GEPHE SUMMARY

Gephebase Gene

Insulin-like growth factor 1 (IGF1) (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Insulin-like growth factor 1 (IGF1)^#gephebase-summary-title)

GepheID

GP00000501

Entry Status

Published

Main curator

Martin

PHENOTYPIC CHANGE

Trait Category

Morphology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Morphology^#gephebase-summary-title)

Trait

Body size (https://www.gephebase.org/search-criteria?/and+Trait=^Body size^#gephebase-summary-title)

Trait State in Taxon A

Canis familiaris - Small breeds

Trait State in Taxon B

Canis familiaris - Giant breeds

Ancestral State

Data not curated

Taxonomic Status

Domesticated (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Domesticated^#gephebase-summary-title)

Taxon A

Latin Name

Canis lupus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Canis lupus^#gephebase-summary-title)

Common Name

gray wolf

Synonyms

gray wolf; grey wolf; Canis lupus Linnaeus, 1758

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Carnivora; Caniformia; Canidae; Canis

Parent

Canis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9611)

NCBI Taxonomy ID

9612 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9612)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

Canis lupus familiaris (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Canis lupus familiaris^#gephebase-summary-title)

Common Name

dog

Synonyms

Canis canis; Canis domesticus; Canis familiaris; dog; dogs; Canis familiaris Linnaeus, 1758; Canis lupus familiaris Linnaeus, 1758

Rank

subspecies

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Deuterostomia; Chordata; Craniata; Vertebrata; Gnathostomata; Teleostomi; Euteleostomi; Sarcopterygii; Dipnotetrapodomorpha; Tetrapoda; Amniota; Mammalia; Theria; Eutheria; Boreoeutheria; Laurasiatheria; Carnivora; Caniformia; Canidae; Canis; Canis lupus

Parent

Canis lupus (gray wolf) - (Rank: species) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9612)

NCBI Taxonomy ID

9615 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9615)

is Taxon B an Infraspecies?

Yes

Taxon B Description

Canis familiaris - Giant breeds

GENOTYPIC CHANGE

Generic Gene Name

Igf1

Synonyms

Igf-1; Igf-I; C730016P09Rik

String

-

Sequence Similarities

Belongs to the insulin family.

GO - Molecular Function

GO:0008083 : growth factor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008083)
GO:0005496 : steroid binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005496)
GO:0005179 : hormone activity (https://www.ebi.ac.uk/QuickGO/term/GO:0005179)
GO:0005158 : insulin receptor binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005158)
GO:0005159 : insulin-like growth factor receptor binding

UniProtKB Mus musculus

P05017 (http://www.uniprot.org/uniprot/P05017)

GenebankID or UniProtKB

AHI17168 (https://www.ncbi.nlm.nih.gov/nuccore/AHI17168)

(https://www.ebi.ac.uk/QuickGO/term/GO:0005159)
GO:0005178 : integrin binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005178)
GO:0043539 : protein serine/threonine kinase activator activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0043539)

