear
✓ P2Y12 Receptor Platelet Disorder (P2Y12)	Clear



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OTHER RESULTS

✓ Pachyonychia Congenita (KRT16, Dogue de Bordeaux Variant)	Clear
✓ Paroxysmal Dyskinesia, PxD (PIGN)	Clear
✓ Persistent Mullerian Duct Syndrome, PMDS (AMHR2)	Clear
✓ Pituitary Dwarfism (POU1F1 Intron 4, Karelian Bear Dog Variant)	Clear
✓ Polycystic Kidney Disease, PKD (PKD1)	Clear
✓ Pompe's Disease (GAA, Finnish and Swedish Lapphund, Lapponian Herder Variant)	Clear
✓ Prekallikrein Deficiency (KLKB1 Exon 8)	Clear
✓ Primary Ciliary Dyskinesia, PCD (NME5, Alaskan Malamute Variant)	Clear
✓ Primary Ciliary Dyskinesia, PCD (STK36, Australian Shepherd Variant)	Clear
✓ Primary Ciliary Dyskinesia, PCD (CCDC39 Exon 3, Old English Sheepdog Variant)	Clear
✓ Primary Hyperoxaluria (AGXT)	Clear
✓ Primary Open Angle Glaucoma (ADAMTS17 Exon 11, Basset Fauve de Bretagne Variant)	Clear
✓ Primary Open Angle Glaucoma (ADAMTS10 Exon 17, Beagle Variant)	Clear
✓ 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 5, PRA5 (NECAP1 Exon 6, Giant Schnauzer Variant)	Clear





ROCKO



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OTHER RESULTS

✓ Progressive Retinal Atrophy, Bardet-Biedl Syndrome (BBS2 Exon 11, Shetland Sheepdog Variant)	Clear
✓ Progressive Retinal Atrophy, CNGA (CNGA1 Exon 9)	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
✓ Proportionate Dwarfism (GH1 Exon 5, Chihuahua Variant)	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
✓ Pyruvate Kinase Deficiency (PKLR Exon 7, Labrador Retriever Variant)	Clear
✓ Pyruvate Kinase Deficiency (PKLR Exon 7, Pug Variant)	Clear
✓ Recurrent Inflammatory Pulmonary Disease, RIPD (AKNA, Rough Collie Variant)	Clear
✓ Retina Dysplasia and/or Optic Nerve Hypoplasia (SIX6 Exon 1, Golden Retriever Variant)	Clear



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OTHER RESULTS

✓ Severe Combined Immunodeficiency, SCID (PRKDC, Terrier Variant)	Clear
✓ Severe Combined Immunodeficiency, SCID (RAG1, Wetterhoun Variant)	Clear
✓ Shaking Puppy Syndrome (PLP1, English Springer Spaniel Variant)	Clear
✓ Shar-Pei Autoinflammatory Disease, SPAID, Shar-Pei Fever (MTBP)	Clear
✓ Skeletal Dysplasia 2, SD2 (COL11A2, Labrador Retriever Variant)	Clear
✓ Skin Fragility Syndrome (PKP1, Chesapeake Bay Retriever Variant)	Clear
✓ Spinocerebellar Ataxia (SCN8A, Alpine Dachsbracke Variant)	Clear
✓ Spinocerebellar Ataxia with Myokymia and/or Seizures (KCNJ10)	Clear
✓ Spongy Degeneration with Cerebellar Ataxia 1 (KCNJ10)	Clear
✓ Spongy Degeneration with Cerebellar Ataxia 2 (ATP1B2)	Clear
✓ Stargardt Disease (ABCA4 Exon 28, Labrador Retriever Variant)	Clear
✓ 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
✓ 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



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OTHER RESULTS

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





ROCKO



DNA Test Report

Test Date: February 18th, 2025

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HEALTH REPORT

Notable result

ALT Activity

Rocko inherited both copies of the variant we tested for Alanine Aminotransferase Activity

Why is this important to your vet?

