

## Chapter 4: Histology: The Study of Tissues

### I. Tissues and Histology

#### A. Tissues

1. Tissues are collections of \_\_\_\_\_ and the \_\_\_\_\_
2. The classification of tissue types is based on:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
3. Name the four primary tissue types:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_
4. The classification of epithelial and connective tissue is based on:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
5. The classification of muscle and nervous tissue is based on:
  - a. \_\_\_\_\_

#### B. Histology

1. What is histology? \_\_\_\_\_
2. What is a biopsy? \_\_\_\_\_

### II. Embryonic Tissue

#### A. Endoderm

1. Considering position of the layers which layer is the endoderm? \_\_\_\_\_
2. Endoderm will form \_\_\_\_\_

#### B. Mesoderm

1. Considering position of the layers which layer is the mesoderm? \_\_\_\_\_
2. Mesoderm will form \_\_\_\_\_

C. Ectoderm

1. Considering position of the layers which layer is the ectoderm? \_\_\_\_\_
2. Ectoderm will form \_\_\_\_\_

**III. Epithelial Tissue**

A. General Characteristics of Epithelium

1. Epithelium is composed mostly of \_\_\_\_\_ with very little \_\_\_\_\_
2. Epithelium covers \_\_\_\_\_ and forms \_\_\_\_\_
  - a. On what body surfaces would one expect to find epithelium?  
\_\_\_\_\_  
\_\_\_\_\_
3. Define the following epithelial terms:
  - a. Free or apical surface \_\_\_\_\_
  - b. Lateral surface \_\_\_\_\_
  - c. Basal surface \_\_\_\_\_
  - d. How is a basement membrane formed? \_\_\_\_\_  
\_\_\_\_\_
  - e. What does the basement membrane do? \_\_\_\_\_  
\_\_\_\_\_
4. What holds adjacent epithelial cells together? \_\_\_\_\_
5. Epithelial tissue is "avascular" since it is not penetrated by blood vessels. So how do nutrients reach the epithelial cells? \_\_\_\_\_
  - a. Where are the most metabolically active cells? \_\_\_\_\_

B. List the Five Major Functions of Epithelia

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

C. Classification of Epithelium

1. Classification is based on \_\_\_\_\_ & \_\_\_\_\_
2. Three major types of epithelium based on number of cell layers:
  - a. Observing a simple epithelium one would expect to see: \_\_\_\_\_  
\_\_\_\_\_
  - b. Observing a stratified epithelium one would expect to see: \_\_\_\_\_  
\_\_\_\_\_
  - c. Observing pseudostratified columnar epithelium one would expect to see:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
1. Where might you find this type of epithelium? \_\_\_\_\_
3. List and describe the three shapes of epithelial cells:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
4. Types of epithelium are given two names based on:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
5. Describe how "moist stratified squamous epithelium" differs from "keratinized stratified squamous epithelium": \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Transitional Epithelium

- a. Where is it found? \_\_\_\_\_
- b. What shape are the cells when they are not stretched? \_\_\_\_\_
- c. What shape are the cells when they are stretched? \_\_\_\_\_

D. Functional Characteristics

1. Cell Layers and Cell Shapes

- a. Simple epithelium functions to:
  1. \_\_\_\_\_
  2. \_\_\_\_\_

3. \_\_\_\_\_
  4. \_\_\_\_\_
- b. Stratified epithelium functions for \_\_\_\_\_
1. As outer cells are \_\_\_\_\_ they are \_\_\_\_\_
- c. Flat and thin cells will allow \_\_\_\_\_ and \_\_\_\_\_
- d. Cuboidal or columnar cells are usually involved in \_\_\_\_\_
2. Cell Surfaces
- a. What do smooth surfaces do? \_\_\_\_\_
  - b. What do microvilli do for a cell? \_\_\_\_\_
    1. Therefore they are found in cells involved in what? \_\_\_\_\_
  - c. Elongated microvilli are called \_\_\_\_\_
    1. They are found where what is an important function? \_\_\_\_\_
  - d. What purpose do cilia serve in the human body? \_\_\_\_\_
3. Cell Connections
- a. List the three functions of cellular connections:
    1. \_\_\_\_\_
    2. \_\_\_\_\_
    3. \_\_\_\_\_
  - b. Describe the structure of a desmosome: \_\_\_\_\_
 

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    1. What does a hemidesmosome do? \_\_\_\_\_
  - c. Tight junctions \_\_\_\_\_ & \_\_\_\_\_
    1. Where is the zonula adherens and what does it do? \_\_\_\_\_
 

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    2. The zonula occludens forms \_\_\_\_\_
      - a. The tight seal prevents \_\_\_\_\_
  - d. What does a gap junction do? \_\_\_\_\_
    1. They are most important in \_\_\_\_\_ & \_\_\_\_\_
    2. In ciliated epithelial cells they may \_\_\_\_\_
4. Glands
- a. Glands that connect to the surface by a duct are called \_\_\_\_\_

- b. Glands that do not connect by a duct are called \_\_\_\_\_
  - 1. These glands secrete into the \_\_\_\_\_
  - 2. These glands produce \_\_\_\_\_
- c. An exocrine gland consisting of a single cell is called \_\_\_\_\_
  - 1. An example would be \_\_\_\_\_
- d. An exocrine gland consisting of many cells is called \_\_\_\_\_
  - 1. The duct system of an exocrine gland can be:
    - a. Simple which means \_\_\_\_\_
    - b. Compound which means \_\_\_\_\_
    - c. Tubular (tubule) which means \_\_\_\_\_
    - d. Acinar (acini) which means \_\_\_\_\_
    - e. Alveolar (alveoli) which means \_\_\_\_\_
- e. Describe how each of the three functional types of exocrine glands work:
  - 1. Merocrine Glands: \_\_\_\_\_  
\_\_\_\_\_
  - 2. Apocrine Glands: \_\_\_\_\_  
\_\_\_\_\_
  - 3. Holocrine Glands: \_\_\_\_\_  
\_\_\_\_\_

#### IV. Connective Tissue

##### A. General Characteristics of Connective Tissue

- 1. Connective tissue \_\_\_\_\_ are separated by \_\_\_\_\_
- 2. Connective tissue structure is \_\_\_\_\_ and performs \_\_\_\_\_

##### B. List the seven major categories of connective tissue function:

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_

7. \_\_\_\_\_

### C. Cells of Connective Tissue

1. Define the function that each cell would have based on the suffix:
  - a. Blasts \_\_\_\_\_
  - b. Cytes \_\_\_\_\_
  - c. Clasts \_\_\_\_\_
2. What type of connective tissue does each of the following prefixes refer to:
  - a. Fibro \_\_\_\_\_
  - b. Chondro \_\_\_\_\_
  - c. Osteo \_\_\_\_\_
3. Adipose Cells (adipocytes)
  - a. What do adipose cells do? \_\_\_\_\_
  - b. What do adipose cells look like? \_\_\_\_\_
4. Mast Cells
  - a. Where are mast cells found? \_\_\_\_\_
  - b. What chemicals do they contain? \_\_\_\_\_
  - c. What is their function? \_\_\_\_\_
5. What cells continuously move into connective tissue? \_\_\_\_\_
6. What do macrophages do? \_\_\_\_\_
  - a. A fixed macrophage \_\_\_\_\_
  - b. A wandering macrophage \_\_\_\_\_
7. Embryonic connective tissue cells that persist in adult tissues are called:  
\_\_\_\_\_
  - a. Their potential is to \_\_\_\_\_

### D. Extracellular Matrix

1. List the three major components of connective tissue matrix:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
2. The structure of the matrix is responsible for \_\_\_\_\_
3. Protein Fibers of the Matrix

- a. Collagen fibers are composed of \_\_\_\_\_
  - 1. Describe the structure of a collagen molecule: \_\_\_\_\_  
\_\_\_\_\_
  - 2. What are the physical properties of collagen?  
\_\_\_\_\_ & \_\_\_\_\_ but \_\_\_\_\_
  - 3. How many types of collagen are there? \_\_\_\_\_
- b. Reticular fibers are actually \_\_\_\_\_
  - 1. Describe reticular fibers: \_\_\_\_\_
  - 2. Functionally reticular fibers \_\_\_\_\_
- c. Elastic fibers contain \_\_\_\_\_
  - 1. This protein has the ability to \_\_\_\_\_
  - 2. Describe an elastin molecule: \_\_\_\_\_
  - 3. How are elastin molecules arranged in the tissue? \_\_\_\_\_  
\_\_\_\_\_
- 4. Other Matrix Molecules
  - a. What is ground substance? \_\_\_\_\_
  - b. Describe the shape of hyaluronic acid molecules: \_\_\_\_\_
  - c. What quality does hyaluronic acid give to fluids? \_\_\_\_\_
  - d. What are proteoglycan monomers? \_\_\_\_\_  
\_\_\_\_\_
  - e. What can proteoglycans do when they trap large quantities of water?  
\_\_\_\_\_
  - f. What do adhesive molecules do in connective tissue? \_\_\_\_\_  
\_\_\_\_\_

**V. Classification of Connective Tissue**

A. Classification of connective tissue is influenced by:

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

## B. Embryonic Connective Tissue

1. It is properly called \_\_\_\_\_
2. Structurally it is made up of:
  - a. Irregularly \_\_\_\_\_
  - b. Surrounded by \_\_\_\_\_
  - c. In which \_\_\_\_\_
3. Where is mucous connective tissue found? \_\_\_\_\_

## C. Adult Connective Tissue

### 1. Loose Connective Tissue

- a. It is sometimes referred to as \_\_\_\_\_
- b. Loose connective tissue consists of:
  1. Protein \_\_\_\_\_
  2. With numerous \_\_\_\_\_
- c. Functionally areolar connective tissue is:
  1. \_\_\_\_\_
  2. \_\_\_\_\_
- d. Structurally it contains \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_ fibers and a \_\_\_\_\_ of cells.

### 2. Dense Connective Tissue

- a. Protein fibers form \_\_\_\_\_
- b. Dense Regular Connective Tissue
  1. What does the term "regular" in the name refer to? \_\_\_\_\_
  2. Dense regular connective tissue has abundant \_\_\_\_\_
    - a. This makes the tissue appear what color? \_\_\_\_\_
  3. Dense regular collagenous connective tissue forms:
    - a. \_\_\_\_\_
    - b. \_\_\_\_\_
- c. Dense Regular Elastic Connective Tissue
  1. Composed of bundles of \_\_\_\_\_ & abundant \_\_\_\_\_
    - a. This makes the tissue appear what color? \_\_\_\_\_
  2. Dense regular elastic connective tissue forms \_\_\_\_\_



3. Functionally when stretched they \_\_\_\_\_
- d. Dense Irregular Connective Tissue
  1. Contains protein fibers arranged \_\_\_\_\_
  2. Functionally forms sheets that have \_\_\_\_\_
  3. Where would you find dense irregular collagenous connective tissue?  
\_\_\_\_\_
  4. Where would you find dense irregular elastic connective tissue?  
\_\_\_\_\_
3. Connective Tissue with Special Properties
  - a. Adipose Tissue
    1. Consists of adipocytes containing \_\_\_\_\_
    2. Adipose is composed of \_\_\_\_\_ cells and a small amount of \_\_\_\_\_ that consists of \_\_\_\_\_
    3. Functionally adipose is:
      - a. \_\_\_\_\_
      - b. \_\_\_\_\_
      - c. \_\_\_\_\_
  - b. Reticular Tissue
    1. Forms the \_\_\_\_\_ of lymphatic tissue.
    2. Characterized by a network of \_\_\_\_\_ & \_\_\_\_\_
4. Cartilage
  - a. Cartilage is composed of cells called \_\_\_\_\_ that are in spaces called \_\_\_\_\_ inside an \_\_\_\_\_
  - b. The matrix of cartilage contains \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_
  - c. The proteoglycans can trap \_\_\_\_\_
    1. This allows cartilage to \_\_\_\_\_
  - d. The collagen fibers give cartilage \_\_\_\_\_
  - e. What is the perichondrium? \_\_\_\_\_
  - f. Why does cartilage heal slowly? \_\_\_\_\_
  - g. Hyaline Cartilage
    1. It has large amounts of \_\_\_\_\_ & \_\_\_\_\_

2. Where would you find hyaline cartilage?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. It also covers \_\_\_\_\_
- h. Fibrocartilage
  1. It has more \_\_\_\_\_ than \_\_\_\_\_
  2. Functionally it is slightly \_\_\_\_\_ & \_\_\_\_\_
  3. Where would you find fibrocartilage? \_\_\_\_\_
- i. Elastic Cartilage
  1. It has \_\_\_\_\_ fibers in addition to \_\_\_\_\_ & \_\_\_\_\_
  2. Where would you find elastic cartilage? \_\_\_\_\_
5. Bone
  - a. Bone consists of \_\_\_\_\_ & \_\_\_\_\_
  - b. The organic portion consists of \_\_\_\_\_ fibers, primarily \_\_\_\_\_
  - c. The inorganic portion consists of \_\_\_\_\_
    1. What minerals do they contain? \_\_\_\_\_ & \_\_\_\_\_
  - d. Bone cells are called \_\_\_\_\_ & are located in \_\_\_\_\_
  - e. Cancellous or Spongy Bone
    1. Composed of plates called \_\_\_\_\_ surrounding \_\_\_\_\_
  - f. Compact Bone
    1. What is a lamellae? \_\_\_\_\_
  - g. Why does bone repair so easily? \_\_\_\_\_
6. Hemopoietic Tissue and Blood
  - a. Why is blood unusual among connective tissues? \_\_\_\_\_
  - b. What does hemopoietic tissue do? \_\_\_\_\_
  - c. What is yellow bone marrow composed of? \_\_\_\_\_
  - d. What is red bone marrow composed of? \_\_\_\_\_

## VI. Muscle Tissue

- A. The main characteristic of muscle tissue is \_\_\_\_\_
- B. Muscle Tissue Structure

1. What does striated mean? \_\_\_\_\_
2. Therefore nonstriated would mean? \_\_\_\_\_

C. Muscle Tissue Function

1. What does voluntary mean? \_\_\_\_\_
2. What does involuntary mean? \_\_\_\_\_

D. Based on structural and functional classification (B & C above):

1. Skeletal muscle is \_\_\_\_\_
2. Cardiac muscle is \_\_\_\_\_
3. Smooth muscle is \_\_\_\_\_

## VII. Nervous Tissue

A. Nervous tissue has the ability to \_\_\_\_\_

B. Describe each of the major parts of a neuron:

1. Cell body: \_\_\_\_\_
2. Nerve cell processes consist of \_\_\_\_\_
2. Dendrite: \_\_\_\_\_
  - a. A dendrite \_\_\_\_\_ the action potential and \_\_\_\_\_
3. Axon: \_\_\_\_\_
  - b. An axon usually conducts \_\_\_\_\_

C. Describe the structure of the three types of neurons:

1. Multipolar neurons have \_\_\_\_\_
2. Bipolar neurons have \_\_\_\_\_
3. Unipolar neurons have \_\_\_\_\_

D. Neuroglia are \_\_\_\_\_

1. Functionally neuroglia:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_

## VIII. Membranes

A. Mucous Membrane

1. It consists of \_\_\_\_\_, \_\_\_\_\_, a thick \_\_\_\_\_, & sometimes, \_\_\_\_\_
2. Mucous membranes line \_\_\_\_\_
3. Functions include \_\_\_\_\_, \_\_\_\_\_, & \_\_\_\_\_

**B. Serous Membrane**

1. It consists of \_\_\_\_\_ called \_\_\_\_\_, its \_\_\_\_\_ & \_\_\_\_\_
3. Serous membranes line \_\_\_\_\_
4. The membrane is moistened by \_\_\_\_\_ which \_\_\_\_\_
5. Functionally serous membranes:
  - a. Protect \_\_\_\_\_
  - b. Help \_\_\_\_\_
  - c. Act as \_\_\_\_\_

**C. Synovial Membrane**

1. It is composed of \_\_\_\_\_
2. Synovial membranes line \_\_\_\_\_
3. They produce a fluid rich in \_\_\_\_\_ which makes \_\_\_\_\_ thereby \_\_\_\_\_

**IX. Inflammation**

**A. The inflammatory response:**

1. Mobilizes \_\_\_\_\_
2. Isolates \_\_\_\_\_
3. Removes \_\_\_\_\_

**B. List the five major manifestations (symptoms) of an inflammatory response:**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

C. Mediators of inflammation include:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_ & others

D. Why is dilation of blood vessels beneficial? \_\_\_\_\_

E. What does increased permeability of blood vessels do? \_\_\_\_\_

F. What is edema and why does it occur? \_\_\_\_\_

G. The site of injury is "walled off" from surrounding tissues by \_\_\_\_\_

## X. Tissue Repair

A. Tissue repair is the substitution of \_\_\_\_\_ for \_\_\_\_\_

B. Which type of repair results in normal function? \_\_\_\_\_

C. Which type of repair will produce scar tissue? \_\_\_\_\_

D. Classification of Cells

1. What group of cells continues to divide throughout life? \_\_\_\_\_

2. What group of cells divides only in response to injury? \_\_\_\_\_

3. What group of cells has a very limited ability to divide? \_\_\_\_\_

E. \_\_\_\_\_ heals wounds when the edges are close together.

F. \_\_\_\_\_ heals wounds when the edges are far apart.

## XI. Tissues and Aging

A. In older people cells \_\_\_\_\_

B. In older people collagen fibers \_\_\_\_\_

1. Collagen connective tissue becomes less \_\_\_\_\_ & more \_\_\_\_\_

C. Elastic fibers \_\_\_\_\_, bind to \_\_\_\_\_, & become \_\_\_\_\_