GO - Biological Process

GO:0043066 : negative regulation of apoptotic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0043066)
GO:0007399 : nervous system development
(https://www.ebi.ac.uk/QuickGO/term/GO:0007399)
GO:0045944 : positive regulation of transcription by RNA polymerase II
(https://www.ebi.ac.uk/QuickGO/term/GO:0045944)
GO:0006417 : regulation of translation
(https://www.ebi.ac.uk/QuickGO/term/GO:0006417)
GO:0030166 : proteoglycan biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0030166)
GO:0045893 : positive regulation of transcription, DNA-templated
(https://www.ebi.ac.uk/QuickGO/term/GO:0045893)
GO:0010629 : negative regulation of gene expression
(https://www.ebi.ac.uk/QuickGO/term/GO:0010629)
GO:1901215 : negative regulation of neuron death
(https://www.ebi.ac.uk/QuickGO/term/GO:1901215)
GO:0051246 : regulation of protein metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0051246)
GO:0008283 : cell proliferation (https://www.ebi.ac.uk/QuickGO/term/GO:0008283)
GO:0097192 : extrinsic apoptotic signaling pathway in absence of ligand
(https://www.ebi.ac.uk/QuickGO/term/GO:0097192)
GO:0008284 : positive regulation of cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0008284)
GO:0050731 : positive regulation of peptidyl-tyrosine phosphorylation
(https://www.ebi.ac.uk/QuickGO/term/GO:0050731)
GO:0051897 : positive regulation of protein kinase B signaling
(https://www.ebi.ac.uk/QuickGO/term/GO:0051897)
GO:0046579 : positive regulation of Ras protein signal transduction
(https://www.ebi.ac.uk/QuickGO/term/GO:0046579)
GO:0035264 : multicellular organism growth
(https://www.ebi.ac.uk/QuickGO/term/GO:0035264)
GO:0008285 : negative regulation of cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0008285)
GO:2001237 : negative regulation of extrinsic apoptotic signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:2001237)
GO:0010628 : positive regulation of gene expression
(https://www.ebi.ac.uk/QuickGO/term/GO:0010628)
GO:0043568 : positive regulation of insulin-like growth factor receptor signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0043568)
GO:0043410 : positive regulation of MAPK cascade
(https://www.ebi.ac.uk/QuickGO/term/GO:0043410)
GO:0060740 : prostate gland epithelium morphogenesis
(https://www.ebi.ac.uk/QuickGO/term/GO:0060740)
GO:0060736 : prostate gland growth (https://www.ebi.ac.uk/QuickGO/term/GO:0060736)
GO:0030307 : positive regulation of cell growth
(https://www.ebi.ac.uk/QuickGO/term/GO:0030307)
GO:0048468 : cell development (https://www.ebi.ac.uk/QuickGO/term/GO:0048468)
GO:0001649 : osteoblast differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0001649)
GO:0050679 : positive regulation of epithelial cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0050679)
GO:0045669 : positive regulation of osteoblast differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0045669)
GO:0007623 : circadian rhythm (https://www.ebi.ac.uk/QuickGO/term/GO:0007623)
GO:0030324 : lung development (https://www.ebi.ac.uk/QuickGO/term/GO:0030324)
GO:0010468 : regulation of gene expression
(https://www.ebi.ac.uk/QuickGO/term/GO:0010468)
GO:0030104 : water homeostasis (https://www.ebi.ac.uk/QuickGO/term/GO:0030104)
GO:0045840 : positive regulation of mitotic nuclear division
(https://www.ebi.ac.uk/QuickGO/term/GO:0045840)
GO:0048009 : insulin-like growth factor receptor signaling pathway
(https://www.ebi.ac.uk/QuickGO/term/GO:0048009)
GO:0001974 : blood vessel remodeling
(https://www.ebi.ac.uk/QuickGO/term/GO:0001974)
GO:0010001 : glial cell differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0010001)
GO:0045471 : response to ethanol (https://www.ebi.ac.uk/QuickGO/term/GO:0045471)
GO:0048286 : lung alveolus development
(https://www.ebi.ac.uk/QuickGO/term/GO:0048286)
GO:0060463 : lung lobe morphogenesis
(https://www.ebi.ac.uk/QuickGO/term/GO:0060463)
GO:0048661 : positive regulation of smooth muscle cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0048661)

