

**"AXLE"**

**JRL AXLE**



DNA Test Report

Test Date: November 19th, 2020

[embk.me/jrlaxle](https://embk.me/jrlaxle)

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## GENETIC STATS

Predicted adult weight: **66 lbs**

Genetic age: **19 human years**

Based on the date of birth you provided

## TEST DETAILS

Kit number: EM-24119936

Swab number: 31020061503282

Registration: AKC SS14772204



## LABRADOR RETRIEVER



The Labrador Retriever has been the most popular AKC breed in the United States every year for the past 25 years. Their origins have been traced to the St. John's dog, named for the capital city of the Canadian province "Newfoundland and Labrador." The St. John's was developed from imported European dogs for fishing and hunting on the island of Newfoundland in the 18th century. During the 19th century St John's were bred in England and developed into the Labradors we know and love. Labradors were recognized as a breed by the British Kennel Club in 1903 and by the AKC in 1917. With their friendly dispositions and weatherproof build, they are terrific family dogs and outdoor companions. Most Labradors are very active with an appetite to match, and need plenty of exercise. Labradors often love to swim. Their double-coated weather-resistant fur can cause heavy shedding. Great hunting dogs and popular household companions, Labrador Retrievers are also employed as guide dogs and search-and-rescue dogs.

### Fun Fact

We're pretty sure Labradors came from the island of Newfoundland, and many experts believe that the Newfoundland breed was developed in neighboring Labrador! By our calculations, there are 10 times as many Labradors in North America than there are people living in Labrador and Newfoundland.

