

Demo 4: How does the GU tract develop?

- Using the GUDMAP Tutorials

To get to the Tutorials, go to the [GUDMAP Home Page](#) and select 'Overview' from the 'Development' pull-down menu.



The screenshot displays the GUDMAP website interface. At the top, the GUDMAP logo is centered. Below it is a horizontal navigation bar with the following items: Home, About GUDMAP, Gene Expression, Resources, Development, Disease, and Help. The 'Development' menu is open, showing a sub-menu with 'Overview', 'Urinary', and 'Reproductive' options. A red arrow points to the 'Overview' option. On the left side, there is a vertical sidebar with a 'Home' button and a list of links: About GUDMAP, Gene Expression, Resources, Development, Disease, Help, and News. The main content area features a large image of a developing embryo with purple-stained structures. Below the image, there is text describing the GUDMAP database and its resources, including a list of bullet points: 'the GU system', 'tutorials describing GU organogenesis', and 'rapid access to primary data via the GUDMAP database'. At the bottom of the main content area, there is a section titled 'GUDMAP For:' with four buttons: Clinicians, Biologists, Bioinformaticians, and General Public. On the right side, there is a smaller image of a developing embryo with purple-stained structures, with the caption 'Image courtesy of: Melissa Little Group' and 'Gene Expression: Dppa5a'. Below this image is a row of five smaller images showing different views of the embryo. At the bottom of this section is a link for 'Image use policy'.

From the [Tutorial Overview](#) you can select either [Urinary System Development](#) or [Reproductive System Development](#) from the left-hand menu bar.

Tutorial Overview

GUDMAP Tutorial
Development of the Mouse Urogenital System

Over-view of urogenital development

The developing urinary and reproductive systems tend to be viewed as a single entity because both arise mainly from a common embryological origin, the intermediate mesoderm. This differentiates to form the nephrogenic cord, a column of condensed mesodermal tissue that extends caudally from the future cervical (neck) region. The intermediate mesoderm extends towards, but does not reach, the **urogenital sinus**, which is initially continuous with the most caudal (and ventral) component of the embryonic hindgut, but which will later become separated from it (see below).

The initial renal anlage that develops from the most rostral part of each nephrogenic cord is termed the pronephros and is not believed to function in any mammal. It consists of a small number of pronephric (or nephrotoma) vesicles that drain into the pronephric portion of the nephric duct. Despite the later degeneration of the pronephros, the pronephric duct is retained and extends caudally to be used by the **mesonephros** (also termed the "Wolffian" body), and is only then termed the **mesonephric portion of the nephric duct**.

The **mesonephros** develops primitive glomeruli, 4-6 of which drain through a **mesonephric tubule** to the **mesonephric portion of the nephric duct**, and this temporary kidney is therefore believed to be functional, producing some amniotic fluid. Each mesonephros also produces about 35 more caudal tubules, which do not connect to the mesonephric duct in mice.

In both sexes, a gonadal ridge forms along most of the medial aspect of the **mesonephros**. Primordial **germ cells**, arising from the yolk sac, then invade the gonadal ridge by way of the wall of the hindgut and its dorsal mesentery. In male embryos, the **primary sex cords** differentiate from the surface tissue of the gonads, invade the subjacent tissue and give rise to the **seminiferous cords** within which the germ cells are located. The "drainage" system of each future

Urinary System

GUDMAP Tutorial
Development of the Mouse Urogenital System

Development of the murine urinary system

- A note about staging
- Development of the murine kidneys
- Development of the murine bladder
- Observations on urinary development obtained from the analysis of staged histologically sectioned mouse embryos

A Note About Staging

The definitions of Thelier stages used in this essay, and their relationship to days post-ovulum (dpc), are those that appear on the [EMAP website](#).

In this document, each Thelier stage is identified with one 'average' age, and a range of variation of real ages, centring on this average, that can be seen when real developing embryos are studied. These appear below. For simplicity, the rest of this essay quotes only the average age.