GO:0060527 : prostate epithelial cord arborization involved in prostate glandular acinus morphogenesis (https://www.ebi.ac.uk/QuickGO/term/GO:0060527)
GO:1990314 : cellular response to insulin-like growth factor stimulus (https://www.ebi.ac.uk/QuickGO/term/GO:1990314)
GO:1905564 : positive regulation of vascular endothelial cell proliferation (https://www.ebi.ac.uk/QuickGO/term/GO:1905564)
GO:0007613 : memory (https://www.ebi.ac.uk/QuickGO/term/GO:0007613)
GO:0046326 : positive regulation of glucose import (https://www.ebi.ac.uk/QuickGO/term/GO:0046326)
GO:0000187 : activation of MAPK activity (https://www.ebi.ac.uk/QuickGO/term/GO:0000187)
GO:0042531 : positive regulation of tyrosine phosphorylation of STAT protein (https://www.ebi.ac.uk/QuickGO/term/GO:0042531)
GO:0009408 : response to heat (https://www.ebi.ac.uk/QuickGO/term/GO:0009408)
GO:0030335 : positive regulation of cell migration (https://www.ebi.ac.uk/QuickGO/term/GO:0030335)
GO:2000679 : positive regulation of transcription regulatory region DNA binding (https://www.ebi.ac.uk/QuickGO/term/GO:2000679)
GO:0014068 : positive regulation of phosphatidylinositol 3-kinase signaling (https://www.ebi.ac.uk/QuickGO/term/GO:0014068)
GO:0042127 : regulation of cell proliferation (https://www.ebi.ac.uk/QuickGO/term/GO:0042127)
GO:0032148 : activation of protein kinase B activity (https://www.ebi.ac.uk/QuickGO/term/GO:0032148)
GO:0035630 : bone mineralization involved in bone maturation (https://www.ebi.ac.uk/QuickGO/term/GO:0035630)
GO:0048754 : branching morphogenesis of an epithelial tube (https://www.ebi.ac.uk/QuickGO/term/GO:0048754)
GO:0001775 : cell activation (https://www.ebi.ac.uk/QuickGO/term/GO:0001775)
GO:1904646 : cellular response to amyloid-beta (https://www.ebi.ac.uk/QuickGO/term/GO:1904646)
GO:0071333 : cellular response to glucose stimulus (https://www.ebi.ac.uk/QuickGO/term/GO:0071333)
GO:0050650 : chondroitin sulfate proteoglycan biosynthetic process (https://www.ebi.ac.uk/QuickGO/term/GO:0050650)
GO:0050974 : detection of mechanical stimulus involved in sensory perception (https://www.ebi.ac.uk/QuickGO/term/GO:0050974)
GO:0070371 : ERK1 and ERK2 cascade (https://www.ebi.ac.uk/QuickGO/term/GO:0070371)
GO:0031017 : exocrine pancreas development (https://www.ebi.ac.uk/QuickGO/term/GO:0031017)
GO:0048839 : inner ear development (https://www.ebi.ac.uk/QuickGO/term/GO:0048839)
GO:0060426 : lung vasculature development (https://www.ebi.ac.uk/QuickGO/term/GO:0060426)
GO:0030879 : mammary gland development (https://www.ebi.ac.uk/QuickGO/term/GO:0030879)
GO:0014896 : muscle hypertrophy (https://www.ebi.ac.uk/QuickGO/term/GO:0014896)
GO:0045445 : myoblast differentiation (https://www.ebi.ac.uk/QuickGO/term/GO:0045445)
GO:0051450 : myoblast proliferation (https://www.ebi.ac.uk/QuickGO/term/GO:0051450)
GO:0014904 : myotube cell development (https://www.ebi.ac.uk/QuickGO/term/GO:0014904)
GO:0060766 : negative regulation of androgen receptor signaling pathway (https://www.ebi.ac.uk/QuickGO/term/GO:0060766)
GO:1904193 : negative regulation of cholangiocyte apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:1904193)
GO:0043154 : negative regulation of cysteine-type endopeptidase activity involved in apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:0043154)
GO:0070373 : negative regulation of ERK1 and ERK2 cascade (https://www.ebi.ac.uk/QuickGO/term/GO:0070373)
GO:0002683 : negative regulation of immune system process (https://www.ebi.ac.uk/QuickGO/term/GO:0002683)
GO:0010656 : negative regulation of muscle cell apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:0010656)
GO:1900142 : negative regulation of oligodendrocyte apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:1900142)
GO:0060283 : negative regulation of oocyte development (https://www.ebi.ac.uk/QuickGO/term/GO:0060283)
GO:0050732 : negative regulation of peptidyl-tyrosine phosphorylation (https://www.ebi.ac.uk/QuickGO/term/GO:0050732)
GO:0090201 : negative regulation of release of cytochrome c from mitochondria (https://www.ebi.ac.uk/QuickGO/term/GO:0090201)
GO:0034392 : negative regulation of smooth muscle cell apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:0034392)
GO:1905460 : negative regulation of vascular associated smooth muscle cell apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:1905460)
GO:0014065 : phosphatidylinositol 3-kinase signaling

(https://www.ebi.ac.uk/QuickGO/term/GO:0014065)
GO:0048015 : phosphatidylinositol-mediated signaling
(https://www.ebi.ac.uk/QuickGO/term/GO:0048015)
GO:0042104 : positive regulation of activated T cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0042104)
GO:0043536 : positive regulation of blood vessel endothelial cell migration
(https://www.ebi.ac.uk/QuickGO/term/GO:0043536)
GO:0070886 : positive regulation of calcineurin-NFAT signaling cascade
(https://www.ebi.ac.uk/QuickGO/term/GO:0070886)
GO:0010613 : positive regulation of cardiac muscle hypertrophy
(https://www.ebi.ac.uk/QuickGO/term/GO:0010613)
GO:0061051 : positive regulation of cell growth involved in cardiac muscle cell development
(https://www.ebi.ac.uk/QuickGO/term/GO:0061051)
GO:0021940 : positive regulation of cerebellar granule cell precursor proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0021940)
GO:0043388 : positive regulation of DNA binding
(https://www.ebi.ac.uk/QuickGO/term/GO:0043388)
GO:0045600 : positive regulation of fat cell differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0045600)
GO:0048146 : positive regulation of fibroblast proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0048146)
GO:0060252 : positive regulation of glial cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0060252)
GO:0045725 : positive regulation of glycogen biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0045725)
GO:0045821 : positive regulation of glycolytic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0045821)
GO:0010560 : positive regulation of glycoprotein biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0010560)
GO:2000288 : positive regulation of myoblast proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:2000288)
GO:0033160 : positive regulation of protein import into nucleus, translocation
(https://www.ebi.ac.uk/QuickGO/term/GO:0033160)
GO:0050714 : positive regulation of protein secretion
(https://www.ebi.ac.uk/QuickGO/term/GO:0050714)
GO:0071902 : positive regulation of protein serine/threonine kinase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0071902)
GO:0014911 : positive regulation of smooth muscle cell migration
(https://www.ebi.ac.uk/QuickGO/term/GO:0014911)
GO:0090031 : positive regulation of steroid hormone biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0090031)
GO:1904075 : positive regulation of trophectodermal cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:1904075)
GO:1904707 : positive regulation of vascular smooth muscle cell proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:1904707)
GO:0060741 : prostate gland stromal morphogenesis
(https://www.ebi.ac.uk/QuickGO/term/GO:0060741)
GO:0043491 : protein kinase B signaling
(https://www.ebi.ac.uk/QuickGO/term/GO:0043491)
GO:0050821 : protein stabilization (https://www.ebi.ac.uk/QuickGO/term/GO:0050821)
GO:0051924 : regulation of calcium ion transport
(https://www.ebi.ac.uk/QuickGO/term/GO:0051924)
GO:0032878 : regulation of establishment or maintenance of cell polarity
(https://www.ebi.ac.uk/QuickGO/term/GO:0032878)
GO:0045428 : regulation of nitric oxide biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0045428)
GO:0001932 : regulation of protein phosphorylation
(https://www.ebi.ac.uk/QuickGO/term/GO:0001932)
GO:0007608 : sensory perception of smell
(https://www.ebi.ac.uk/QuickGO/term/GO:0007608)
GO:0014834 : skeletal muscle satellite cell maintenance involved in skeletal muscle regeneration (https://www.ebi.ac.uk/QuickGO/term/GO:0014834)
GO:0060509 : type I pneumocyte differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0060509)
GO:0060510 : type II pneumocyte differentiation
(https://www.ebi.ac.uk/QuickGO/term/GO:0060510)

