GEPHE SUMMARY

Gephebase Gene
aggrecan (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^aggrecan^#gephebase-summary-title)

GepheID
GP00002141

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

Trait State in Taxon A
European cattle breeds with normal size

Trait State in Taxon B
Dexter cattle with Red Poll-Jersey ancestry (dwarf = dominant trait ; recessive lethal)

Ancestral State
Taxon A

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

Taxon A

Latin Name
Bos taurus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Bos taurus^#gephebase-summary-title)

Common Name
cattle

Synonyms
Bos bovis; Bos primigenius taurus; cattle; bovine; cow; dairy cow; domestic cattle; domestic cow; Bos taurus Linnaeus, 1758; Bos Tauurus

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; Artiodactyla; Ruminantia; Pecora; Bovidae; Bovinae; Bos

Parent
Bos (oxen, cattle) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9903)

NCBI Taxonomy ID
9913 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9913)

is Taxon A an Infraspecies?
No

Taxon B

Latin Name
Bos taurus (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Bos taurus^#gephebase-summary-title)

Common Name
cattle

Synonyms
Bos bovis; Bos primigenius taurus; cattle; bovine; cow; dairy cow; domestic cattle; domestic cow; Bos taurus Linnaeus, 1758; Bos Tauurus

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; Artiodactyla; Ruminantia; Pecora; Bovidae; Bovinae; Bos

Parent
Bos (oxen, cattle) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9903)

NCBI Taxonomy ID
9913 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9913)

is Taxon B an Infraspecies?
No

GENOTYPIC CHANGE

Generic Gene Name
ACAN

Synonyms
AGC1; SEDK; AGCAN; CSPG1; MSK16; CSPGCP; SSOAOD

String
9606.ENSP00000387356 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=9606.ENSP00000387356)

Sequence Similarities
Belongs to the aggrecan/versican proteoglycan family.

GO - Molecular Function
GO:0046872 : metal ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0046872)
GO:0030246 : carbohydrate binding (https://www.ebi.ac.uk/QuickGO/term/GO:0030246)
GO:0005201 : extracellular matrix structural constituent (https://www.ebi.ac.uk/QuickGO/term/GO:0005201)
GO:0030021 : extracellular matrix structural constituent conferring compression resistance (https://www.ebi.ac.uk/QuickGO/term/GO:0030021)

UniProtKB Homo sapiens
P16112 (http://www.uniprot.org/uniprot/P16112)

GenebankID or UniProtKB
()

GO:0005540 : hyaluronic acid binding
(https://www.ebi.ac.uk/QuickGO/term/GO:0005540)

GO - Biological Process

GO:0007155 : cell adhesion (https://www.ebi.ac.uk/QuickGO/term/GO:0007155)
GO:0007417 : central nervous system development
(https://www.ebi.ac.uk/QuickGO/term/GO:0007417)
GO:0001502 : cartilage condensation
(https://www.ebi.ac.uk/QuickGO/term/GO:0001502)
GO:0002063 : chondrocyte development
(https://www.ebi.ac.uk/QuickGO/term/GO:0002063)
GO:0030199 : collagen fibril organization
(https://www.ebi.ac.uk/QuickGO/term/GO:0030199)
GO:0030198 : extracellular matrix organization
(https://www.ebi.ac.uk/QuickGO/term/GO:0030198)
GO:0007507 : heart development (https://www.ebi.ac.uk/QuickGO/term/GO:0007507)
GO:0018146 : keratan sulfate biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0018146)
GO:0042340 : keratan sulfate catabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0042340)
GO:0030166 : proteoglycan biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0030166)
GO:0006508 : proteolysis (https://www.ebi.ac.uk/QuickGO/term/GO:0006508)
GO:0001501 : skeletal system development
(https://www.ebi.ac.uk/QuickGO/term/GO:0001501)

GO - Cellular Component

GO:0005576 : extracellular region (https://www.ebi.ac.uk/QuickGO/term/GO:0005576)
GO:0062023 : collagen-containing extracellular matrix
(https://www.ebi.ac.uk/QuickGO/term/GO:0062023)
GO:0005604 : basement membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0005604)
GO:0031012 : extracellular matrix (https://www.ebi.ac.uk/QuickGO/term/GO:0031012)
GO:0098982 : GABA-ergic synapse (https://www.ebi.ac.uk/QuickGO/term/GO:0098982)
GO:0098978 : glutamatergic synapse
(https://www.ebi.ac.uk/QuickGO/term/GO:0098978)
GO:0005796 : Golgi lumen (https://www.ebi.ac.uk/QuickGO/term/GO:0005796)
GO:0043202 : lysosomal lumen (https://www.ebi.ac.uk/QuickGO/term/GO:0043202)
GO:0098966 : perisynaptic extracellular matrix
(https://www.ebi.ac.uk/QuickGO/term/GO:0098966)

Presumptive Null

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

Molecular Type

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

Aberration Type

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

Molecular Details of the Mutation

â^'198C>T transition predicted to introduce a new ATG start codon 199 bp upstream of the normal start codon

Experimental Evidence

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

Main Reference

Bulldog dwarfism in Dexter cattle is caused by mutations in ACAN. (2007) (https://pubmed.ncbi.nlm.nih.gov/17952705)

Authors

Cavanagh JA; Tammen I; Windsor PA; Bateman JF; Savarirayan R; Nicholas FW; Raadsma HW

Abstract

Bulldog dwarfism in Dexter cattle is one of the earliest single-locus disorders described in animals. Affected fetuses display extreme disproportionate dwarfism, reflecting abnormal cartilage development (chondrodysplasia). Typically, they die around the seventh month of gestation, precipitating a natural abortion. Heterozygotes show a milder form of dwarfism, most noticeably having shorter legs. Homozygosity mapping in candidate regions in a small Dexter pedigree suggested aggrecan (ACAN) as the most likely candidate gene. Mutation screening revealed a 4-bp insertion in exon 11 (2266_2267insGGCA) (called BD1 for diagnostic testing) and a second, rarer transition in exon 1 (-198C>T) (called BD2) that cosegregate with the disorder. In chondrocytes from cattle heterozygous for the insertion, mutant mRNA is subject to nonsense-mediated decay, showing only 8% of normal expression. Genotyping in Dexter families throughout the world shows a one-to-one correspondence between genotype and phenotype at this locus. The heterozygous and homozygous-affected Dexter cattle could prove invaluable as a model for human disorders caused by mutations in ACAN.

Additional References

RELATED GEPHE

Related Genes

5 (GH, LCORL, PLAG1, PRKG2, RNF11) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^9913^/and+Trait=Body size/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

1 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^aggrecan^/and+Taxon ID=^9913^/or+Gene Gephebase=^aggrecan^/and+Taxon ID=^9913^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

https://omia.org/OMIA001271/9913/ @AllelicSeries @HeterozygoteAdvantage