Tissues

I. Introduction
A. Cells are the basic units of structure and function.
B. Tissues are groups of cells with specialized structures and functions.
C. All tissues contain a nonliving extracellular (intercellular) matrix that surrounds and supports the cells.

II. Epithelial Tissues
A. General Characteristics
1. Covers all surfaces (protects).
2. Line most internal organs (absorbs, excretes).
3. Major tissue of glands (secretes).
4. One side exposed to the outside or an open space.
5. Underside anchored to connective tissue by a basement membrane.
6. Tightly packed (lack blood vessels).
7. Reproduce quickly

II. Epithelial Tissues
B. Carcinoma
2. 90% of all cancers
3. Many carcinogens don’t penetrate deep tissue.

II. Epithelial Tissues
C. Covering and Lining Epithelium
1. Simple Squamous
   a. Single layered, thin, flattened cells
   b. Nuclei are broad and thin
   c. Substances pass through easily.
   d. Functions are diffusion and filtration.
   e. Lines lungs, walls of blood and lymph vessels, capillaries.
   f. Delicate and easily damaged.
2. Simple Cuboidal
   b. Nuclei are centered and spherical.
   c. Functions are secretion and absorption (kidneys).
   d. In glands it secretes the glandular products (protein, hormones)
   e. Covers ovaries, kidney tubules, ducts of salivary glands, thyroid gland, pancreas, liver.
II. Epithelial Tissues

3. Simple Columnar
   a. Elongated (longer than wide), single layered, thick.
   b. Nuclei are close to the basement membrane.
   c. Protects underlying tissue (lines uterus, stomach, small and large intestine).
   d. Secrete digestive fluids, absorbs nutrients (may possess microvilli).
   e. Contain goblet cells that secrete mucus for protection.

4. Stratified Squamous
   a. Many-layered, reproduction is in deeper layers, older cells pushed outward.
   b. Function is protection.
   c. Form epidermis of skin.
   d. As skin cells age, they accumulate keratin (protein), harden and die.
   e. Prevents water loss, protects underlying tissue.
   f. Lines mouth, throat, vagina, anal canal (not keratinized, cells are alive).

5. Stratified Cuboidal
   a. Two or three layers that line a lumen (space within a tube).
   b. Main function is protection.
   c. Line ducts in mammary glands, sweat glands, salivary glands, pancreas.
   d. Lines developing ovarian follicles (female) and seminiferous tubules (male).

6. Stratified Columnar
   a. Layers of cells; superficial are elongated, basal layer are cubed.
   b. Functions are protection and secretion.
   c. In the male urethra and vas deferens, also in the pharynx.

7. Pseudostratified Columnar
   a. Appear layered because of two levels of nuclei.
   b. Protection, secretion, movement of mucus and sex cells.
   c. Commonly possess cilia and goblet cells (mucus).
   d. Found in respiratory (trachea) and reproductive (tubules) systems.

8. Transitional
   a. Change shape in response to tension.
   b. From cuboidal (relaxed) to flat (under tension).
   c. Functions are distensability (stretching) and protection.
   d. Inner lining of urinary bladder and urinary tract.
II. Epithelial Tissues

D. Glandular Epithelium
1. Gland cells that produce secretions, commonly in columnar or cuboidal epithelia.
2. Endocrine Glands - secrete products into tissue or blood
3. Exocrine Glands
   a. Secrete products into ducts.
   b. Classified by method of secretion and composition of secretion.

II. Epithelial Tissues

4. Types of Glands
   a. Merocrine Glands
      1) Watery, protein-rich secretions by exocytosis.
      2) Serous fluid - watery with a lot of enzymes.
      3) Mucus - rich in the glycoprotein mucin
      4) No loss of cytoplasm (cell stays intact)
      5) Salivary, pancreatic, certain sweat glands
      6) Most abundant type of gland

b. Apocrine Gland
   1) Small portions of cytoplasm are pinched off.
   2) Mammary and certain sweat glands (stinky).

c. Holocrine Gland
   1) Entire cell lyses releasing products.
   2) Sebaceous gland

III. Connective Tissues

A. General Characteristics
1. More widely spaced than epithelial (more intercellular matrix)
2. Matrix consists of fibers and ground substance (fluid to solid)
3. Tissue specific functions

B. Cell Types
1. Resident Cells (stable in number)
   a. Fibroblasts
      1) Most common type
      2) Produce collagenous and elastic fibers.

b. Mast Cells
   1) Located near blood vessels.
   2) Release heparin (prevents blood clotting)
   3) Release histamine (inflammation and allergic reactions)

2. Macrophages
   1) Carry on phagocytosis
   2) Act as scavengers and defenders.
III. Connective Tissues

C. Fiber Types - produced by fibroblasts
1. Collagenous Fibers
   a. Collagen protein, great tensile strength.
   b. Found in parallel bundles, only slightly elastic (resist pulling).
   c. Part of tendons and ligaments.
      i. Tendons - muscle to bone
      ii. Ligaments - bone to bone
   d. Called white fibers.

