



# Canine Analysis report

SAMPLE REPORT



Owner Name
Sample report

Test Report Code 8000016



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# 1 Overview

### Overview

Lily was submitted for a full set of genetic testing for dogs, including breed identification, single-gene genetic disease detection, complex disease detection, hair trait and behaviour determination. The data analysis of the experimental results was completed on Jan, 19, 2022 Hong Kong time.

### Sample quality

In the samples received in this batch, DNA extraction was successful. The specific information is as follows:

Sample ID	Total Reads	Reads matched with primer	Effective average depth	Ontarget ratio	Q20
Lily	679423	520266	328.2435	0.7657	0.9623

### **Breed identification**

In this test, the sample is a mixed blood of Staffordshire Bull Terrier, Labrador Retriever and Dachshund.



Staffordshire Bull Terrier



**Labrador Retriever** 



Dachshund

### **Disease detection**

133 canine single-gene genetic diseases was tested. 1 single gene mutation was detected in this sample.

Single-gene genetic diseases	Risk
Factor VII deficiency	Carrier

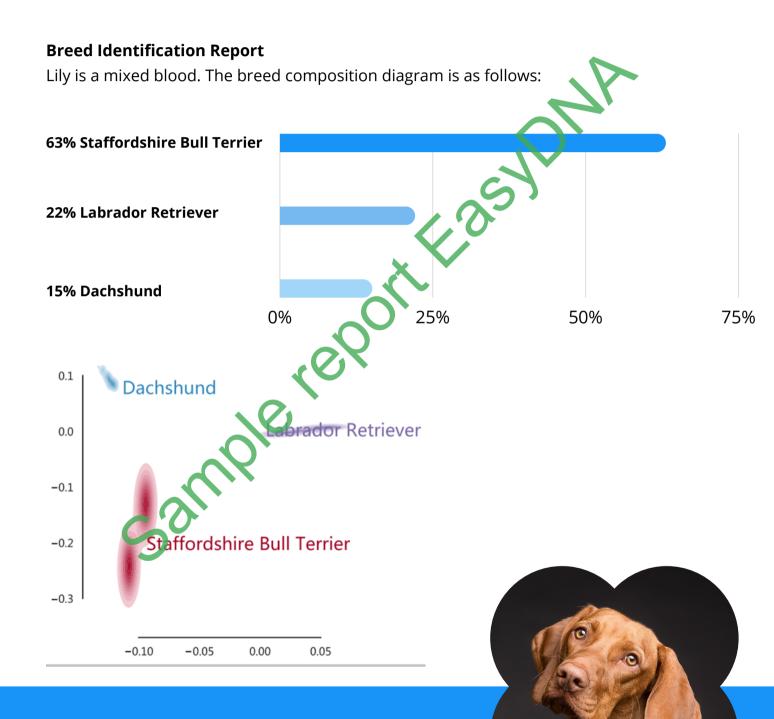
Detected Complex genetic diseases are as follows:

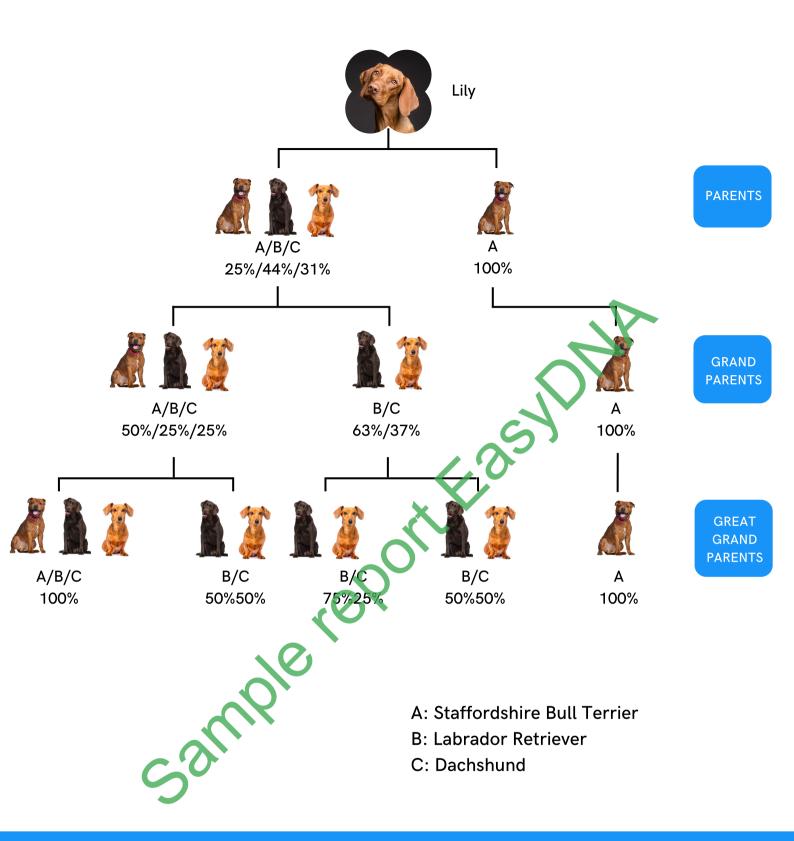
Complex genetic diseases	Relative risk(%)
Osteosarcoma	89.68
Hypothyroidism	69.19
Hip dysplasia	55.38
Lymphoma	31.69
Samole	





