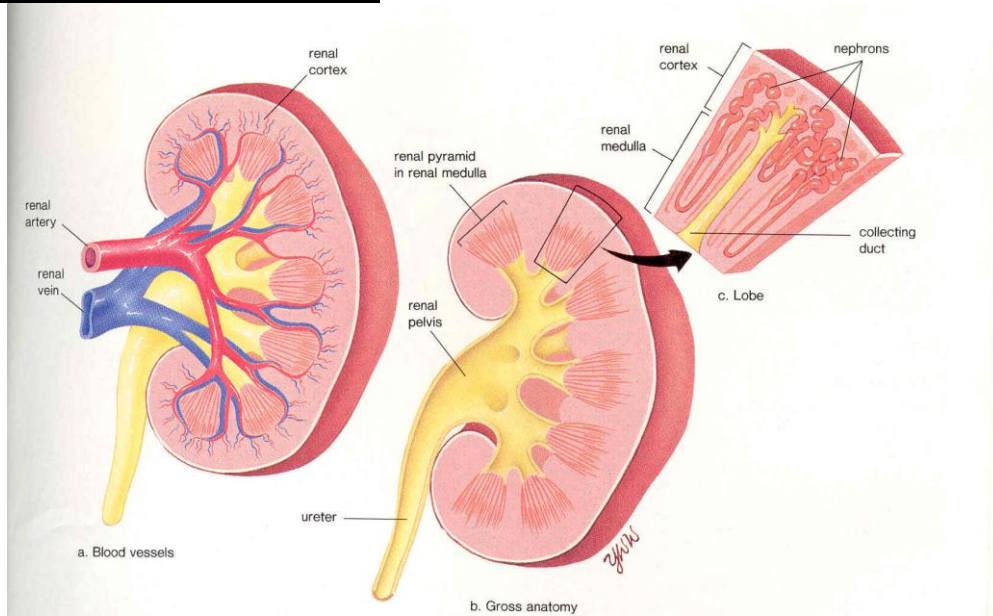


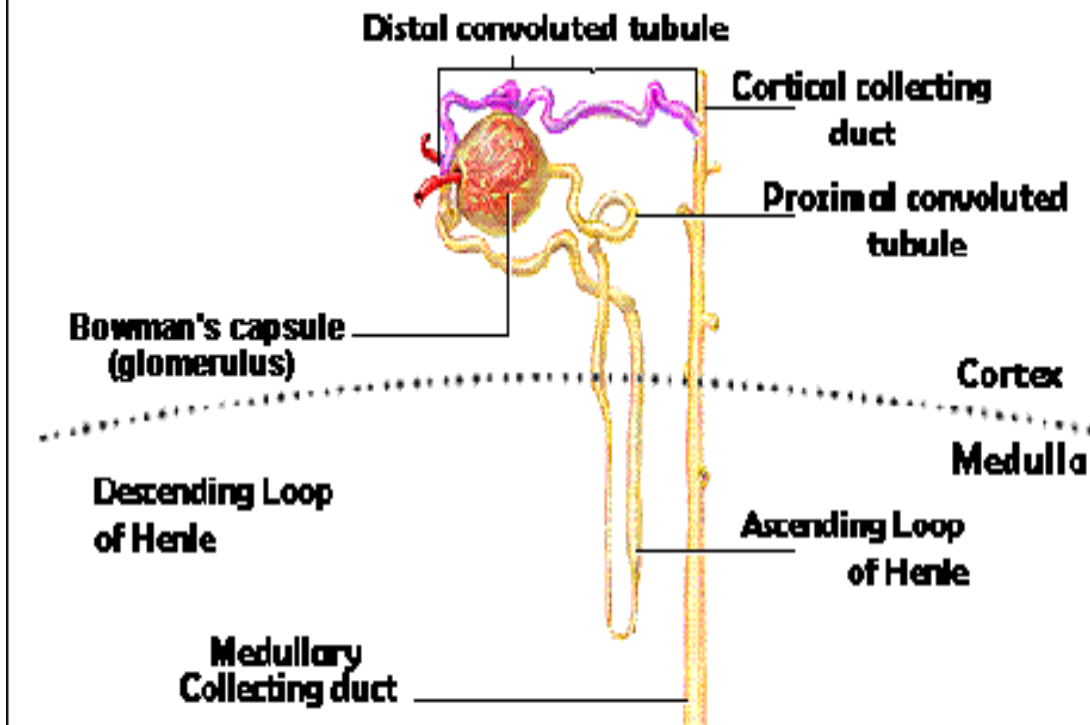
Unit O Notes #2 : Nephrons and Urine Formation

