



# GUDMAP









# www.gudmap.org

# Genitourinary Development Molecular Anatomy Project

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# About GUDMAP

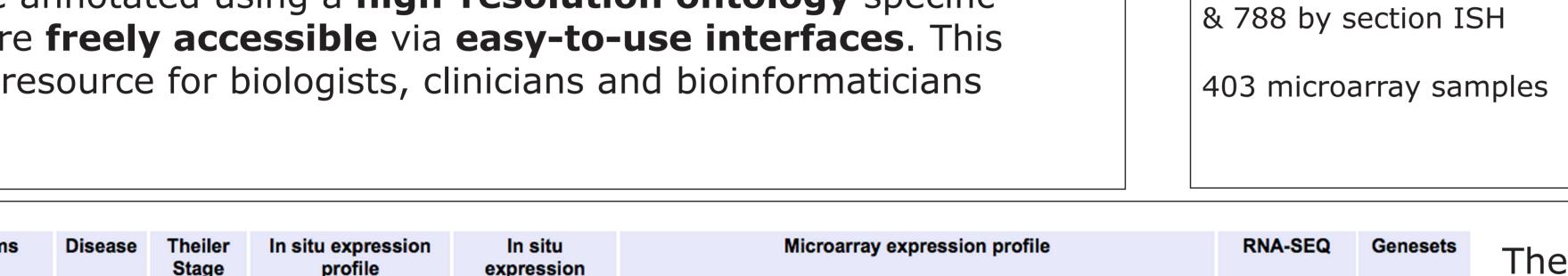
The GenitoUrinary Development Molecular Anatomy Project (GUDMAP) is a consortium of laboratories working to provide the scientific and medical community with gene expression data, transgenic mice and tools to facilitate research.

The data provided by GUDMAP include large-scale in-situ hybridisation screens and microarray gene expression data of microdissected, laser-captured and FACS-sorted components of the developing mouse genitourinary (GU) system. These expression data are annotated using a high-resolution ontology specific to the developing murine GU system. GUDMAP data are freely accessible via easy-to-use interfaces. This curated, high-resolution dataset serves as a powerful resource for biologists, clinicians and bioinformaticians interested in the developing urogenital system.

# Gene Strips

GUDMAP data can be accessed via simple or advanced queries.

A gene query will return 'Gene Strips' - these summaries provide an overview of the expression data available for a



The gene strip links out to in-situ data & images, disease/phenotype associations and microarray expression

Breakdown of in-situ entries and gene coverage by

anatomical focus group.

Inclusion of RNA-SEQ data and Genesets are part of GUDMAP future

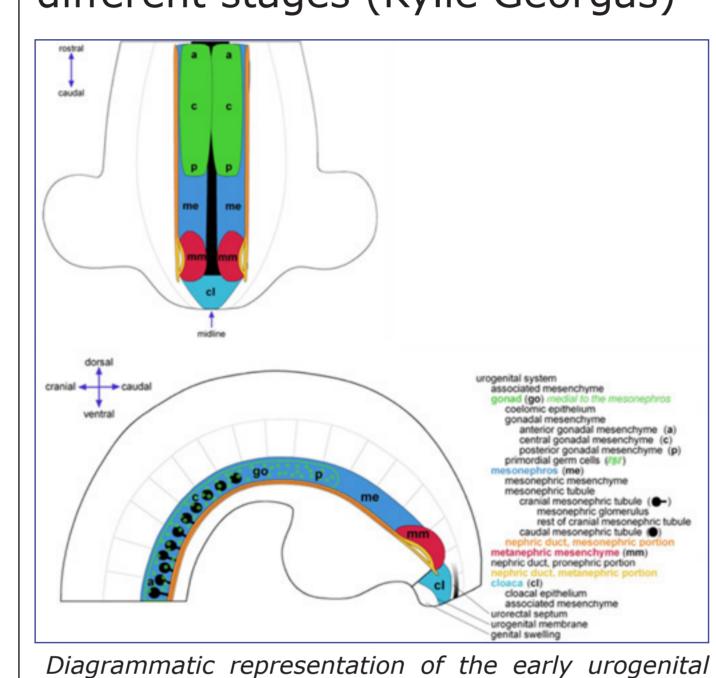
in the ureteric bud shown against samples from the developing kidney

