

Introduction Module

1. On which mouse chromosome would you find the vang-like 2 gene (*Vangl2*)

- a) Chr 1
b) Chr 4
c) Chr 10
d) Chr 19
e) Chr X

Gene positional coordinates can be found in several places in MGI, but notably within the “**Sequence Map**” row on Gene Detail pages. Gene detail pages can be accessed via the Quick Search.

Vangl2
Gene Detail

Symbol Vangl2
Name vang-like 2 (van gogh, Drosophila)
ID MGI:2135272

Synonyms CS30001F03Rik, loop-tail, Lpp1, Ltap, mKIAA1215, ska17, ska, strabismus

Feature Type protein coding gene

Genetic Map
Chromosome 1
79.54 cM
[Detailed Genetic Map ± 1 cM](#)
Mapping data(31)

Sequence Map
Chr1:172009960-172028444 bp, - strand
From VEGA annotation of GRCm38
Get FASTA | 27485 bp ± 0 kb flank
[VEGA Genome Browser](#) | [Ensembl Genome Browser](#) | [UCSC Browser](#) | [NCBI Map Viewer](#)

Vertebrate homology
HomoloGene:62161 [Vertebrate Homology Class](#)
1 human; 1 mouse; 1 rat; 1 chimpanzee; 1 rhesus macaque; 1 cattle; 1 chicken; 1 zebrafish
Protein SuperFamily: [Vang-like protein](#)
Gene Tree: [Vangl2](#)

Human homologs
Human Homolog VANGL2, VANGL planar cell polarity protein 2
NCBI Gene ID 57216
neXtProt AC NX_09ULK5
Human Synonyms LPP1, LTAP, STB1, STBM, STBM1
Human Chr (Location) 1q22-q23; chr1:160400574-160428678 (+) GRCh38
Disease Associations (13) [Diseases Associated with Human VANGL2](#)

Alleles and phenotypes
All alleles(22) : Targeted(12) Gene trapped(6) Spontaneous(1) Chemically induced(3)
Homozygous animals do not survive past birth. Developmental defects are seen in the nervous, cardiovascular, skeletal, vestibular, and respiratory systems. Kinked or looped tails are noted in heterozygotes with partial penetrance, along with a head wobble and some nervous system deficits.
Human Diseases Modeled Using Mouse Vangl2 (1) [Alleles Annotated to Human Diseases\(1\)](#) [Phenotype Images\(7\)](#)

Gene Ontology (GO) classifications
All GO classifications: (89 annotations)
Process anterior/posterior pattern specification, apical protein localization, ...
Component apical plasma membrane, basolateral plasma membrane, ...

2. How many phenotypic alleles have been described for *Vangl2*?

- a) 1
b) 3
c) 7
d) 14
→ e) 22

Phenotypic alleles are described on Gene Detail pages in the “**Alleles and Phenotypes**” row. For *Vangl2*, the hyperlinked number next to “**All alleles**” is 22. The hyperlinks reading 12, 6, 1 and 3 correspond to specific allele category subsets.

Alleles and phenotypes
All alleles(22) Targeted(12) Gene trapped(6) Spontaneous(1) Chemically induced(3)
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3. Has a mouse mutant of this gene been used to model a human disease? If yes, which one?

- a) No
→ b) Yes, Neural Tube Defects
c) Yes, Cancer
d) Yes, Alzheimer Disease
e) Yes, polydactyly

At the bottom of the Alleles and phenotypes row is an annotation for “**Human Diseases Modeled Using Mouse Vangl2 (1)**”. Clicking the hyperlinked number in brackets will generate a pop-up for **Human Disease Models Associates with Alleles of Mutant Vangl2** which indicates the specific disease associations(s) - in this case, Neural Tube Defects - along with hyperlinks to MGI’s corresponding Human Disease and Mouse Model page(s) and OMIM page(s).

Human Disease Models Associated with Alleles of Mouse Vangl2 Close X

Diseases listed here are those where a mutant allele of this gene is involved in a mouse genotype used as a model. This does not mean that mutations in this gene contribute to or are causative of the disease.

| Human Disease | OMIM ID |
|---------------------|---------|
| Neural Tube Defects | 182940 |

4. What category of allele is *Vangl2^{Lp-m1Jus}*?

- Reporter
- Gene trap
- Spontaneous
- Chemically induced (ENU)
- Targeted (null/knockout)

Go to the Phenotypic alleles summary by clicking the hyperlinked (22) next to **All Alleles**. Locate the allele symbol *Vangl2^{Lp-m1Jus}* in the first column, then look to the corresponding information found in the **Category** column. Allele generation type and attributes are also located in the **Mutation details** section of Allele Detail pages.

