## Details

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<th>Activities</th>
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<th>Required Materials</th>
<th>Estimated Time</th>
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| 7-1: Identifying Epithelial Tissue | Identify various types of epithelial tissue | • Colored pencils  
• Microscope  
• Epithelial tissue slides (see Instructor Resources for some ideas) | 60–70 min |
| 7-2: Identifying Connective Tissue | • Identify various types of connective tissue  
• List the components of connective tissue  
• Identify cells and fibers in various types of connective tissue | • Colored pencils  
• Microscope  
• Connective tissue slides (see Instructor Resources for some ideas) | 60–70 min |
| 7-3: Mystery Slides | Apply knowledge gained in the previous laboratory exercises | • Colored pencils  
• Microscope  
• Organ slides (see Instructor Resources for some ideas) | 10–20 min |
Overview

Just after her 14th birthday, Shavani went for her annual checkup. Her physician recommended that she undergo yearly Pap smears to screen for cervical cancer. In this simple procedure, the physician obtains a cell sample from the cervix, which is the opening to the uterus. The cells are smeared on a glass slide and examined microscopically. Any questionable results are sent to a pathologist, who specializes in the analysis of tissue for the presence of disease. Shavani agreed to the test, and one week later her physician asked her to come back to discuss the results. The physician began, “Shavani, we detected an abnormality in your Pap smear. Some of the cells look distinctly different from normal cells, and we are a bit concerned that these abnormal cells might develop into cancer.” To be on the safe side, Shavani underwent laser surgery, which eradicated the abnormal cervical cells. Happily, a follow-up Pap smear 6 months later did not show any abnormalities.

Cervical cancer can be deadly because it often causes symptoms only after it spreads to other tissues. Many lives are saved by the early diagnosis of cervical precancerous growths using Pap smears. The ability to recognize healthy and unhealthy tissue is thus a critical skill for all health professionals. Today’s lab introduces histology, the study of tissue. We concentrate on two types of tissue: epithelial tissue and connective tissue.

Remember that histology requires practice and patience. If you take the time to precisely focus your microscope and really look at the slides, you will see amazing details emerge from what initially appears to be a “sea of pink.” The more time that you invest in learning to recognize the types of epithelial and connective tissues, the easier it will be in future labs when you revisit these tissues as components of specific organs.

Need to Know

● Epithelial tissue
  ● Consists of tightly packed cells joined together by tight junctions.
  ● Lines the lumen (or interior space) of hollow organs and makes up the top layer (epidermis) of the skin. The basal surface of the epithelium rests on a dense protein mat called the basement membrane. The apical surface of the epithelium lines the lumen and may have modifications, such as cilia or microvilli.
  ● It is classified by the number of cell layers:
    ○ Simple epithelium consists of a single layer of cells, which all attach to the basement membrane.
    ○ Stratified epithelium consists of two or more layers of cells, and only one layer attaches to the basement membrane.
  ● Also classified by cell shape:
    ○ Squamous cells are flat (resembling fish scales).
    ○ Cuboidal cells are boxy, with large central nuclei.
    ○ Columnar cells are tall, with nuclei close to the basement membrane.
  ● Example: simple cuboidal epithelium is a single layer of box-shaped cells.
**Connective tissue**
- Develops from primitive embryonic tissue called **mesenchyme**.
- Consists of cells separated by the **extracellular matrix**.
  - Cells include fibroblasts or specialized cells.
  - Extracellular matrix consists of protein fibers suspended in a featureless gel called **ground substance**.
  - Ground substance can be liquid (such as blood plasma), gel-like, or even solid (as in bone).
- Example: blood
  - Blood cells are erythrocytes and leukocytes.
  - Blood has a ground substance called **plasma**, which contains water, protein, glucose, and electrolytes.
  - Fibers (fibrinogen) are present in blood only during injury.
- Example: dense connective tissue proper
  - Its cells are fibroblasts.
  - It has minimal ground substance.
  - It has collagen protein fibers.
Pre-Lab Activity

Students should complete this activity before completing the lab activities that follow.

1. Describe the difference in the number of cell layers between simple epithelium and stratified epithelium.

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___________________________________________________________________________________________________________

2. Comparing epithelial and connective tissues, which tissue type contains closely packed cells? Which tissue type contains cells further apart and also includes fibers?

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Activity 7-1

Identifying Epithelial Tissue

This activity asks you to classify different epithelial tissues based on cell shape and the number of layers. See Figure 3.27 in your textbook for illustrations of the different types of epithelial tissue.

Activity Instructions

1. Look at slides containing epithelial tissue. Remember, you are looking for tightly packed cells (cells right next to one another). Note that one slide contains abnormal (cancerous) epithelial tissue.

2. Use colored pencils to draw what you see in the corresponding circles below. Add a written description to support your drawing. The drawings or descriptions should be good enough that you can study them at home and remember what the specific tissue looks like.

3. Label the drawings, record the total magnification (TM), and record the name of the slide. Most slides are best observed at either low or high power.

4. Look at several different slides showing the same type of tissue and record the names of those slides.

Simple Squamous Epithelium

TM ________________________________

Slide name _______________________________________________________

Other slides _______________________________________________________

Description _______________________________________________________

_______________________________________________________________

_______________________________________________________________

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_______________________________________________________________

_______________________________________________________________
**Simple Cuboidal Epithelium**

- Look for **microvilli** on some slides.
- Look for **goblet cells** on some slides.