Rocko has two copies of a variant in the GPT gene and is likely to have a lower than average baseline ALT activity. ALT is a commonly used measure of liver health on routine veterinary blood chemistry panels. As such, your veterinarian may want to watch for changes in Rocko's ALT activity above their current, healthy, ALT activity. As an increase above Rocko's baseline 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?

Alanine aminotransferase (ALT) is a clinical tool that can be used by veterinarians to better monitor liver health. This result is not associated with liver disease. ALT is one of several values veterinarians measure on routine blood work to evaluate the liver. It is a naturally occurring enzyme located in liver cells that helps break down protein. When the liver is damaged or inflamed, ALT is released into the bloodstream.

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.



ROCKO



DNA Test Report

Test Date: February 18th, 2025

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HEALTH REPORT

Notable result

Canine Multifocal Retinopathy, cmr1

Rocko inherited one copy of the variant we tested for Canine Multifocal Retinopathy, cmr1

What does this result mean?

This variant should not impact Rocko'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. Rocko is unlikely to develop this condition due to this variant because he only has one copy of the variant.

What is Canine Multifocal Retinopathy, cmr1?

This is a non-progressive retinal disease that, in rare cases, can lead to vision loss. Dogs with larger lesions can suffer from vision loss. CMR is fairly non-progressive; new lesions will typically stop forming by the time a dog is an adult, and some lesions will even regress with time.

When signs & symptoms develop in affected dogs

cmr1 typically develops in puppies at 11 to 16 weeks and becomes stable by the time they are 1 year old.

How vets diagnose this condition

CMR is typically only identified when a vet examines the back of the eye which, in dogs with CMR, reveals multiple retinal abnormalities that range from small, flat folds (called "retinal folds") to larger, irregularly edged raised lesions (called "geographic lesions").

How this condition is treated

Currently, there is no treatment for CMR. However, CMR rarely affects vision to a significant degree, and as we stated, even the associated retinal abnormalities can regress over time.

Actions to take if your dog is affected

- Carefully monitoring your dog's vision and seeking a veterinary ophthalmologist's opinion if you are concerned are the best ways you can help your affected dog.



ROCKO



DNA Test Report

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INBREEDING AND DIVERSITY

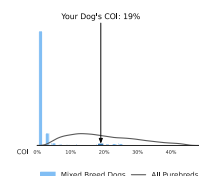
CATEGORY

RESULT

Inbreeding | Gene: *n/a* | Genetic Result: **19%**

Inbreeding is a measure of how closely related this dog's parents were. The higher the number, the more closely related the parents. In general, greater inbreeding is associated with increased incidence of genetically inherited conditions.

19%

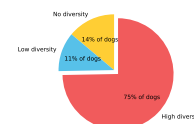


Immune Response 1 | Gene: *DRB1* | Genetic Result: **High Diversity**

Diversity in the Major Histocompatibility Complex (MHC) region of the genome has been found in some studies to be associated with the incidence of certain autoimmune diseases. Dogs that have less diversity in the MHC region—i.e. the Dog Leukocyte Antigen (DLA) inherited from the mother is similar to the DLA inherited from the father—are considered less immunologically diverse. A High Diversity result means the dog has two highly dissimilar haplotypes. A Low Diversity result means the dog has two similar but not identical haplotypes. A No Diversity result means the dog has inherited identical haplotypes from both parents. Some studies have shown associations between certain DRB1 haplotypes and autoimmune diseases such as Cushing's disease, but these findings have yet to be scientifically validated.

High Diversity

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



Immune Response 2 | Gene: *DQA1 and DQB1* | Genetic Result: **High Diversity**

Diversity in the Major Histocompatibility Complex (MHC) region of the genome has been found in some studies to be associated with the incidence of certain autoimmune diseases. Dogs that have less diversity in the MHC region—i.e. the Dog Leukocyte Antigen (DLA) inherited from the mother is similar to the DLA inherited from the father—are considered less immunologically diverse. A High Diversity result means the dog has two highly dissimilar haplotypes. A Low Diversity result means the dog has two similar but not identical haplotypes. A No Diversity result means the dog has inherited identical haplotypes from both parents. 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:

