



# Certificate of Breed

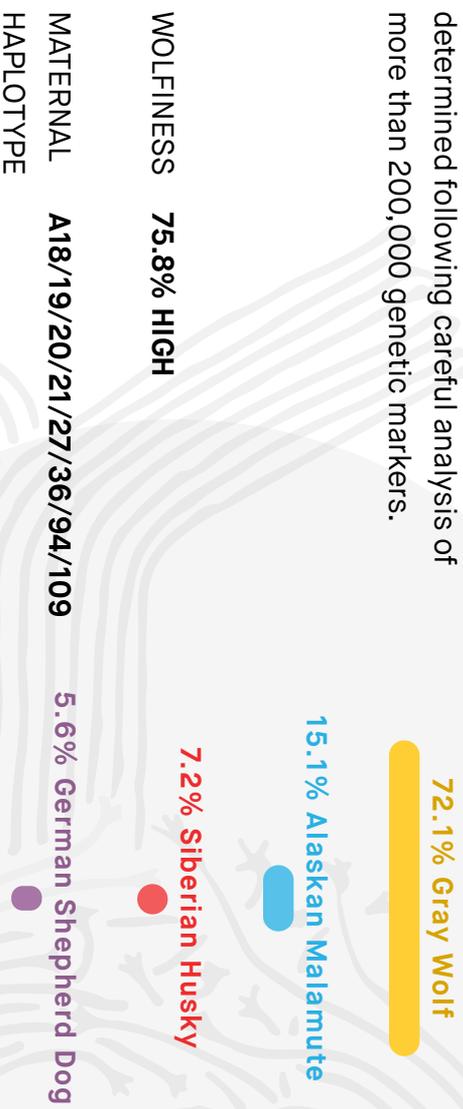
OWNER'S NAME:

DOG'S NAME: Leia

TEST DATE: July 16th, 2017

This certifies the authenticity of **Leia's** canine genetic background as determined following careful analysis of more than 200,000 genetic markers.

Welcome to the  
**Embark** family!



WOLFINESS **75.8% HIGH**

MATERNAL **A18/19/20/21/27/36/94/109**

HAPLOTYPE

  
Adam Boyko, Ph.D.  
CHIEF SCIENCE OFFICER

  
Ryan Boyko  
CHIEF EXECUTIVE OFFICER

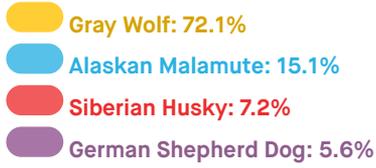


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## BREED MIX



## GENETIC STATS

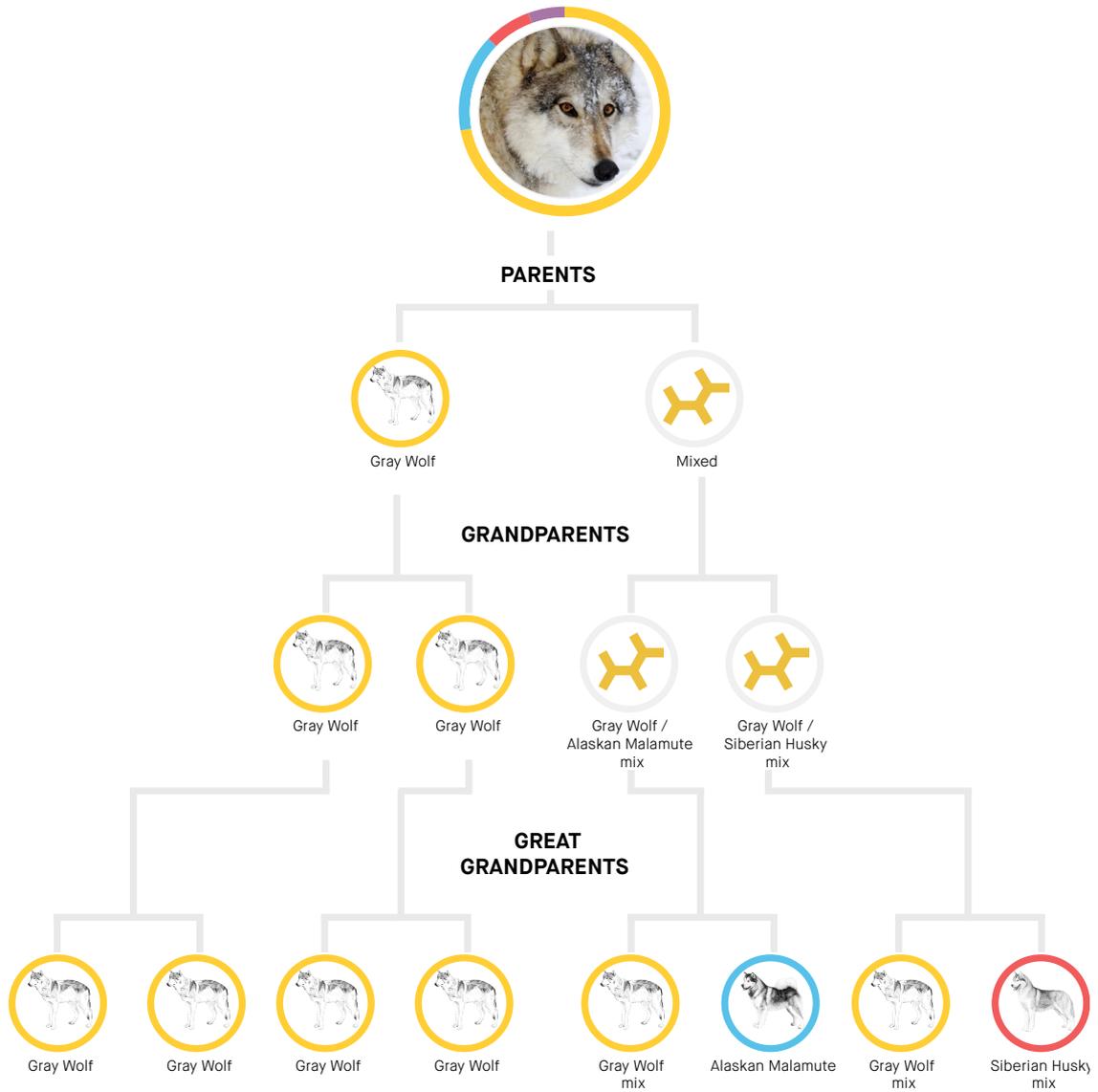
Wolfiness: 75.8 % **HIGH**  
Predicted adult weight: **61 lbs**  
Genetic age: **62 human years**

## BREED MIX BY CHROMOSOME

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



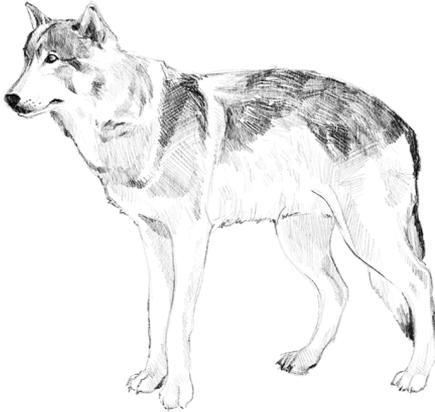
## FAMILY TREE



Our algorithms predict this is the most likely family tree to explain Leia's breed mix, but this family tree may not be the only possible one.



## GRAY WOLF



The Gray Wolf is clearly not a dog breed, though these wild animals are the ancestors of the domesticated dog. The Gray Wolf, or Timber Wolf, is the largest wolf species. It is understood that these wolves play an essential part in maintaining balance in their ecosystems, keeping deer and elk populations in check. These are social animals with a complex pack hierarchy. The Gray Wolf is found widespread throughout the Northern Hemisphere. Wolves are typically shy and reserved around people, but can obviously be extremely dangerous. While the Gray Wolf has recently entered the domestic dog gene-pool again through the rising popularity of wolf hybrids, it is important to remember that a wolf is not a pet.

### Alternative Names

### Fun Fact

On average, these wolves will eat 20 to 30 pounds in a sitting, but they can also go up to 14 days between meals with ease.

