CRF GUNNER

Veterinary Report by Embark

embarkvet.com

Test Date: August 10th, 2020

Customer-supplied information

Owner Name: Marlene Tinsley
Dog Name: CRF Gunner
Sex: Male (intact)
Date of birth: 06/11/19

Breed type: purebred
Breed: Golden Retriever
Breed registration: AKC SS13115706
Microchip: n/a

Genetic summary

Genetic breed identification:
Golden Retriever

Predicted adult weight: **77 lbs**
Calculated from 17 size genes.

Genetic age: **27 human years**
Human equivalent age based on size, date of birth provided, and other factors

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)

- CRF Gunner's baseline ALT level may be Low Normal

Why is this important to your vet?
CRF Gunner has one copy of a variant associated with reduced ALT activity as measured on veterinary blood chemistry panels. Please inform your veterinarian that CRF Gunner has this genotype, as ALT is often used as an indicator of liver health and CRF Gunner is likely to have a lower than average resting ALT activity. As such, an increase in CRF Gunner's 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.

Health Report

How to interpret CRF Gunner's genetic health results:
If CRF Gunner 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 CRF Gunner 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!
CRF Gunner is not at increased risk for the genetic health conditions that Embark tests.

Breed-Relevant Genetic Conditions	**9 variants not detected**
Additional Genetic Conditions	**184 variants not detected**

Breed-Relevant Conditions Tested

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

- **Progressive Retinal Atrophy, prcd (PRCD Exon 1)**
- **Golden Retriever Progressive Retinal Atrophy 1, GR-PRA1 (SLC4A3)**
- **Golden Retriever Progressive Retinal Atrophy 2, GR-PRA2 (TTC8)**
- **Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 Deletion, Golden Retriever Variant)**
- **Degenerative Myelopathy, DM (SOD1A)**
- **Muscular Dystrophy (DMD, Golden Retriever Variant)**
- **Dystrophic Epidermolysis Bullosa (COL7A1, Golden Retriever Variant)**
- **Ichthyosis, ICH1 (PNPLA1, Golden Retriever Variant)**
- **Osteogenesis Imperfecta, Brittle Bone Disease (COL1A1, Golden Retriever Variant)**

Additional Conditions Tested

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

- **MDR1 Drug Sensitivity (ABCB1)**
- **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, German Shepherd Variant 1)**
- **Factor VIII Deficiency, Hemophilia A (F8 Exon 1, German Shepherd Variant 2)**
- **Thrombopathia (RASGRP1 Exon 5, Basset Hound Variant)**
- **Thrombopathia (RASGRP1 Exon 8, Landseer Variant)**
- **Thrombopathia (RASGRP1 Exon 5, American Eskimo Dog Variant)**
- **Von Willebrand Disease Type III, Type III vWD (VWF Exon 4, Terrier Variant)**
- **Von Willebrand Disease Type III, Type III vWD (VWF Exon 7, Shetland Sheepdog Variant)**
- **Von Willebrand Disease Type I, Type I vWD (VWF)**
- **Von Willebrand Disease Type II, Type II vWD (VWF, Pointer Variant)**
- **Canine Leukocyte Adhesion Deficiency Type I, CLAD I (ITGB2, Setter Variant)**
- **Canine Leukocyte Adhesion Deficiency Type III, CLAD III (FERMT3, German Shepherd Variant)**
- **Congenital Macrothrombocytopenia (TUBB1 Exon 1, Cairn and Norfolk Terrier Variant)**
- **Canine Elliptocytosis (SPTB Exon 30)**
- **Glanzmann's Thrombasthenia Type I (ITGA2B Exon 13, Great Pyrenees Variant)**
- **Glanzmann's Thrombasthenia Type I (ITGA2B Exon 12, Otterhound Variant)**
- **May-Hegglin Anomaly (MYH9)**
- **Prekallikrein Deficiency (KLKB1 Exon 8)**
- **Pyruvate Kinase Deficiency (PKLR Exon 5, Basenji Variant)**