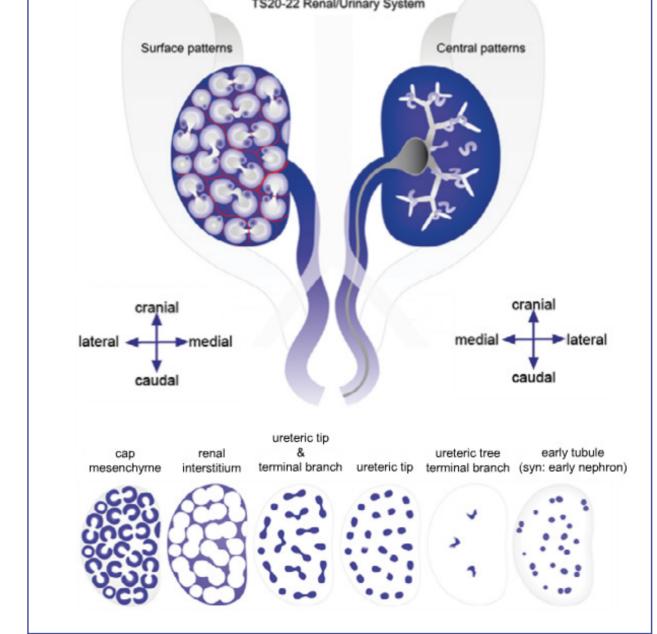
(www.gudmap.org/gudmap/pages/genelist\_folder.html)

# Tutorials on GU Development

The website provides **tutorials** describing GU organogenesis (Matt Kaufman)

These are supplemented with schematics diagrams that serve to illustrate the developing components of the mouse GU system over different stages (Kylie Georgas)





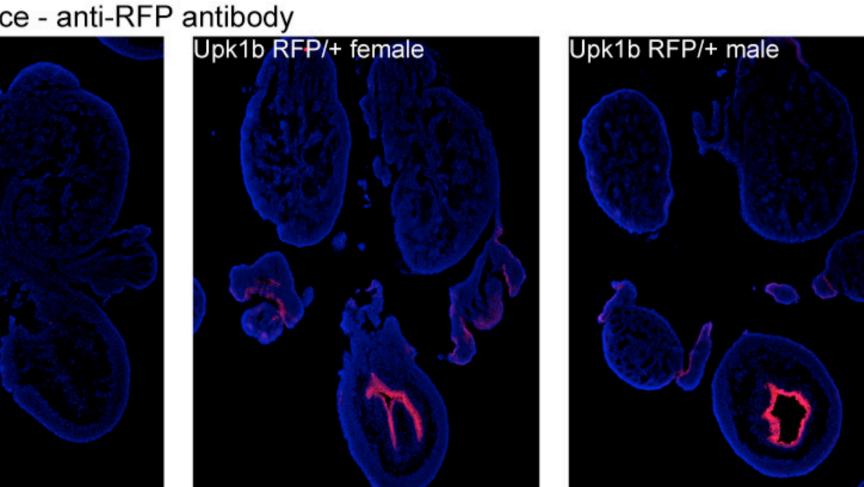
structures of the developing kidne

# Reporter Strains - Gene Nominations

The project has generated a resource of novel transgenic mouse strains (25 strains, Oct 2012) carrying genetic markers, with charaterisation, verification and the new strategy for production of reproter strains available at:

www.gudmap.org/Resources/ MouseStrains/index.html

Strains were chosen on the basis of in situ expression results, to facilitate detailed



Example of GUDMAP strain characterisation. RFP signal is detected in the urothelium of the bladder, as well as the gonads of Upk1bRFP/+ samples.

## GUDMAP will continue to generate novel transgenic mouse strains

Using gene-specific targeting to mark key cell populations of broad interest to the community and to facilitate genetic modification within the cell-of-interest.

Gene nominations for targeting are sought from the research community. Genes expressed throughout the urogenital system will be considered, with a preference towards gene targets expressed in the lower urinary tract. Once generated and verified, mice will be made available to nominating investigators and deposited in a MMRRC (public repository) for broader distribution to the community.

www.gudmap.org/About/News/MS\_GeneNoms.php

Origin of Clone used to make the Probe:

Probe Type: RNA
Type: antise

Type: antisense

Labelled with: digoxigenin

Visualisation method: alkaline phosphatase + BM purple

### ew annotated components as a list Show annotation under groups Nephrogenic zone & cortex. Wnt4 RNA signal in early nephrons. Note that Calb1 protein Nephrogenic zone. Wnt4 in renal vesicle on left and pretubular aggregate on the right of the Calb1 expressing ureteric tips. Both Wnt4 and Calb1 are absent from the connecting metanephros (EMAP:8226) renal capsule (EMAP:8237) nephrogenic zone (EMAP:27724) Nephrogenic zone and cortex. Wnt4 in early nephrons. Note S-shaped body at centre nephrogenic interstitium (EMAP:2773 cap mesenchyme (EMAP:27738) pretubular aggregate (EMAP:27745) renal vesicle (EMAP:27831)

# **GUDMAP Contains:**

- In-situ hybridization screens (wholemount and section)
- In-situ analysis of transgenic reporter screens (wholemount)
- Immunohistochemistry (section)

**LEFT:** Main features of a GUDMAP In-Situ Entry. A. Images. B. Annotation (user can select list or tree view). C. Probe details.