### RELATED BREEDS



**Flat-Coated Retriever**  
Sibling breed



**Golden Retriever**  
Sibling breed

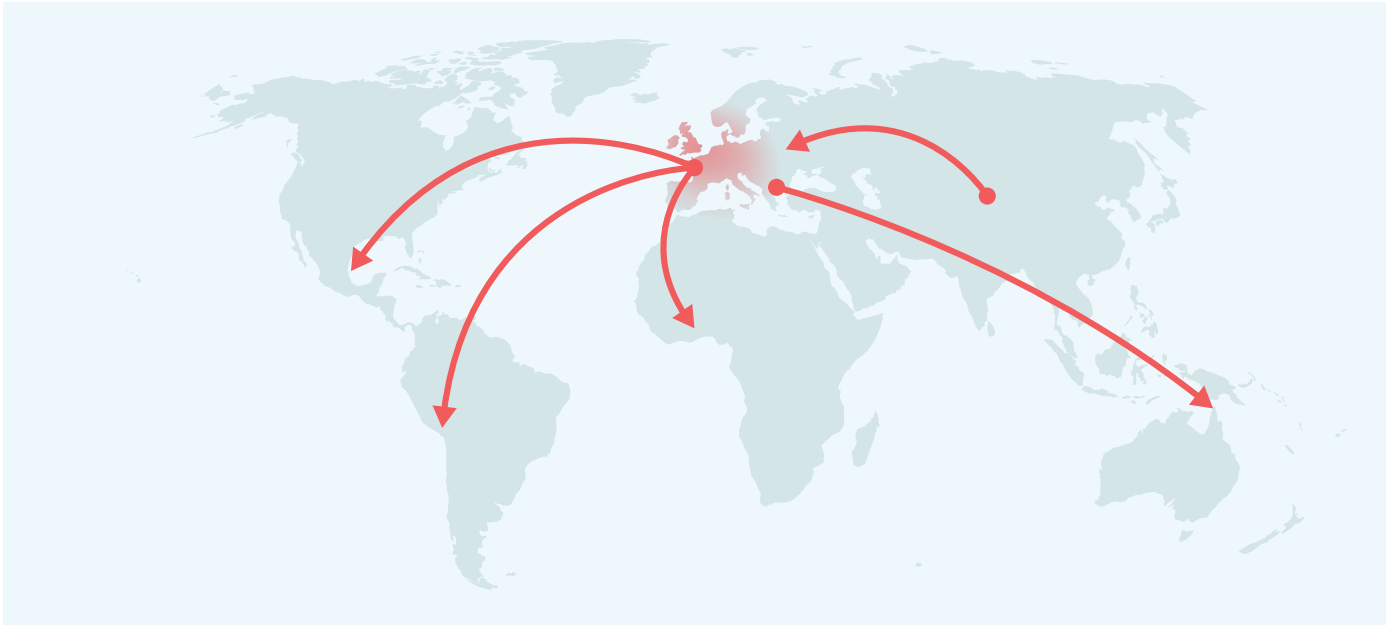


**Chesapeake Bay Retriever**  
Cousin breed



**Newfoundland**  
Cousin breed

## MATERNAL LINE



Through Axle’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: A1a

A1a is the most common maternal lineage among Western dogs. This lineage traveled from the site of dog domestication in Central Asia to Europe along with an early dog expansion perhaps 10,000 years ago. It hung around in European village dogs for many millennia. Then, about 300 years ago, some of the prized females in the line were chosen as the founding dogs for several dog breeds. That set in motion a huge expansion of this lineage. It’s now the maternal lineage of the overwhelming majority of Mastiffs, Labrador Retrievers and Gordon Setters. About half of Boxers and less than half of Shar-Pei dogs descend from the A1a line. It is also common across the world among village dogs, a legacy of European colonialism.

### HAPLOTYPE: A400

Part of the A1a haplogroup, this haplotype occurs most frequently in mixed breed dogs.

## PATERNAL LINE



Through Axle'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: A2b

A2b appears to have split a few times in succession, which means that some of the Central Asian male ancestors of this lineage went their separate ways before their respective Y chromosomes made their rounds. There is not much diversity in this lineage, meaning that it has only begun to take off recently. Two iconic breeds, the Dachshund and Bloodhound, represent this lineage well. Over half of Rottweilers are A2b, as are the majority of Labrador Retrievers and Cavalier King Charles Spaniels. While A2a is restricted mostly to East Asia, this paternal line is also found among European breeds.

### HAPLOTYPE: Hc.17

Part of the A2b haplogroup, this haplotype occurs most frequently in mixed breed dogs.

## TRAITS: COAT COLOR

TRAIT	RESULT
<b>E Locus (MC1R)</b> <p>The E Locus determines if and where a dog can produce dark (black or brown) hair. Dogs with two copies of the recessive <b>e</b> 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 (I) Locus, which has yet to be genetically mapped. 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 <b>Em</b> allele usually have a melanistic mask (dark facial hair as commonly seen in the German Shepherd and Pug). Dogs with no copies of <b>Em</b> but one or two copies of the <b>Eg</b> 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").</p>	<b>Can have a melanistic mask (E<sup>m</sup>e)</b>
<b>K Locus (CBD103)</b> <p>The K Locus <b>K<sup>B</sup></b> allele "overrides" the A Locus, meaning that it prevents the A Locus genotype from affecting coat color. For this reason, the <b>K<sup>B</sup></b> allele is referred to as the "dominant black" allele. As a result, dogs with at least one <b>K<sup>B</sup></b> allele will usually have solid black or brown coats (or red/cream coats if they are <b>ee</b> 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 <b>k<sup>Y</sup>k<sup>Y</sup></b> genotype will show a coat color pattern based on the genotype they have at the A Locus. Dogs who test as <b>K<sup>B</sup>k<sup>Y</sup></b> may be brindle rather than black or brown.</p>	<b>More likely to have a mostly solid black or brown coat (K<sup>B</sup>K<sup>B</sup>)</b>
<b>A Locus (ASIP)</b> <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>	<b>Not expressed (a<sup>t</sup>a)</b>

## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
<b>D Locus (MLPH)</b>  Dogs with two copies of the <b>d</b> allele 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 dilute dogs have a higher incidence of Color Dilution Alopecia, especially in certain breeds. Dogs with one copy of the <b>d</b> allele will not be dilute, but can pass the <b>d</b> allele on to their puppies.	<b>Dark areas of hair and skin are not lightened (DD)</b>
<b>B Locus (TYRP1)</b>  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".	<b>Black or gray hair and skin (BB)</b>
<b>Saddle Tan (RALY)</b>  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>ll</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.	<b>Not expressed (NI)</b>