Thelier stage	Average dpc	range
10	?	6 1/2 - 7 1/2
11	7 1/2	7 1/2 - 8

GUDMAP Tutorial
Development of the Mouse Urogenital System

Development of the murine reproductive system

- A note about staging
- Overview
- Primordial germ cells
- The indifferent gonad stage
- The testis and its immediate drainage system
- Development of the ovary and the internal genital duct system in the female
- The development of the external genitalia
- Observations on reproductive development obtained from the analysis of staged histologically sectioned mouse embryos

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Reproductive System

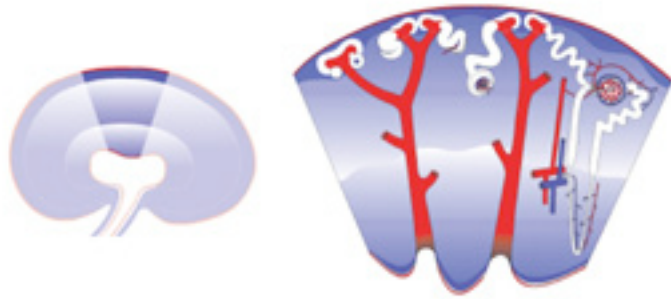


Figure 2
Diagram showing the anatomical regions of the whole kidney at 15 dpc (TS23) and a wedge of metanephros. The metanephros is cut longitudinally down the midline to reveal the cross section of layers from the outer renal capsule through to the pelvis.

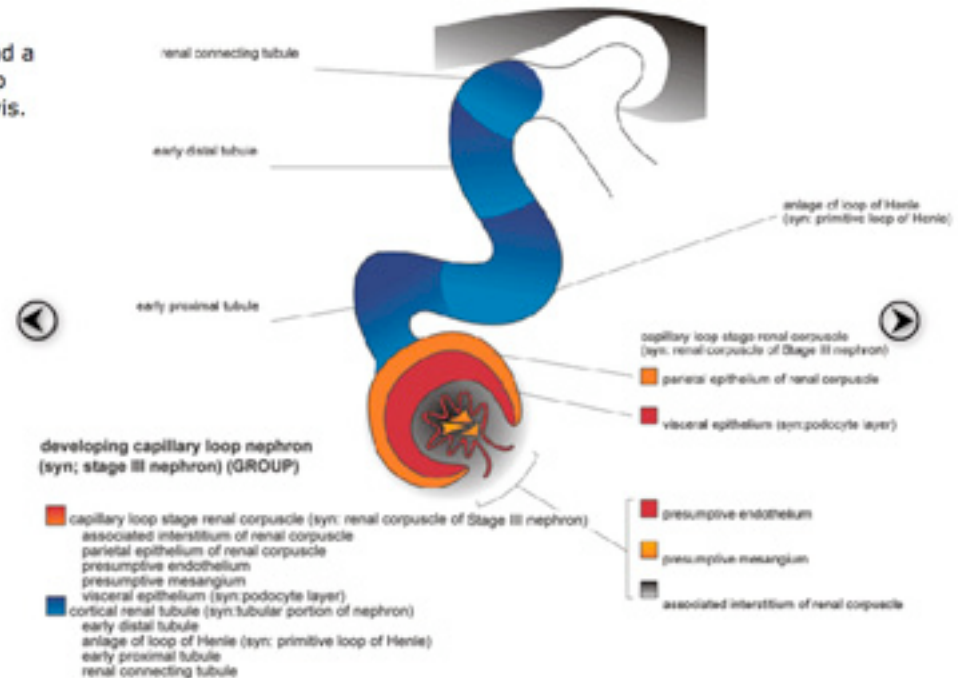


Figure 3
The development of the nephron from its most primitive stage, renal vesicle (stage I nephron), through to the mature nephron is shown. Click on the arrows to view these different stages. The renal vesicle elongates to become a comma-shaped body and then an S-shaped body (stage II nephron). The developing capillary loop nephron (stage III nephron) is marked by the development of the glomerulus and elongation of the immature nephron to form the proximal tubule, loop of Henle and distal tubule.