The **high-resolution anatomy ontology** has been developed by the GUDMAP consortium to describe in detail the sub-compartments of the developing murine genitourinary tract

**BELOW:** Example images from GUDMAP



comma-shaped body (EMAP:27837)

s-shaped body (EMAP:27855)

epupper limb of comma-shaped body (EMAP:2784?

Flower limb of comma-shaped body (EMAP:2784)

renal connecting segment of comma-shaped body (EMAF

- B: (GUDMAP:11296) Wnt4 RNA expression in the early nephron
- C: (GUDMAP:11389) Ets1 RNA expression in components of the urogenital sinus and urorectal septum
- D: (GUDMAP:8200; GUDMAP:8209) Metanephros double-stained for Wt1 protein (orange) and Wnt4 RNA (blue) E: (GUDMAP:14088) Wt1 expression in the metanephros (TS23)

# Microarray Data & **Analysed Genelists**

**Database Statistics** 

Over 9,200 in-situ

entries covering in

2892 unique genes

excess of 3,100 genes.

analysed by wholemoun

# cDNA Microarray data

Microarray Expression Profile for: Ureteric Bud (gene list) (View Microarray Analysis He

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1441742\_at 1445186\_at

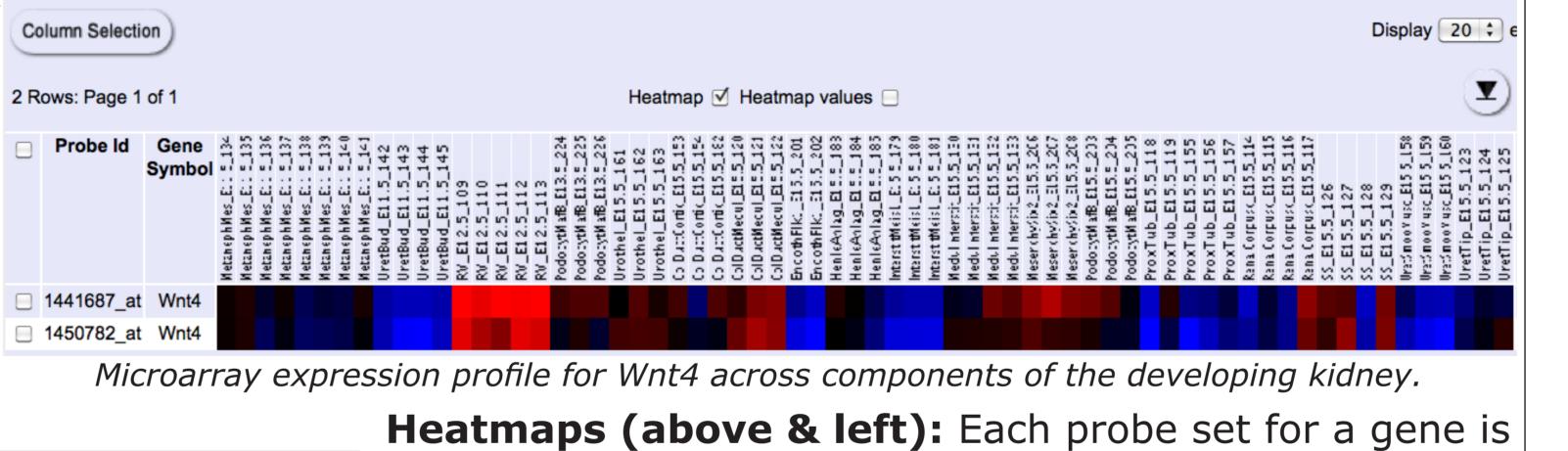
1435438\_at

1455947\_at 1424880\_at 1428223\_at

1432783\_at 4930556A17Ri

(Brunskill et al., 2008).

- Array analysis of laser-captured components of the developing GU
- Array analysis of FACS-isolated cells from transgenic reporter mice



urinary tract & reproductive systems Analysis & Genelists (left): Brunskill et al. generated microarray gene expression data for 15 separate subcompartments of the developing kidney. Analysis identified genes enriched in these compartments. These analysed gene lists are available on the GUDMAP Current work is bringing a much broader analysis of

displayed on a single row, with each column representing

an individual microarray sample. These are viewable

over different samples sets for developing kidney, lower

genes to the GUDMAP website. Provision of pre-analysed genelists - covering different sample sets and including Above: Heatmap view of analysed microarray genelists. Genes enriched clustered gene sets. These can be extended to enable comparison of genelists and the ability to perform on-the-fly analysis via ToppGene (CCHMC) (http:// toppgene.cchmc.org/).