## TRAITS: COAT COLOR (CONTINUED)

TRAIT	RESULT
<b>S Locus (MITF)</b>  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.	<b>Likely to have little to no white in coat (SS)</b>
<b>M Locus (PMEL)</b>  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 <b>M*m</b> result are likely to be phenotypically merle or could be "phantom" merle, that is, they have a merle allele that does not affect coat color. Dogs with an <b>M*M*</b> result are likely to be phenotypically merle or double merle. Dogs with an <b>mm</b> result have no merle alleles and are unlikely to have a merle coat pattern.  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.	<b>No merle alleles (mm)</b>
<b>H Locus (Harlequin)</b>  This pattern is recognized in Great Danes and causes dogs to have a white coat with patches of darker pigment. A dog with an <b>Hh</b> result will be harlequin if they are also <b>M*m</b> or <b>M*M*</b> at the M Locus and are not <b>ee</b> at the E locus. Dogs with a result of <b>hh</b> will not be harlequin. This trait is thought to be homozygous lethal; a living dog with an <b>HH</b> genotype has never been found.	<b>No harlequin alleles (hh)</b>

## TRAITS: OTHER COAT TRAITS

TRAIT	RESULT
<b>Furnishings (RSPO2) LINKAGE</b>	
Dogs with one or two copies of the <b>F</b> allele have "furnishings": the mustache, beard, and eyebrows characteristic of breeds like the Schnauzer, Scottish Terrier, and Wire Haired Dachshund. A dog with two <b>I</b> alleles will not have furnishings, which is sometimes called an "improper coat" in breeds where furnishings are part of the breed standard. The mutation is a genetic insertion which we measure indirectly using a linkage test highly correlated with the insertion.	<b>Likely unfurnished (no mustache, beard, and/or eyebrows) (II)</b>
<b>Coat Length (FGF5)</b>	
The FGF5 gene is known to affect hair length in many different species, including cats, dogs, mice, and humans. In dogs, the <b>T</b> allele confers a long, silky haircoat as observed in the Yorkshire Terrier and the Long Haired Whippet. The ancestral <b>G</b> allele causes a shorter coat as seen in the Boxer or the American Staffordshire Terrier. In certain breeds (such as Corgi), the long haircoat is described as "fluff."	<b>Likely short or mid-length coat (GG)</b>
<b>Shedding (MC5R)</b>	
Dogs with at least one copy of the ancestral <b>C</b> allele, like many Labradors and German Shepherd Dogs, are heavy or seasonal shedders, while those with two copies of the <b>T</b> allele, including many Boxers, Shih Tzus and Chihuahuas, tend to be lighter shedders. Dogs with furnished/wire-haired coats caused by RSPO2 (the furnishings gene) tend to be low shedders regardless of their genotype at this gene.	<b>Likely heavy/seasonal shedding (CC)</b>
<b>Coat Texture (KRT71)</b>	
Dogs with a long coat and at least one copy of the <b>T</b> allele have a wavy or curly coat characteristic of Poodles and Bichon Frises. Dogs with two copies of the ancestral <b>C</b> allele are likely to have a straight coat, but there are other factors that can cause a curly coat, for example if they at least one <b>F</b> allele for the Furnishings (RSPO2) gene then they are likely to have a curly coat. Dogs with short coats may carry one or two copies of the <b>T</b> allele but still have straight coats.	<b>Likely straight coat (CC)</b>



## TRAITS: OTHER COAT TRAITS (CONTINUED)

TRAIT	RESULT
<b>Hairlessness (FOXI3) LINKAGE</b>	
<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>	<b>Very unlikely to be hairless (NN)</b>
<b>Hairlessness (SGK3)</b>	
<p>Hairlessness in the American Hairless Terrier arises from a mutation in the SGK3 gene. Dogs with the <b>ND</b> genotype are likely to be hairless while dogs with the <b>NN</b> genotype are likely to have a normal coat.</p>	<b>Very unlikely to be hairless (NN)</b>
<b>Oculocutaneous Albinism Type 2 (SLC45A2) LINKAGE</b>	
<p>Dogs with two copies <b>DD</b> of this deletion in the SLC45A2 gene have oculocutaneous albinism type 2 (OCA2), 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>