# 2.1 Breed







Please note, the family tree above only shows the most likely scenario according to laws of genetics. It's just for reference.

# **Variety Description**

### **Staffordshire Bull Terrier**

Historical Origin

It originated in Britain hundreds of years ago

### Characteristics

Stanfordshire Bulldog is a medium-sized short-haired dog, belonging to the type of bulldog. This modern breed is very suitable as a companion dog. It is known for its fearlessness and toughness, and likes to be big Natural, low-key, quiet, stable and reliable, it is an important multi-purpose dog. Average height: 13-16 inches (33-41cm). Average weight: 24-37 lbs (11-17kg).

### Anecdote

The early bulldogs and terriers were not bred like today's breeds, but were bred to fight against large animals such as bears or bulls. This required testing the strength and skills of dogs. As the UK began With the implementation of the Animal Welfare Law, these bloody sports were officially cancelled in 1835.

### Common Genetic Diseases

L2 hydroxyglutaric aciduria, Hereditary cataract, Encephalopathy, Cerebellar Ataxia. (All of these were tested and showed in this report)





# **Variety Description**

### **Labrador Retriever**

Historical Origin

It originated in Newfoundland before 1800 AD.

Migration and Development

Migration to England in the 19th Century.

### Characteristics

The Labrador Retriever is one of the most popular dog breeds in the United States, Britain and Canada. They are often trained to help the blind and autistic patients as treatment dogs. It also completes screening and testing for law enforcement agencies and other official agencies. In addition, they are also sporting dogs and hunting dogs. Average height: 21.5-22.5 inches (54-57 cm). Average weight: 55-80 lbs (25-36 kg).

### Anecdote

In 1903, the Kennel Club recognized the Labrador Retriever. In 1917, people registered the first Labrador Retriever in the American Kennel Club. It appeared on December 12, 1928. The first dog on the cover of "Life" magazine s the black Labrador retriever named "Blind Arden".

### Common Genetic Diseases

Alexander disease, Centronuclear Myopathy, Congenital Myasthenic Syndrome, Canine elliptocytosis, Hyperuricosuria, Narcolepsy, X-linked Myotubular Myopathy, Progressive Retinal Atrophy, Von Willebrand disease, Pyruvate kinase deficiency, Degenerative myelopathy, Hereditary Nasal Parakeratosis, Exercise Induced Collapse, Developmental dysplasia of the hip (DDH).

(All of these were tested and showed in this report)





# Variety Description

### **Dachshund**

Historical Origin It originated in Germany.

### Characteristics

The dachshund is a short-legged hunting dog. Standard-sized dachshunds can complete the work of olfactory exploration and tracking; mini dachshunds can search for smaller prey. In the United States, they are used for Hunting, for example, tracking injured deer. They also participated in performances organized by the American Kennel Club, field trials and other activities, ranking 13th in the most popular list in the United States.

### Average height:

- Standard 14-19 inches (35-47cm)
- Miniature 12-15 inches (25-37cm)
- Rabbit 9.8-13 inches (25-32cm)

### Anecdote

Some experts infer that the dachshund can be traced back to ancient Egypt, where people found murals engraved with basset hounds. When American scholars found mummy-like dachshunds in ancient Egyptian graves, they were even more convinced of the above Inferred. Out on Victoria was a fan of this breed.

