

GUDMAP



GenitoUrinary Development Molecular Anatomy Project

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About GUDMAP

The GenitoUrinary Development Molecular Anatomy Project (GUDMAP) is an open access online resource developed by a consortium of researchers working to provide the scientific and medical community with gene expression data, transgenic mice and tools to facilitate research and teaching. Initially GUDMAP focused on the murine urogenital system. Recently, GUDMAP has extended its efforts to include two new elements:

- Nociceptive GUDMAP (nGUDMAP) focuses on nociceptors and cell types associated with pain processing for the murine lower urinary tract and pelvic region.
- Human GUDMAP (hGUDMAP) extends the gene expression database to include data sets that annotate human bladder, urethra and kidney.

GUDMAP data includes: Large-scale in-situ hybridisation screens, 3D OPT data,

Schematics, Tutorials & Tissue Summaries

GUDMAP holds an extensive archive of high-quality schematics diagrams that illustrate different views of the developing mouse GU system

www.gudmap.org/Schematics/index.php

These **tutorials** supplement prior descriptions of GU organogenesis (Matt Kaufman) and enrich the GUDMAP Tissue Summary pages.



microarray gene expression data and sequencing data of the developing mouse genitourinary (GU) system. Expression data are annotated using a high-resolution **ontology** specific to the developing GU system.

GUDMAP Data

Summary 'gene-strip' (below) provides an overview of expression data available for each gene. Clickable links connect to in-situ data & images, disease/ phenotype associations and microarraydata.

Gene	Synonyms	Disease	Theiler Stage	Expression Profile	Expression Images	Microarray expression profile	RNA-SEQ
Krt5	Krt2-5, Tfip8, 3300001P10Rik	OMIM(6)	TS17-28		Y		View on UCS View on IGV

Images Bladder urothelium.	Expression Mapping	View apportated components as a list. Show apportation under process
Ser	Expression Strengths Key:	View annotated components as a list. Snow annotation under groups
1 m	Present (unspecified strength)	mouse (EMAP:25791)
Pladder urotholium	Present (strong)	Èr⊖organ system (EMAP:11160)
Bladder drottleildin.	Present (moderate)	D Ovisceral organ (EMAP:11161)
<u>\</u>	Present (weak)	D Ourinary system (EMAP:12246)
	(?) Uncertain	E: metanenhros (EMAP:12254)
Bladder urothelium.	(-) Not Detected	Orenal artery (EMAP:28375)
12	Expression Patterns Key:	Drenal vein (EMAP:28378)
	Homogeneous	Dureter (EMAP:12264)
Bladder urothelium.	Graded	E bladder (EMAP:12248)
Idr	Regional	empurothelium of bladder (EMAP:28606)
2/	Spotted	Terrina propria of bladder (EMAP:30093)
Epithelial layer of the urethra	a. Ubiquitous	Submucosa of bladder (EMAP:32393)
11	Restricted	Detrusor muscle of bladder (EMAP:28642)
11.	 Single cell 	🖶 🗍 serosa of bladder (EMAP:28666)
	Nerve Density:	adventitia of bladder (EMAP:28830)
Example of GUDMAP	Relative to Total:	Ovasculature of bladder (EMAP:26684)
In-Situ Entry	🔅 Maximum	
	Moderate	Ourethra of female (EMAP:28752)
(GUDMAP:20862),	🕚 Low	urethra of male (EMAP:12309)
displaying images	Relative to P0/Adult:	Ourorectal septum (EMAP:12273)
uspidying images	Increase, large	pelvic ganglion (EMAP:31647)
(above) and expression	 Increase, small 	G developing vasculature of urinary system GROUP (EMAP:31774)
manned on anatomy	Decrease, large	G renal atterial system (EMAP31440)
mapped on anatomy	 Decrease, small 	G renal venous system (EMAP:31454)
ontology (right)		E G nerves of urethra GROUP (EMAP:31810)

Database Statistics	23-Oct	-2015	
Assay Type	Entries	Genes	
All In Situ Hybridisation (ISH):	10766	3692	
Wholemount ISH (WISH):	7352	2896	
Section ISH (SISH):	3414	1437	
OPT ISH:	64	32	
Immunohistochemistry (IHC):	125	31	
Transgenic Reporters:	115	37	
Microarray:	461	-	
Sequencing:	246	-	

PLUR CUGS Primitive bladder (TS19-21) & TS28 / Adult Bladder E18 / P1 Bladder (TS22-28) cell types: Up2-Cfp Trp63 Krt5 Krt5-BC -++ undifferentiated epithelial cells (TS19-20) 😈 BL 🖓 + O cells (TS19-21) superficial cells (SC, TS22-28) intermediate cells (IC, TS21-28) Krt5-basal cells (Krt5-BC, TS23-28) Upk expression **Top:** Annotated sections of the bladder at TS20 Adult Male / TS28 Adult Male Acta2 Cdh1 Acta1 (12 dpc), TS21 (13 dpc), TS23 (15 dpc) and TS28 (adult). Middle: TS28 (adult) annotated section of the bladder with corresponding immunohistochemistry section. **Right:** TS28 (adult) annotated section of the male prostate with corresponding immunohistrochemistry section.

Novel Mouse Strains for Visualising, Isolating and Genetically Manipulating the GU System

Goals:

- To mark key cell populations in order to isolate, trace or modulate gene activity
- Promote nominations of candidate loci from scientific community.
- Mice made available through the MMRRC (Jackson Labs).
- Nominate strains: www.gudmap.org/MS_GeneNoms.html



3D Atlas of Gene Expression in Developing Genital Tubercle and Urethra OPT (M. Cohn Lab)

E14

E15





Developing DRG Immunohistochemistry (Southard-Smith Lab)





Human GUDMAP "hGUDMAP" In Situ Hybridization (A. McMahon Lab)

Human Kidney



Part I: Use BAC mediated mouse transgenesis to drive eGFP and **RFPT::Cre::ERT2** fusion proteins in specific cell types in the GU system



Part II: Obtain ES Cell clones through **KOMP(NIH)** and **EUCOMM** Consortia, create new alleles by dual Recombinase Mediated Cassette Exchange (dRCME) to drive eGFP and CRE::ERT2 proteins





Gene Expresssion Profile Analyses of GUDMAP Data

IGV Genome Browser View of Single Cell Data -- E11.5 metanephric mesenchyme (S. Potter and B. Arronow)





Immunohistochemistry Adult LUT (Keast Lab)







Immunohistochemistry



References

All past contributors to GUDMAP can be found at **www.gudmap.org/About/Projects/**

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