

GEPHE SUMMARY

	Gephebase Gene	GephelD
Twist2 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Twist2 "#gephebase-summary-title")	GP00002035	Main curator
Published	Entry Status	Courtier

PHENOTYPIC CHANGE

	Trait Category		
Morphology (https://www.gephebase.org/search-criteria?/and+Trait Category="Morphology">#gephebase-summary-title")	Trait		
Coloration (coat; white belt) (https://www.gephebase.org/search-criteria?/and+Trait=^Coloration+(coat;+white+belt)^#gephebase-summary-title)	Trait State in Taxon A		
Bos taurus	Trait State in Taxon B		
Bos taurus - white belt	Ancestral State		
Taxon A	Taxonomic Status		
Domesticated (https://www.gephebase.org/search-criteria?/and+Taxonomic Status="Domesticated">#gephebase-summary-title")			
Taxon A	Latin Name	Taxon B	Latin Name
Bos taurus (#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Bos+taurus">#gephebase-summary-title)		Bos taurus (#gephebase-summary-title">https://www.gephebase.org/search-criteria?/and+Taxon+and+Synonyms=^Bos+taurus">#gephebase-summary-title)	
cattle	Common Name	cattle	Common Name
Bos bovis; Bos primigenius taurus; cattle; bovine; cow; dairy cow; domestic cattle; domestic cow; Bos taurus Linnaeus, 1758; Bos Taurus	Synonyms	Bos bovis; Bos primigenius taurus; cattle; bovine; cow; dairy cow; domestic cattle; domestic cow; Bos taurus Linnaeus, 1758; Bos Taurus	Synonyms
species	Rank	species	Rank
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	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	Lineage
Bos (oxen, cattle) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9903)	Parent	Bos (oxen, cattle) - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9903)	Parent
9913 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9913)	NCBI Taxonomy ID	9913 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9913)	NCBI Taxonomy ID
No	is Taxon A an Infraspecies?	No	is Taxon B an Infraspecies?

GENOTYPIC CHANGE

	Generic Gene Name		
Twist2	Q9D030 (http://www.uniprot.org/uniprot/Q9D030)		UniProtKB Mus musculus
Dermo1; bHLHa39	Synonyms		GenebankID or UniProtKB
10090.ENSMUSP00000139531 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=10090.ENSMUSP00000139531)	String	0	
-	Sequence Similarities		
GO:0046983 : protein dimerization activity (https://www.ebi.ac.uk/QuickGO/term/GO:0046983)	GO - Molecular Function		
GO:0003700 : DNA-binding transcription factor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0003700)			
GO:0008134 : transcription factor binding (https://www.ebi.ac.uk/QuickGO/term/GO:0008134)			

GO:0003677 : DNA binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0003677>)
GO:0003682 : chromatin binding (<https://www.ebi.ac.uk/QuickGO/term/GO:0003682>)
GO:0019904 : protein domain specific binding
(<https://www.ebi.ac.uk/QuickGO/term/GO:0019904>)

GO - Biological Process

GO:0043066 : negative regulation of apoptotic process
(<https://www.ebi.ac.uk/QuickGO/term/GO:0043066>)
GO:0006357 : regulation of transcription by RNA polymerase II
(<https://www.ebi.ac.uk/QuickGO/term/GO:0006357>)
GO:0000122 : negative regulation of transcription by RNA polymerase II
(<https://www.ebi.ac.uk/QuickGO/term/GO:0000122>)
GO:0045892 : negative regulation of transcription, DNA-templated
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045892>)
GO:0008285 : negative regulation of cell proliferation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0008285>)
GO:0001649 : osteoblast differentiation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0001649>)
GO:0048701 : embryonic cranial skeleton morphogenesis
(<https://www.ebi.ac.uk/QuickGO/term/GO:0048701>)
GO:0030335 : positive regulation of cell migration
(<https://www.ebi.ac.uk/QuickGO/term/GO:0030335>)
GO:0043392 : negative regulation of DNA binding
(<https://www.ebi.ac.uk/QuickGO/term/GO:0043392>)
GO:0032720 : negative regulation of tumor necrosis factor production
(<https://www.ebi.ac.uk/QuickGO/term/GO:0032720>)
GO:0045668 : negative regulation of osteoblast differentiation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045668>)
GO:0044092 : negative regulation of molecular function
(<https://www.ebi.ac.uk/QuickGO/term/GO:0044092>)
GO:0061303 : cornea development in camera-type eye
(<https://www.ebi.ac.uk/QuickGO/term/GO:0061303>)
GO:0060325 : face morphogenesis (<https://www.ebi.ac.uk/QuickGO/term/GO:0060325>)
GO:0045638 : negative regulation of myeloid cell differentiation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0045638>)
GO:0010838 : positive regulation of keratinocyte proliferation
(<https://www.ebi.ac.uk/QuickGO/term/GO:0010838>)

