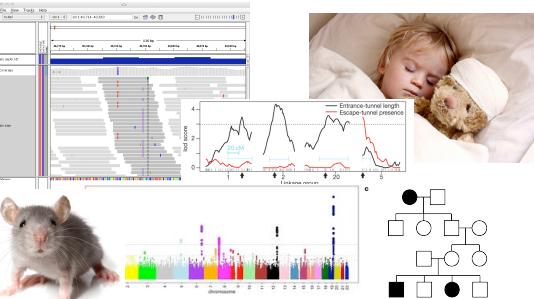




## The Human-Mouse: Disease Connection in MGI

Short Course Bioinformatics Workshops  
July 2014

### Connecting Mouse Models to Human Disease

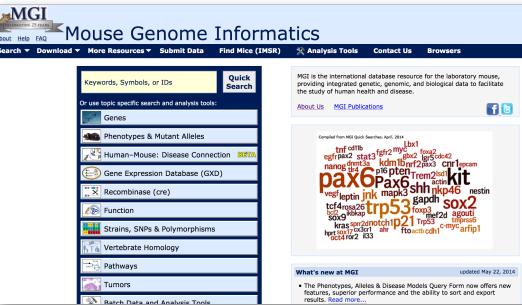


### HMDC in a Nutshell



- Search for mouse models by
  - gene symbol (mouse or human)
  - exome results (VCF file)
  - genome locations
  - key words
- Quick access to phenotype and disease annotations, references, mouse model availability

### Mouse Genome Informatics



<http://www.informatics.jax.org>

**Human-Mouse: Disease Connection**

Relating human diseases and mouse models

**Search by genes**

Search by genome locations

Search by disease or phenotype terms

Upload a VCF File

**Spotlight on mouse models of human disease**

Human T-Cell Immunodeficiency, Congenital Alopecia, and Nail dystrophy (OMIM: 601703)

Introduction to Mouse Genetics

Glossary of Terms

## Search by Gene Symbol

**Search by genes**

Gja8  
Mapk10  
Rspn9  
Il20ra  
Jak3  
Frg1

**Search by genome locations**

Ex: Chr12:30000000-100000000

Need to convert genome build? Use this [converter tool](#).

**Search by disease or phenotype terms**

Ex: diabetes, 105830

Select from autocomplete or continue typing. Use quotes for exact match.

GO  
Reset  
BETA

## View associated gene, phenotype and disease results

Gene Homologs x Phenotypes/Diseases

Genes (21) Diseases (5)

Legend: █ - Terms are annotated to genes in **human**. Darker colors indicate [more annotations](#). N - No abnormal phenotype observed.

NOTE: Searching by phenotype/disease term restricts the gene results based on the search term. Search by gene or genome location for the complete phenotype profile of gene mutations. [More...](#)

		Mammalian (mouse) Phenotypes										Human disease (OMIM)								
		behavioral	cardiovascular	cellular	depressive	digestive	immune	metabolic	neurological	reproductive	skin	urinary	blood	ear	central	digestive	endocrine	immune	metabolic	neurological
Human Gene	Mouse Gene	Gja8	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Il20ra	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Mapk10	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Frg1	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Rspn9	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Gja8	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Il20ra	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Mapk10	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

Aspects of the system are reported to show a normal phenotype. Indicates phenotype varies with strain background.

		Mouse Genotype										Human								
		abnormal behavior morphology	decreased leukocyte cell number	increased leukocyte cell number	increased neutrophil cell number	increased neutrophil cell number	abnormal dendritic cell morphology	increased dendritic cell differentiation	decreased lymphocyte morphology	decreased neutrophil cell number	decreased T cell number									
Human Gene	Mouse Genotype	Jak3 <sup>tm1</sup> /Jak3 <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	
		Jak3 <sup>tm1</sup> ps <sup>tm1</sup> /Jak3 <sup>tm1</sup> ps <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> fl <sup>tm1</sup> /Jak3 <sup>tm1</sup> fl <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> lbp <sup>tm1</sup> /Jak3 <sup>tm1</sup> lbp <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> Ths <sup>tm1</sup> Ths <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> Ths <sup>tm1</sup> Ths <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> Ths <sup>tm1</sup> Ths <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> Ths <sup>tm1</sup> Ths <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> Ths <sup>tm1</sup> Ths <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
		Jak3 <sup>tm1</sup> Ths <sup>tm1</sup> Ths <sup>tm1</sup>	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

### Disease associations

**Data for GJA8, Gja8 and Cataract**

Mouse Genotype	Cataract, Multiple Types, C-
Gja8 <sup>No2</sup> /Gja8 <sup>No2</sup>	
Gja8 <sup>R205G</sup> /Gja8 <sup>R205G</sup>	
Gja8 <sup>tm1Paul</sup> /Gja8 <sup>tm1Paul</sup>	
Gja8 <sup>No2</sup> /Gja8 <sup>+</sup>	
<b>Human Gene</b>	
<b>GJA8</b>	

**Click to modify search**

**Results**  
You searched for:  
Genes matching [Gja8 Mapk10 Rspn9 Il20ra Frg1 Jak3]

Gene Homologs x Phenotypes/Diseases    Genes (21)    Diseases (5)

### Tabs for Genes & Diseases information

**Filter grid by phenotype and gene (select what you want to keep)**

Gene Homologs x Phenotypes/Diseases    Genes (21)    Diseases (5)

Legend: N - Term are annotated to genes in human/mouse. Darker colors indicate more annotations.

