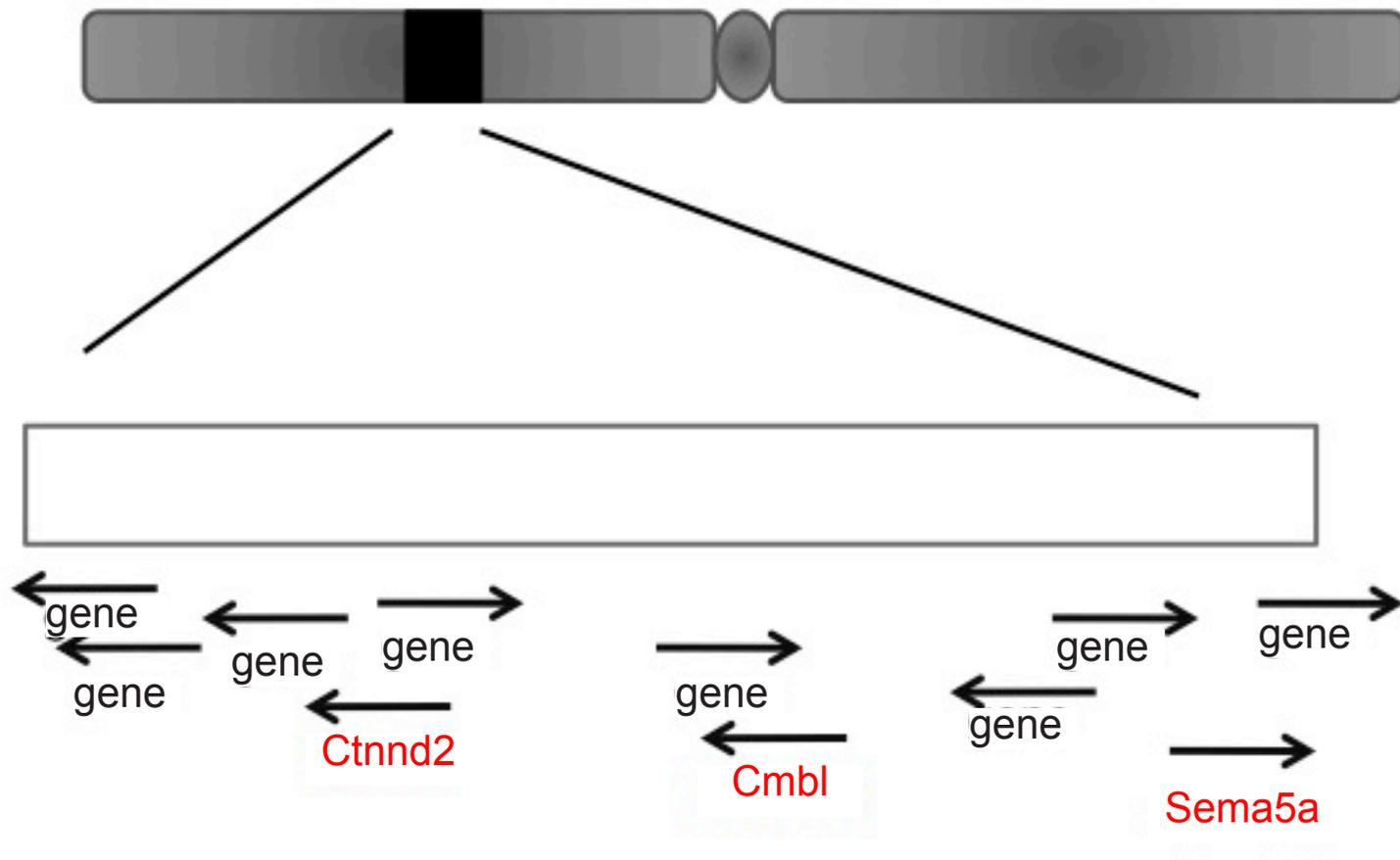


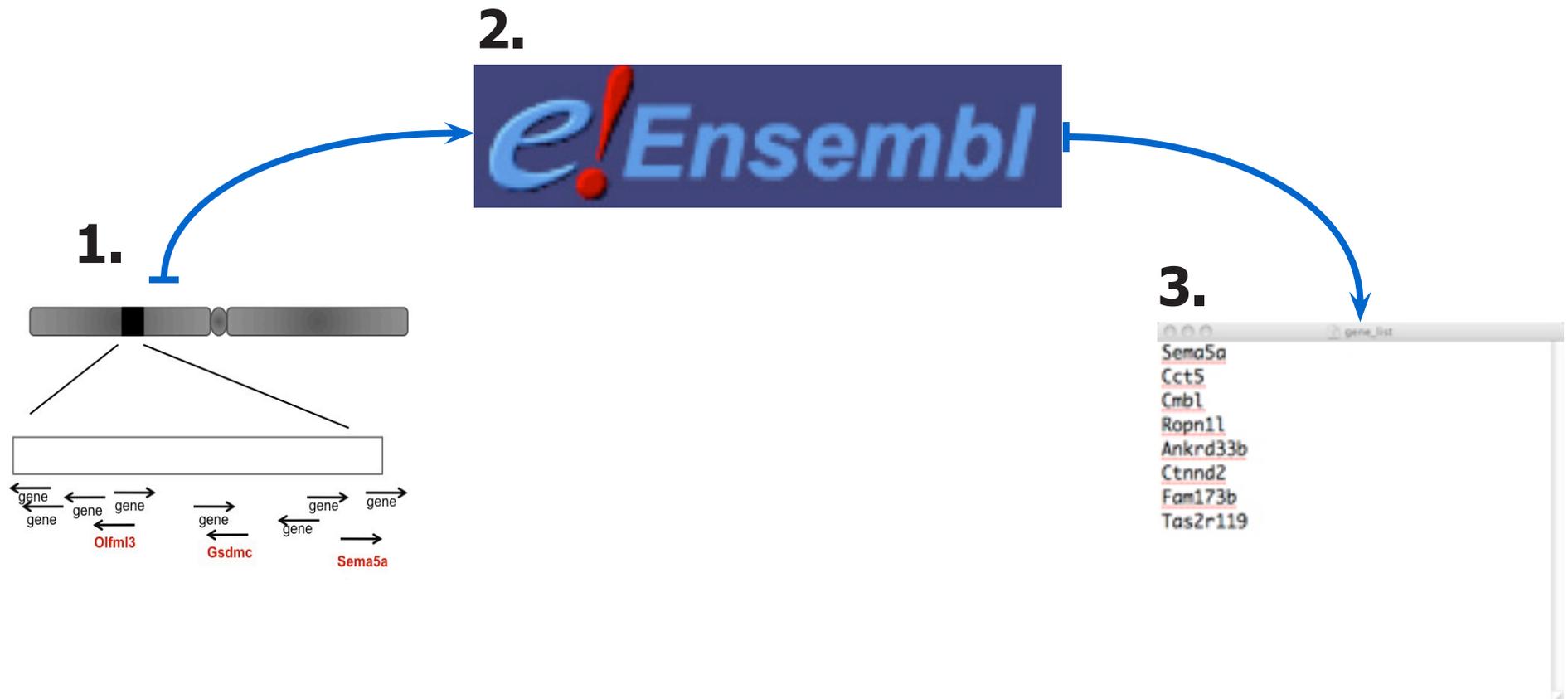
## **Demo 3: What genes, within a genetic interval, are likely to have disease-causing mutations?**

- Starting with a human genomic interval associated with a human disease
- Find mouse orthologs of human genes in this interval (e.g. using Ensembl BioMart)
- Search GUDMAP for the expression patterns of these genes to help select those that may be involved in the disease.

A region of the human genome is identified that contains the disease causing gene(s). Now we can search for the genes in this interval and get their mouse orthologs in order to search GUDMAP.



Use [Ensembl BioMart](#) to find human genes in the interval and their mouse orthologues; output the result as a list of gene symbols. This file can then be read directly into GUDMAP as a batch query. [Help with using Ensembl BioMart](#).



1. Start with known genomic interval
2. Use a utility like Emsembl to find genes within the interval
3. Output a list of the mouse orthologs of genes in the interval
4. Upload as a batch query into GUDMAP

From the [GUDMAP gene expression home page](#) click on 'Options' beside the Gene Query text box. This brings up the Gene Search Options.

