GEPHE SUMMARY

Gephebase Gene
B4GALT7 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^B4GALT7^#gephebase-summary-title)

GepheID
GP00002151

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
Friesian horse

Trait State in Taxon B
Dwarf friesian horse ; recessive

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?
Yes

Taxon A Description
Friesian breed

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?
Yes

Taxon B Description
Friesian breed

GENOTYPIC CHANGE

Generic Gene Name
B4GALT7

Synonyms
XGPT; EDSP1; XGPT1; EDSSLA; XGALT1; EDSSPD1; UNQ748/PRO1478

String
9606.ENSP00000029410 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=9606.ENSP00000029410)

Sequence Similarities
Belongs to the glycosyltransferase 7 family.

GO - Molecular Function
GO:0030145 : manganese ion binding (https://www.ebi.ac.uk/QuickGO/term/GO:0030145)
GO:0003831 : beta-N-acetylglucosaminylglycopeptide beta-1,4-galactosyltransferase activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003831)

UniProtKB Homo sapiens
Q9UBV7 (http://www.uniprot.org/uniprot/Q9UBV7)

GenebankID or UniProtKB
()

GO:0008378 : galactosyltransferase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0008378)
GO:0046525 : xylosylprotein 4-beta-galactosyltransferase activity
(https://www.ebi.ac.uk/QuickGO/term/GO:0046525)

GO - Biological Process

GO:0005975 : carbohydrate metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0005975)
GO:0006029 : proteoglycan metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0006029)
GO:0006487 : protein N-linked glycosylation
(https://www.ebi.ac.uk/QuickGO/term/GO:0006487)
GO:0006464 : cellular protein modification process
(https://www.ebi.ac.uk/QuickGO/term/GO:0006464)
GO:0006024 : glycosaminoglycan biosynthetic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0006024)
GO:0030203 : glycosaminoglycan metabolic process
(https://www.ebi.ac.uk/QuickGO/term/GO:0030203)
GO:0048147 : negative regulation of fibroblast proliferation
(https://www.ebi.ac.uk/QuickGO/term/GO:0048147)
GO:0097435 : supramolecular fiber organization
(https://www.ebi.ac.uk/QuickGO/term/GO:0097435)

GO - Cellular Component

GO:0016021 : integral component of membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0016021)
GO:0000139 : Golgi membrane (https://www.ebi.ac.uk/QuickGO/term/GO:0000139)
GO:0005794 : Golgi apparatus (https://www.ebi.ac.uk/QuickGO/term/GO:0005794)
GO:0032580 : Golgi cisterna membrane
(https://www.ebi.ac.uk/QuickGO/term/GO:0032580)

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

-

Molecular Details of the Mutation

g.3,772,591C>T ; c.50G>A ; p.R17K ; last nucleotide of exon 1 and leads to a splicing deficiency of B4GALT7 transcripts ; All 29 dwarfs of which DNA was available were homozygous for the mutation . . . the 8 obligate carriers were heterozygous

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	-	-	-

Main Reference

Dwarfism with joint laxity in Friesian horses is associated with a splice site mutation in B4GALT7. (2016) (https://pubmed.ncbi.nlm.nih.gov/27793082)

Authors

Leegwater PA; Vos-Loohuis M; Ducro BJ; Boegheim IJ; van Steenbeek FG; Nijman IJ; Monroe GR; Bastiaansen JW; Dibbits BW; van de Goor LH; Hellinga I; Back W; Schurink A

Abstract

Inbreeding and population bottlenecks in the ancestry of Friesian horses has led to health issues such as dwarfism. The limbs of dwarfs are short and the ribs are protruding inwards at the costochondral junction, while the head and back appear normal. A striking feature of the condition is the flexor tendon laxity that leads to hyperextension of the fetlock joints. The growth plates of dwarfs display disorganized and thickened chondrocyte columns. The aim of this study was to identify the gene defect that causes the recessively inherited trait in Friesian horses to understand the disease process at the molecular level.

We have localized the genetic cause of the dwarfism phenotype by a genome wide approach to a 3Â Mb region on the p-arm of equine chromosome 14. The DNA of two dwarfs and one control Friesian horse was sequenced completely and we identified the missense mutation ECA14:g.4535550Câ€‰>â€‰T that cosegregated with the phenotype in all Friesians analyzed. The mutation leads to the amino acid substitution p.(Arg17Lys) of xylosylprotein beta 1,4-galactosyltransferase 7 encoded by B4GALT7. The protein is one of the enzymes that synthesize the tetrasaccharide linker between protein and glycosaminoglycan moieties of proteoglycans of the extracellular matrix. The mutation not only affects a conserved arginine codon but also the last nucleotide of the first exon of the gene and we show that it impedes splicing of the primary transcript in cultured fibroblasts from a heterozygous horse. As a result, the level of B4GALT7 mRNA in fibroblasts from a dwarf is only 2Â % compared to normal levels. Mutations in B4GALT7 in humans are associated with Ehlers-Danlos syndrome progeroid type 1 and Larsen of Reunion Island syndrome. Growth retardation and ligamentous laxity are common manifestations of these syndromes.

We suggest that the identified mutation of equine B4GALT7 leads to the typical dwarfism phenotype in Friesian horses due to deficient splicing of transcripts of the gene. The mutated gene implicates the extracellular matrix in the regular organization of chrondrocyte columns of the growth plate. Conservation of individual amino acids may not be necessary at the protein level but instead may reflect underlying conservation of nucleotide sequence that are required for efficient splicing.

Additional References

RELATED GEPHE

Related Genes

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

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS

@Splicing https://omia.org/OMIA002068/9796/