2. Elastic Fibers
   a. Elastin protein, stretch easily.
   b. Thin, branching fibers, form complex networks.
   c. Found in vocal cords.
   d. Called yellow fibers.

3. Reticular Fibers
   a. Very thin, highly branched, collagenous fibers.
   b. Support various tissue.

D. Types of Connective Tissue
1. Loose Fibrous
   a. Forms thin membranes between organs.
   b. Mainly fibroblasts with many collagenous and elastic fibers.
   c. Binds skin to underlying organs, fills spaces between muscles.

2. Adipose Tissue
   a. Specialized for storing fat droplets.
   b. Beneath the skin, between muscles, around kidneys, behind eyeballs, surface of heart.
   c. Cushions joints and organs, insulates, stores energy.

3. Dense Fibrous
   a. Many, closely packed, thick collagenous fibers.
   b. A fine network of elastic fibers, and a few cells(fibroblasts)
   c. Binds body parts together
   d. White layer of eyeball, deeper skin layers.

4. Cartilage
   a. Functions
      1) Provides support, frameworks, attachments.
      2) Protects underlying tissue.
      3) Forms structural models for developing bones.
III. Connective Tissues

b. Cartilage Structure
1) Matrix is collagenous fibers in a gel-like ground substance.
2) Chondrocytes (cartilage cells) are in small chambers (lacunae).
3) Perichondrium (loose connective tissue) surrounds cartilage and diffuses nutrients into chondrocytes.
4) Lack of direct blood flow → slow healing torn cartilage.

III. Connective Tissues
c. Types of Cartilage - by matrix substances
1) Hyaline
   i. Most common type.
   ii. Fine collagenous fibers, looks like white plastic.
   iii. Ends of bones, soft part of nose, rings of trachea.

III. Connective Tissues
2) Elastic
   i. Dense network of elastic fibers.
   ii. Framework for ears and larynx.

III. Connective Tissues
3) Fibrocartilage
   i. Many collagenous fibers (very tough)
   ii. Acts as a shock absorber (knees, pelvic girdle)
   iii. Forms intervertebral disks

III. Connective Tissues
d. Bone Structure
1) Deposited in thin layers (lamellae)
2) Forms circles around tubes called ostonic canals (Haversian canals).
3) Bone cell (osteocyte) is located in lacunae
4) Osteocytes have cytoplasmic processes that extend into the matrix (canaliculi)
5) Osteon (Haversian System) - osteocyte, lamellae, and their associated ostonic canal.

III. Connective Tissues
5. Bone
   a. Supports, protects, attachment for muscles.
   b. Houses marrow
   c. Stores inorganic chemicals (calcium and phosphorus)

III. Connective Tissues
6. Blood
   a. Transports substances
   b. Helps maintain stable internal environment.
   c. Composed of cells suspended in a fluid matrix (blood plasma)
   1) red blood cells
   2) white blood cells
   3) platelets - cellular fragments
IV. Muscle Tissue

A. Moves body parts by contraction of fibers.

B. Three Types
   1. Skeletal Muscle (striated)
      a. Voluntary muscle.
      b. Long, cylinder like cells with striations and many nuclei.

   2. Smooth Muscle (non-striated)
      a. Involuntary muscle.
      b. Shorter than skeletal, spindle-shaped, lack striations, one nucleus.
      c. In walls of hollow organs (stomach, intestine, bladder, uterus, blood vessels)

   3. Cardiac Muscle
      a. Involuntary muscle, only in the heart.
      b. Striated, branched, interconnected, joined end to end, one nucleus.
      c. Junction with another cell is called an intercalated disk.

V. Nervous Tissue

A. Found in brain, spinal cord, and peripheral nerves.

B. Neuron (nerve cell)
   1. Transmits impulses along fibers to other cells.
   2. Coordinate, regulate, and integrate body functions.

C. Neuroglial Cells
   1. Support and bind components of the nervous system.
   2. Carry on phagocytosis.
   3. Help supply nutrients to neurons by connecting them to blood vessels.