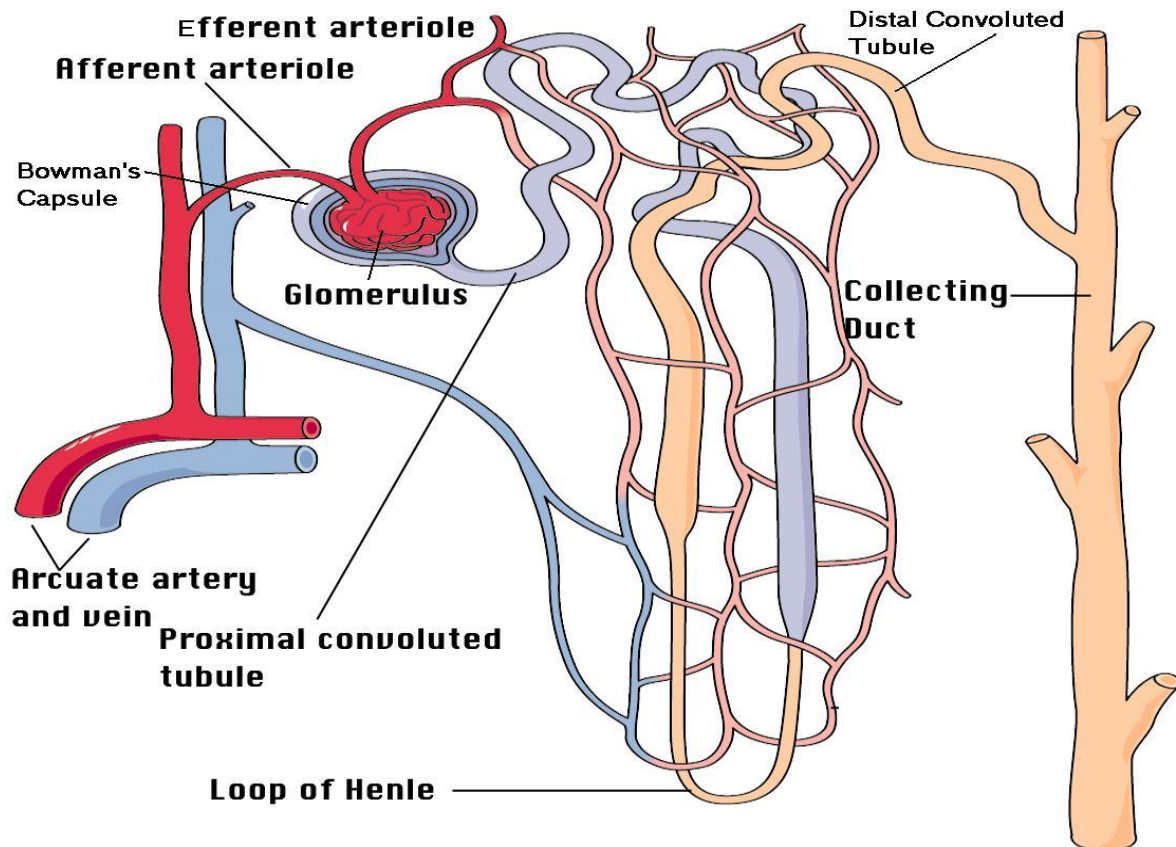
A) Nephron Structure:



- Microscopically, the kidney is composed of over one million nephrons (or renal tubules)

NEPHRON STRUCTURE: TUBULAR SEGMENTS





NOTE : ** “Arcuate” means curved, many parts of the body have arcuate arteries and veins.