## TRAITS: OTHER BODY FEATURES

TRAIT	RESULT
<b>Muzzle Length (BMP3)</b> <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>	<b>Likely medium or long muzzle (CC)</b>
<b>Tail Length (T)</b> <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>	<b>Likely normal-length tail (CC)</b>
<b>Hind Dewclaws (LMBR1)</b> <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>TT</b> or <b>TC</b> dogs will have hind dewclaws.</p>	<b>Unlikely to have hind dew claws (CC)</b>

## TRAITS: OTHER BODY FEATURES (CONTINUED)

TRAIT	RESULT
<p><b>Blue Eye Color (ALX4) LINKAGE</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>Larger (NN)</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>Larger (TT)</b>
<b>Body Size (GHR - E191K)</b> The A allele is associated with smaller body size.	<b>Intermediate (GA)</b>
<b>Body Size (GHR - P177L)</b> The T allele is associated with smaller body size.	<b>Larger (CC)</b>

## TRAITS: PERFORMANCE

TRAIT	RESULT
<b>Altitude Adaptation (EPAS1)</b>  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 <b>A</b> allele are less susceptible to "altitude sickness." This mutation was originally identified in breeds from high altitude areas such as the Tibetan Mastiff.	<b>Normal altitude tolerance (GG)</b>
<b>Appetite (POMC) LINKAGE</b>  This mutation in the POMC gene is found primarily in Labrador and Flat Coated Retrievers. Compared to dogs with no copies of the mutation ( <b>NN</b> ), dogs with one ( <b>ND</b> ) or two ( <b>DD</b> ) 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 ( <a href="https://embarkvet.com/resources/blog/pomc-dogs/">https://embarkvet.com/resources/blog/pomc-dogs/</a> ). We measure this result using a linkage test.	<b>Normal food motivation (NN)</b>

## CLINICAL TOOLS

These clinical genetic tools can inform clinical decisions and diagnoses. These tools do not predict increased risk for disease.

### Alanine Aminotransferase Activity (GPT)

 Axle's baseline ALT level is Normal

#### 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.

## HEALTH REPORT

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

If Axle 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 Axle 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.



### Good news!

Axle is not at increased risk for the genetic health conditions that Embark tests.

**Breed-Relevant Genetic Conditions**

**16 variants not detected**



**Additional Genetic Conditions**

**176 variants not detected**



## BREED-RELEVANT CONDITIONS TESTED



**Axle did not have the variants that we tested for, that are relevant to his breed:**

- ✓ Canine Elliptocytosis (SPTB Exon 30)
- ✓ Pyruvate Kinase Deficiency (PKLR Exon 7 Labrador Variant)
- ✓ Progressive Retinal Atrophy, prcd (PRCD Exon 1)
- ✓ Golden Retriever Progressive Retinal Atrophy 2, GR-PRA2 (TTC8)
- ✓ Progressive Retinal Atrophy - crd4/cord1 (RPGRIP1)
- ✓ Achromatopsia (CNGA3 Exon 7 Labrador Retriever Variant)
- ✓ Macular Corneal Dystrophy, MCD (CHST6)
- ✓ Hyperuricosuria and Hyperuricemia or Urolithiasis, HUU (SLC2A9)
- ✓ Alexander Disease (GFAP)
- ✓ Narcolepsy (HCRTR2 Intron 6)
- ✓ Centronuclear Myopathy (PTPLA)
- ✓ Exercise-Induced Collapse (DNM1)
- ✓ Myotubular Myopathy 1, X-linked Myotubular Myopathy, XL-MTM (MTM1, Labrador Variant)
- ✓ Congenital Myasthenic Syndrome (COLQ)
- ✓ Hereditary Nasal Parakeratosis (SUV39H2)
- ✓ Skeletal Dysplasia 2, SD2 (COL11A2)



## ADDITIONAL CONDITIONS TESTED



**Axle did not have the variants that we tested for, in the following conditions that the potential effect on dogs with Axle's breed may not yet be known.**