Click 'Options'

The screenshot displays the GUDMAP Expression Database interface. At the top, the GUDMAP logo is centered, with a navigation bar containing links for Home, About GUDMAP, Gene Expression, Resources, Development, Disease, and Help. A 'LOGIN' link is located in the top right corner. On the left side, there is a vertical navigation menu with categories: Expression Database, Organ Summaries, Analysis, Annotate, Downloads, Labs, and Collections. The main content area is titled 'Expression Database' and is divided into two sections: 'Query' and 'Browse'. The 'Query' section includes a search box and a dropdown menu with 'Options' selected. A red box highlights the 'Gene Search Options' dialog, which contains a 'Search for:' dropdown set to 'GUDMAP entries', a 'Theiler Stage' dropdown set to 'ALL', and an 'Upload a batch query file:' section with a 'Browse...' button and an 'Upload' button. The 'Browse' section includes a grid of filters for Array, Theiler Stage, Gene, In situ, Transgenic, Series, Sample, Platform, RNA, Protein, and RNA and Protein. On the right side, there is a table with columns for Assay, Genes, and Entries, and a list of anatomical systems with corresponding icons: Lower urinary system, Early reproductive system, Male reproductive system, and Female reproductive system.

Assay	Genes	Entries
Close	177	7801
		259
		11
		6

System	Icon
Lower urinary system	
Early reproductive system	
Male reproductive system	
Female reproductive system	

Set the Gene Search Options to search for 'GUDMAP entries'. Then, in the lower half of the options, click on browse to locate the text file containing the list of genes you want to search for. Click 'Upload' to run the query. For help with running a batch query please refer to the [GUDMAP Query Help](#) pages.

Close

**Gene Search Options**

Search for:

Theiler Stage

1. Select 'GUDMAP entries'

Upload a [batch query](#) file:  
(Max 100 gene symbols)