### RELATED BREEDS



**Central Asian Village Dog**  
Sibling breed



**Red Wolf**  
Cousin breed



**Dire Wolf**  
Cousin breed



**Coyote**  
Cousin breed



**LEIA**

## ALASKAN MALAMUTE



The largest and oldest of the Arctic sled dogs, the Alaskan Malamute possesses great strength and endurance. He is not designed to race, but rather to carry large loads over long distances. Today, many Malamutes are family pets, but are highly athletic and still capable of enjoying sledding, weight-pulling, back-packing, jogging and swimming with their owners. The Malamute coat is thick and coarse, with a plumed tail carried over the back. The coat usually ranges in color from light gray to black or from sable to red. Face markings, including a cap on the head and a bar/mask on the face are often distinguishing features.

The Alaskan Malamute is believed to be a descendant of the domesticated wolf-dogs who accompanied the Paleolithic hunters who crossed the land bridges of the Bering Strait and migrated into the North American continent roughly 4,000 years ago.

### Alternative Names

### Fun Fact

The Alaskna Malamute is one of the oldest artic sled dogs.

### RELATED BREEDS



**Siberian Husky**  
Sibling breed



**Greenland Sledge Dog**  
Sibling breed



**Chinook**  
Cousin breed

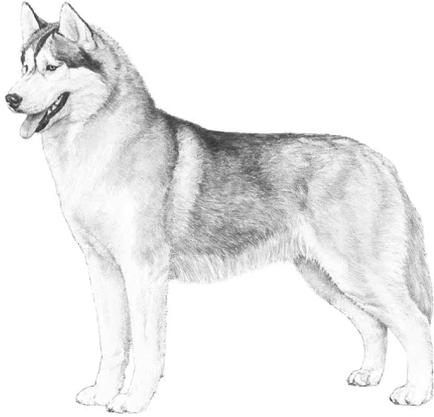


**Carolina Dog**  
Cousin breed



**LEIA**

## SIBERIAN HUSKY



The Siberian Husky originated from the extreme north east of Siberia. They were initially domesticated by the Chukchi -an ancient population that thrived by herding reindeer and moving with each season to new grazing regions. They came to America in 1909 and found their place in the Alaskan wilderness. They love to be out in cold weather and are known to be the ideal sled dog. They have strong insulated paws that are perfect for traction in the snow. The Siberian Husky also has two layers in their coat that protects them from Arctic winters.

### Alternative Names

### Fun Fact

In 1925 a team of Siberian Huskies saved Nome, Alaska by carrying the serum to cure diphtheria a considerable distance by sled. The run was done in the middle of a blizzard and in conditions below -23 degrees Fahrenheit. The run is remembered by the annual Iditarod Trail Sled Race, and Balto, the famous sled dog who led his team through the final leg.

### RELATED BREEDS



**Alaskan Malamute**  
Sibling breed



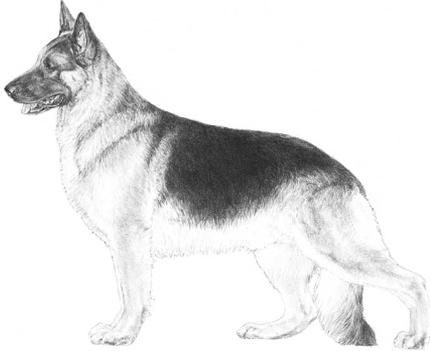
**Greenland Sledge Dog**  
Sibling breed



**Samoyed**  
Cousin breed



## 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. 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 Stronghold and Rin Tin Tin.

### Alternative Names

### 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.

### RELATED BREEDS



**White Shepherd**  
Sibling breed



**Belgian Sheepdog**  
Cousin breed



**Belgian Tervuren**  
Cousin breed



**Belgian Malinois**  
Cousin breed



**Transmontano Mastiff**  
Cousin breed



## MATERNAL LINE



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

### HAPLOGROUP: A1b

This female lineage was very likely one of the original lineages in the wolves that were first domesticated into dogs in Central Asia about 15,000 years ago. Since then, the lineage has been very successful and travelled the globe! Dogs from this group are found in ancient Bronze Age fossils in the Middle East and southern Europe. By the end of the Bronze Age, it became exceedingly common in Europe. These dogs later became many of the dogs that started some of today's most popular breeds, like German Shepherds, Pugs, Whippets, English Sheepdogs and Miniature Schnauzers. During the period of European colonization, the lineage became even more widespread as European dogs followed their owners to far-flung places like South America and Oceania. It's now found in many popular breeds as well as village dogs across the world!