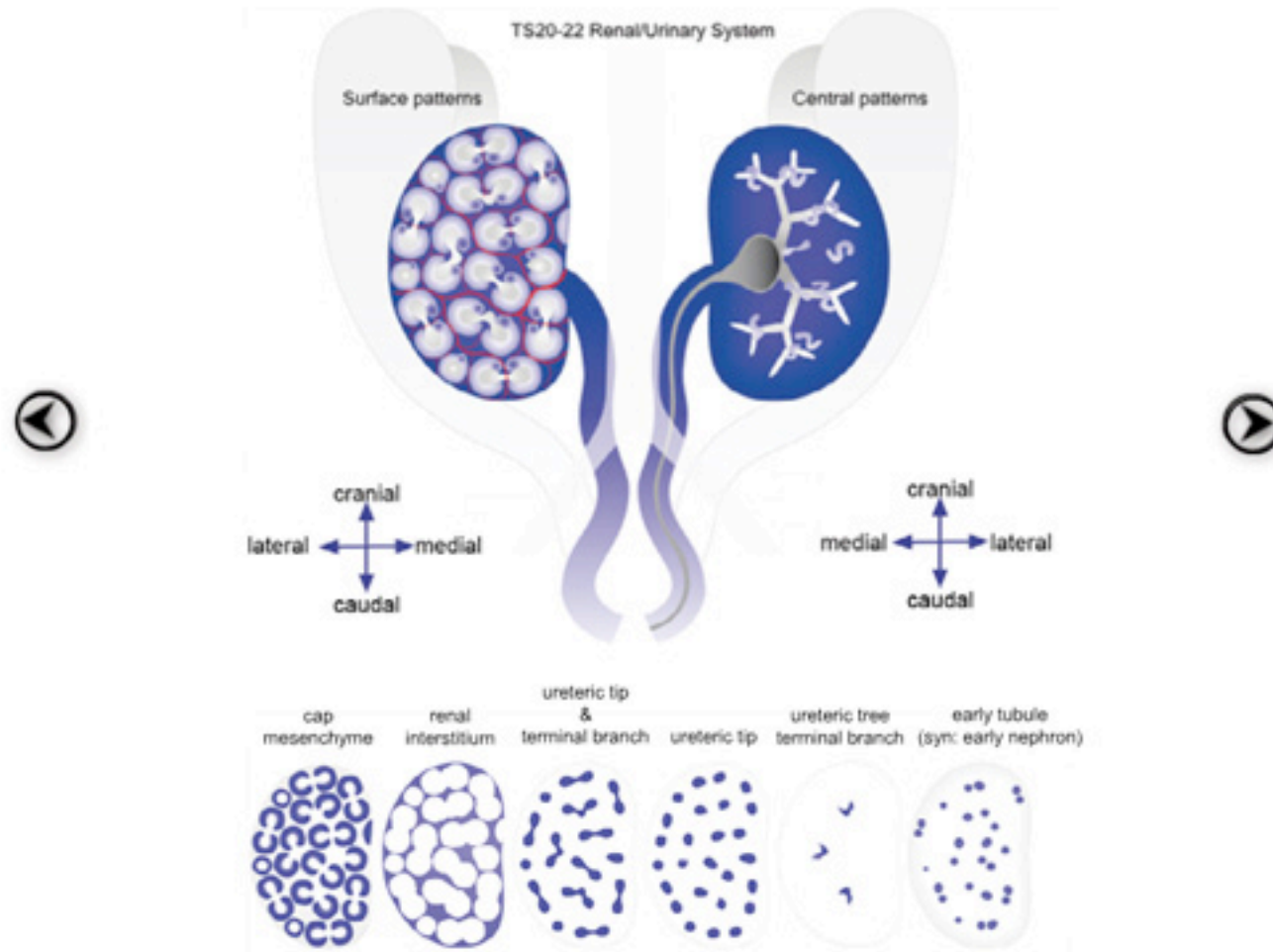


Figure 4

Anatomical structures of the developing kidney. **Click on the arrows to view these different structures.** Anatomical structures represented include: 1-2) surface and sub-surface structures; 3) deeper structures; 4) developing nephrons; 5) ureteric bud and its derivatives; 6) ureter.

Summary

The tutorials are designed to help you understand the development of the GU tract. Use them to:

- better understand the anatomy ontology
(see the [Boolean Anatomy Query Page](#) and [Little et al 2007](#))
- make informed queries using the database
- better understand the results returned from the database