- **The Bowman’s capsule (1) and proximal convoluted tubule (2) are located in the cortex.**
- **Loop of Henle (3) dips down into the medulla.**
- **Distal convoluted tubule (4) back up in the cortex.**
- **Collecting ducts (5) are located running from the cortex into the medulla (most of duct is in the medulla)**

B) Urine (95% water) Formation:

- **Renal Artery – Brings blood to the kidneys to be “cleaned”. Blood is high in urea (product of the deamination of NH_3)**

- Renal Veins – Returns clean blood back to the inferior vena cava. Much lower urea content.

- It is the nephrons that filter the blood, and each nephron has its own blood supply.

Including two capillary regions:

1.The Glomerulus (capillary tuft inside Bowman’s Cap)

2.The Peritubular capillary which surrounds the rest of the nephron.

Tracing the Formation of Urine :

a. Pressure filtration

b. Selective reabsorption

c. Reabsorption of water

d. Tubular excretion

e. Excretion →Urination

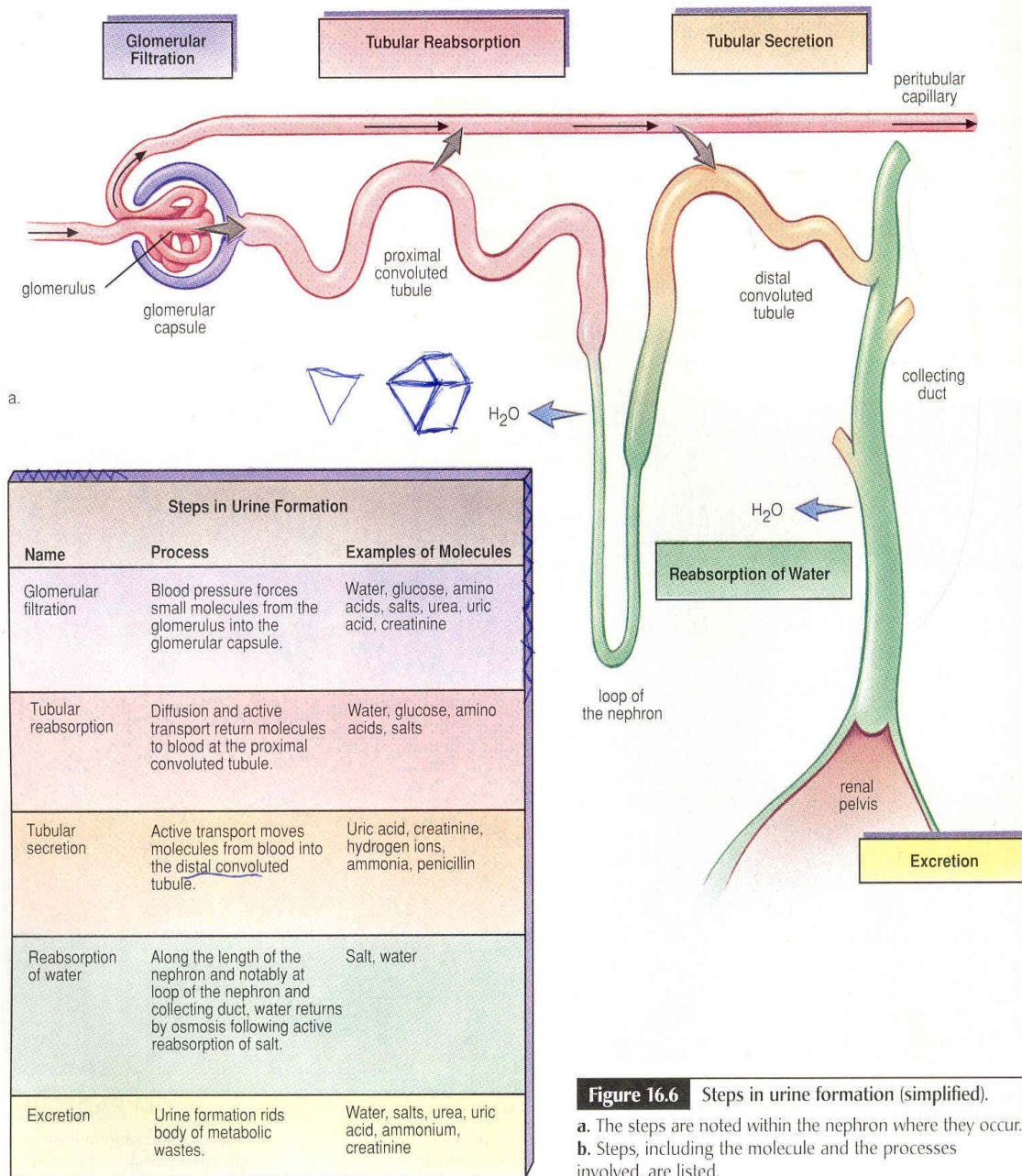


Figure 16.6 Steps in urine formation (simplified).

a. The steps are noted within the nephron where they occur.
 b. Steps, including the molecule and the processes involved, are listed.

a) First, blood from renal arterioles (afferent) enters the many Glomeruli, which are surrounded by the Bowman's capsule. Here, Pressure Filtration occurs. Water, nutrients, and wastes enter the Bowman's Capsule. Large organic molecules do not enter (filtered). The liquid (Filtrate) that collects in the

Bowman's capsule is basically blood plasma minus the blood proteins.

Filtered Blood

Components

Water

Nitrogenous Wastes

Nutrients

Salt (ions)

Non-Filtered Blood

Components

Formed elements-

(blood cells and platelets)

Proteins

- Blood pressure is very important. If blood pressure is too low, filtration will not occur. A hormone called Renin is released from a specialized tissue in the Glomerulus that causes the constriction of the Glomerulus thus the blood pressure is increased to an adequate level.

b) Selective Reabsorption is the process of reabsorbing the good stuff (water, glucose/AA's, some salts like Na^+ , and Cl^-) out of the filtrate and returning it to the blood. This process occurs mainly between the proximal convoluted tubule and the peritubular capillary network. Most reabsorption requires active reabsorption using ATP to maintain pumps.

c. Reabsorption Of Water: The body cannot afford to lose too much water, much of the water in the filtrate must be reabsorbed into the blood. The cells of the loop of Henle actively pump Na^+ out of the filtrate going through the tubule and drive the Na^+ into the blood. The result of this is that the negative ion (Cl^-) and water

passively follow the sodium by osmosis (this evens out the concentration gradients).

- Water is reabsorbed along the entire length of the nephron. Therefore urine becomes quite concentrated as it passes along the nephron. The blood in the capillaries is hypertonic to the filtrate running through the fluid spaces of the nephron. The cells of the loop of Henle create a high osmotic pressure in the medulla. The fluid going up the distal (farthest from the Glomerulus) side of the loop of Henle has a greater concentration of wastes and little nutrient value.

d. Tubular Excretion is the second process whereby wastes enter the fluid space of the nephron. This time excess molecules in the blood, such as H^+ ions, Histamine, Penicillin, and ammonia are secreted into the distal convoluted tubule from the blood of the peritubular capillary. This active transport plays a role in helping to maintain homeostasis, like blood pH.

e) Excretion → Urination: Concentrated Urine from the collecting tubules collects down in the Renal pelvis; from there it will drain down through the ureters to the urinary bladder.