Additional Conditions Tested

- Pyruvate Kinase Deficiency (PKLR Exon 7, Labrador Retriever Variant)
- Pyruvate Kinase Deficiency (PKLR Exon 7, Pug Variant)
- Pyruvate Kinase Deficiency (PKLR Exon 7, Beagle Variant)
- Pyruvate Kinase Deficiency (PKLR Exon 10, Terrier Variant)
- Trapped Neutrophil Syndrome, TNS (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, SCID (PRKDC, Terrier Variant)
- Severe Combined Immunodeficiency, SCID (RAG1, Wetterhoun Variant)
- X-linked Severe Combined Immunodeficiency, X-SCID (IL2RG Exon 1, Basset Hound Variant)
- X-linked Severe Combined Immunodeficiency, X-SCID (IL2RG, Corgi Variant)
- 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, PRA1 (CNGB1)
- Progressive Retinal Atrophy (SAG)
- Progressive Retinal Atrophy, crd1 (PDE6B, American Staffordshire Terrier Variant)
- Progressive Retinal Atrophy, crd4/cord1 (RPGRIP1)
- X-Linked Progressive Retinal Atrophy 1, XL-PRA1 (RPGR)
- Progressive Retinal Atrophy, PRA3 (FAM161A)

Additional Conditions Tested

- Collie Eye Anomaly, Choroidal Hypoplasia, CEA (NHEJ1)
- Day blindness, Cone Degeneration, Achromatopsia (CNGB3 Exon 6, German Shorthaired Pointer Variant)
- Achromatopsia (CNGA3 Exon 7, German Shepherd Variant)
- Achromatopsia (CNGA3 Exon 7, Labrador Retriever Variant)
- Autosomal Dominant Progressive Retinal Atrophy (RHO)
- Canine Multifocal Retinopathy, cmr1 (BEST1 Exon 2)
- Canine Multifocal Retinopathy, cmr2 (BEST1 Exon 5, Coton de Tulear Variant)
- Canine Multifocal Retinopathy, cmr3 (BEST1 Exon 10 Deletion, Finnish and Swedish Lapphund, Lapponian Herder Variant)
- Primary Open Angle Glaucoma (ADAMTS10 Exon 9, Norwegian Elkhound Variant)
- Primary Open Angle Glaucoma (ADAMTS17 Exon 11, Basset Fauve de Bretagne Variant)
- Primary Open Angle Glaucoma and Primary Lens Luxation (ADAMTS17 Exon 2, Chinese Shar-Pei Variant)
- Goniodysgenesis and Glaucoma, Pectinate Ligament Dysplasia, PLD (OLFM3)
- Hereditary Cataracts, Early-Onset Cataracts, Juvenile Cataracts (HSF4 Exon 9, Australian Shepherd Variant)
- Primary Lens Luxation (ADAMTS17)
- Congenital Stationary Night Blindness (RPE65, Briard Variant)
- 2,8-Dihydroxyadenine Urolithiasis, 2,8-DHA Urolithiasis (APRT)
- Cystinuria Type I-A (SLC3A1, Newfoundland Variant)
- Cystinuria Type II-A (SLC3A1, Australian Cattle Dog Variant)
- Cystinuria Type II-B (SLC7A9, Miniature Pinscher Variant)
- Hyperuricosuria and Hyperuricemia or Urolithiasis, HUU (SLC2A9)
- Polycystic Kidney Disease, PKD (PKD1)
- Primary Hyperoxaluria (AGXT)
- Protein Losing Nephropathy, PLN (NPHS1)
- X-Linked Hereditary Nephropathy, XLHN (COL4A5 Exon 35, Samoyed Variant 2)