### Common Genetic Diseases

Progressive Retinal Atrophy, Von Willebrand disease, Osteogenesis imperfecta, Neuronal Ceroid Lipofuscinosis 1, Neuronal Ceroid Lipofuscinosis 2, Narcolepsy. (All of these were tested and showed in this report)







# Single-gene disease detection report

pathogenic mutation which is located in the F7 gene of chromosome 22. It's caused by insufficient production of coagulation factor VII or abnormal structure and function (only 1%-2.5% of normal). The body is unable to produce enough coagulation factor VII protein (prothromboplastin, auxiliary thromboplastin) causing coagulopathy bleeding disease. VII coagulation factor is essential for the formation of blood prothrombin activator.

Test results

Genotype

GA

Genetic model

Recessive

50.0% probability of passing at least one mutation to the next generation

Risk interpretation

Risk gene carrier

If the factor is insufficient, it will hinder the formation of prothrombin activator, the formation of thrombin by prothrombin will be delayed, and the activation of fibrinogen will be affected successively, so that the formation of fibrin will be hindered.

The coagulation factor VII protein is vitamin K dependent. Glycoprotein is an important part of the blood coagulation process. It is synthesized in the liver and then participates in the blood circulation. This protein is activated and plays a key role in the initial coagulation process. If the blood vessel is damaged, it will coagulate with the participation of calcium. After factor VII binds to tissue factor (a transmembrane single-chain glycoprotein composed of amino acid residues), it splits factor IX and factor V, thereby activating them, and finally producing thrombin.





# Complex disease detection report

**Osteosarcoma** is a primary bone tumour in dogs, caused by mesenchymal stem cells in the bone, originating deep inside the bone, and as it grows outward the bone is destroyed from the inside, producing intense pain.

The causes of osteosarcoma are mainly due to accumulation or exposure to carcinogens and genetic factors. It accounts for up to 85% of all skeletal malignancies, mainly affects middleaged to older dogs, and especially affects the leg bones of large breeds such as the Great Dane and Irish Wolfhound.

Test results

High risk

Relative risk

89.68%

Gene

FBL

near;KIAA1462;None

Genotype

G,G;C,C;C,A

The relative risk of Osteosarcoma in this sample is higher than 89.68% of dogs.

However, it can also occur in any other skeletal structure, with the extremities accounting for 75% to 85% of all cases. Other bones that can be affected include the maxilla, mandible, spine, skull, ribs, nasal cavity, paranasal sinuses, and pelvis. Osteosarcoma in extraosseous sites is rare, but has been reported in breast tissue, subcutaneous tissue, spleen, gut, liver, kidney, testis, vagina, eye, stomach, ligament, synovium, meninges, and adrenal glands.

Osteosarcoma is one of the serious cancers a dog can have because it spreads quickly and is difficult to remove surgically. Tumours initially appear in a swollen or painful area of a dog's leg and can cause the affected dog to limp, lick, or whimper in pain. This bone is much weaker than healthy bone and can break accidentally.





# Hip dysplasia

Hip dysplasia is an abnormality in the hip socket where, due to inconsistencies in the muscles and overgrown bone, hip instability leads to subluxation of the acetabulum and femoral head, and the hip joint cannot remain stable. Daily body activities such as standing, walking, weight-bearing and other sports will cause wear and tear of the hip joint. As the damage accumulates over time, the hip joint will undergo morphological and structural changes such as thickening of the femoral neck, osteophytes and acetabular sclerosis, osteoarthritis and pain.

Test results

Medium risk

Relative risk

55.38%

CHST3;CCND1
near;SRBD1;RPN1
near;KIF26B

Genotype

C,C;T,T;C,C;C,T;T,C

The relative risk of Hip dysplasia in this sample is higher than 55.38% of dogs.

Severe cases can lead to lameness and painful arthritis. In many dog breeds, especially large breeds, hip dysplasia is the single most common cause of hip arthritis. Hip dysplasia usually begins at 18 months and can range from mild mobility problems to severe paralysis and osteoarthritis. Affected dogs often have reduced hip mobility, leading to "rabbit hopping," where the two hind legs move together, which can also lead to muscle stiffness. Because the hip joint does not move fully, dogs often adjust to changes in the hip joint by adjusting the spine, resulting in problems with the spine, knees, or soft tissue.