**Simple Columnar Epithelium**

- Look for **microvilli** on some slides.
- Look for **goblet cells** on some slides.
**Pseudostratified Columnar Epithelium**

- Look for **cilia** on some of the slides.
- Look for **goblet cells** on some slides.

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**Nonkeratinized Stratified Squamous Epithelium**

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Keratinized Stratified Squamous Epithelium

TM

Slide name

Other slides

Description

Keratinized Stratified Squamous Epithelium (Cancer)

TM

Slide name

Description
Stratified Cuboidal Epithelium

TM __________________________

Slide name _____________________

Other slides _____________________

Description _____________________


Stratified Columnar Epithelium

TM __________________________

Slide name _____________________

Other slides _____________________

Description _____________________
Activity Questions

1. Describe the difference in appearance between keratinized and nonkeratinized stratified squamous epithelium.

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2. Explain what the word *pseudostratified* in pseudostratified columnar epithelium refers to.

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3. Describe the difference in the number of cell layers between stratified cuboidal epithelium and stratified squamous epithelium (keratinized or nonkeratinized).

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4. Describe the general structure of epithelial tissue.

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5. Describe the differences between the skin cancer slide (keratinized stratified squamous epithelium) and the normal skin slide.

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Activity 7-2

Identifying Connective Tissue

This activity asks you to classify connective tissue based on the identity of the cells and the composition of the extracellular matrix. See Figure 3.30 in your textbook for images of the different types of connective tissue.

Activity Instructions

1. Look at slides containing connective tissue.

2. Use colored pencils to draw what you see in the corresponding circles below. Add a written description to support your drawing. The drawings or descriptions should be good enough that you can study them at home and remember what the specific tissue looks like.

3. Label the drawings, record the total magnification (TM), and record the name of the slide. Most slides are best observed at either low or high power.

4. Name the type(s) of cells and fiber(s) seen. Name the ground substance for each type of connective tissue, even if you cannot see it.

5. Look at several different slides showing the same type of tissue and record the names of those slides.

Mesenchyme

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<th>TM</th>
<th>Cell(s)</th>
<th>Fiber(s)</th>
<th>Slide name</th>
<th>Other slides</th>
<th>Description</th>
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Activity 7-2  Identifying Connective Tissue

**Loose Areolar Tissue**

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**Adipose Tissue**

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<th>Fiber(s)</th>
<th>Slide name</th>
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**Dense Connective Tissue**

- TM
- Cell(s)
- Fiber(s)
- Slide name
- Other slides

**Hyaline Cartilage**

- TM
- Cell(s)
- Fiber(s)
- Slide name
- Other slides

Description
Activity 7-2  Identifying Connective Tissue

**Fibrocartilage**

- TM ____________________________
- Cell(s) _______________________
- Fiber(s) _______________________
- Slide name ____________________
- Other slides __________________
- Description ____________________

**Elastic Cartilage**

- TM ____________________________
- Cell(s) _______________________
- Fiber(s) _______________________
- Slide name ____________________
- Other slides __________________
- Description ____________________
**Blood**

- TM
- Cell(s)
- Fiber(s)
- Slide name
- Other slides
- Description

**Bone Tissue**

- TM
- Cell(s)
- Fiber(s)
- Slide name
- Other slides
- Description
Activity Questions

1. Adipocytes in adipose tissue look “empty” but are not. What is found in the adipocyte? Is the substance ever used? If so, when?

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2. Think about the structure of dense (fibrous) connective tissue. Why does it make sense that ligaments and tendons are composed of that specific tissue?

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3. Describe the differences in appearance between the three types of cartilage.

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4. Critical Thinking: Epithelial tissue is avascular (does not contain blood vessels) but is alive, therefore requiring oxygen and glucose. How, exactly, does it receive nutrients? Through diffusion from underlying connective tissue! Review the connective tissues that you have seen under the microscope and the types of cells and extracellular matrix that each contains. Which one of these tissues do you think underlies most epithelial tissues? Support your answer with facts and observations. (Hint: The answer here is not “blood.” The epithelium needs the gases from blood, however, so the tissue must be a type that is highly vascularized. “Adipose” is not the correct answer because adipose tissue typically surrounds the entire organ.)

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Activity 7-3

Mystery Slides

Activity Instructions

1. View the demonstration microscopes that have different slides and different total magnifications.

2. Use colored pencils to draw what you see in the corresponding circles. Add written descriptions to support your drawings. Determine the type of tissue for each slide. Record your answers below.

3. After recording all of your answers to the mystery slides, check your answers. For any missed identification, go back to the microscope and look at the slide again. Figure out the source of error and write down any new observations.

Mystery Slide 1

TM ____________________________________________  
Description ____________________________________  
________________________________________________  
________________________________________________  
Tissue type ______________________________________

Mystery Slide 2

TM ____________________________________________  
Description ____________________________________  
________________________________________________  
________________________________________________  
Tissue type ______________________________________
**Mystery Slide 3**

- **TM:**
- **Description:**
- **Tissue type:**

**Mystery Slide 4**

- **TM:**
- **Description:**
- **Tissue type:**
Post-Lab Assessment

1. Color each of the following figures according to the color key listed below:
   - Chondrocytes: green
   - Collagen fibers: pink
   - Columnar epithelium: gray
   - Cuboidal epithelium: orange
   - Elastic fibers: blue
   - Erythrocytes: red
   - Fibroblasts: brown
   - Leukocytes: purple
   - Osteocytes: yellow
   - Squamous epithelium: black

2. Write the name of each type of tissue beside or below the image.