Additional Conditions Tested

- Autosomal Recessive Hereditary Nephropathy, Familial Nephropathy, ARHN (COL4A4 Exon 3, Cocker Spaniel Variant)
- Primary Ciliary Dyskinesia, PCD (CCDC39 Exon 3, Old English Sheepdog Variant)
- Congenital Keratoconjunctivitis Sicca and Ichthyosiform Dermatosis, Dry Eye Curly Coat Syndrome, CKCSID (FAM83H Exon 5)
- X-linked Ectodermal Dysplasia, Anhidrotic Ectodermal Dysplasia, XHED (EDA Intron 8)
- Renal Cystadenocarcinoma and Nodular Dermatofibrosis, RCND (FLCN Exon 7)
- Canine Fucosidosis (FUCA1)
- Glycogen Storage Disease Type II, Pompe's Disease, GSD II (GAA, Finnish and Swedish Lapphund, Lapponian Herder Variant)
- Glycogen Storage Disease Type IA, Von Gierke Disease, GSD IA (G6PC, Maltese Variant)
- Glycogen Storage Disease Type IIIA, GSD IIIA (AGL, Curly Coated Retriever Variant)
- Mucopolysaccharidosis Type I, MPS I (IDUA, Plott Hound Variant)
- Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6, Dachshund Variant)
- Mucopolysaccharidosis Type IIIA, Sanfilippo Syndrome Type A, MPS IIIA (SGSH Exon 6, New Zealand Huntaway Variant)
- Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 5, Terrier Brasileiro Variant)
- Mucopolysaccharidosis Type VII, Sly Syndrome, MPS VII (GUSB Exon 3, German Shepherd Variant)
- 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, Dachshund Variant 1)
- Neuronal Ceroid Lipofuscinosis 2, NCL 2 (TPP1 Exon 4, Dachshund Variant 2)
- Neuronal Ceroid Lipofuscinosis, Cerebellar Ataxia, NCL4A (ARSG Exon 2, American Staffordshire Terrier Variant)
- Neuronal Ceroid Lipofuscinosis 5, NCL 5 (CLN5 Exon 4 SNP, Border Collie Variant)
- Neuronal Ceroid Lipofuscinosis 6, NCL 6 (CLN6 Exon 7, Australian Shepherd Variant)

- **Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8 Exon 2, English Setter Variant)**
- **Neuronal Ceroid Lipofuscinosis 7, NCL 7 (MFSD8, Chihuahua and Chinese Crested Variant)**

Additional Conditions Tested

- Neuronal Ceroid Lipofuscinosis 8, NCL 8 (CLN8, Australian Shepherd Variant)
- Neuronal Ceroid Lipofuscinosis 10, NCL 10 (CTSD Exon 5, American Bulldog Variant)
- Adult-Onset Neuronal Ceroid Lipofuscinosis, NCL A, NCL 12 (ATP13A2, Tibetan Terrier Variant)
- Late-Onset Neuronal Ceroid Lipofuscinosis, NCL 12 (ATP13A2, Australian Cattle Dog Variant)
- GM1 Gangliosidosis (GLB1 Exon 15, Shiba Inu Variant)
- GM1 Gangliosidosis (GLB1 Exon 15, Alaskan Husky Variant)
- GM1 Gangliosidosis (GLB1 Exon 2, Portuguese Water Dog Variant)
- GM2 Gangliosidosis (HEXB, Poodle Variant)
- GM2 Gangliosidosis (HEXA, Japanese Chin Variant)
- Globoid Cell Leukodystrophy, Krabbe disease (GALC Exon 5, Terrier Variant)
- Autosomal Recessive Amelogenesis Imperfecta, Familial Enamel Hypoplasia (ENAM Deletion, Italian Greyhound Variant)
- Autosomal Recessive Amelogenesis Imperfecta, Familial Enamel Hypoplasia (ENAM SNP, 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)
- Alexander Disease (GFAP)
- Cerebellar Abiotrophy, Neonatal Cerebellar Cortical Degeneration, NCCD (SPTBN2, Beagle Variant)
- Cerebellar Ataxia, Progressive Early-Onset Cerebellar Ataxia (SEL1L, Finnish Hound Variant)
- Cerebellar Hypoplasia (VLDLR, Eurasier Variant)
- Spinocerebellar Ataxia, Late-Onset Ataxia, LoSCA (CAPN1)
- Spinocerebellar Ataxia with Myokymia and/or Seizures (KCNJ10)
- Hereditary Ataxia, Cerebellar Degeneration (RAB24, Old English Sheepdog and Gordon Setter Variant)
- Benign Familial Juvenile Epilepsy, Remitting Focal Epilepsy (LGI2)

