

## **Chapter 5 -Tissues**

### **5.1 Introduction (Table 5.1)**

- A. Cells are arranged in tissues that provide specific functions for the body.
- B. Cells of different tissues are structured differently, which leads to their differences in function.
- C. The tissues of the human body include four major types: epithelial tissues, connective tissues, muscle tissues, and nervous tissues

### **5.2 Epithelial Tissues (Table 5.3)**

- A. General Characteristics
  - 1. Epithelial tissue is widespread throughout the body, covers organs, and lines body surfaces.
  - 2. Epithelial tissues are anchored to a basement membrane, are made up of tightly packed cells containing little intercellular material, generally lack blood vessels, and are replaced frequently.
  - 3. They function in protection, secretion, absorption, excretion, and sensory reception.
- B. Simple Squamous Epithelium (Fig. 5.1)
  - 1. Simple squamous epithelium is made up of a single layer of thin, flattened cells.
  - 2. Because it is suited for diffusion, it functions in the exchange of gases in the lungs and lines blood and lymph vessels as well as body cavities.
- C. Simple Cuboidal Epithelium (Fig. 5.2)
  - 1. Simple cuboidal epithelium consists of a single layer of cube-shaped cells with centrally located nuclei.
  - 2. It functions in secretion and absorption in the kidneys, and in secretion in glands.
- D. Simple Columnar Epithelium (Fig. 5.3)
  - 1. Simple columnar epithelium is made up of a row of elongated cells whose nuclei are all located near the basement membrane. It may be ciliated.
  - 2. It lines the uterus, stomach, and intestines where it protects underlying tissues, secretes digestive fluids, and absorbs nutrients.
  - 3. In the intestine, these cells possess microvilli that increase the surface area available for absorption.
  - 4. Mucus-secreting goblet cells can be found among columnar cells.
- E. Pseudostratified Columnar Epithelium (Fig. 5.4)
  - 1. These cells appear layered due to the varying positions of their nuclei within the row of cells, but are not truly layered.
  - 2. Cilia may be present, along with mucus-secreting goblet cells, that line and sweep debris from respiratory tubes.
- F. Stratified Squamous Epithelium (Fig. 5.5)
  - 1. This type of tissue is made up of layers of flattened cells that are designed to protect underlying layers.
  - 2. It makes up the outer layer of skin, and lines the mouth, throat, vagina, and anal canal.
  - 3. In the skin, outer layers of cells undergo keratinization; however, this process does not occur where tissues remain moist in the throat, vagina, or anal canal.
- G. Stratified Cuboidal Epithelium (Fig. 5.6)
  - 1. This tissue consists of two to three layers of cuboidal cells lining a lumen of the mammary glands, sweat glands, salivary glands, and pancreas.
  - 2. Several layers of cells provide greater protection than one single layer.
- H. Stratified Columnar Epithelium (Fig. 5.7)
  - 1. This tissue consists of several layers of cells and is found in the ductus deferens, part of the male urethra, and parts of the pharynx.

- I. Transitional Epithelium (Fig. 5.8)
  - 1. Transitional epithelium is designed to distend and return to its normal size, as it does in the lining of the urinary bladder.
  - 2. This design provides distensibility and keeps urine from diffusing back into the internal cavity.
- J. Glandular Epithelium (Fig. 5.9; Tables 5.2,5.3)
  - 1. This tissue is made up of cells designed to produce and secrete substances into ducts or into body fluids.
  - 2. Glands that secrete products into ducts are exocrine; those that secrete into body fluids and blood are called endocrine.
  - 3. Glands are classified by the ways the glands secrete their products.
    - a. Merocrine glands release fluid products by exocytosis (pancreas) and are grouped as serous (which produce a watery fluid), or mucus (which produce a thicker, protective substance).
    - b. Apocrine glands lose portions of their cell bodies during secretion (mammary glands).
    - c. Holocrine glands release entire cells (sebaceous glands).

