embark™

Certificate of Breed

OWNER'S NAME: Liesbeth Roelants | DOG'S NAME: Moo | TEST DATE: September 14th, 2018

MIXED BREED

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

Welcome to the **Embark** family!

WOLFINESS **0.9% MEDIUM**

MATERNAL HAPLOTYPE **B1b**

PATERNAL HAPLOTYPE **H1a.7/H1a.8**

Adam Boyko, Ph.D.
CHIEF SCIENCE OFFICER

Ryan Boyko
CHIEF EXECUTIVE OFFICER

MOO

GENETIC STATS

Wolfiness: 0.9 % **MEDIUM**
Predicted adult weight: **51 lbs**
Genetic age: **20 human years**

TEST DETAILS

Kit number: EM-4173704
Swab number: 31001805241982

MOO

DNA Test Report | Test Date: September 14th, 2018 | embk.me/moo5

MATERNAL LINE

Through Moo'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: B1

B1 is the second most common maternal lineage in breeds of European or American origin. It is the female line of the majority of Golden Retrievers, Basset Hounds, and Shih Tzus, and about half of Beagles, Pekingese and Toy Poodles. This lineage is also somewhat common among village dogs that carry distinct ancestry from these breeds. We know this is a result of B1 dogs being common amongst the European dogs that their conquering owners brought around the world, because nowhere on earth is it a very common lineage in village dogs. It even enables us to trace the path of (human) colonization: Because most Bichons are B1 and Bichons are popular in Spanish culture, B1 is now fairly common among village dogs in Latin America.

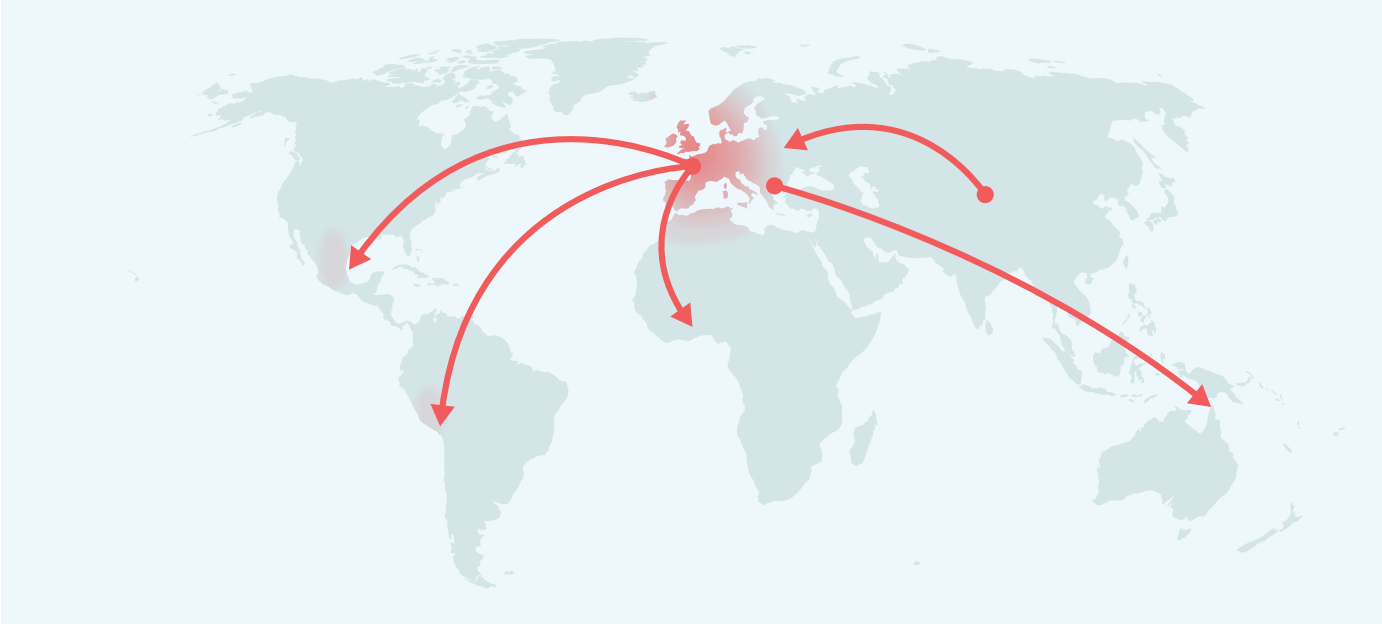
HAPLOTYPE: B1b

Part of the large B1 haplogroup, we see this haplotype in village dogs across the world, including those from Central America, the Middle East, South Asia, and the French Polynesian Islands. Among the 31 breed dogs we see it in, we see it in Poodles, Otterhounds, and Labrador Retrievers. It is also our most commonly-sampled Golden Retriever haplotype!

MOO

DNA Test Report | Test Date: September 14th, 2018 | embk.me/moo5

PATERNAL LINE



Through Moo'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 Americas, and scavenging throughout Old World settlements.

HAPLOTYPE: H1a.7/H1a.8

Part of the large A1a haplogroup, this very common haplotype occurs in village dogs throughout the world (including southeast Asia, which is uncommon for A1a's). Among the 25 breeds we see this haplotype in, it occurs most frequently in Labrador Retriever, Vizsla, and English Springer Spaniel.