Additional Conditions Tested

- Fetal-Onset Neonatal Neuroaxonal Dystrophy (MFN2, Giant Schnauzer Variant)
- Hypomyelination and Tremors (FNIP2, Weimaraner Variant)
- Shaking Puppy Syndrome, X-linked Generalized Tremor Syndrome (PLP1, English Springer Spaniel Variant)
- Neuroaxonal Dystrophy, NAD (TECPR2, Spanish Water Dog Variant)
- Neuroaxonal Dystrophy, NAD (VPS11, Rottweiler Variant)
- L-2-Hydroxyglutaricaciduria, L2HGA (L2HGDH, Staffordshire Bull Terrier Variant)
- Neonatal Encephalopathy with Seizures, NEWS (ATF2)
- Polyneuropathy (NDRG1 Deletion, Greyhound Variant)
- Polyneuropathy, AMPN (NDRG1 SNP, Alaskan Malamute Variant)
- Narcolepsy (HCRTR2 Intron 6, Labrador Retriever Variant)
- Narcolepsy (HCRTR2 Exon 1, Dachshund Variant)
- Progressive Neuronal Abiotrophy, Canine Multiple System Degeneration, CMSD (SERAC1 Exon 15, Kerry Blue Terrier Variant)
- Progressive Neuronal Abiotrophy, Canine Multiple System Degeneration, CMSD (SERAC1 Exon 4, Chinese Crested Variant)
- 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, Spaniel and Pointer Variant)
- 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, Doberman Pinscher Variant 1)
- Dilated Cardiomyopathy, DCM2 (TTN, Doberman Pinscher Variant 2)
- Long QT Syndrome (KCNQ1)
- Muscular Dystrophy (DMD, Cavalier King Charles Spaniel Variant 1)

Additional Conditions Tested

- Limb Girdle Muscular Dystrophy (SGCD, Boston Terrier Variant)
- Centronuclear Myopathy (PTPLA)
- Exercise-Induced Collapse (DNM1)
- Inherited Myopathy of Great Danes (BIN1)
- Myostatin Deficiency, Bully Whippet Syndrome (MSTN)
- Myotonia Congenita (CLCN1 Exon 7, Miniature Schnauzer Variant)
- Myotonia Congenita (CLCN1 Exon 23, Australian Cattle Dog Variant)
- Myotubular Myopathy 1, X-linked Myotubular Myopathy, XL-MTM (MTM1, Labrador Retriever Variant)
- Hypocatalasia, Acatalasemia (CAT)
- Pyruvate Dehydrogenase Deficiency (PDP1, Spaniel Variant)
- Malignant Hyperthermia (RYR1)
- Imerslund-Grasbeck Syndrome, Selective Cobalamin Malabsorption (CUBN Exon 53, Border Collie Variant)
- Imerslund-Grasbeck Syndrome, Selective Cobalamin Malabsorption (CUBN Exon 8, Beagle Variant)
- Inherited Selected Cobalamin Malabsorption with Proteinuria (CUBN, Komondor Variant)
- Lundehund Syndrome (LEPREL1)
- Congenital Myasthenic Syndrome, CMS (CHAT, Old Danish Pointing Dog Variant)
- Congenital Myasthenic Syndrome, CMS (COLQ, Labrador Retriever Variant)
- Congenital Myasthenic Syndrome, CMS (CHRNE, Jack Russell Terrier Variant)
- Episodic Falling Syndrome (BCAN)
- Paroxysmal Dyskinesia, PxD (PGIN)
- Dystrophic Epidermolysis Bullosa (COL7A1, Central Asian Shepherd Dog Variant)
- Ectodermal Dysplasia, Skin Fragility Syndrome (PKP1, Chesapeake Bay Retriever Variant)
- Ichthyosis, Epidermolytic Hyperkeratosis (KRT10, Terrier Variant)
- Ichthyosis (SLC27A4, Great Dane Variant)