### **5.3 Connective Tissues (Table 5.4)**

- A. General Characteristics
  - 1. Connective tissues bind, support, protect, serve as frameworks, fill spaces, store fat, produce blood cells, protect against infection, and repair tissue damage.
  - 2. Unlike epithelial tissues, connective tissues have abundant matrix, or intercellular material, throughout, and have good blood supplies (except cartilage).
  - 3. Major Cell Types (Figs. 5.10-5.12)
    - a. The fibroblast is the most common cell type, and is a fixed, star-shaped cell that secretes fibers and is large in size.
    - b. Wandering macrophages function as scavenger cells and defend against infection.
    - c. Mast cells are large and are located near blood vessels where they release heparin (anticoagulant) and histamine (promotes inflammation).
  - 4. Connective Tissue Fibers (Fig. 5.13)
    - a. Strong collagenous fibers (white fibers), made of the protein collagen, add strength for holding body parts together.
    - b. Elastic fibers (yellow fibers), made of the protein elastin, are stretchy and add flexibility to certain types of connective tissues.
    - c. Reticular fibers are thin collagenous fibers that form supportive networks in a variety of tissues.
- B. Categories of Connective Tissue
  - 1. Loose Connective Tissue
    - a. Areolar Tissue (Fig. 5.13)
      - i. This type of tissue forms delicate, thin membranes throughout the body that bind body parts together such as skin and underlying organs.
      - ii. The majority of the cells are fibroblasts that are separated by a gel-like ground substance that contains collagenous and elastic fibers.
    - b. Adipose Tissue (Fig. 5.14)
      - i. Adipose tissue is loose connective tissue designed to store fat.
      - ii. It is found beneath the skin, around joints, padding the kidneys and other internal organs, and in certain abdominal membranes.
    - c. Reticular Connective Tissue
      - i. Is composed of thin, collagenous fibers in a 3-D network.

- ii. It helps to provide framework of certain internal organs (liver and spleen).
- 2. Dense Connective Tissue (Fig. 5.15)
  - a. This tissue consists of densely packed collagenous fibers and is very strong but lacks a good blood supply.
  - b. It is found as part of tendons and ligaments.
- 3. Cartilage (Figs. 5.16-5.18)
  - a. Cartilage is a rigid connective tissue that provides a supportive framework for various structures. It lacks a vascular system and so heals slowly.
  - b. Cartilage cells (chondrocytes) lie within lacunae in the gel-like fluid matrix.
  - c. Cartilaginous structures are enclosed within a connective tissue perichondrium.
  - d. The most common, hyaline cartilage, is white with abundant fine collagen fibers, is found at the ends of bones, and supports respiratory passages.
  - e. Elastic cartilage, with elastic fibers, provides a framework for the external ears and parts of the larynx.
  - f. Fibrocartilage, with many collagenous fibers, is a tough tissue that provides a shock-absorbing function in intervertebral disks and in the knees and pelvic girdle.
- 4. Bone (Fig. 5.19)
  - a. Bone is the most rigid connective tissue, with deposits of mineral salts and collagen within the matrix.
  - b. Bone internally supports the body, protects, forms muscle attachments and is the site for blood cell formation.
  - c. Bone cells, called osteocytes, lie within lacunae and are arranged in concentric circles (osteons) around osteonic canals interconnected by canaliculi.
  - d. Bone has a good blood supply, enabling rapid recovery after an injury.
- 5. Blood (Fig. 5.20)
  - a. Blood is composed of cells (red and white) suspended in a liquid matrix called plasma.
  - b. It functions to transport substances throughout the body.

#### **5.4 Types of Membranes**

- A. Epithelial membranes are sheet-like structures composed of an epithelial layer and a layer of connective tissue
- B. Four main types of epithelial membranes are serous, mucus, synovial, and cutaneous

#### **5.5 Muscle Tissues**

- A. General Characteristics
  - 1. Muscle cells, or fibers, can contract and consist of three major types.
- B. Skeletal Muscle Tissue (Fig. 5.21)
  - 1. Skeletal muscle is attached to bone and can be controlled by conscious effort (voluntary).
  - 2. The cells (muscle fibers) are long and cylindrical, striated, have many nuclei and contract from nervous impulse.
- C. Smooth Muscle Tissue (Fig. 5.22)
  - 1. Smooth muscle tissue lacks striations, is uninucleate, and consists of spindle-shaped cells.
  - 2. This involuntary muscle is found in the walls of internal organs, and in the digestive tract, blood vessels, and urinary bladder.
- D. Cardiac Muscle Tissue (Fig. 5.23)
  - 1. Cardiac muscle tissue is found only in the heart and consists of branching fibers that

are connected to each other with intercalated disks.

2. This involuntary muscle has a single nucleus in each cell but appears striated.

#### **5.6 Nervous Tissues (Fig. 5.24; Table 5.6)**

- A. Nervous tissues are found in the brain, spinal cord, and nerves.
- B. Neurons, or nerve cells, conduct nervous impulses while helper cells, or neuroglia, support and nourish the neurons.