5. What are the mutation details for *Vangl2^{Lp-m1Jus}*?

- Exon 1 is floxed
- Exon 4 was targeted and replaced by a neomycin cassette
- A transversion mutation changing Asp255 to Glu
- A stop codon mutation truncating the protein at amino acid 410
- The entire gene was deleted

Specific information about an allele's construction can be found in the **Mutation details** row of Allele Detail pages. Click on the triangle toggle (▶) next to **Mutation description** to expand this section and reveal specifics, in this case, an Asp255Glu substitution. A J# will also appear indicating the original publication which describes the generation or characterization of the allele. Click on an allele symbol to go to the Allele Detail page.

6. Which of the following **nervous system** phenotypes have been observed in mice **homozygous** for *Vangl2^{Lp-m1Jus}*?

- craniorachischisis
- abnormal synapse morphology
- abnormal kidney morphology
- decreased Purkinje cell number
- no observed nervous system phenotypes

In MGI, phenotypes are annotated to genotypes, rather than alleles (which can have background dependence), or genes (where different alleles may have varied impacts). Find the *hm1* genotype which indicates homozygosity in the **Allele composition** column, click the triangle (▶) next to **nervous system** in the **Affected Systems** table to expand sub-terms and locate check marks in the column which corresponds to genotype *hm1*. Click on checks or column headers for a free text popup and references for each observation.

| Alleles and phenotypes | All alleles(22) | Targeted(12) | Gene trapped(6) | Spontaneous(1) | Chemically induced(1) |
|------------------------|--|--------------|-----------------|----------------|-----------------------|
| | Homozygous animals do not survive past birth. Developmental skeletal, vestibular, and respiratory systems. Kinked or looped penetrance, along with a head wobble and some nervous system phenotypes. | | | | |
| | Human Diseases Modeled Using Mouse <i>Vangl2</i> (1) Alleles Annotated | | | | |

?

Phenotypic Alleles

Query Results – Summary

Symbol

Vangl2

Name

vang-like 2 (van gogh, Drosophila)

ID

MGI:2135272

22 matching Alleles (1 Gene/Marker represented)

| Allele Symbol | Chr | Synonyms | Category | Abnormal Phenotypes Reported in these Systems | Human Disease Models |
|--|-----|---|-----------------------------|--|----------------------------|
| Gene: Allele Name | | | | | |
| Vangl2 ^{Lp} vang-like 2 (van gogh, Drosophila); loop tail (3) | 1 | looptail, Lp, lpt, Ltap ^{Lp} , Vangl2 ^{S464N} | Spontaneous | behavior, cardiovascular, craniofacial, digestive/alimentary, embryogenesis, growth/size, hearing/vestibular/ear, hematopoietic, homeostasis, limbs/digits/tail, mortality/aging, nervous system, other, reproductive, respiratory, skeleton, vision/eye | Neural Tube Defects 182940 |
| Vangl2 ^{Lp-m1Jus} vang-like 2 (van gogh, Drosophila); loop tail, mutation 1, Monica J Justice | 1 | | Chemically induced (ENU) | embryogenesis, growth/size, hearing/vestibular/ear, limbs/digits tail, nervous system | |
| Vangl2 ^{M1Yem} vang-like 2 (van gogh, Drosophila); mutation 1, Yangzhou University Comparative Medicine Center | 1 | | Chemically induced (ENU) | embryogenesis, growth/size, limbs/digits/tail, nervous system, vision/eye | |
| Vangl2 ^{Abx17} vang-like 2 (van gogh, Drosophila); skeletal/axial 17 | 1 | Lp ^{m2Jus} , skm ^{m17Jus} , Vangl2 ^{R259L} | Chemically induced (ENU) | embryogenesis, hearing/vestibular/ear, limbs/digits/tail, nervous system, reproductive, vision/eye | |