The pain usually occurs after activities, and will be significantly relieved or disappear after rest, and manifest at night. Pets may whine, whimper, and frequently lick their fur, especially on the thighs, legs, and abdomen. Weakness, falls, and even refuses to climb stairs when going upstairs. The hind limbs are placed forward, and the load is concentrated on the forelimbs, showing a clear rabbit hopping gait.



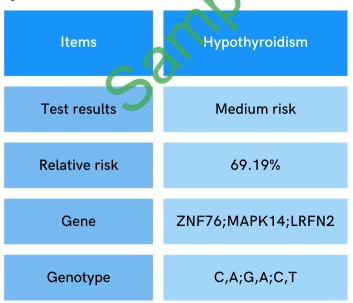


The hip joint is swollen, red, and warm to the touch. Stiffness of the hip joint, especially in the morning with markedly abnormal gait, stiffness and inability to bend. Difficulty lying down and squatting up and taking longer. Bone fricative can be heard during exercise. Joint instability, walking hind limbs showed X-shaped, swaying gait.

Reduced activity, reluctance to exercise, lying on the stomach for a long time, bedsores and calluses develop in heavy load-bearing places, such as forelimb elbows and buttocks. In many cases, the disease is usually bilateral, and only unilateral hip dysplasia occurs in about 7% of cases. The time for obvious symptoms to appear may vary. Some can show obvious discomfort at 5-10 months, but most of them will not show until adulthood, and some symptoms such as walking and limp appearing until 4-5 years old.

# Hypothyroidism

**Hypothyroidism** is caused by a deficiency of thyroxine T4 and triiodothyronine T3, resulting in clinical symptoms involving nearly all organ systems.



The relative risk of Hypothyroidism in this sample is higher than 69.19% of dogs.

Mental disorders and abnormal skeletal development lead to disproportionate dwarfism, and goitre may also be present. Skin pigmentation, keratinization and seborrhoea, dryness, loss of coat or pyoderma due to weakened immunity. Affected dogs have a protruding tongue and eyeball, resulting in an abnormal appearance, listlessness, lethargy, loss of appetite, constipation and cramps, ataxia.





# 2.3 Hair trait

# Hair trait report

The coat colour most likely to be carried by the next generation of this sample are pure black. The hair type most likely to be carried in the next generation of this sample is short straight hair. The coat color of dogs is determined by the interaction of multiple genetic loci, and completely opposite results may be obtained between different loci. Therefore, the test is only for reference, please refer to the actual appearance.

Associated genes	Genotype	Mutation	Result
B (brown) locus	c,c	None	
B (brown) locus	00,	Homozygous	bb
B (brown) locus	ACCAGC,ACCAGC	None	
E (extension) locus	G,G	None	EE
K (dominant black) locus	-,-	Homozygous	K <sup>B</sup> K <sup>B</sup>
A (agouti) locus	т,т	None	
A (agouti) locus	A,A	None	A <sup>y</sup> A <sup>y</sup>
A (agouti) locus	C,C	None	
D (dilute) locus	G,G	None	DD

<sup>\*</sup>bb refers to brown  $\cdot$  chocolate or liver;

<sup>\*</sup>EE refers to normal extension, means pattern expressed as per alleles present at A and K loci;

 $<sup>*</sup>K^BK^B$  refers to dominant black (black);

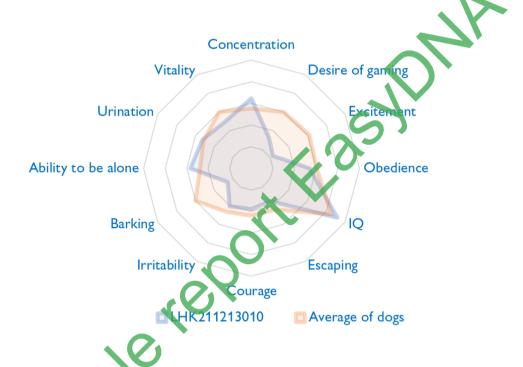
<sup>\*</sup>A<sup>y</sup>A<sup>y</sup> refers to fawn or sable;

<sup>\*</sup>DD refers to not diluted color.



