RENAL SYSTEM

This laboratory contains virtual slides in addition to the usual static images. To access the virtual slides, click on the image of the microscope slide on the thumbnail page. Most of the items below may be found on the virtual slides.

A. KIDNEY – Slides: Ren 1-3

1. General structure:

   Study the section under low magnification and identify:

   **Capsule** - is the connective tissue investment. There is an outer alveolar c.t. covering consisting of a large amount of fat - sometimes referred to as the *capsula adiposa* and a deeper *tunica fibrosa* c.t. consisting mainly of collagen and elastic fibers.

   **Hilus** - the point of entrance and exit of major renal vessels and the ureter.

   **Renal Sinus** - is the central cavity of the kidney which contains the pelvis of the ureter, the major blood vessels and fat.

   **Renal Pelvis** - is the proximal expanded portion of the ureter which occupies the renal sinus.
**Cortex** - is the primary functional area of the kidney which occupies the space between the base of the pyramids and the renal capsule.

The renal cortex consists mainly of nephrons (renal corpuscles, proximal and distal convoluted tubules) and their associated blood vessels. The area peripheral to the base of each pyramid is characterized by a striated appearance due to the medullary rays which consist of parallel straight collecting tubules. This area is known as the **pars radiata** in contrast to the rest of the cortex, the **pars convoluta**.

**Medulla** - is the central portion consisting of:

- **Renal pyramids** - are the triangular structures which extend from the cortex to the renal sinus. Note that the basal portion rests on the cortex and the apex opens into a calyx.

- **Renal papillae** - are the apices of the renal pyramids which project into calyces.

2. Structure of the Renal Tubules or **Nephron**:

- **Glomerulus** - the central tuft of capillary loops which are bordered by endothelial cells.

- **Bowman's capsule** - is the double-walled epithelial investment of the glomerulus consisting of:
  - **Visceral epithelium** - squamous epithelium closely adherent to capillary walls.
  - **Parietal epithelium** - the squamous lining of the external wall of the capsule. Note that it is continuous with the lining of the tubule.
  - **Urinary space** - the space located between the two epithelia.

- **Proximal convoluted tubule** - located in the pars convoluta. It is the widest (40-60 µ) part of the nephron. Epithelium is cuboidal or low columnar. The cells are large and have an acidophilic cytoplasm with indistinct outlines; show a brush border (microvilli), and have large, lightly stained nuclei.

- **Descending limb of Henle's loop** - located in the renal pyramid. Diameter of 14-22 µ. Epithelium: squamous type with a clear structure-less cytoplasm. Note nuclei often bulge into lumen of tubule.

- **Ascending limb of Henle's Loop** - Located in the pars radiata and the boundary zone of the medulla. Diameter 25-50 µ. The epithelium consists of simple
cuboidal cells with deeply staining cytoplasm. The cell outlines are indistinct - often with a basal striated border.

**Distal convoluted tubule** - located in the pars convoluta. Diameter 20-50µ. The cuboidal cells forming the epithelium have a basal striated border but no brush border. The cytoplasm is not as acidophilic as the proximal convoluted tubule. Lumen is wider than the PCT.

**Macula Densa** - forms part of the distal tubule. Identify the **vascular pole** (the point of entry of afferent and efferent arterioles) and the **urinary pole** (where the proximal convoluted tubule originates). Locate a portion of the distal tubules in contact with the vascular pole of the renal corpuscle. Note also at this point the cells of the distal tubule are taller - or cylindrical - and aggregated and appear darker in section. These cells are collectively called the macula densa.

**Juxtaglomerular apparatus** - the macula densa plus epithelioid enlarged smooth muscle cells of the middle layer of the afferent arteriole (juxtaglomerular cells) make up the juxtaglomerular apparatus. The J-G cells are the source of renin production.

3. **Collecting Tubules of the Kidney** - The distal convoluted tubules lead into the collecting tubules - characterized by a large lumen, cuboidal epithelium in which the cell outlines are distinct, with clear cytoplasm and deeply staining spherical nuclei. The tubules lead in to papillary ducts (of Bellini) located in the renal papilla. The duct opens into a minor calyx. The area of the calyx on which the papillary foramina are located is known as the area cribosa.

4. **System of blood vessels:** *Slide Ren 3*

   This is a section of a kidney that had the vessels injected. Identify the **arcuate, interlobular, afferent arterioles, peritubular capillaries and vasa recta**. Efferent arterioles are present, but are difficult to visualize in this prep.

**B. URETER – Slide: Ren 4**

Examine the cross section of the ureter and identify the following:

- **Mucosa** - present longitudinal folds in the contracted condition.

- **Epithelium** - is of the transitional type. Does it rest on a basement membrane? Is it glandular?

- **Tunica propria** - is the subepithelial reticular tissue.
Submucosa - is a layer of areolar c.t.; not clearly demarcated from the tunica propria.

Muscularis - consists of large amounts of intermuscular fascia in which coarse bundles of smooth muscle arranged as: inner longitudinal and outer circular.

C. BLADDER – Slide: Ren 5

Essentially the same as ureter in histological features; except muscularis is very thick.