### HAPLOTYPE: A18/19/20/21/27/36/94/109

Part of the large A1b haplogroup, we see this haplotype in village dogs in over 25 countries across the world. We have detected this haplotype in lots of breeds, and it occurs most commonly in German Shepherd Dogs, Maltese, English Springer Spaniels, and English Setters.



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## TRAITS

### Coat Color

E Locus (Mask/Grizzle/Red)	EE
K Locus (Dominant Black)	k <sup>y</sup> k <sup>y</sup>
A Locus (Agouti)	a <sup>wa</sup> a <sup>t</sup>
D Locus (Dilute)	DD
B Locus (Brown/Chocolate/Liver)	BB

### Other Coat Traits

Furnishings / Improper Coat (RSPO2)	II
Long Haircoat (FGF5)	GG
Shedding (MC5R)	CC
Curly Coat (KRT71)	CC

### Body Size

IGF1	NN
IGF1R	GG
STC2	TT
GHR (E195K)	GA
GHR (P177L)	CC

### Genetic Diversity

Inbreeding Coefficient	0%
MHC Class II - DLA DRB1	High Diversity
MHC Class II - DLA DQA1 and DQB1	High Diversity

### Other Body Features

Brachycephaly (BMP3)	CC
Natural Bobtail (T)	CC
Hind Dewclaws (LMBR1)	CC

### Performance

Altitude Adaptation (EPAS1)	GG
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## CLINICAL TRAITS

These clinical genetic traits can inform clinical decisions and diagnoses. These traits do not predict a disease state or increased risk for disease. We currently assess one clinical trait: Alanine Aminotransferase Activity.

### **Alanine Aminotransferase Activity result: Normal**

Leia has two normal alleles at ALT.

More information on Alanine Aminotransferase Activity:

Known to be highly expressed in liver cells, activity levels of alanine aminotransferase, or ALT, is a common value on most blood chemistry panels and is known to be a sensitive measure of liver health. Dogs with two ancestral G alleles show "normal" activity. Dogs that have one or two copies of the derived A allele may have lower resting levels of ALT activity, known as "low normal". If your dog's result is "low normal" then when a blood chemistry panel is being interpreted the values that you and your veterinarian consider "normal" may need to be adjusted. Please note that neither a "normal" nor a "low normal" result for this predicts a disease state or increased risk for liver disease. Moreover, this mutation does not associate with increased levels of ALT: If your dog has high ALT levels, please consult your veterinarian.



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## HEALTH

Good news! Leia did not test positive for any of the genetic diseases that Embark screens for. Read on to learn more about the conditions we test for, but rest assured that Leia does not have the mutations known to cause them.

It is still important to let your veterinarian know these results because they could help guide Leia's diagnosis and treatment if she gets sick in the future. Many other diseases caused by environmental factors or undiscovered genetic variants can cause symptoms similar to diseases we test for. By ruling out these mutations, your veterinarian will be able to find the true cause more quickly. Your veterinarian will also know they can safely prescribe medications some dogs are sensitive to.

**0**  
AT RISK

**0**  
CARRIER

**160**  
CLEAR



**LEIA**



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## OTHER CONDITIONS

Good news! Leia tested clear for 9 genetic conditions that are common in her breed mix.

- Multidrug Sensitivity (MDR1)
- Canine Leukocyte Adhesion Deficiency Type III (FERMT3)
- X-linked Ectodermal Dysplasia, Anhidrotic Ectodermal Dysplasia (EDA Intron 8)
- Mucopolysaccharidosis Type VII, Sly Syndrome (GUSB Exon 3)
- Polyneuropathy (NDRG1 Exon 4)
- Factor VIII Deficiency, Hemophilia A (F8 Exon 11, Shepherd Variant 1)
- Hyperuricosuria and Hyperuricemia or Urolithiasis (SLC2A9)
- Renal Cystadenocarcinoma and Nodular Dermatofibrosis (RCND) (FLCN Exon 7)
- Degenerative Myelopathy (SOD1A)

## FULL TEST PANEL

To help ensure healthy breeds, every test includes analysis of our full panel of over 160 genetic diseases.

Leia is also clear of 151 other genetic diseases that Embark tests for.