NOTE: Searching by phenotype/disease term restricts the gene results based on the search term. Search by gene or genomic location for the complete phenotype profile of gene mutations. [More...](#)

Human Gene	Mouse Gene	Behavior/mentality	Cardiovascular system	Digestive system	Endocrine/lipid	Immune/inflammatory system	Integumentary system	Metabolic/stabolism	Neurological system	Reproductive system	Respiratory system	Stomach system	Urinary system	Cataract	Ciliary Dyskinesia, Primary	Faciocutaneous Muscular -	Severe Combined Immunodeficie-
GJA8	Gja8																
IL20RA	I20ra																
JAK3	Jak3																
MAPK10	Mapk10																
Tg(ACTA1-Frg1)highRotu																	
Tg(ACTA1-Frg1)lowRotu																	
Tg(ACTA1-Frg1)mediRotu																	
FRG1	Frg1																
RSPH9	Rspn9																

Apply Filters: Retain selected columns

Genes tab: References and mouse models

References in MGI    Mice With Mutations In this Gene (IMSR)

Organism: Gene Symbol: FRG1

All Mouse: 31    5

All Mouse: 77    Disease Relevant: 3 7

Immodeficiency, Autosomal Reccessive, T Cell Negative, B Cell Positive, NK Cell Positive, hematopoietic system, immune system, monocyte/macrophage, All Mouse: 113 22

5

6

### IMSR = International Mouse Strain Resource

[International Mouse Strain Resource \(IMSR\)](#)

Search for:  Search Reset Show Options

You searched for: [ES Cell, embryo, live, ovaries, sperm]  
Showing items 1 - 5 of 5

N	Strain Name	Synonyms	Status	Repository	Mutation Types	Aliases	Genes	Strain Types
?	C57BL/6N-AFg1 <sup>TM1Wkmc</sup> mp <sub>1</sub>	ES Gaf	WT16	Targeted mutation	Frg <sup>tm1Wkmc</sup> mp <sub>1</sub>	Frg <sup>tm1Wkmc</sup> mp <sub>1</sub>	Frg <sup>tm1Wkmc</sup> mp <sub>1</sub>	mutant strain
?	C57BL/6N-AFg1 <sup>TM1Wkmc</sup> mp <sub>1</sub>	ES Gaf	WT16	Targeted mutation	Frg <sup>tm1Wkmc</sup> mp <sub>1</sub>	Frg <sup>tm1Wkmc</sup> mp <sub>1</sub>	Frg <sup>tm1Wkmc</sup> mp <sub>1</sub>	mutant strain
?	C57BL/6N-Frg1 <sup>TM1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	ES Gaf	TGIM	Other	gene trap	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	unclassified
?	AGout ES cell line	ES Gaf	Other	gene trap	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	unclassified
?	SGTR ES cell line	ES Gaf	MWRC	Other	gene trap	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	unclassified
?	CD112 <sup>mp</sup> <sub>1</sub>	ES Gaf	Other	gene trap	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	Frg <sup>tm1Wkmc</sup> WT16 <sup>mp</sup> <sub>1</sub>	unclassified

[www.findmice.org](http://www.findmice.org)

### Human Disease and Mouse Model Detail

Human Disease: Cataract 1, Multiple Types; CTRCT1  
OMIM ID: 116200

Synonyms: Cataract; Cataract 1, Multiple Types, with or without Microcornea; Cataract, Duffy-Linked; Cataract, Zonular Pulverulent, 1; CZP1; C2P; CAEL

View all mouse models: View ALL (4) mouse models for this human disease.

Gene and mouse models: Mutations in human and/or mouse homologs are associated with this disease

Gene: **Gja8\*** is associated with the disease in this species

Mouse Homologs | Human Homologs | Mouse Models | Mouse : Human Homology Class

References: Disease References using Mouse Models (1)

In this case both the mouse gene and human ortholog are associated with the Cataract 1 disease.

