GEPHE SUMMARY

Gephebase Gene

BMP15 (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^BMP15^#gephebase-summary-title)

GepheID

GP00002156

Entry Status

Published

Main curator

Martin

PHENOTYPIC CHANGE

Trait Category

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

Trait

Fertility (increased ovulation rate) (https://www.gephebase.org/search-criteria?/and+Trait=^Fertility (increased ovulation rate)^#gephebase-summary-title)

Trait State in Taxon A

Ovis aries

Trait State in Taxon B

Ovis aries - Lacaune - High fertility in heterozygotes

Ancestral State

Taxon A

Taxonomic Status

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

Taxon A

Latin Name

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

Common Name

sheep

Synonyms

Ovis ammon aries; Ovis orientalis aries; Ovis ovis; sheep; domestic sheep; lambs; wild sheep; Ovis aries 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; Artiodactyla; Ruminantia; Pecora; Bovidae; Caprinae; Ovis

Parent

Ovis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9935)

NCBI Taxonomy ID

9940 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9940)

is Taxon A an Infraspecies?

No

Taxon B

Latin Name

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

Common Name

sheep

Synonyms

Ovis ammon aries; Ovis orientalis aries; Ovis ovis; sheep; domestic sheep; lambs; wild sheep; Ovis aries 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; Artiodactyla; Ruminantia; Pecora; Bovidae; Caprinae; Ovis

Parent

Ovis () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9935)

NCBI Taxonomy ID

9940 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 9940)

is Taxon B an Infraspecies?

Yes

Taxon B Description

Ovis aries - Lacaune

GENOTYPIC CHANGE

Generic Gene Name

Bmp15

Synonyms

Bmp-15; C86824; C87336; GDF-9B; AU015375; AU018861; AU021453; Gdf9b

String

10090.ENSMUSP00000024049 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier=10090.ENSMUSP00000024049)

Sequence Similarities

Belongs to the TGF-beta family.

GO - Molecular Function

GO:0005125 : cytokine activity (https://www.ebi.ac.uk/QuickGO/term/GO:0005125)
GO:0008083 : growth factor activity (https://www.ebi.ac.uk/QuickGO/term/GO:0008083)
GO:0005160 : transforming growth factor beta receptor binding (https://www.ebi.ac.uk/QuickGO/term/GO:0005160)

UniProtKB Mus musculus

Q9Z0L4 (http://www.uniprot.org/uniprot/Q9Z0L4)

GenebankID or UniProtKB

AHB23439 (https://www.ncbi.nlm.nih.gov/nuccore/AHB23439)

GO - Biological Process

GO:0045893 : positive regulation of transcription, DNA-templated (https://www.ebi.ac.uk/QuickGO/term/GO:0045893)
GO:0001541 : ovarian follicle development (https://www.ebi.ac.uk/QuickGO/term/GO:0001541)
GO:0030509 : BMP signaling pathway (https://www.ebi.ac.uk/QuickGO/term/GO:0030509)
GO:0048468 : cell development (https://www.ebi.ac.uk/QuickGO/term/GO:0048468)
GO:0060016 : granulosa cell development (https://www.ebi.ac.uk/QuickGO/term/GO:0060016)
GO:0010862 : positive regulation of pathway-restricted SMAD protein phosphorylation (https://www.ebi.ac.uk/QuickGO/term/GO:0010862)
GO:0042981 : regulation of apoptotic process (https://www.ebi.ac.uk/QuickGO/term/GO:0042981)
GO:0043408 : regulation of MAPK cascade (https://www.ebi.ac.uk/QuickGO/term/GO:0043408)
GO:0060395 : SMAD protein signal transduction (https://www.ebi.ac.uk/QuickGO/term/GO:0060395)

GO - Cellular Component

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)

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

c.G>A p.C321Y missense nonconservative substitution ; in vitro studies showed that the C53Y mutation was responsible for the impairment of the maturation process of the BMP15 protein resulting in a defective secretion of both the precursor and mature peptide

Experimental Evidence

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

	Taxon A	Taxon B	Position
Codon	-	-	-
Amino-acid	Cys	Tyr	321

Main Reference

Mutations in an oocyte-derived growth factor gene (BMP15) cause increased ovulation rate and infertility in a dosage-sensitive manner. (2000) (https://pubmed.ncbi.nlm.nih.gov/10888873)

Authors

Galloway SM; McNatty KP; Cambridge LM; Laitinen MP; Juengel JL; Jokiranta TS; McLaren RJ; Luiro K; Dodds KG; Montgomery GW; Beattie AE; Davis GH; Ritvos O

Abstract

Multiple ovulations are uncommon in humans, cattle and many breeds of sheep. Pituitary gonadotrophins and as yet unidentified ovarian factors precisely regulate follicular development so that, normally, only one follicle is selected to ovulate. The Inverdale (FecXI) sheep, however, carries a naturally occurring X-linked mutation that causes increased ovulation rate and twin and triplet births in heterozygotes (FecXI/FecX+; ref. 1), but primary ovarian failure in homozygotes (FecXI/FecXI; ref. 2). Germ-cell development, formation of the follicle and the earliest stages of follicular growth are normal in FecXI/FecXI sheep, but follicular development beyond the primary stage is impaired. A second family unrelated to the Inverdale sheep also has the same X-linked phenotype (Hanna, FecXH). Crossing FecXI with FecXH animals produces FecXI/FecXH infertile females phenotypically indistinguishable from FecXI/FecXI females. We report here that the FecXI locus maps to an orthologous chromosomal region syntenic to human Xp11.2-11.4, which contains BMP15, encoding bone morphogenetic protein 15 (also known as growth differentiation factor 9B (GDF9B)). Whereas BMP15 is a member of the transforming growth factor beta (TGFbeta) superfamily and is specifically expressed in oocytes, its function is unknown. We show that independent germline point mutations exist in FecXI and FecXH carriers. These findings establish that BMP15 is essential for female fertility and that natural mutations in an ovary-derived factor can cause both increased ovulation rate and infertility phenotypes in a dosage-sensitive manner.

Additional References

RELATED GEPHE

Related Genes

3 (B4GALNT2, BMP receptor IB (BMPRIB), GDF9) (https://www.gephebase.org/search-criteria?/or+Taxon ID=^9940^/and+Trait=Fertility/and+groupHaplotypes=true#gephebase-summary-title)

Related Haplotypes

9 (https://www.gephebase.org/search-criteria?/or+Gene Gephebase=^BMP15^/and+Taxon ID=^9940^/or+Gene Gephebase=^BMP15^/and+Taxon ID=^9940^#gephebase-summary-title)

EXTERNAL LINKS

COMMENTS

Heterozygote shows phenotype; homozygote results in ovarian failure ; @HeterozygoteAdvantage @SexualTrait https://omia.org/OMIA001357/9940/