| Vangl2 ^{Lp-m1Jus} | | | | Your Input Welcome | | | | | | | | | | | | | | | | | | | | |
|---|---|---|--------------|--------------------|----------|---------------------|--------------------|--------------|-----|--|--------------------------------------|--|-----|---|--------------------------------------|--|-----|--|--|--|-----|---|--|--|
| Chemically induced Allele Detail | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomenclature Mutation origin Mutation description Expression Phenotypes Find Mice (IMSR) References | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomenclature | | Symbol: Vangl2^{Lp-m1Jus} Name: vang-like 2 (van gogh, Drosophila); loop tail, mutation 1, Monica J Justice MGI ID: MGI:1934175 Gene: Vangl2 Location: Chr1:172000960-172028444 bp, - strand Genetic Position: Chr1, 79.54 cM | | | | | | | | | | | | | | | | | | | | | | |
| Mutation origin | | Strain of Origin: (101/RI × C3H/RI)F1 | | | | | | | | | | | | | | | | | | | | | | |
| Mutation description | | Allele Type: Chemically induced (ENU) Mutation: Single point mutation Mutation details: A transversion point mutation that alters a T to an A at position 765. This mutation is predicted to change aspartate 255 to glutamine (p.70272) Inheritance: Semidominant | | | | | | | | | | | | | | | | | | | | | | |
| Phenotypes | | Key: hm homozygous ht heterozygous tg involves transgenes v phenotype observed cn conditional genotype cx complex: > 1 genome feature ot other: hemizygous, indeterminate, ... N normal phenotype Genotypes: <table><thead><tr><th>Genotype</th><th>Allelic Composition</th><th>Genetic Background</th><th>Cell Line(s)</th></tr></thead><tbody><tr><td>hm1</td><td>Vangl2^{Lp}/Vangl2^{Lp-m1Jus}</td><td>involves: 101/RI * C3H/RI * C57BL/6J</td><td></td></tr><tr><td>ht2</td><td>Vangl2^{Lp-m1Jus}/Vangl2⁺</td><td>involves: 101/RI * C3H/RI * C57BL/6J</td><td></td></tr><tr><td>ht3</td><td>Vangl2^{Lp}/Vangl2^{Lp-m1Jus}</td><td>involves: 101/RI * C3H/RI * C57BL/6J * LPT/LeJ</td><td></td></tr><tr><td>cx4</td><td>Dact1^{tm1.18Bnc}/Dact1^{tm1.18Bnc} Vangl2^{Lp-m1Jus}/Vangl2⁺</td><td>involves: 101/RI * 129 * C3H/RI * C57BL/6J</td><td></td></tr></tbody></table> Phenotypes: | | | Genotype | Allelic Composition | Genetic Background | Cell Line(s) | hm1 | Vangl2 ^{Lp} /Vangl2 ^{Lp-m1Jus} | involves: 101/RI * C3H/RI * C57BL/6J | | ht2 | Vangl2 ^{Lp-m1Jus} /Vangl2 ⁺ | involves: 101/RI * C3H/RI * C57BL/6J | | ht3 | Vangl2 ^{Lp} /Vangl2 ^{Lp-m1Jus} | involves: 101/RI * C3H/RI * C57BL/6J * LPT/LeJ | | cx4 | Dact1 ^{tm1.18Bnc} /Dact1 ^{tm1.18Bnc} Vangl2 ^{Lp-m1Jus} /Vangl2 ⁺ | involves: 101/RI * 129 * C3H/RI * C57BL/6J | |
| Genotype | Allelic Composition | Genetic Background | Cell Line(s) | | | | | | | | | | | | | | | | | | | | | |
| hm1 | Vangl2 ^{Lp} /Vangl2 ^{Lp-m1Jus} | involves: 101/RI * C3H/RI * C57BL/6J | | | | | | | | | | | | | | | | | | | | | | |
| ht2 | Vangl2 ^{Lp-m1Jus} /Vangl2 ⁺ | involves: 101/RI * C3H/RI * C57BL/6J | | | | | | | | | | | | | | | | | | | | | | |
| ht3 | Vangl2 ^{Lp} /Vangl2 ^{Lp-m1Jus} | involves: 101/RI * C3H/RI * C57BL/6J * LPT/LeJ | | | | | | | | | | | | | | | | | | | | | | |
| cx4 | Dact1 ^{tm1.18Bnc} /Dact1 ^{tm1.18Bnc} Vangl2 ^{Lp-m1Jus} /Vangl2 ⁺ | involves: 101/RI * 129 * C3H/RI * C57BL/6J | | | | | | | | | | | | | | | | | | | | | | |