GO - Cellular Component

GO:0005737 : cytoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005737>)
GO:0005654 : nucleoplasm (<https://www.ebi.ac.uk/QuickGO/term/GO:0005654>)
GO:0005634 : nucleus (<https://www.ebi.ac.uk/QuickGO/term/GO:0005634>)
GO:0005667 : transcription factor complex
(<https://www.ebi.ac.uk/QuickGO/term/GO:0005667>)
GO:0005730 : nucleolus (<https://www.ebi.ac.uk/QuickGO/term/GO:0005730>)

Presumptive Null

No (<https://www.gephbase.org/search-criteria?/and+Presumptive+Null=%No%#gephbase-summary-title>)

Molecular Type

Cis-regulatory (<https://www.gephbase.org/search-criteria?/and+Molecular+Type=%Cis-regulatory%#gephbase-summary-title>)

Aberration Type

Insertion (<https://www.gephbase.org/search-criteria?/and+Aberration+Type=%Insertion%#gephbase-summary-title>)

Insertion Size

10-100 kb

Molecular Details of the Mutation

quadruplication (CNV) of a 6 kb non-coding sequence located approximately 16 kb upstream of the TWIST2 gene

Experimental Evidence

Linkage Mapping (<https://www.gephbase.org/search-criteria?/and+Experimental+Evidence=%Linkage+Mapping%#gephbase-summary-title>)

Main Reference

A structural variant in the 5'-flanking region of the TWIST2 gene affects melanocyte development in belted cattle. (2017) (<https://pubmed.ncbi.nlm.nih.gov/28658273>)

Authors

Awasthi Mishra N; Drägergemüller C; Jagannathan V; Keller I; Wägner D; Bruggmann R; Beck J; Schätzl E; Brenig B; Demmel S; Moser S; Signer-Hasler H; Piekkowska-Schelling A; Schelling C; Sande M; Rongen R; Rieder S; Kelsh RN; Mercader N; Leeb T

Abstract

Belted cattle have a circular belt of unpigmented hair and skin around their midsection. The belt is inherited as a monogenic autosomal dominant trait. We mapped the causative variant to a 37 kb segment on bovine chromosome 3. Whole genome sequence data of 2 belted and 130 control cattle yielded only one private genetic variant in the critical interval in the two belted animals. The belt-associated variant was a copy number variant (CNV) involving the quadruplication of a 6 kb non-coding sequence located approximately 16 kb upstream of the TWIST2 gene. Increased copy numbers at this CNV were strongly associated with the belt phenotype in a cohort of 333 cases and 1322 controls. We hypothesized that the CNV causes aberrant expression of TWIST2 during neural crest development, which might negatively affect melanoblasts. Functional studies showed that ectopic expression of bovine TWIST2 in neural crest in transgenic zebrafish led to a decrease in melanocyte numbers. Our results thus implicate an unsuspected involvement of TWIST2 in regulating pigmentation and reveal a non-coding CNV underlying a captivating Mendelian character.

Additional References

Remapping of the belted phenotype in cattle on BTA3 identifies a multiplication event as the candidate causal mutation. (2018) (<https://pubmed.ncbi.nlm.nih.gov/29980171>)

A shared 336 kb haplotype associated with the belt pattern in three divergent cattle breeds. (2010) (<https://pubmed.ncbi.nlm.nih.gov/19917047>)

RELATED GEPHE

Related Genes

11 (Agouti, coatomer protein complex subunit alpha (COPA), Kit (type III receptor protein-tyrosine kinase), Kit ligand, MC1R, Melanophilin (MLPH), Microphthalmia-associated

No matches found.

EXTERNAL LINKS

COMMENTS

<https://omia.org/OMIA001469/9913/> @CNV