Chapter 5: Histology

- Study of Tissues
  - Primarily Tissue Class
    - Tissue: group of similar cells that arise from the same region of the embryo & work together to perform specific functions
    - Extracellular Matrix: surrounds the cell
      - Composed of fibrous proteins & a clear gel known as ground substance, tissue fluid, extracellular fluid, or interstitial fluid
        - Water, gases, minerals, nutrients, and hormones
  - Embryonic Tissue
    - Primary Germ Layers
      - Ectoderm: outer layer that gives rise to epidermis and nervous system
      - Mesoderm: middle layer with more loosely organized cells
        - Mesenchyme: fine, wispy collagen fibers
        - Gives rise to muscle, bone, and blood
      - Endoderm: gives rise to mucous membrane
  - Interpreting Tissue Sections
    - Histological Sections: thin slices of tissue that are artificially colored
      - Preserved in a fixative
        - Chemical like formalin
      - Cut into sections: 1 or 2 cells thick and stained
        - Longitudinal, transverse, cross, oblique
      - Smears: rubbed or spread
      - Spreads: laid
- Epithelial Tissue: sheet of closely adhering cells, one or more cells thick with upper surface usually exposed to the environment or an internal space
  - Protection: protects deeper tissue from invasion and injury
    - Inner lining of stomach and epidermis
  - Secretion: mucous, sweat, enzymes, and hormones
  - Excretion: void wastes
    - CO_2 and bile
  - Absorption: absorbs chemical and nutrients
    - Small intestine
  - Filtration:
    - Blood vessels and kidney
  - Sensation: nerve endings
    - Skin and stomach
  - Extracellular material: very thin
  - Avascular
  - High Rate of mitosis

- Basement membrane: between epithelium and underlying connective tissue
    - Contains: collagen, glycoprotein, and other carbohydrate-protein complexes
    - Blends into connective tissue
        - Anchor epithelium to connective tissue
- Basal surface: faces basement membrane
- Apical surface: faces away
- Simple Epithelia: only one layer of cells
    - Simple squamous: dry and scaly
    - Simple cuboidal: squarish and round
    - Simple columnar: tall and narrow
    - Psuedostratified:
        - Goblet Cells: wine glass-shaped that produce protective mucous coating over mucous membrane
- Stratified Epithelia: range from 2-20 layers of cells resting directly on top one another and only the deepest layer attached to the basement membrane
    - Stratified squamous: most widespread
        - Exfoliation: the loss or flaking of dead squamous cells
        - Keratinized: found in the epidermis and covered with dead compressed cells
            - Compact with keratin and coated with water-repellent glycolipid
        - Nonkeratinized: lack a layer of dead cells
            - Abrasion-resistant, moist & slippery
            - Vagina, tongue, esophagus
    - Stratified Cuboidal
    - Stratified Columnar
        - Rare and minor importance
    - Transitional Epithelium: Domed surface with a unique protection property
        - Umbrella cells
            - Upper surface & outer phospholipid layer is thick than usual and has dense patches (lipid raft) embedded with uroplakins (impermeable to urine)
        - Found only in the urinary tract
- Connective Tissue: most abundant, widely distributed, and histologically variable of the primary tissues
    - Their cells occupy less space than the extracellular matrix
        - Cells are not usually in direct contact with each other
    - Overview

        - Binding of Organs: tendons bind muscle to bone, ligaments bind one bone to another, fat holds the kidneys and eyes in place
        - Support: Support body and it's parts
        - Physical Protection: bones and fat provide most protection
        - Immune Protection: connective tissue cells attack foreign invaders, fibers provide a battle field, & mucous provides quick mobility to immune cells
        - Movement: Bones & cartilage
        - Storage: fat and bone
        - Heat production: metabolism of brown fat
        - Transport: blood
    - Fibrous Connective Tissue: most diverse type
        - Components of Fibrous Connective Tissue:
            - Cells
                - Fibroblasts: large, fusiform or stellate cells, with branches that produce the fibers and ground substance of matrix of the tissue
                - Macrophage: large phagocytic cells that engulf and destroy bacteria, foreign particles, or dead cells
                    - Activate immune system when they sense antigens
                    - They arise from white blood cells called monocytes
                - Leukocytes (white blood cells): spend time in the blood vessels, but most time in connective tissue
                    - Neurophils: wander and attack bacteria
                    - Lymphocytes: react against bacteria, toxins, and other foreign agents
                        - Form dense patches in mucous membranes
                - Plasma Cells: certain lymphocytes turn into plasma cells when they detect foreign agents
                    - Synthesize antibodies
                    - Rarely seen except in wall of intestines and inflamed tissue
                - Mast Cells: secrete heparin that inhibits blood clotting and histamine that increases blood flow by dilating blood vessels alongside blood vessles
                - Adipocytes (fat cells): small clusters in some connective tissue
            - Fibers
                - Collagenous Fibers: made of collagen and are tough & flexible and resist stretching
                    - Most abundant protein