2. Click 'Browse...'

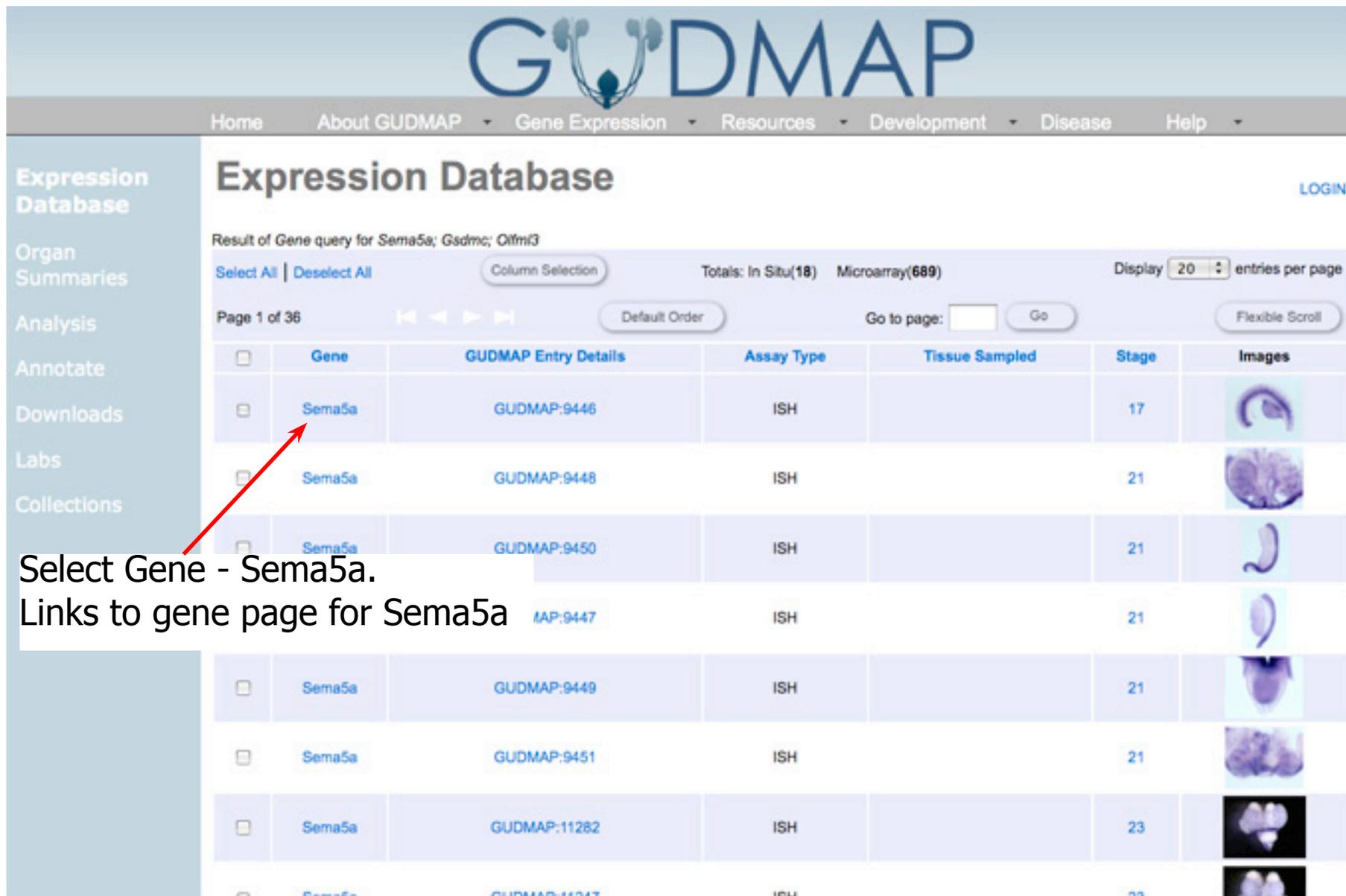
3. Locate text file

4. Click 'Upload' to perform batch query

gene\_list

Sema5a  
Cct5  
Cnbl  
Ropn11  
Ankrd33b  
Ctnd2  
Fam173b  
Tas2r119

The result of the query brings back a list of GUDMAP entries for each of the genes. Each entry represents an individual assay. By clicking on a gene symbol you can go to the gene page and get a summary of the expression data available for that gene.



The screenshot shows the GUDMAP Expression Database interface. The header includes the GUDMAP logo and navigation links: Home, About GUDMAP, Gene Expression, Resources, Development, Disease, and Help. A sidebar on the left contains links for Expression Database, Organ Summaries, Analysis, Annotate, Downloads, Labs, and Collections. The main content area displays the results of a gene query for Sema5a. The results are presented in a table with columns for Gene, GUDMAP Entry Details, Assay Type, Tissue Sampled, Stage, and Images. A red arrow points to the 'Sema5a' link in the first row of the table.

Result of Gene query for Sema5a; Gsdmc; Olfmi3

Select All | Deselect All    Column Selection    Totals: In Situ(18)    Microarray(689)    Display 20 entries per page

Page 1 of 36    Default Order    Go to page:    Go    Flexible Scroll

<input type="checkbox"/>	Gene	GUDMAP Entry Details	Assay Type	Tissue Sampled	Stage	Images
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:9446	ISH		17	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:9448	ISH		21	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:9450	ISH		21	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:9447	ISH		21	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:9449	ISH		21	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:9451	ISH		21	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:11282	ISH		23	
<input type="checkbox"/>	<a href="#">Sema5a</a>	GUDMAP:11247	ISH		23	

Select Gene - Sema5a.  
Links to gene page for Sema5a

Here, for example, is the [gene page for Sema5a](#). The Gene Strip gives a summary of the gene expression for Sema5a, with links to in situ expression and microarray expression entries. The in situ expression profile is split into six anatomical focus groups (coloured bars). To view in situ expression entries for Sema5a, annotated for the metanephros, click on the green bar in the 'In situ expression profile' box.

**GUDMAP**

Home About GUDMAP Gene Expression Resources Development Disease Help

**Expression Database** LOGIN

**Gene Details**

**Symbol** Sema5a

**Name** sema domain, seven thrombospondin repeats (type 1 and type 1-like), transmembrane domain (TM) and short cytoplasmic domain, (semaphorin) 5A

**Synonyms** M-Sema D, semF, Semaf, 9130201M22Rik

**Chromosome** Chromosome: 15  
Start: 32174568  
End: 32626096  
Genome Build: Ensembl, April 2007

Gene	Disease	Theiler Stage	In situ expression profile	In situ expression images	Microarray expression profile	Genesets
Sema5a	OMIM(0)	TS17-28				Genesets(n)

**Probes Linked to Gene** MGI:3550401  
maprobe:5500

**Links** MGI: MGI:107556  
Ensembl: ENSMUSG0000...  
UCSC: View probes for this gene in UCSC Browser  
OMIM: Search OMIM

**Gene Strip for Sema5a** →

Select green bar for ISH entries for metanephros

The result is a list of [in situ entries](#), for [Sema5a](#), where there is annotation on a structure within the [metanephros](#). Each entry represents a single assay and clicking on the ID in the GUDMAP Entry Details column takes you to that entry page. This contains all the annotation, expression details and images for that assay/entry.