### Diseases tab: Disease and mouse model details

[Gene Homologs x Phenotypes/Diseases](#) [Genes \(21\)](#) [Diseases \(5\)](#)

Export: Text File

Disease	OMIM ID	Mouse Models	Associated Mouse Genes	Associated Human Genes	References using Mouse Models
Cataract 1, Multiple Types; CTRCT1	116200	4	Gja8	GJA8	<a href="#">3</a>
Ciliopathy, Primary, 13	612650			RSPH9	
Facioscapulohumeral Muscular Dystrophy 1; FSHD1	158900	3	Large, Tg <sup>(ACTA1-Frg1)highRot</sup> , Tg <sup>(ACTA1-Frg1)medRot</sup> , Tg <sup>(Dux4)FTap</sup>	DUX4, FRG1, FSHMD1A	<a href="#">4</a>
Severe Combined Immunodeficiency, Autosomal Recessive, T Cell-Negative, B Cell-Positive, NK Cell-Negative	600802			JAK3	
Severe Combined Immunodeficiency, Autosomal Recessive, T Cell-Negative, B Cell-Positive, NK Cell-Positive	608971	6	Coro1a, Jak3	IL7R, PTPRC	<a href="#">3</a>

<< first < prev 1 next > last >> 250

Showing results(s) 1 - 5 of 5

### Human Disease and Mouse Model Detail

Human Disease: Severe Combined Immunodeficiency, Autosomal Recessive, T Cell-Negative, B Cell-Positive, NK Cell-Positive  
OMIM ID: 608971

Synonyms: SCID, Autosomal Recessive, T Cell-Negative, B Cell-Positive, NK Cell-Positive; Severe Combined Immunodeficiency

View all mouse models: View ALL (6) mouse models for this human disease.

Gene and mouse models: Mutations in human and/or mouse homologs are associated with this disease

Gene: **Gja8\*** is associated with the disease in this species

Mouse Homologs | Human Homologs | Mouse Models | Mouse : Human Homology Class

Coro1a\* CORO1A View 4 models 1:1 Homology

Jak3\* JAK3 View 2 models 1:1 Homology

Il7r\* IL7R\* View 2 models 1:1 Homology

Ptprc\* PTPRC\* View 2 models 1:1 Homology

In this case different mouse and human genes are associated with the disease.

### Search by genes in VCF files

**Search by genes**

Ex: `Bmp4, Pax*, NM_013627`

Enter symbols, names or IDs. Use \* for wildcard.

Upload Genes File (.txt):  No file selected.

**Search by genome locations**

Human(GRCh38)  Mouse(GRCm38)

**Search by disease or phenotype terms**

 Processing file and caching data matches. Please wait.

complete or continue for exact match.

**GO** **Reset** **BETA**

An example vcf file is available on the github site

**Results**

You searched for: Human locations matching [file=Pfeiffer.vcf]

Gene Homologs x Phenotype/Diseases | Genes (1741) | Diseases (263)

Legend: Terms are annotated to genes in Human Disease colors indicate more annotation.

NOTE: Search for gene or phenotype terms restricts the gene results based on the search term. Search by gene or genome location for the complete phenotype profile of gene mutations. [More...](#)

Human Gene	Mouse Gene	Phenotype/Disease
PTEN	PTEN	Rare
REST	Rest	Ubiquitous
UBR4B	Ubr4b	Ubiquitous
CASP2B	Casp2b	Caspase
NBL1	Nbl1	Ubiquitous
PTENP1	PTENP1	Ubiquitous
EPF4C3	EPF4c3	Ubiquitous
D2Z2A1	D2z2a1	Ubiquitous

**Search by genes in VCF files**

**Search by genes**

Ex: `Bmp4, Pax*, NM_013627`

Enter symbols, names or IDs. Use \* for wildcard.

Upload Genes File (.txt):  No file selected.

**Search by genome locations**

Human(GRCh38)  Mouse(GRCm38)

**Search by disease or phenotype terms**

VCF file successfully processed.

- 2416 Coordinates Ignored
- 33293 Rows Ignored Due to Non-Empty ID Column
- 0 Rows Ignored Due to FILTER Other Than 'PASS'
- 1634 Genes Matched On Mouse Genome
- 1741 Genes Matched On Human Genome

5830

complete or continue for exact match.

**GO** **Reset** **BETA**

Please verify your organism selection before hitting "GO".

### Search terms can be combined

**Search by genome locations**

Human(GRCh37)  Mouse(GRCm38)

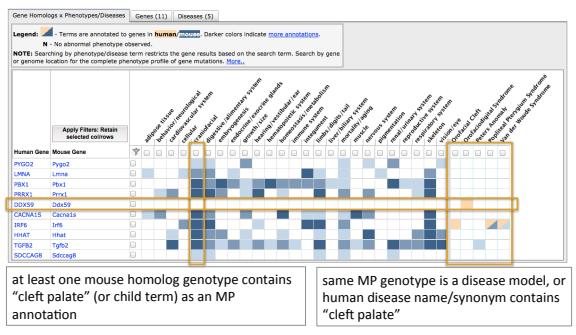
Chr1:15000000-250000000

**Search by disease or phenotype terms**

type "cleft palate" (matches whole)  
or  
type cleft palate (matches as two terms)  
or select  
cleft palate *Mammalian phenotype*  
or select

Cleft Palate; CP [Cleft palate isolated, CPI] OMIM

## Results for a search by both genome region and key word



## Your Turn !

- Use the HMDC for a disease, gene, or phenotype you are interested in or have heard about at the Short Course
  - There are also example VCF files available on the github site

## Summary

- The Human-Mouse: Disease Connection supports rapid access to disease and phenotype associations
- The HMDC is in Beta release
  - contact mgi-help@jax.org with questions and suggestions