Introduction to Basic Renal Processes

Urinary system

- Kidney, urinary bladder, ureters, urethra

Main functions of the kidneys

- To filter 200 liters of blood daily, allowing toxins, metabolic wastes & excess ions to leave the body in **urine**, thereby regulating the volume and chemical makeup of blood as well as maintaining proper water-salt and acid-base balance

Nephron

- Renal corpuscle
  - **Glomerulus**: a clump of capillaries associated with a renal tubule
  - **Bowman's capsule**: cup-shaped end of a renal tubule surrounding the glomerulus
- Renal tubule

Capillary beds of the nephron: Glomerulus, peritubular capillaries (& vasa recta)

Mechanism of urine formation: Glomerular filtration, tubular reabsorption, tubular secretion

Glomerular filtration

- Fluids & solutes are forced out of the blood throughout glomerulus by high blood pressure
- Filtration membrane
  - Allows solute-rich, protein-free filtrate to pass from blood into glomerular capsule
  - **Endothelium** of fenestrated **capillaries**
  - **Visceral membrane** of glomerular capsule (**podocytes**)
  - **Basement membrane** composed of fused basal laminas of other layers
- Glomerular filtration rate (GFR): Total amount of filtrate formed per minute by the kidneys
- Factors governing filtration rate
  - Total surface area available for filtration (constant)
  - Filtration membrane permeability (constant)
  - Net filtration pressure (variable)

Tubular reabsorption

- Substances move from the tubule lumen into peritubular capillaries
- All organic nutrients are reabsorbed
- Water & ion reabsorption is hormonally controlled

Tubular secretion

- Substances move from peritubular capillaries (or tubule cells) into filtrate by active transport

Urine concentration

- Dilute urine is formed if antidiuretic hormone (ADH) is not being secreted
- Concentrated urine is formed if ADH is being secreted