# 2.3 Behaviours

# **Behaviours determination**



**Concentration** refers to the degree to which a dog's concentration is affected by external stimuli, such as being attracted by a leaf on the asphalt road, a long one of many intermittent and short sounds, being attracted by a plastic bag blown by the wind, or chasing a fly. Birds and other small animals that have passed by, the lower the score, the more the surface is affected by external stimuli, and the lower the concentration.

Lily can concentrates, but is sometimes interrupted by other things. If training, it is recommended to start with no distractions.

**Desire** of gaming refers to the activity of the dog, the desire to play games, the higher the score, the more active, the more energetic, and the stronger the desire to play. Lily is a dog who likes to play games. The more time you play with it, the more lively it will be.



**Excitement** refers to the dog's response after being stimulated. The higher the score, the stronger the response to stimulation or excitement, such as walking, driving, doorbell ringing, guests visiting, the owner returning home after a period of time, and the dog's excitement. Lily is a Buddhist, and it seems that few things can interest it.

**Obedience** refers to dog's willingness to obey orders. Dogs with high scores show more concern for their owners, willingness to obey orders, positive reactions, quick learning, and high obedience. Lily holds a teachable type. As long as you do it properly and tell it well, it will still be willing to learn with you.

*IQ* refers to the dog's IQ index, the higher the score, the smarter it is. For a new command, Lily can understand what it means without giving it more than 5 times, and obey the master's first command at more than 95% of the time.

**Escaping** refers to the probability that the dog will run away, or escape home or owner at the first opportunity. The higher the score, the greater the probability. Lily will not run away easily, but will often run away from you because of seeing things that are more interesting. In most cases, it can be recalled. It depends on the relationship between you. Remember to ue the rope when you go out.

**Courage** refers to the dog's fear and anxiety about unfamiliar things. The higher the score, the easier it is to have fear or anxiety. Lily is a brave dog with a peaceful mind and a very stable child.

*Irritability* refers to the dog's aggression. The higher the score, the easier it is to produce aggressive behavior, which has nothing to do with combat effectiveness.

Lily is a typical dog that doesn't conduct active attacks. If you don't provoke it, it won't fry.

**Barking** refers to the degree of continuous barking of the dog. The higher the score, the more severe the continuous barking when the dog is excited or stimulated. Lily is not a talkative dog. This kind of non-noisy dog is the ideal type for many people.

Ability to be alone refers to the dog's perception of loneliness and whether it is prone to separation anxiety. The higher the score, the stronger the perception of loneliness and the lower the ability to be alone. Lily is a sensible dog who can be alone for a while, but it also misses you, don't let it wait too long,

**Urination** refers to the disorder of urination when the dog is at home alone. The higher the score, the greater the possibility of disorderly urination. Lily usually won't pee at will unless it can't help it or it wants to tell you something by peeing.

Vitality refers to the activity of the dog, the higher the score, the more lively, energetic, and the more interesting and noisy personality, the greater the amount of exercise required. Lily is a dog that is suitable for both movement and stillness. It is as quiet as a virgin, and moving as a rabbit.