The screenshot shows the GUDMAP Expression Database interface. The main header is "GUDMAP" with a logo. Below it is a navigation bar with links: Home, About GUDMAP, Gene Expression, Resources, Development, Disease, Help. The left sidebar contains a menu with "Expression Database" selected, and other options: Organ Summaries, Analysis, Annotate, Downloads, Labs, Collections. The main content area is titled "Expression Database > Metanephros" and includes a "LOGIN" link. Below the title, it says "In Situ submissions in *Metanephros* --Gene: Sema5a". There are controls for "Select All | Deselect All", "Apply Filter", "Column Selection", and "Display 20 entries per page". The table below shows five entries with columns: GUDMAP Entry Details, Gene, Theiller Stage, Lab, Specimen Type, Probe Name, Genotype, Probe Type, and Images. The entry "GUDMAP:9448" is circled in red. At the bottom, there are options to "Add to my Entries", "Replace my Entries", and "View my Entries (or other selections)", along with a "My Entries" section and two Venn diagram icons.

<input type="checkbox"/>	GUDMAP Entry Details	Gene	Theiller Stage	Lab	Specimen Type	Probe Name	Genotype	Probe Type	Images
<input type="checkbox"/>	GUDMAP:9451	Sema5a	21	Little	wholemount	MGI:3550401	Wild Type	RNA	
<input type="checkbox"/>	<b>GUDMAP:9448</b>	Sema5a	21	Little	wholemount	MGI:3550401	Wild Type	RNA	
<input type="checkbox"/>	GUDMAP:11282	Sema5a	23	McMahon	wholemount	maprobe:5500	Wild Type	RNA	
<input type="checkbox"/>	GUDMAP:11247	Sema5a	23	McMahon	wholemount	maprobe:5500	Wild Type	RNA	

To view the annotation of an entry in more detail, scroll down the entry page to Expression Mapping. The strength and pattern of expression is indicated by icons next to structural components in the ontology tree. Additional notes about the expression are also included.

### Expression Mapping

#### Expression Strengths Key:

- Present (unspecified strength)
- Present (strong)
- Present (moderate)
- Present (weak)
- Uncertain
- Not Detected

#### Expression Patterns Key:

- Graded
- Regional
- Spotted
- Ubiquitous
- Restricted
- Single cell
- Contains note

View annotated components as a list Show annotation under groups

Annotations Tree Menu

- mouse (EMAP:25786)
- organ system (EMAP:4908)
- visceral organ (EMAP:4909)
- urinary system (EMAP:5500)
- mesentery (EMAP:5502)
- metanephros (EMAP:5504)
- renal capsule (EMAP:27715)
- nephrogenic zone (EMAP:27722)
- renal vesicle (EMAP:27680)
- comma-shaped body (EMAP:27683)
- s-shaped body (EMAP:27757)
- capillary loop renal corpuscle (EMAP:27771)
- renal tubule (EMAP:27783)
- renal interstitium (EMAP:27793)
- developing vasculature of metanephros (EMAP:27796)
- ureteric trunk (EMAP:28406)
- pelvis (EMAP:5507)
- G early nephron GROUP (EMAP:5513)
- G primitive collecting duct group (EMAP:5508)
- G renal interstitium group (EMAP:31855)
- G nephrogenic zone GROUP (EMAP:31767)
- renal artery (EMAP:28379)
- renal vein (EMAP:28383)
- ureter (EMAP:5509)
- urothelium (EMAP:28585)
- ureteral mesenchyme (EMAP:28557)
- subepithelial layer (EMAP:28563)
- middle layer (EMAP:28568)
- outer layer (EMAP:28571)
- ureteral vasculature (EMAP:30852)
- allantois (EMAP:28549)
- urogenital sinus (EMAP:5517)
- urorectal septum (EMAP:5521)
- urogenital membrane (EMAP:5516)
- G developing vasculature of urinary system GROUP (EMAP:31769)
- G renal vasculature (EMAP:28458)
- reproductive system (EMAP:5522)

Group or group descendent. Groups provide alternative groupings of terms.