# Tissue Summaries Data relating to a specific tissue

of the GU system is summarised in these pages

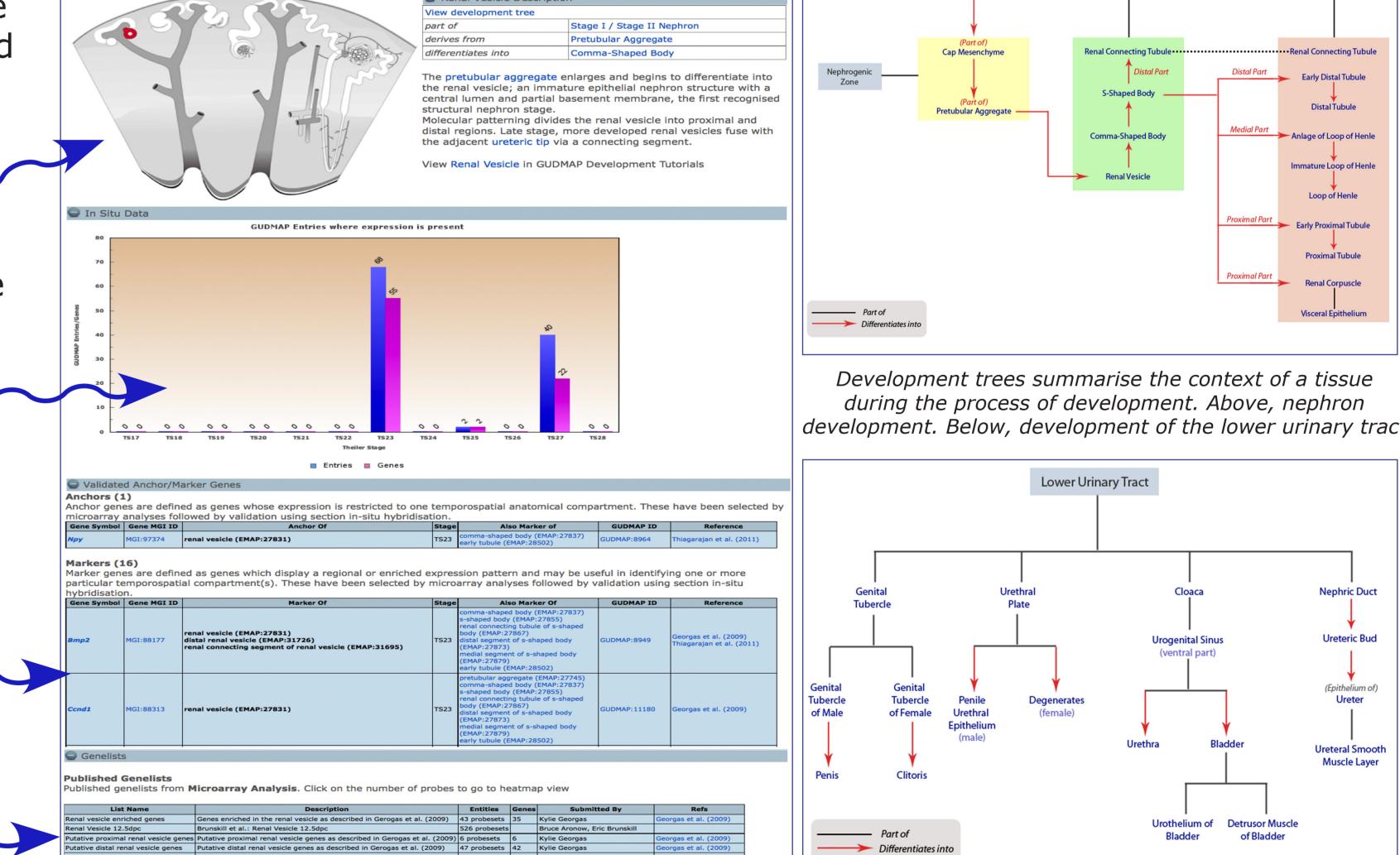
Schematic diagrams, text descriptions and development diagrams (*far-right panels*) give details about the tissue

Graphical display of in-situ database entries and number of genes where expression is present in the tissue

Details of any known anchor or marker genes for the tissue

Analysed genelists associated with tissue

References



Harding SD et al. (2011). The GUDMAP database - an online resource for genitourinary research. Development. 138(13):2845-53 Brunskill EW et al. (2008). Atlas of gene expression in the developing kidney at microanatomic resolution. Dev. Cell. 15(5):781-91 McMahon AP et al. (2008). GUDMAP: the genitourinary development molecular anatomy project. J. Am. Soc. Nephrology. 19(4):667-71 Little MH et al. (2007). A high-resolution anatomical ontology of the developing murine genitourinary tract. Gene Expr Patterns. 7(6):680-99

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