| Key: hm homozygous ht heterozygous tg involves transgenes cn conditional genotype cx complex: > 1 genome feature ot other: hemizygous, indeterminate, ... N normal phenotype | | | | | |
|--|---|--|--------------|--|--|
| Genotypes: | | | | | |
| Genotype | Allele Composition | Genetic Background | Cell Line(s) | | |
| hm1 | Vangl2 ^{Lp} /Vangl2 ^{Lp-m1Jus} | involves: 101/RI * C3H/RI * C57BL/6J | | | |
| ht2 | Vangl2 ^{Lp-m1Jus} /Vangl2 ⁺ | involves: 101/RI * C3H/RI * C57BL/6J | | | |
| ht3 | Vangl2 ^{Lp} /Vangl2 ^{Lp-m1Jus} | involves: 101/RI * C3H/RI * C57BL/6J * LPT/LeJ | | | |
| cx4 | Dact1 ^{tm1.18Bnc} /Dact1 ^{tm1.18Bnc} Vangl2 ^{Lp-m1Jus} /Vangl2 ⁺ | involves: 101/RI * 129 * C3H/RI * C57BL/6J | | | |
| Phenotypes: | | | | | |
| Affected Systems | | | | | |
| show or hide all annotated terms | | | | | |
| digestive/alimentary system | | | | | |
| embryogenesis | | | | | |
| growth/size | | | | | |
| hearing/vestibular/ear | | | | | |
| limbs/digits/tail | | | | | |
| nervous system | | | | | |
| abnormal embryonic neuroepithelium morphology | | | | | |
| enlarged floor plate | | | | | |
| open neural tube | | | | | |
| craniorachischisis | | | | | |
| abnormal forebrain development | | | | | |
| renal/urinary system | | | | | |
| View | | | | | |
| open neural tube (J:68823) • E15.5 mutants show a malformed neural tube that is persistently open from midbrain to tail | | | | | |
| craniorachischisis (J:68823) abnormal forebrain development (J:68823) • malformed forebrain at E10.5 | | | | | |

12. Using the **Phenotypes, Alleles & Diseases Query** form, how many targeted alleles have been annotated to *craniorachischisis*?

Hint: prior to May 22nd “Categories: targeted (all)”, after May 22nd, “Categories: Generation Method: Targeted”

- a) 1
- b) 3
- c) 13
- d) 15
- e) 35

The **Phenotypes, Alleles and Diseases Query** form can be accessed through the options on the **Search** drop down menu, or from the **Phenotypes** (see tab) home page (partially hidden).

On this query form, type “craniorachischisis” into the **Phenotype/Disease** box. Leave the second section (“**Nomenclature & genome location**”) blank in this case, but selecting options here can be used to restrict your list, either by genes/alleles which share text similarity (e.g. certain gene families, or lab codes for alleles), or to markers within a defined genomic region.

In the **Categories** section, you can apply filters to select **Generation Method(s)**, **Allele attribute(s)** and mutant **Collections**. A link in the help documentation at the top of the page (see question mark icon) provides definitions for each of these terms. Multiple selections can be made if desired, but to answer question 6 above, simply select “**Targeted**” in “**Generation Method**”. Click **Search** to execute the query.

The **Phenotypes, Alleles and Disease Models Search** returns a table listing the alleles that match your selected parameters. Look to the count in the top-right corner of the page, or tally the number of rows, which should come to 15.

For any questions, please contact:

mgi-help@jax.org

Search for a phenotype term to find relevant mutant genotypes.

Search for a phenotype term to find relevant mutant genotypes.

Phenotypes, Alleles & Disease Models Search

You searched for... Phenotypes/Diseases: including text **craniorachischisis** searching HP terms, synonyms, IDs, and notes, disease terms, symptoms and QTLs

AND Generation Method: any of [Targeted]

Export:

| Allele Symbol | Chr | Synonyms | Category | Abnormal Phenotypes Reported in these Systems | Human Disease Models |
|---------------------------------------|-----|---|--------------------------|---|--|
| Csk2a^{tm126} | 2 | CK2alpha | Targeted (Null/knockout) | cardiovascular, craniofacial, embryogenesis, growth/size, hearing/vestibular/ear, homeostasis, limbs/digits/tail, mortality/aging, muscle, nervous system, pigmentation, vision/eye | |
| Dact1^{tm186} | 12 | Dact1 ^{tm186} | Targeted (Null/knockout) | cardiovascular, digestive/alimentary, embryogenesis, limbs/digits/tail, mortality/aging, nervous system, renal/urinary, reproductive, skeleton | |
| Dvl1^{tm146} | 4 | Dvl1 ^{tm146} , Dvl1 ^{del131-225} | Targeted (Null/knockout) | behavior, nervous system | |
| Dvl2^{tm146} | 11 | Dvl2 | Targeted (Null/knockout) | cardiovascular, embryogenesis, homeostasis, limbs/digits/tail, mortality/aging, nervous system, skeleton | Transposition of the Great Arteries, Dextro-Looped 1, DTGA1 608808 |
| Dvl3^{tm146} | 16 | dishevelled 3, dsh homolog (Drosophila); targeted mutation 1, Anthony Wynshaw-Boris | Targeted (Null/knockout) | cardiovascular, hearing/vestibular/ear, homeostasis, mortality/aging, nervous system, respiratory, skeleton | |
| Fgf10^{tm256} | 8 | Fgf10 ^{tm256} | Targeted | cardiovascular, embryogenesis, growth/size, | |