Additional Conditions Tested

- **Ichthyosis (NIPAL4, American Bulldog Variant)**
- **Focal Non-Epidermolytic Palmoplantar Keratoderma, Pachyonychia Congenita (KRT16, Dogue de Bordeaux Variant)**
- **Hereditary Footpad Hyperkeratosis (FAM83G, Terrier and Kromfohrlander Variant)**
- **Hereditary Nasal Parakeratosis, HNPK (SUV39H2)**
- **Musladin-Lueke Syndrome, MLS (ADAMTSL2)**
- **Oculocutaneous Albinism, OCA (SLC45A2, Pekingese Variant)**
- **Bald Thigh Syndrome (IGFBP5)**
- **Cleft Lip and/or Cleft Palate (ADAMTS20, Nova Scotia Duck Tolling Retriever Variant)**
- **Hereditary Vitamin D-Resistant Rickets (VDR)**
- **Osteogenesis Imperfecta, Brittle Bone Disease (COL1A2, Beagle Variant)**
- **Osteogenesis Imperfecta, Brittle Bone Disease (SERPINH1, Dachshund Variant)**
- **Osteochondrodysplasia, Skeletal Dwarfism (SLC13A1, Poodle Variant)**
- **Skeletal Dysplasia 2, SD2 (COL11A2, Labrador Retriever Variant)**
- **Craniomandibular Osteopathy, CMO (SLC37A2)**
- **Chondrodystrophy and Intervertebral Disc Disease, CDDY/IVDD, Type I IVDD (FGF4 retrogene - CFA12)**
- **Chondrodystrophy (ITGA10, Norwegian Elkhound and Karelian Bear Dog Variant)**

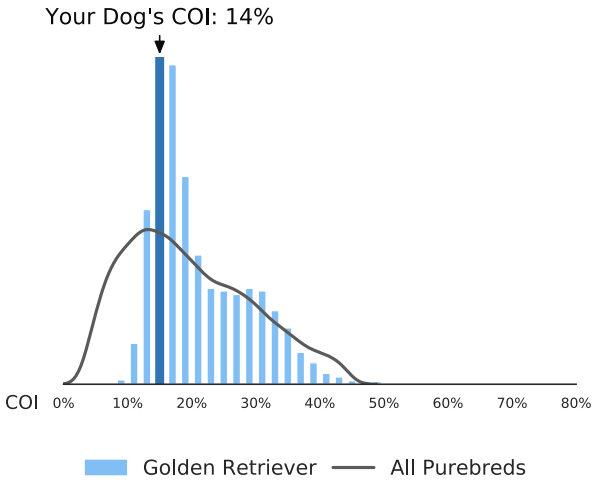
Genetic Diversity and Inbreeding

Coefficient of Inbreeding (COI)

Genetic Result: 14%

Our genetic COI measures the proportion of your dog's genome (her genes) where the genes on the mother's side are identical by descent to those on the father's side. The higher your dog's coefficient of inbreeding (the percentage), the more inbred your dog is.

Your Dog's COI



This graph represents where your dog's inbreeding levels fall on a scale compared to both dogs with a similar breed makeup to her (the blue bars) and all purebred dogs (the grey line).

More on the Science

Embark scientists, along with our research partners at Cornell University, have shown the impact of inbreeding on longevity and fertility and developed a state-of-the-art, peer-reviewed method for accurately measuring COI and predicting average COI in litters.

Citations

Sams & Boyko 2019 "Fine-Scale Resolution of Runs of Homozygosity Reveal Patterns of Inbreeding and Substantial Overlap with Recessive Disease Genotypes in Domestic Dogs" (https://www.ncbi.nlm.nih.gov/pubmed/30429214)

Chu et al 2019 "Inbreeding depression causes reduced fecundity in Golden Retrievers" (https://link.springer.com/article/10.1007/s00335-019-09805-4)

Yordy et al 2019 "Body size, inbreeding, and lifespan in domestic dogs" (https://www.semanticscholar.org/paper/Body-size%2C-inbreeding%2C-and-lifespan-in-domestic-Yordy-Kraus/61d0fa7a71afb26f547f0fb7ff71e23a14d19d2c)

About Embark

Embark Veterinary is a canine genetics company offering research-grade genetic tests to pet owners and breeders. Every Embark test examines over 200,000 genetic markers, and provides results for over 210 genetic health conditions, breed identification, clinical tools, and more.

Embark is a research partner of the Cornell University College of Veterinary Medicine and collaborates with scientists and registries to accelerate genetic research in canine health. We make it easy for customers and vets to understand, share and make use of their dog's unique genetic profile to improve canine health and happiness.

Learn more at embarkvet.com

Veterinarians and hospitals can send inquiries to veterinarians@embarkvet.com.