Urinary System Overview

Kidneys are the major excretory organ of the body. Kidney functions are 1) regulate volume and composition of extracellular fluid (ECF) and 2) excrete waste products from the body.

Kidneys: form urine constantly (drip, drip, drip)
Ureters: carry urine to bladder
Urinary bladder: stores up to 500mL (after which we cannot "hold" it any longer); generally first feel the urge once 200mL has been stored up.
Urethra: carries urine out of the body

Kidney:
*retroperitoneal organs (attached to dorsal body wall) found at about T12 to L3
*fibrous capsule and fat protect kidney from blows, act as shock absorbers

- Cortex
- Medulla
    - Pyramids
        - Apex of each pyramid is the papillae, which urine passes through to reach the calyces.
- Renal pelvis: collects urine from calyces

The functional unit of the kidney is a nephron. There are ~1 million nephrons/kidney.

NEPHRON includes the renal corpuscle, the proximal convoluted tubule (PCT), the loop of Henle, the distal convoluted tubule (DCT) and the collecting duct.

The glomerulus, proximal tubule and distal tubule of each nephron is found in the cortex; the loop of Henle and collecting ducts are found in the medulla.

Blood supply: Aorta → renal artery → segmental arteries → interlobar arteries → arcuate arteries → cortical radiate arteries → **afferent arterioles (microscopic) → glomerulus (capillary bed) → efferent arteriole → peritubular capillaries and vasa recta** → venules and veins converge until reaching the renal vein
*1200mL blood/min (20-25% of cardiac output!!) flows to the two kidneys (all blood in the body every ~4 minutes!)

Renal Corpuscle = Bowman's Capsule (AKA Glomerular Capsule) + Glomerulus
The glomerular capillaries are fenestrated, i.e. extra leaky. The filtrate that leaves the capillaries and enters the nephron via Bowman's Capsule is very similar to plasma. There are several layers of cells that makeup this complex corpuscle, but the most interesting are the podocytes, which are octopus-like cells that cover the capillaries; between the fenestrations and the gaps in the feet of the podocytes are filtration slits, where filtration occurs.

Critical Contents of the filtrate: salts, glucose, amino acids and water
Notably ABSENT: blood cells and proteins

Blood pressure is high in glomerular capillaries (~60 mmHg). Compare this to most other capillary beds pressure of 35 mmHg. This high pressure is maintained (of course) by the arterioles. The afferent arteriole remains more dilated than the efferent one, so pressure is higher in this capillary bed. If for some reason this pressure drops, then filtration ceases (acute renal failure).