# 3 References

# Single-gene genetic diseases:

2-8-Dihydroxyadenine

Alport Syndrome

C3 deficiency

Glanzmanns thrombasthenia Type I

Gangliosidosis 1

Gangliosidosis GM2 Gangliosidosis

Canine Multifocal Retinopathy cmr3

Von Willebrand disease

Canine multifocal retinopathy - Type 2

Von Willebrand disease - Type II

Canine multifocal retinopathy - Type 1

Von Willebrand disease

L-2-HGA-L-2-hydroxyglutaric aciduria

May-Hegglin anomaly

Musladin-Lueke Syndrome

Myotubular Myopathy 1

Axonal Disease Shaking Puppy Syndrome

X-linked Severe Combined Immunodeficiency

Canine leukocyte adhesion deficiency

Pyruvate kinase deficiency

Pyruvate Dehydrogenase Phosphatase Deficiency

Intestinal malabsorption of cobalamin

Imerslund-Grasbeck Syndrome

Osteogenesis imperfecta

Persistant Mullerian Duct Syndrom

Cleft lip with or without cleft palate

Gallbladder mucocele formation

Protein Losing Neph opathy

Progressive Retinal Atrophy

Progressive Retinal Atrophy - rcd4

Progressive retinal atrophy - Dominant

Cerebellar disease Cerebellar ataxia

Collie eye anomaly

Dilated Cardiomyopathy

Phosphofructokinase deficiency

Ligneous Membranitis

Multi-Drug Sensitivity

Malignant Hyperthermia

Narcolepsy

Sensory ataxic neuropathy

Dry eye curly coat syndrome

Hyperuricosuria

Cystinuria

Cystinuria1

Cystinuria2

Cystinuria4

Cystinuria Type II

Cystinuria Type II-B

Spongiforn leukoencephalomyelopathy

Myostatin defect

Centronuclear Myopathy

Muscular dystrophy

Spinocerebellar Ataxia

Spondylocostal Dysostosis

Familial Nephropathy

Episodic falling syndrome

Progressive Retinal Atrophy

Progressive Retinal Atrophy - cord1

Progressive Retinal Atrophy - cord2

Progressive Retinal Atrophy - PRA1

Progressive Retinal Atrophy - RCD1

Trogressive Redinary Repriy

Progressive Retinal Atrophy - RCD3

Progressive Retinal Atrophy - Type A

Progressive Retinal Atrophy - PRCD

Catalase Deficiency

Pachyonychia congenita

Cerebellar disease Cerebellar hypoplasia

Cerebellar Ataxia

Neonatal ataxia

Neonatal Encephalopathy with Seizures

Congenital Myotonia

Congenital Myasthenic Syndrome

\*\*X: Carrier



Mucopolysaccharidosis Type IIIA Mucopolysaccharidosis Type VII MPS VI

★ Factor VII deficiency

Ectodermal dysplasia

Prekallikrein Deficiency

Globoid cell leukodystrophy

Progressive neuronal abiotrophy

Polyneuropathy

Canine elliptocytosis

Lysosomal Storage Disease

Chondrodysplasia

**Neuronal Ceroid Lipofuscinosis** 

Neuronal Ceroid Lipofuscinosis 1

Neuronal Ceroid Lipofuscinosis 10

Neuronal ceroid lipofuscinosis 12

Neuronal Ceroid Lipofuscinosis 2

Neuronal ceroid lipofuscinosis 5

Neuronal Ceroid Lipofuscinosis 6

Neuronal Ceroid Lipofuscinosis 8

**Neuroaxonal Dystrophy** 

Renal Cystadenocarcinoma and Nodular

Dermatofibrosis

Axonal Disease Hypomyelination and Tremor

Glycogen Storage Disease Type IIIa

Glycogen Storage Disease Type II

Glycogen Storage Disease Type Ia

Degenerative myelopathy

Late Onset Ataxia

**Exercise Induced Collapse** 

early retinal degeneration

Long QT Syndrome

Congenital hypothyroidism

**Primary Lens Luxation** 

Congenital Stationary Night Blindness

Congenital Macrothrombocytopenia

Axonal Disease Fetal-onset neonatal neuroaxonal

dystrophy

Cerebellar abiotrophy

Coagulopathy Thrombopathia

Hemophilia A

Hemophilia B

Autosomal Recessive Amelogenesis Imperfecta

Encephalopathy

Alexander disease

Severe Combined Immunodeficiency

Fucosidosis

Oculoskeletal Dysplasia

Hereditary Vitamin D-Resistant Rickets

Hereditary Cataracts

Hereditary Cataracts

Hereditary Nasal Parakeratosis

Trapped Neutrophil Syndrome

Hereditary Footpad Hyperkeratosis

Dystrophic epidermolysis bullosa

Juvenile Epilepsy

**C**hthyosis

Primary hyperoxaluria type I

Primary Open Angle Glaucoma

Primary ciliary dyskinesia

Cyclic neutropenia

Dwarfism

Day blindness

# Complex genetic diseases:

X Hip dysplasia

X Hypothyroidism

Rupture of the cranial cruciate ligament

Obsessive-compulsive disorder

ED

Portosystemic Vascular Anomaly(PSVA)

Mast cell tumor(MCT)