- ✓ MDR1 Drug Sensitivity (MDR1)
- ✓ P2Y12 Receptor Platelet Disorder (P2Y12)
- ✓ Factor IX Deficiency, Hemophilia B (F9 Exon 7, Terrier Variant)
- ✓ Factor IX Deficiency, Hemophilia B (F9 Exon 7, Rhodesian Ridgeback Variant)
- ✓ Factor VII Deficiency (F7 Exon 5)
- ✓ Factor VIII Deficiency, Hemophilia A (F8 Exon 10, Boxer Variant)
- ✓ Factor VIII Deficiency, Hemophilia A (F8 Exon 11, Shepherd Variant 1)
- ✓ Factor VIII Deficiency, Hemophilia A (F8 Exon 1, Shepherd Variant 2)
- ✓ Thrombopathia (RASGRP1 Exon 5, Basset Hound Variant)
- ✓ Thrombopathia (RASGRP1 Exon 8)
- ✓ Thrombopathia (RASGRP1 Exon 5, American Eskimo Dog Variant)
- ✓ Von Willebrand Disease Type III, Type III vWD (VWF Exon 4)
- ✓ Von Willebrand Disease Type III, Type III vWD (VWF Exon 7)
- ✓ Von Willebrand Disease Type I (VWF)
- ✓ Von Willebrand Disease Type II, Type II vWD (VWF)
- ✓ Canine Leukocyte Adhesion Deficiency Type I, CLADI (ITGB2)
- ✓ Canine Leukocyte Adhesion Deficiency Type III, CLADIII (FERMT3)
- ✓ Congenital Macrothrombocytopenia (TUBB1 Exon 1, Cairn and Norfolk Terrier Variant)
- ✓ Glanzmann's Thrombasthenia Type I (ITGA2B Exon 12)
- ✓ May-Hegglin Anomaly (MYH9)
- ✓ Prekallikrein Deficiency (KLKB1 Exon 8)
- ✓ Pyruvate Kinase Deficiency (PKLR Exon 5)
- ✓ Pyruvate Kinase Deficiency (PKLR Exon 7 Pug Variant)

## ADDITIONAL CONDITIONS TESTED

- ✓ Trapped Neutrophil Syndrome (VPS13B)
- ✓ Ligneous Membranitis, LM (PLG)
- ✓ Platelet factor X receptor deficiency, Scott Syndrome (TMEM16F)
- ✓ Methemoglobinemia CYB5R3
- ✓ Congenital Hypothyroidism (TPO, Tenterfield Terrier Variant)
- ✓ Congenital Hypothyroidism (TPO, Rat, Toy, Hairless Terrier Variant)
- ✓ Complement 3 Deficiency, C3 Deficiency (C3)
- ✓ Severe Combined Immunodeficiency (PRKDC)
- ✓ Severe Combined Immunodeficiency (RAG1)
- ✓ X-linked Severe Combined Immunodeficiency (IL2RG Variant 1)
- ✓ X-linked Severe Combined Immunodeficiency (IL2RG Variant 2)
- ✓ Progressive Retinal Atrophy, rcd1 (PDE6B Exon 21 Irish Setter Variant)
- ✓ Progressive Retinal Atrophy, rcd3 (PDE6A)
- ✓ Progressive Retinal Atrophy, CNGA (CNGA1 Exon 9)
- ✓ Progressive Retinal Atrophy (CNGB1)
- ✓ Progressive Retinal Atrophy (SAG)
- ✓ Golden Retriever Progressive Retinal Atrophy 1, GR-PRA1 (SLC4A3)
- ✓ Progressive Retinal Atrophy, crd1 (PDE6B)
- ✓ X-Linked Progressive Retinal Atrophy 1, XL-PRA1 (RPGR)
- ✓ Progressive Retinal Atrophy, PRA3 (FAM161A)
- ✓ Collie Eye Anomaly, Choroidal Hypoplasia, GEA (NHEJ1)
- ✓ Day blindness, Cone Degeneration, Achromatopsia (CNGB3 Exon 6)
- ✓ Achromatopsia (CNGA3 Exon 7 German Shepherd Variant)
- ✓ Autosomal Dominant Progressive Retinal Atrophy (RHO)
- ✓ Canine Multifocal Retinopathy (BEST1 Exon 2)