MOO

DNA Test Report | Test Date: September 14th, 2018 | embk.me/moo5

TRAITS

Coat Color

E Locus (Mask, Grizzle, Recessive Red)	**$E^{m}e$**
K Locus (Dominant Black)	**$K^{B}k^{y}$**
A Locus (Agouti, Sable)	**$a^{t}a^{t}$**
D Locus (Dilute, Blue, Fawn)	**DD**
B Locus (Brown, Chocolate, Liver, Red)	**Bb**

Other Coat Traits

Furnishings / Improper Coat (RSPO2)	**FI**
Long Haircoat (FGF5)	**TT**
Shedding (MC5R)	**CT**
Curly Coat (KRT71)	**CT**

Body Size

Body Size - IGF1	**NI**
Body Size - IGF1R	**GA**
Body Size - STC2	**TT**
Body Size - GHR (E195K)	**GG**
Body Size - GHR (P177L)	**CC**

Other Body Features

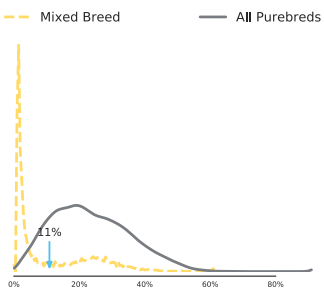
Brachycephaly (BMP3)	**CC**
Natural Bobtail (T)	**CC**
Hind Dewclaws (LMBR1)	**CC**

Performance

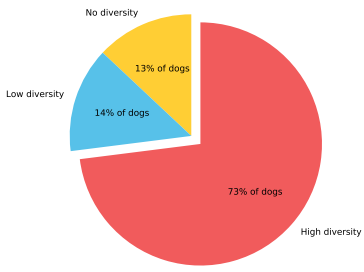
Altitude Adaptation (EPAS1)	**GG**

Genetic Diversity

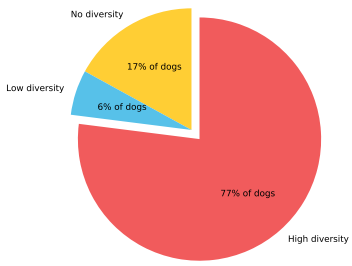
Inbreeding Coefficient **11%**



MHC Class II - DLA DRB1
High Diversity



MHC Class II - DLA DQA1 and DQB1
High Diversity



MOO

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

Moo 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.

MOO

HEALTH

Good news! Moo did not test positive for any of the genetic diseases that Embark screens for.

0	0
AT RISK	CARRIER

MOO

OTHER CONDITIONS

Good news! Moo tested clear for 28 genetic conditions that are common in his breed mix.

- Von Willebrand Disease Type I
  (VWF)
- Canine Elliptocytosis
  (SPTB Exon 30)
- Progressive Retinal Atrophy - prcd
  Progressive rod-cone degeneration (PRCD Exon 1)
- Progressive Retinal Atrophy - crd4/cord1
  (RPGRIP1)
- Macular Corneal Dystrophy (MCD)
  (CHST6)
- Autosomal Recessive Hereditary Nephropathy, Familial Nephropathy
  (COL4A4 Exon 3)
- Glycogen storage disease Type VII, Phosphofructokinase deficiency
  (PFKM Exon 21)
- Neonatal Encephalopathy with Seizures (NEWS)
  (ATF2)
- Muscular Dystrophy
  Cavalier King Charles Spaniel Variant 1
- Exercise-Induced Collapse
  (DNM1)
- Malignant Hyperthermia
  (RYR1)
- Episodic Falling Syndrome
  (BCAN)
- Oculoskeletal Dysplasia 1, Dwarfism-Retinal Dysplasia
  (COL9A3, Labrador Retriever)
- Skeletal Dysplasia 2
  (COL11A2)
- Congenital Macrothrombocytopenia
  (TUBB1 Exon 1, Cavalier King Charles Spaniel Variant)
- Pyruvate Kinase Deficiency
  (PKLR Exon 7 Labrador Variant)
- Golden Retriever Progressive Retinal Atrophy 2
  (TTC8)
- Achromatopsia
  (CNGA3 Exon 7 Labrador Retriever Variant)
- Protein Losing Nephropathy
  (NPHS1)
- Congenital Keratoconjunctivitis Sicca and Ichthyosiform Dermatosis (CKCSID), Dry Eye Curly Coat Syndrome
  (FAM83H Exon 5)
- GM2 Gangliosidosis
  (HEXB, Poodle Variant)
- Degenerative Myelopathy
  (SOD1A)
- Narcolepsy
  (HCRTR2 Intron 6)
- Centronuclear Myopathy
  (PTPLA)
- Myotubular Myopathy 1, X-linked Myotubular Myopathy
  (MTM1)
- Congenital Myasthenic Syndrome
  (COLQ)
- Hereditary Nasal Parakeratosis
  (SUV39H2)
- Osteochondrodysplasia, Skeletal Dwarfism
  (SLC13A1)

MOO

FULL TEST PANEL

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

Moo is also clear of 135 other genetic diseases that Embark tests for.