∠ Lymphoma

Congenital Sensorineural Deafness

★ Osteosarcoma

Congenital megaesophagus

Hemangiosarcoma

**B-cell lymphoma** 

Duchenne muscular dystrophy

Adult-Onset Deafness

**Amylase** 



### **Breed list:**

Havanese Weimaraner

Neapolitan Mastiff St.Bernard Dog

Wirehaired Pointing Griffon

Redbone Coonhound

Akita Inu

✓ Staffordshire Bull Terrier Australian Silky Terrier

Toy Fox Terrier Bull Terrier Norwich Terrier

Basinji Pugs

Bassett Hound Malinois dog Shar Pei

Soft-coated Wheaten Terrier

Cairn Terrier Airedale Terrier German Shepherd

Shih Tzu Keeshond Bull Terrier Goldendoodle Samoyed Sheltie

Coton de Tulear

American Pit Bull Terrier

Xigou

Icelandic Sheepdog

Briard

West Highland White Terrier

Puli dog Kuvasz Vizsla Pomeranian

Chow Chow

Molosser Border Terrier Chinook

Standard Schnauzer English Springer Spaniel

Golden Retriever

American hairless Terrier Pembroke Welsh Corgi Scottish Deerhound Dogue de Bordeaux

Maltese Saluki

Anatolian Shepherd

Petit Basset Griffon Vendéen

Wolf

Black Russia Terrier English Pulldog

Great Swiss Mountain Dog

Jack Russell Terrier

Ibiza Hound

Nova Scotia Duck Hunting Retriever

**Tibet Terrier** 

Parson Russell Terrier Australia Terrier Xoloitzcuintle Palatore Dog Irish Water Spaniel

Tervuren
Irish Setter
Australian Kelpie
Curly-coated retriever
American Pit Bull Terrier
German Wirehaired Pointer

St.huberthound Cardigan Welsh Corgi

Scotch Collie

Alaskan Malamute

Pekingese



Belgian Shepherd Dog

**Papillon** 

Italian Greyhound Large Münsterländer Bellington Terrier

Pyrenean Mountain Dog

Beagle
Doberman
Kelly Blue Terrier
Yorkshire Terrier

Czechoslovakian Wolfdog

Pharaoh Hound

Mastiff Carolina Dog

Bouvier des Flandres

Shiba Inu Brittany

American Eskimo Dog Abruzzo Mastiff Lhasa Apso Cane Corso

Sweden Wa Hande dogs Portuguese Water Dog Chesapeake Bay Retriever

Toy Poodle

Chinese Crested Dog

Chihuahua

Cavalier King Charles Spaniel

Miniature Poodle Peruvian Inca Orchid

Otterhound Schipperke ✔ Rottweiler

> English Cocker Spaniel Labrador Retriever Miniature Bull Terrier

Japanese Chin

Dachshund

Borzoi

Greenland Dog Old English Sheepdog Norwegian Elkhound

Newfoundland Sussex Spaniel Picardy Spaniel Greyhound Eurasier

Tibetan Mastiff

Sloughi

Miniature Dachshund

Komondor Volpino Gordon Setter

Boxer

Boerboel

French Bulldog

Flat-coated Retriever

Catehola Leopard Dog Saarlooswolfdog Scotland Terrier Siberian Husky

Miniature Schnauzer
Curl Bichon Frise

Great Dane Leonberger Bearded Collie

Pumi

German Shorthaired Pointer

Border Collie Afghan Hound

Whibit Rat Terrier English Setter

Australian Cattle Dog

Canis aureus

American Cocker Spaniel

Giant Schnauzer
Boston Terrier
Norfolk Terrier
Tibetan spaniel
Rhodesian Ridgeback
New Guinea Singing Dog
Bernese Mountain Dog
English Foxhound

Toy Manchester Terrier Irish Wolfhound Griffon Bruxellois Irish Terrier Cirneco dell'Etna

Glen

Australian Shepherd

Dalmatian

American Staffordshire Terrier

Field Spaniel Xoloitzcuintle Bracco Finnish Spitz

Greyhound Azawakh

Standard Poodle Miniature Pinscher

Bullmastiff

Curly-coated retriever Wire Hair Fox Terrier





# CANINE BREED COMPOSITION CERTIFICATE

Certified breed analysis and genetic makeup for

Lily

BREED BREAKDOWN

Staffordshire Bull Terrier - 63%

Labrador Retriever - 22%

Dachshund- 15%

LAB SAMPLE ID – LHK211213010 CASE REF: PETGENC1111NZ

7,March, 2022

DATE OF ANALYSIS