## ADDITIONAL CONDITIONS TESTED

- ✓ Canine Multifocal Retinopathy (BEST1 Exon 5)
- ✓ Canine Multifocal Retinopathy (BEST1 Exon 10 Deletion)
- ✓ Canine Multifocal Retinopathy (BEST1 Exon 10 SNP)
- ✓ Glaucoma (ADAMTS10 Exon 9)
- ✓ Glaucoma (ADAMTS10 Exon 17)
- ✓ Glaucoma (ADAMTS17 Exon 11)
- ✓ Glaucoma (ADAMTS17 Exon 2)
- ✓ Goniodysgenesis and Glaucoma (OLFM3)
- ✓ Hereditary Cataracts, Early-Onset Cataracts, Juvenile Cataracts (HSF4 Exon 9 Shepherd Variant)
- ✓ Primary Lens Luxation (ADAMTS17)
- ✓ Congenital Stationary Night Blindness (RPE65)
- ✓ 2,8-Dihydroxyadenine Urolithiasis, 2,8-DHA Urolithiasis (APRT)
- ✓ Cystinuria Type I-A (SLC3A1)
- ✓ Cystinuria Type II-A (SLC3A1)
- ✓ Cystinuria Type II-B (SLC7A9)
- ✓ Polycystic Kidney Disease, PKD (PKD1)
- ✓ Primary Hyperoxaluria (AGXT)
- ✓ Protein Losing Nephropathy, PLN (NPHS1)
- ✓ X-Linked Hereditary Nephropathy, XLHN (COL4A5 Exon 35, Samoyed Variant 2)
- ✓ Autosomal Recessive Hereditary Nephropathy, Familial Nephropathy, ARHN (COL4A4 Exon 3)
- ✓ Primary Ciliary Dyskinesia, PCD (CCDC39 Exon 3)
- ✓ Congenital Keratoconjunctivitis Sicca and Ichthyosiform Dermatitis, Dry Eye Curly Coat Syndrome, CKCSID (FAM83H Exon 5)
- ✓ X-linked Ectodermal Dysplasia, Anhidrotic Ectodermal Dysplasia (EDA Intron 8)
- ✓ Renal Cystadenocarcinoma and Nodular Dermatofibrosis, RCND (FLCN Exon 7)
- ✓ Canine Fucosidosis (FUCA1)

## ADDITIONAL CONDITIONS TESTED

- ✔ Glycogen Storage Disease Type II, Pompe's Disease, GSD II (GAA)
- ✔ Glycogen Storage Disease Type IA, Von Gierke Disease, GSD IA (G6PC)
- ✔ Glycogen Storage Disease Type IIIA, GSD IIIA (AGL)
- ✔ Mucopolysaccharidosis Type I, MPS I (IDUA)
- ✔ Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6 Variant 1)
- ✔ Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6 Variant 2)
- ✔ Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 5)
- ✔ Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 3)
- ✔ Glycogen storage disease Type VII, Phosphofructokinase Deficiency, PFK Deficiency (PFKM Whippet and English Springer Spaniel Variant)
- ✔ Glycogen storage disease Type VII, Phosphofructokinase Deficiency, PFK Deficiency (PFKM Wachtelhund Variant)
- ✔ Lagotto Storage Disease (ATG4D)
- ✔ Neuronal Ceroid Lipofuscinosis 1, NCL 1 (PPT1 Exon 8)
- ✔ Neuronal Ceroid Lipofuscinosis 2, NCL 2 (TPP1 Exon 4)
- ✔ Neuronal Ceroid Lipofuscinosis 1, Cerebellar Ataxia, NCL4A (ARSG Exon 2)
- ✔ Neuronal Ceroid Lipofuscinosis 1, NCL 5 (CLN5 Border Collie Variant)
- ✔ Neuronal Ceroid Lipofuscinosis 6, NCL 6 (CLN6 Exon 7)
- ✔ Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8 English Setter Variant)
- ✔ Neuronal Ceroid Lipofuscinosis (MFSD8)
- ✔ Neuronal Ceroid Lipofuscinosis (CLN8 Australian Shepherd Variant)
- ✔ Neuronal Ceroid Lipofuscinosis 10, NCL 10 (CTSD Exon 5)
- ✔ Neuronal Ceroid Lipofuscinosis (CLN5 Golden Retriever Variant)
- ✔ Adult-Onset Neuronal Ceroid Lipofuscinosis (ATP13A2, Tibetan Terrier Variant)
- ✔ Late-Onset Neuronal Ceroid Lipofuscinosis (ATP13A2, Australian Cattle Dog Variant)
- ✔ GM1 Gangliosidosis (GLB1 Exon 15 Shiba Inu Variant)
- ✔ GM1 Gangliosidosis (GLB1 Exon 15 Alaskan Husky Variant)