Expression **present** in:  
renal interstitium  
pelvis  
ureteral mesenchyme

- renal interstitium (EMAP:27793)
- developing vasculature of metanephros (EMAP:27796)
- ureteric trunk (EMAP:28406)
- pelvis (EMAP:5507)
- G early nephron GROUP (EMAP:5513)
- G primitive collecting duct group (EMAP:5508)
- G renal interstitium group (EMAP:31855)
- G nephrogenic zone GROUP (EMAP:31767)
- renal artery (EMAP:28379)
- renal vein (EMAP:28383)
- ureter (EMAP:5509)
- urothelium (EMAP:28585)
- ureteral mesenchyme (EMAP:28557)

Further down the entry page are the probe details. These assist in knowing which region of the gene was examined - this helps to know which Affy probe used in the microarray analysis is most similar for comparison purposes.

Probe	
Probe Name:	MGI:3550401
Clone Name:	RIKEN clone E030043B19
Sequence:	Fully Sequenced. Probe sequence spans from 4442 to 5393 of AK143026.1
Gene:	Symbol: Sema5a Name: sema domain, seven thrombospondin repeats (type 1 and type 1-like), transmembrane domain (TM) and short cytoplasmic domain, (semaphorin) 5A (MGI:107556)
5' primer sequence:	TGCACTTGGAGTGATTCTGC
3' primer sequence:	CACTGATACGACTCACTATAGGGGTGCCTACCCAGGCCTTAT
5' primer location:	4442
3' primer location:	5393
Origin of Clone used to make the Probe:	Strain: Tissue:
Probe Type:	RNA
Type:	antisense
Labelled with:	digoxigenin
Visualisation method:	alkaline phosphatase + NBT/BCIP
Stage:	TS21
Other Staging System:	
Strain:	CD1
Sex:	male
Genotype:	Wild Type
Specimen Preparation:	wholemount      Fixation Method: 4% paraformaldehyde Embedding:
Experiment Notes:	Male urogenital tract removed and upper urinary tract examined. 1 specimen examined. Experiment: WISH010807 Colour development for 180min. Control probe Wnt4 colour developed for 110min on TS21 whole urogenital tract.

Riken clone E030043B19

Primer locations  
5' 4442  
3' 5393

Probe details show which region of the gene was examined and hence what is the most similar Affy probe.

Back on the [gene page for Sema5a](#). The gene strip gives a summary of the gene expression for Sema5a, with links to in situ expression and microarray expression entries. Each block in the microarray expression profile indicates data for a different chip/platform. Clicking on one of these will take you to the [microarray expression profile of that chip/platform for Sema5a](#).

**GUDMAP**

Home About GUDMAP Gene Expression Resources Development Disease Help

## Expression Database

LOGIN

### Gene Details

**Symbol** Sema5a

**Name** sema domain, seven thrombospondin repeats (type 1 and type 1-like), transmembrane domain (TM) and short cytoplasmic domain, (semaphorin) 5A

**Synonyms** M-Sema D, semF, Semaf, 9130201M22Rik

**Chromosome** Chromosome: 15  
Start: 32174568  
End: 32626096  
Genome Build: Ensembl, April 2007

Gene	Disease	Theiler Stage	In situ expression profile	In situ expression images	Microarray expression profile	Genesets
Sema5a	OMIM(0)	TS17-28				Genesets(n)

**Probes Linked to Gene** MGI:3550401  
maprobe:5500

**Links** MGI: MGI:107556  
Ensembl: ENSMUSG00000022231  
UCSC: View probes for this gene in UCSC Browser  
OMIM: Search OMIM

Select microarray expression profile



## Summary

What genes, within a genetic interval, are like to have disease-causing mutations?

- Use an external utility to find mouse orthologs of human genes from in a genetic interval
- Search GUDMAP using a batch gene query
- Link to gene expression data from Gene Strip to find where expression is present
- Use information about gene expression from the GUDMAP database to shortlist candidates genes for further study