GEPHE SUMMARY

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

GepheID
GP00002143

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
Miniature horses

Trait State in Taxon B
Miniature horses with dwarf phenotype (chondrodysplasia) including the Miniatiure Shetland pony

Ancestral State
Taxon A

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

Taxon A

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

Common Name
horse

Synonyms
Equus przewalskii f. caballus; Equus przewalskii forma caballus; horse; domestic horse; equine; Equus caballus 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; Perissodactyla; Equidae; Equus; Equus

Parent
Equus () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 35510)

NCBI Taxonomy ID
9796 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9796)

is Taxon A an Infraspecies?
No

Taxon B

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

Common Name
horse

Synonyms
Equus przewalskii f. caballus; Equus przewalskii forma caballus; horse; domestic horse; equine; Equus caballus 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; Perissodactyla; Equidae; Equus; Equus

Parent
Equus () - (Rank: subgenus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 35510)

NCBI Taxonomy ID
9796 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9796)

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

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

GenebankID or UniProtKB
()

(https://www.ebi.ac.uk/QuickGO/term/GO:0030021)
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

No (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^No^#gephebase-summary-title)

Molecular Type

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

Aberration Type

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

SNP Coding Change

Nonsynonymous

Molecular Details of the Mutation

g.95282140C>G ; p.Ala505Pro

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Ala	Pro	505

Main Reference

Whole-genome sequencing reveals a potential causal mutation for dwarfism in the Miniature Shetland pony. (2017) (https://pubmed.ncbi.nlm.nih.gov/27942904)

Authors

Metzger J; Gast AC; Schrimpf R; Rau J; Eikelberg D; Beineke A; Hellige M; Distl O

Abstract

The Miniature Shetland pony represents a horse breed with an extremely small body size. Clinical examination of a dwarf Miniature Shetland pony revealed a lowered size at the withers, malformed skull and brachygnathia superior. Computed tomography (CT) showed a shortened maxilla and a cleft of the hard and soft palate which protruded into the nasal passage leading to breathing difficulties. Pathological examination confirmed these findings but did not reveal histopathological signs of premature ossification in limbs or cranial sutures. Whole-genome sequencing of this dwarf Miniature Shetland pony and comparative sequence analysis using 26 reference equids from NCBI Sequence Read Archive revealed three probably damaging missense variants which could be exclusively found in the affected foal. Validation of these three missense mutations in 159 control horses from different horse breeds and five donkeys revealed only the aggrecan (ACAN)-associated g.94370258G>C variant as homozygous wild-type in all control samples. The dwarf Miniature Shetland pony had the homozygous mutant genotype C/C of the ACAN:g.94370258G>C variant and the normal parents were heterozygous G/C. An unaffected full sib and 3/5 unaffected half-sibs were heterozygous G/C for the ACAN:g.94370258G>C variant. In summary, we could demonstrate a dwarf phenotype in a miniature pony breed perfectly associated with a missense mutation within the ACAN gene.

Additional References

Multiple alleles of ACAN associated with chondrodysplastic dwarfism in Miniature horses. (2018) (https://pubmed.ncbi.nlm.nih.gov/30058072)

Related Genes

3 (B4GALT7, HMGA2, LCORL) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^9796^/and+Trait=Body size/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

3 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^aggrecan^/and+Taxon ID=^9796^/or+Gene Gephebase=^aggrecan^/and+Taxon ID=^9796^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

https://omia.org/OMIA001271/9796/ @AllelicSeries