## ADDITIONAL CONDITIONS TESTED

- ✓ GM1 Gangliosidosis (GLB1 Exon 2)
- ✓ GM2 Gangliosidosis (HEXB, Poodle Variant)
- ✓ GM2 Gangliosidosis (HEXA)
- ✓ Globoid Cell Leukodystrophy, Krabbe disease (GALC Exon 5)
- ✓ Autosomal Recessive Amelogenesis Imperfecta, Familial Enamel Hypoplasia (Italian Greyhound Variant)
- ✓ Autosomal Recessive Amelogenesis Imperfecta, Familial Enamel Hypoplasia (Parson Russell Terrier Variant)
- ✓ Persistent Mullerian Duct Syndrome, PMDS (AMHR2)
- ✓ Deafness and Vestibular Syndrome of Dobermans, DVDob, DINGS (MYO7A)
- ✓ Shar-Pei Autoinflammatory Disease, SPAID, Shar-Pei Fever (MTBP)
- ✓ Alaskan Husky Encephalopathy, Subacute Necrotizing Encephalomyelopathy (SLC19A3)
- ✓ Cerebellar Abiotrophy, Neonatal Cerebellar Cortical Degeneration, NCCD (SPTBN2)
- ✓ Cerebellar Ataxia, Progressive Early-Onset Cerebellar Ataxia (SEL1L)
- ✓ Cerebellar Hypoplasia (VLDLR)
- ✓ Spinocerebellar Ataxia, Late-Onset Ataxia, LoSCA (CAPN1)
- ✓ Spinocerebellar Ataxia with Myokymia and/or Seizures (KCNJ10)
- ✓ Hereditary Ataxia (RAB24)
- ✓ Benign Familial Juvenile Epilepsy, Remitting Focal Epilepsy (LG12)
- ✓ Degenerative Myelopathy, DM (SOD1A)
- ✓ Fetal-Onset Neonatal Neuroaxonal Dystrophy (MFN2)
- ✓ Hypomyelination and Tremors (FNIP2)
- ✓ Shaking Puppy Syndrome, X-linked Generalized Tremor Syndrome (PLP)
- ✓ Neuroaxonal Dystrophy, NAD (Spanish Water Dog Variant)
- ✓ Neuroaxonal Dystrophy, NAD (Rottweiler Variant)
- ✓ L-2-Hydroxyglutaricaciduria, L2HGA (L2HGDH)
- ✓ Neonatal Encephalopathy with Seizures, NEWS (ATF2)

## ADDITIONAL CONDITIONS TESTED

- ✔ Polyneuropathy, NDRG1 Greyhound Variant (NDRG1 Exon 15)
- ✔ Polyneuropathy, NDRG1 Malamute Variant (NDRG1 Exon 4)
- ✔ Progressive Neuronal Abiotrophy, Canine Multiple System Degeneration, CMSD (SERAC1 Exon 15)
- ✔ Progressive Neuronal Abiotrophy, Canine Multiple System Degeneration, CMSD (SERAC1 Exon 4)
- ✔ Juvenile Laryngeal Paralysis and Polyneuropathy, Polyneuropathy with Ocular Abnormalities and Neuronal Vacuolation, POANV (RAB3GAP1, Rottweiler Variant)
- ✔ Hereditary Sensory Autonomic Neuropathy, Acral Mutilation Syndrome, AMS (GDNF-AS)
- ✔ Juvenile-Onset Polyneuropathy, Leonberger Polyneuropathy 1, LPN1 (LPN1, ARHGEF10)
- ✔ Juvenile Myoclonic Epilepsy (DIRAS1)
- ✔ Juvenile-Onset Polyneuropathy, Leonberger Polyneuropathy 2, LPN2 (GJA9)
- ✔ Spongy Degeneration with Cerebellar Ataxia 1, SDCA1, SeSAME/EAST Syndrome (KCNJ10)
- ✔ Spongy Degeneration with Cerebellar Ataxia 2, SDCA2 (ATP1B2)
- ✔ Dilated Cardiomyopathy, DCM1 (PDK4)
- ✔ Dilated Cardiomyopathy, DCM2 (TTN)
- ✔ Long QT Syndrome (KCNQ1)
- ✔ Muscular Dystrophy (DMD, Cavalier King Charles Spaniel Variant 1)
- ✔ Muscular Dystrophy (DMD Pembroke Welsh Corgi Variant )
- ✔ Muscular Dystrophy (DMD Golden Retriever Variant)
- ✔ Limb Girdle Muscular Dystrophy (SGCD, Boston Terrier Variant)
- ✔ Inherited Myopathy of Great Danes (BIN1)
- ✔ Myostatin Deficiency, Bully Whippet Syndrome (MSTN)
- ✔ Myotonia Congenita (CLCN1 Exon 7)
- ✔ Myotonia Congenita (CLCN1 Exon 23)
- ✔ Hypocatalasia, Acatlasemia (CAT)
- ✔ Pyruvate Dehydrogenase Deficiency (PDP1)
- ✔ Malignant Hyperthermia (RYR1)

## ADDITIONAL CONDITIONS TESTED

- ✔ Imerslund-Grasbeck Syndrome, Selective Cobalamin Malabsorption (CUBN Exon 53)
- ✔ Imerslund-Grasbeck Syndrome, Selective Cobalamin Malabsorption (CUBN Exon 8)
- ✔ Lundehund Syndrome (LEPREL1)
- ✔ Congenital Myasthenic Syndrome (CHAT)
- ✔ Episodic Falling Syndrome (BCAN)
- ✔ Paroxysmal Dyskinesia, PxD (PGIN)
- ✔ Dystrophic Epidermolysis Bullosa (COL7A1)
- ✔ Ectodermal Dysplasia, Skin Fragility Syndrome (PKP1)
- ✔ Ichthyosis, Epidermolytic Hyperkeratosis (KRT10)
- ✔ Ichthyosis (PNPLA1)
- ✔ Ichthyosis (SLC27A4)
- ✔ Ichthyosis (NIPAL4)
- ✔ Focal Non-Epidermolytic Palmoplantar Keratoderma, Pachyonychia Congenita (KRT16)
- ✔ Hereditary Footpad Hyperkeratosis (FAM83G)
- ✔ Musladin-Lueke Syndrome (ADAMTSL2)
- ✔ Oculocutaneous Albinism, OCA2 (Pekingese Type)
- ✔ Bald Thigh Syndrome (IGFBP5)
- ✔ Cleft Lip and/or Cleft Palate (ADAMTS20)
- ✔ Hereditary Vitamin D-Resistant Rickets (VDR)
- ✔ Osteogenesis Imperfecta, Brittle Bone Disease (COL1A2)
- ✔ Osteogenesis Imperfecta, Brittle Bone Disease (SERPINH1)
- ✔ Osteogenesis Imperfecta, Brittle Bone Disease (COL1A1)
- ✔ Osteochondrodysplasia, Skeletal Dwarfism (SLC13A1)
- ✔ Craniomandibular Osteopathy, CMO (SLC37A2)
- ✔ Chondrodystrophy and Intervertebral Disc Disease, CDDY/IVDD, Type I IVDD (FGF4 retrogene - CFA12)

# "AXLE"

## JRL AXLE



DNA Test Report

Test Date: November 19th, 2020

[embk.me/jrlaxle](https://embk.me/jrlaxle)

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### ADDITIONAL CONDITIONS TESTED

 Chondrodystrophy, Norwegian Elkhound and Karelian Bear Dog Variant (ITGA10)

Registration: AKC SS14772204





## INBREEDING AND DIVERSITY

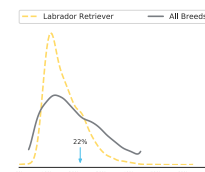
### CATEGORY

### RESULT

#### Coefficient Of Inbreeding

22%

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

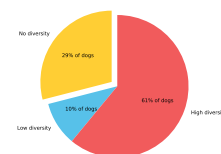


#### MHC Class II - DLA DRB1

### No Diversity

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.

How common is this amount of diversity in purebreds:



#### MHC Class II - DLA DQA1 and DQB1

### No Diversity

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.

How common is this amount of diversity in purebreds:

