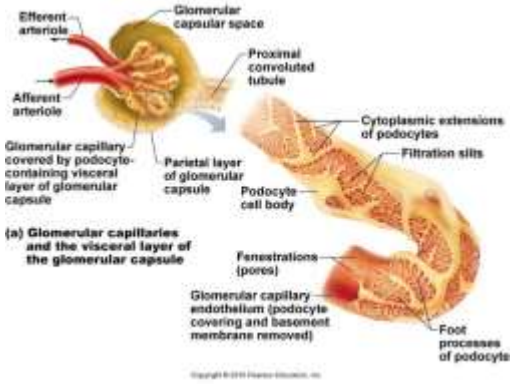
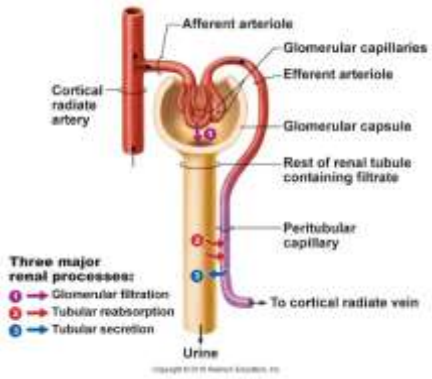
URINE FILTRATION

EQ: How do you keep what you need but get rid of your waste?

I. Non-Selective Filtration
   a. Glomerular (blood) hydrostatic pressure (HP_g = 55 mm Hg)
   b. Blood colloid osmotic pressure (OP_g = 30 mm Hg)
   c. Capsular hydrostatic pressure (HP_c = 15 mm Hg)
   d. Filtration Membrane



   i.
   e. Renal Physiology



   i.

II. Tubular Reabsorption
   a. Proximal convoluted tubule
      i. 65% of filtrate volume reabsorbed
      ii. Na^+, glucose, amino acids, and other nutrients actively transported; H_2O and many ions follow passively
      iii. H^+ and NH_4^+ secretion and HCO_3^- reabsorption to maintain blood pH
      iv. Some drugs are secreted
      v. Tubular Reabsorption at the PCT
         1. Glucose, lactate, amino acids and vitamins – 100%
         2. Bicarbonate ions (HCO_3^-)– 90%
         3. Water and sodium ions – 65%
         4. Potassium ions – 55%
         5. Chloride ions – 50%
   b. Descending limb of loop of Henle
      i. Freely permeable to H_2O
      ii. Not permeable to NaCl
      iii. Filtrate becomes increasingly concentrated as H_2O leaves by osmosis
   c. Ascending limp of loop of Henle
      i. Impermeable to H_2O
      ii. Permeable to NaCl

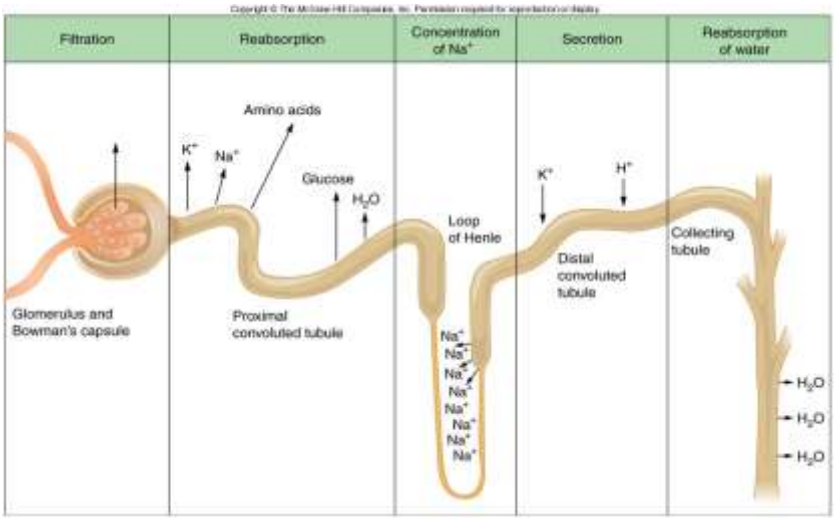
iii. Filtrate becomes increasingly dilute as salt is reabsorbed
iv. Countercurrent Mechanism
v. Tubular Reabsorption at the Loop
1. Chloride – 35%
2. Potassium – 30%
3. Sodium ions – 25%
4. Water – 10%

d. Distal convoluted tubule
i. Na^+ reabsorption regulated by aldosterone
ii. Ca^{2+} reabsorption regulated by parathyroid hormone (PTH)
iii. Cl^- cotransported with Na^+
iv. Tubular Reabsorption at the DCT
1. Water – 25%
2. Chloride – 10%
3. Sodium ions – 10%

e. Collecting duct
i. H_2O reabsorption through aquaporins regulated by ADH
ii. Na^+ reabsorption and K+ secretion regulated by aldosterone
iii. H^+ and HCO_3^- reabsorption or secretion to maintain blood pH
iv. Urea reabsorption increased by ADH

III. Tubular Secretion

a.



IV. Urine Formation

a. Urine composition
i. 90-95% water
ii. Solutes constitute the other 5%
1. Metabolic wastes (urea, uric acid, and creatinine)
2. Ions (Na^+, K^+, PO_4^{3-}, SO_4^{2-}, Ca^{2+}, Mg^{2+})
3. Toxins and pigments (urochrome)
4. Hormones

b. Urine characteristics
i. Yellow in color
ii. Slightly aromatic or ammonia odor
iii. pH slightly acidic (can vary from 4.5 to 8.0)
iv. Specific gravity 1.001 to 1.035