Labs 7 and 8
Histology

Histology is a systemic study of tissue types. The four basic tissue types in the human include:

Epithelial Tissue
Connective Tissue
Muscle Tissue
Nervous Tissue

Each of these categories includes several subcategories, based on differences in structure and function. We will consider some of the major subcategories in this lab.

Before you begin:
Read the appropriate chapter in your book (Ch. 5 Tissues)
Prepare your materials – microscope, colored pencils, unlined paper with appropriate labels, prepared slides

Directions:
1. Read the following descriptions of the tissue types.
2. Obtain the samples indicated and sketch the sample under HIGH power in color. Be as detailed and neat as possible in your drawings. Label each sample clearly and indicate the total magnification.
3. Answer the conclusions questions.

Epithelial Tissue

Epithelial tissue can have either of two basic roles: covering/lining; and glandular.

The first kind, covering/lining epithelium, is found in sheets that cover body structures or line body spaces. A key characteristic of covering/lining epithelium is that it always has one side exposed, or free to face outward (covering) or inward (lining). Because the cells form a continuous sheet, they are held together very tightly and have very little matrix (extracellular material). The nonfree face of the epithelial sheet is attached to underlying connective tissue by the **basement membrane**. The basement membrane is a thin, glue-like layer that holds the epithelium in place while remaining highly permeable to water and other substances. This is important because epithelia do not have their own blood supply – they are **avascular**. Water and other important substances must diffuse between the cells and underlying tissue through the basement membrane.

The second kind of epithelium is the type that forms glands. Glandular epithelium forms the functional portions of **exocrine** glands (glands that secrete substances into ducts that empty onto epithelial surfaces). It also forms endocrine glands (glands that secrete substances that diffuse into the bloodstream).

**In many (not all) prepared epithelia, the cytoplasm will appear either as a clear/cloudy area or a very pale pink. The cell membranes are usually faint bust may be visible as medium pink lines. The nuclei are often stained dark pink to violet bluish.*

View the following under HIGH power. Label and sketch each sample.

Epithelial Tissue Samples

1. Simple squamous
2. Simple cuboidal
3. Simple columnar
4. Stratified columnar

Connective Tissue

Some tissues are called connective tissues because they act as connections among various other tissues. **Bone**, **cartilage**, and **fibrous** connective tissues actually hold parts together or support them in some way. **Blood** tissue connects other tissues in the sense of transporting materials between them.

An additional function of some connective tissues is storage. For example, bone tissue is an important storage site for calcium and phosphorous, minerals vital to proper function in many parts of the body.

A structural feature common to all connective tissues is the dominance of the matrix. Recall that epithelial tissues have almost no extracellular material separating individual cells. Connective tissue cells are often widely separated by one of three basic types of matrix:

Protein matrix is extracellular material composed of many substances but with a dominance of protein fibers. **Collagen** is a common protein, forming bundles of tough, flexible fibers. Because they have a whitish color, collagen fibers are often called *white fibers*. **Elastin** is a stretchy, fibrous protein that forms thick, single fibers in connective tissue matrices. Elastin fibers are sometimes called *yellow fibers*. Connective tissue that fall into this category include dense, reticular, and loose (areolar). Also included is **adipose** tissue or fat tissue, a modified form of areolar tissue filled with store lipids.

Protein/ground substance matrix is extracellular material that has some protein fibers in it but also a great deal of nonfibrous protein and other substances. **Cartilage** has a rubbery quality because its matrix is composed of a combination of fibers and ground substance. **Hyaline** cartilage has a moderate amount of collagen fiber, while **fibrocartilage** has a large amount of collagen in its matrix. This large amount of collagen makes fibrocartilage the strongest of the cartilage tissue types. **Elastic** cartilage is distinguished by the presence of elastin fibers, giving it a stretchy quality. **Bone** tissues have a matrix of collagen fibers encrusted with mineral crystals that give it a solid consistency. There are two types of bone tissue- **compact** and **cancellous** (spongy). Compact bone forms rather large, dense pieces of bone matrix. Cancellous bone forms thin, narrow beams of hard bone matrix in which red bone marrow can be supported (site of blood cell formation).

Fluid matrix is composed of a water-based solution with a fluid consistency. **Blood** is the major type of fluid matrix connective tissue. Blood cells are suspended within the fluid plasma and can slide past one another freely. Another type of fluid matrix tissue is **hematopoietic** tissue which produces blood cells.

View the following under HIGH power. Label and sketch each sample.
Connective Tissue Samples

5. Adipose tissue
6. Bone (ground sample)
7. Cartilage – hyaline
8. Cartilage – elastic
9. Blood

Muscle Tissue

All three muscle tissue types contain cells with the ability to contract. Contraction in muscle tissue allows a muscle organ to pull with great force. Such pulling can move a skeleton or squeeze the contents of a hollow organ. In addition to this common function, all muscle tissues are composed of long, cylindrical cells called **muscle fibers**. Muscle fibers are living cells, unlike connective tissue fibers with are nonliving protein fibers.

Skeletal muscle gets its name because it forms muscular organs that attach to the skeleton and move its parts. This tissue is also called striated voluntary muscle because it has striations (stripes) and can be controlled by the conscious mind. Skeletal muscle cells are large, fiberlike cells with fine cross stripes and many nuclei per cell. Skeletal fibers and bundles of muscle fibers often have a coating of fibrous connective tissue (fascia).

Cardiac muscle is also known as striated involuntary muscle. This tissue also has striations, though less distinct than in skeletal muscle. Cardiac muscle is involuntary in the sense that subconscious mechanisms regulate its contraction. Cardiac muscle is found only in the walls of the heart. Because it must encircle and compress the heart chambers with great strength to pump blood, cardiac muscle requires some features not found in other muscle types. For example, the individual fibers are branched, allowing the fibers to mesh with other cells at different layers. Also, cardiac muscle fibers are fused end to end by **intercalated disks**. This branching and fusing gives a group of cells the ability to functionally imitate a giant cell encircling one or more chambers of the heart.

Smooth muscle gets its name because it has no distinct striations. Like cardiac muscle, it also is an involuntary muscle type. Smooth muscle is found in the walls of hollow organs, such as digestive organs and blood vessels. This tissue type is composed of long, threadlike cells, each with a single nucleus. The cells are generally parallel with one another and with the edge of the wall in which they are embedded.

View the following under HIGH power. Label and sketch each sample.
Muscle Tissue Samples

10. Skeletal muscle
11. Cardiac muscle
12. Smooth muscle

Nervous Tissue

Nerve tissue composes organs of the nervous system: the brain, spinal cord, and nerves. Two basic types of cells are found in this tissue – **neurons** and **glia (neuroglia)**. Neurons have the ability to conduct impulses – they are excitable. Neurons are large cells with nucleated bodies and projections called axons and dendrites. Glia surround and support neurons physically or biochemically.

Conclusions

1. What is histology?
2. Simple squamous epithelium can be found in the alveoli of lungs where diffusion of respiratory gases between alveolar air and blood occurs. Explain how this function relates to its structure.
3. Describe the difference in structure between the simple columnar and stratified columnar epithelium samples.
4. What does the term "avascular" mean?
5. What is a basement membrane?
6. Researchers are always looking for new ways to deliver therapeutic drugs to the bloodstream for distribution throughout the body. Currently, biomedical research teams are using epithelial tissue cultures to investigate a relatively new approach the drug introduction. For some time, science has known that certain compounds are easily absorbed by epithelial membranes and picked up by the blood. How could a clinician apply epithelial absorption techniques?
7. Why is blood classified as connective tissue?
8. What is the function of hematopoietic tissue?
9. What is the main difference between connective tissue fibers and muscle tissue fibers?
10. What does the term "striated" mean?
11. Which muscle tissues are striated?
12. Which muscle tissue is voluntary?
13. Which muscle tissues are involuntary?
14. What is the importance of intercalated disks in cardiac tissue?
15. What two types of cells are found in nervous tissue?

Name _____ Period _____

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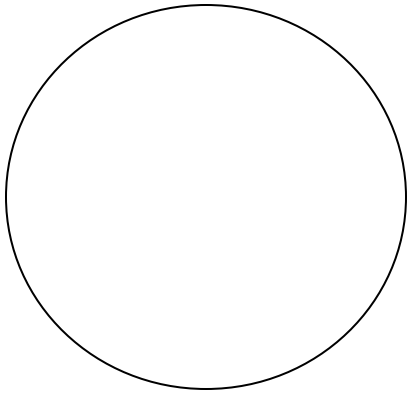
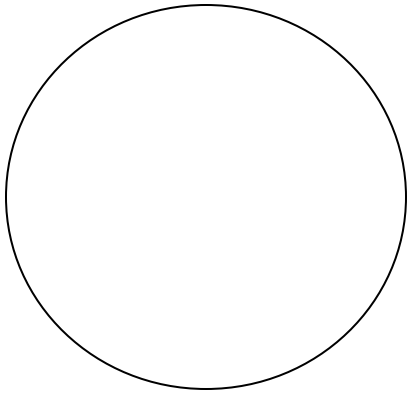
Total Magnification of Samples: _____





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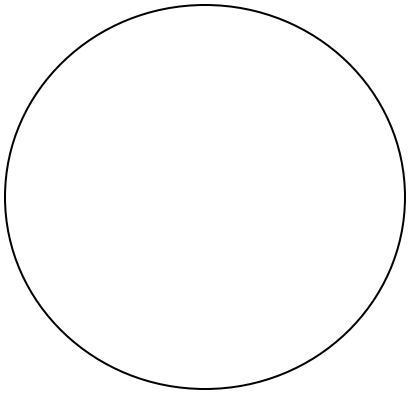

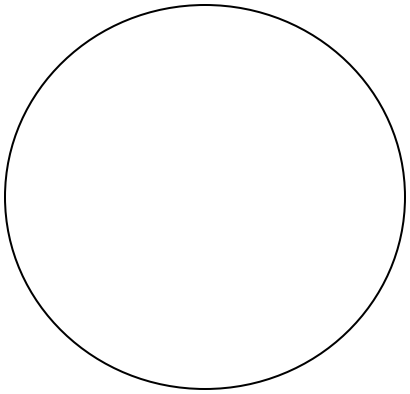

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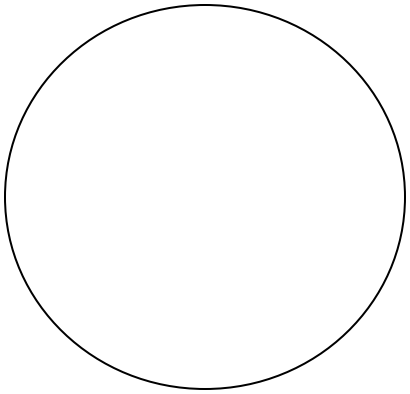

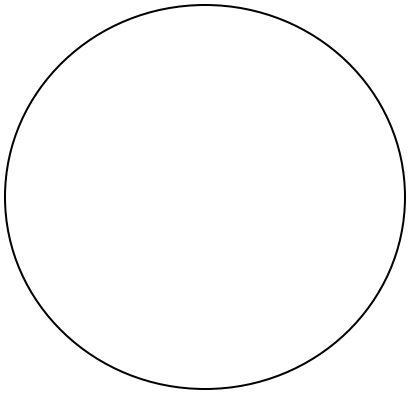

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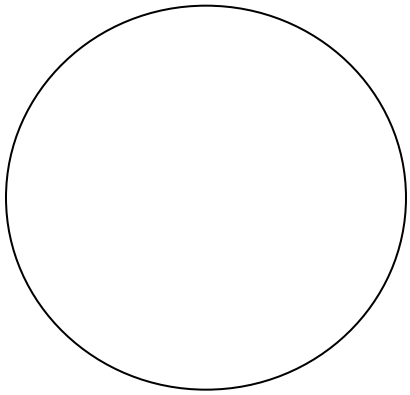

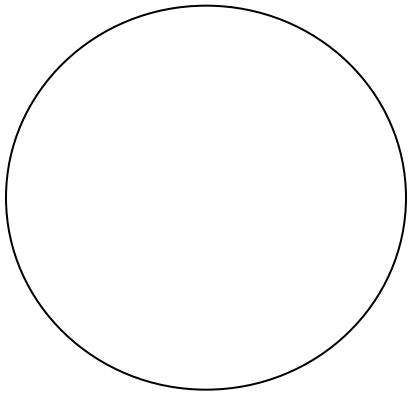

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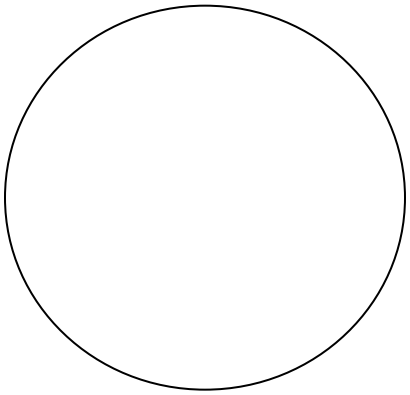

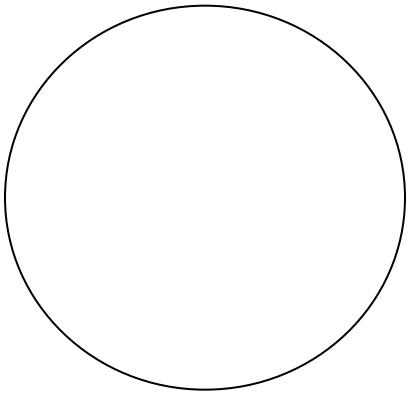

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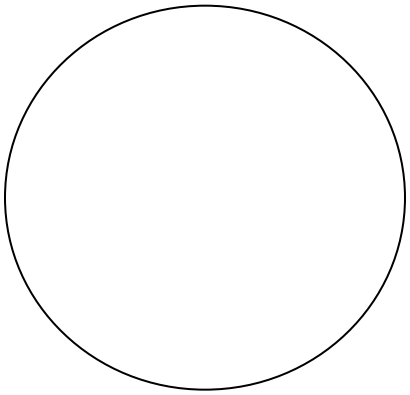

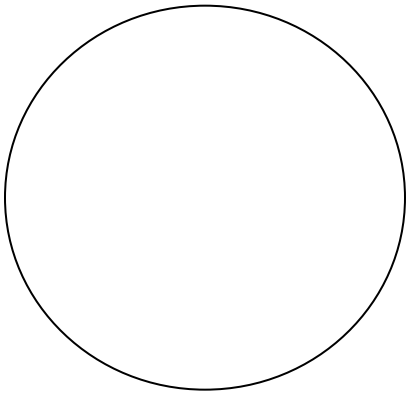

Specimen 11: _____

Specimen 12: _____

Answer Conclusions on your own paper and attach to lab report.