GO - Cellular Component

GO:0005886 : plasma membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005886)
GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737)
GO:0005615 : extracellular space (https://www.ebi.ac.uk/QuickGO/term/GO:0005615)
GO:0043025 : neuronal cell body (https://www.ebi.ac.uk/QuickGO/term/GO:0043025)
GO:0035867 : alphav-beta3 integrin-IGF-1-IGF1R complex
(https://www.ebi.ac.uk/QuickGO/term/GO:0035867)
GO:0070382 : exocytic vesicle (https://www.ebi.ac.uk/QuickGO/term/GO:0070382)
GO:0042567 : insulin-like growth factor ternary complex
(https://www.ebi.ac.uk/QuickGO/term/GO:0042567)
GO:0005614 : interstitial matrix (https://www.ebi.ac.uk/QuickGO/term/GO:0005614)
GO:0031091 : platelet alpha granule (https://www.ebi.ac.uk/QuickGO/term/GO:0031091)

Presumptive Null

Unknown (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Unknown^#gephebase-summary-title)

Molecular Type

Cis-regulatory (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Cis-regulatory^#gephebase-summary-title)

Aberration Type

Unknown (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Unknown^#gephebase-summary-title)

Molecular Details of the Mutation

Not identified / several haplotypes

Experimental Evidence

Association Mapping (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Association Mapping^#gephebase-summary-title)

Main Reference

A single IGF1 allele is a major determinant of small size in dogs. (2007) (https://pubmed.ncbi.nlm.nih.gov/17412960)

Authors

Sutter NB; Bustamante CD; Chase K; Gray MM; Zhao K; Zhu L; Padhukasahasram B; Karlins E; Davis S; Jones PG; Quignon P; Johnson GS; Parker HG; Fretwell N; Mosher DS; Lawler DF; Satyaraj E; Nordborg M; Lark KG; Wayne RK; Ostrander EA

Abstract

The domestic dog exhibits greater diversity in body size than any other terrestrial vertebrate. We used a strategy that exploits the breed structure of dogs to investigate the genetic basis of size. First, through a genome-wide scan, we identified a major quantitative trait locus (QTL) on chromosome 15 influencing size variation within a single breed. Second, we examined genetic variation in the 15-megabase interval surrounding the QTL in small and giant breeds and found marked evidence for a selective sweep spanning a single gene (IGF1), encoding insulin-like growth factor 1. A single IGF1 single-nucleotide polymorphism haplotype is common to all small breeds and nearly absent from giant breeds, suggesting that the same causal sequence variant is a major contributor to body size in all small dogs.

Additional References

Derived variants at six genes explain nearly half of size reduction in dog breeds. (2013) (https://pubmed.ncbi.nlm.nih.gov/24026177)

RELATED GEPHE

Related Genes

5 (growth hormone receptor (GHR), HMGA2, Insulin-like growth factor receptor 1 (IGF1R), SMAD family member 2 (SMAD2), stanniocalcin 2 (STC2)) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^9612^/and+Trait=Body size/or+Taxon ID=^9615^/and+Trait=Body size/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS