Lab 10: Tissues & Histology

BIOL-8

Name: _____ **Date:** _____

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Objectives

By the end of this lab, you will be able to:

- **Define histology** and explain the relationship between cells, tissues, and organs
- **Identify the four primary tissue types** under a microscope
- **Classify epithelial tissues** based on cell shape and layer number
- **Distinguish connective tissue types** by their matrix and fiber types
- **Compare the structure and function** of skeletal, cardiac, and smooth muscle
- **Identify neurons** and glial cells in nervous tissue

Introduction

Histology is the microscopic study of **tissues**—groups of similar cells working together to perform a specific function. The human body is built from four primary tissue types:

1. **Epithelial**: Covers surfaces, lines cavities, forms glands
2. **Connective**: Supports, protects, binds other tissues together
3. **Muscle**: Specialized for contraction (movement)
4. **Nervous**: Specialized for communication (electrical signals)

In this lab, you will examine prepared microscope slides of these tissues to understand how their **structure** (form) relates to their **function** (physiology).

Materials

- Compound light microscope
- Prepared slides:
- Simple squamous epithelium (lung)
- Simple cuboidal epithelium (kidney)
- Simple columnar epithelium (intestine)
- Stratified squamous epithelium (skin/esophagus)
- Adipose tissue
- Hyaline cartilage
- Bone (ground)
- Blood smear
- Skeletal, Cardiac, and Smooth muscle
- Motor neuron smear
- Colored pencils for sketching

Part 1: Epithelial Tissue

> ***Key Characteristic:*** *Highly cellular, very little extracellular matrix, always has a free (apical) surface and a basement membrane.*

Epithelial tissues are classified by **number of layers** and **cell shape**.

Layers	Shape
Simple (one layer)	**Squamous** (flat)
Stratified (multi-layer)	**Cuboidal** (cube-like)
	Columnar (tall/narrow)

Observation 1: Simple Squamous Epithelium

- **Slide:** Lung (alveoli) or Kidney (glomerulus)
- **Look for:** Single layer of very flat cells; looks like a tiled floor from above or a thin line from the side.
- **Function:** Rapid diffusion and filtration.

Observation 2: Stratified Squamous Epithelium

- **Slide:** Skin (keratinized) or Esophagus (non-keratinized)
- **Look for:** Many layers of cells. Cells near the bottom are cuboidal; cells at the top are flat (squamous).
- **Function:** Protection against abrasion.

Sketching

Epithelial Tissue Sketches

#	Simple Squamous (400x)	Stratified Squamous (400x)
1		

Part 2: Connective Tissue

> ***Key Characteristic:*** *Sparse cells scattered in an abundant* ***extracellular matrix*** *(fibers + ground substance).*

The properties of connective tissue depend largely on the **matrix**.

Observation 3: Adipose Tissue (Fat)

- **Slide:** Adipose
- **Look for:** Large, empty-looking cells (signet ring shape). The nucleus is pushed to the very edge.
- **Function:** Energy storage, insulation, cushioning.

Observation 4: Hyaline Cartilage

- **Slide:** Trachea or Rib
- **Look for:** Cells (**chondrocytes**) sitting in small cavities called **lacunae**. The matrix is smooth/glassy (purple/blue).
- **Function:** Support and reinforcement.

Observation 5: Bone (Osseous Tissue)

- **Slide:** Ground bone
- **Look for:** Tree-ring pattern. Each unit is an **osteon** with a central canal. Cells (**osteocytes**) are in lacunae connected by tiny canals (**canaliculi**).
- **Function:** Support, protection, calcium storage.

Observation 6: Blood

- **Slide:** Human blood smear
- **Look for:** Many molecules!
- **Red blood cells (RBCs):** Small, round, pink, no nucleus.
- **White blood cells (WBCs):** Larger, purple-stained nucleus.
- **Platelets:** Tiny purple fragments.
- **Matrix:** Plasma (fluid, not visible).
- **Function:** Transport of gases, nutrients, wastes.

Sketching

Connective Tissue Sketches

#	Hyaline Cartilage (400x)	Bone (Osteon) (400x)
1		

Part 3: Muscle Tissue

> ***Key Characteristic:*** *Specialized for contraction.*

Observation 7: Skeletal Muscle

- **Slide:** Skeletal muscle (longitudinal)
- **Look for:** Long, cylindrical cells (fibers). **Multinucleate** (nuclei at edges). Obvious **striations** (stripes).
- **Control:** Voluntary.

Observation 8: Cardiac Muscle

- **Slide:** Cardiac muscle
- **Look for:** Branched cells. Usually one nucleus. Faint striations. **Intercalated discs** (dark perpendicular lines joining cells).
- **Control:** Involuntary.

Observation 9: Smooth Muscle

- **Slide:** Intestine or Uterus
- **Look for:** Spindle-shaped cells (tapered ends). One central nucleus. **No striations**. Cells pack closely to form sheets.
- **Control:** Involuntary.

Comparison Table

Muscle Tissue Comparison

#	Type	Striations? (Yes/No)	# of Nuclei	Voluntary? (Yes/No)	Location Example
1					
2					
3					
4					

Part 4: Nervous Tissue

> ***Key Characteristic:*** *Conductivity.*

Observation 10: Multipolar Neuron

- **Slide:** Motor nerve smear (ox spinal cord)

- **Look for:** Large, star-shaped cells (**neurons**).
- **Cell body (soma):** Contains the nucleus.
- **Processes:** Axons and dendrites extending out.
- **Glial cells:** Tiny dark dots surrounding the neurons (support cells).

Sketching

Nervous Tissue Sketch

#	Multipolar Neuron (400x)
1	

Conclusion & Analysis

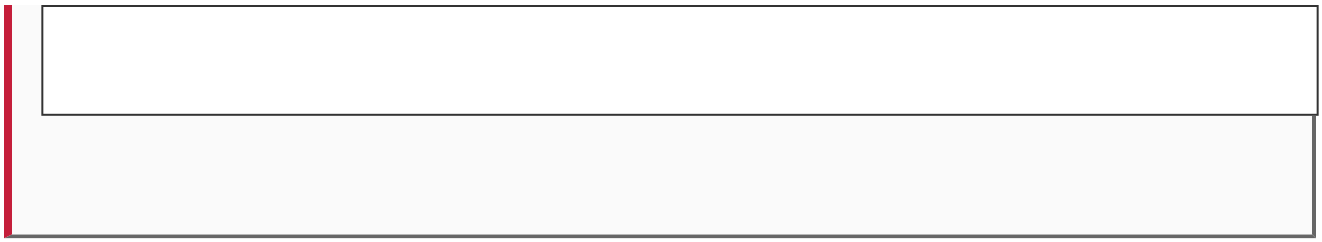
1. How does the structure of simple squamous epithelium fits its function in the lungs?

2. Why is bone tissue hard and rigid, while blood is fluid, even though both are "connective tissues"? What component makes the difference?

3. If you were looking at a muscle slide and saw striations and branching cells with intercalated discs, which muscle type would it be?

4. What is the difference between a neuron and a glial cell?

5. A patient has a condition where their stratified squamous epithelium is replaced by simple columnar epithelium in the esophagus (Barrett's Esophagus). Why might this be a problem given the function of the esophagus?



Lab created for BIOL-8: Human Biology