LAB 1: Microscopes, Cells, and Tissues

Please bring your textbook to lab

Objectives: This lab will serve as an **introduction to plant anatomy, microscopy, and the structure of a variety of plant tissues**.

Tissue: a group of cells with some similarity in structure, function or position.

Differentiation: the process by which a cell becomes specialized for a particular function.

Indeterminate growth: growth that continues until death, without reaching a final, fully grown form.

Determinate growth: growth that stops at a predetermined point in an organism's development.

Meristem: plant tissue that contains undifferentiated cells that divide and contribute to plant growth.

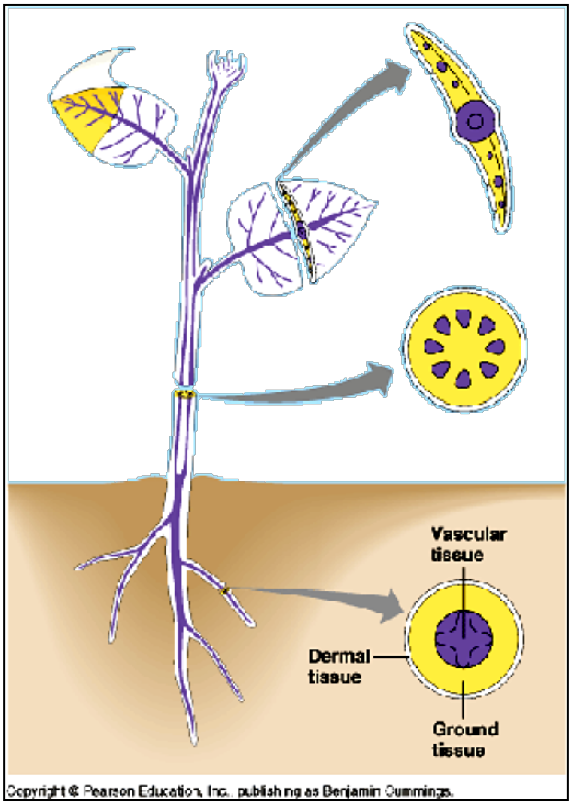
Background:

Plants have three main organs: **roots, stems,** and **leaves.** Spines, hairs, tendrils, and thorns are usually modified leaves or stems, or modified parts of the epidermis of leaves and stems. Cactus spines, for example, are modified leaves!

Look at the diagram of plant parts to the right and identify these parts on the plants in front of you. Draw what you see on pp. 6-8.

Plant roots, stems, and leaves consist of groups of **tissues**, which carry out the processes essential to life. When they are first formed, plant cells are relatively unspecialized. They acquire their unique forms as they age, a process called **differentiation.** Growth in plants is a nearly constant process terminated only by death (**indeterminate growth** compared to the **determinate growth** seen in animals).

Within the multi-celled plants are tissues that "specialize" in growth. That is, tissues whose cells remain undifferentiated and retain the ability to divide. These tissues, called **meristems**, occur at strategic positions where growth is required to support the plant's continuing quest for light, water, and other essentials from the environment. As these cells divide they give rise to cells that "specialize" through differentiation to form other tissues in the plant.



There are **three kinds of plant tissue:**

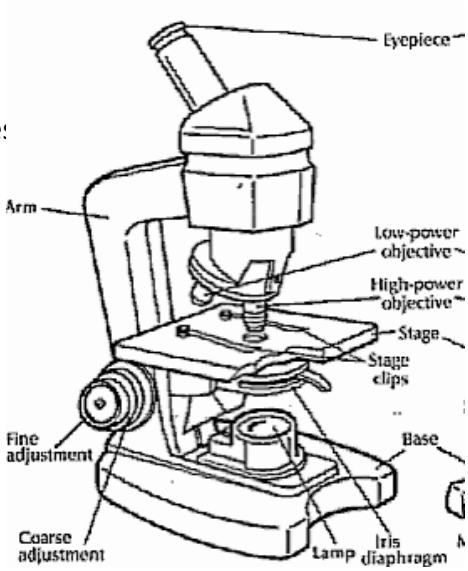
1. **Dermal:** Dermal tissue is adapted almost exclusively for protection against desiccation or external agents such as pathogens.
2. **Vascular:** Vascular tissue is adapted primarily for physical support and translocation or movement of materials within the plant.
3. **Ground:** Ground tissue is the most varied in function and form, but is generally associated with functions of synthesis and accumulation of organic compounds.

As you work through the exercises,

- **Examine each organ or tissue**
- **Locate the three basic tissue types**
- **Examine the variations of cell types within these tissues, and their relative positions to one another**
- **Remind yourself of the functions of the tissues**, or if the function is not clear, **speculate about the function as you examine the forms**

Part 1: Microscopy

In the first portion of the lab you will use a microscope to examine various plant tissues. Most of the tissue will be on already prepared slides, but some will be living and you will make the slides yourself.



1. **Familiarize yourself with the different parts of the compound light microscope**: the eyepieces, objectives, stage, condenser and light source.

2. **Now put in a prepared slide of the letter "e."** Look at the slide without the microscope. Then, at the lowest power (4X), locate the letter and focus.

3. **Examine the letter at each magnification,** using all the objectives. Was the slide in focus and centered at all the magnifications?

4. **Answer the following question:**

What is the magnification of your eyepiece? What is the magnification of each objective?

Lens	Magnification	Total magnification
Eyepiece		xxx
Objective 1		
Objective 2		
Objective 3		

Part 2: Stems

Look at the prepared slides of bean and corn stems.

Identify the following three types of tissue in the prepared slides:

- **Dermal tissue**
- **Ground tissue**
- **Vascular tissue**

Primary meristems giving rise to these tissues differentiate into various cell types in bean and corn stems.

1. Look at the prepared cross-sections of bean and corn under the microscope. **For either the bean or corn cross-section**, draw what you see and label the three types of tissue. Record the magnification. If possible, label the **xylem** and **phloem** as well as **sieve-tube members**, **companion cells**, **tracheids**, and **vessel members**. Are corn and bean monocots or dicots?

2. What differences do you see between bean and corn stem anatomy?

Note: whenever you draw what you see under the microscope, you should record the magnification at which you are viewing the slide. If you can't see something that is asked for, note that.

Part 3: Root Anatomy & Meristems

Plants produce new cells throughout their lifetime as a result of cell divisions in meristems. Tissues produced from apical meristems are called **primary tissues** (because they are new), and this growth is called **primary growth**. Primary growth occurs at the *shoot* and *root tips.* Away from the zone of active cell division, new cells elongate and differentiate resulting in, for example, parenchyma and epidermis.

Examine a prepared slide of a longitudinal section through the root tip of a *Lillium* (Lily). A longitudinal section (abbreviated l.s.) cuts a root (or stem, etc.) parallel to its length.

Use low power at first and then increase magnification. Look at prepared slides of Smilax (greenbrier) and Salix (willow) root cross-sections and draw what you see. Answer questions 1-4 based on your observations:

1. Describe the location of the meristem relative to other parts of the root. Use the images in your textbook as guides.

2. Draw the *Smilax* (monocot) root cross-section and label the three types of tissue (dermal, ground and vascular tissue). Record the magnification. If possible, label the **epidermis, cortex, endodermis, stele (vascular cylinder), pericycle, xylem,** and **phloem.**

3. Draw the *Salix* (dicot) root cross-section and label the three types of tissue. Record the magnification. If possible, label the **epidermis, cortex, endodermis, stele (vascular cylinder), pericycle, xylem,** and **phloem.**

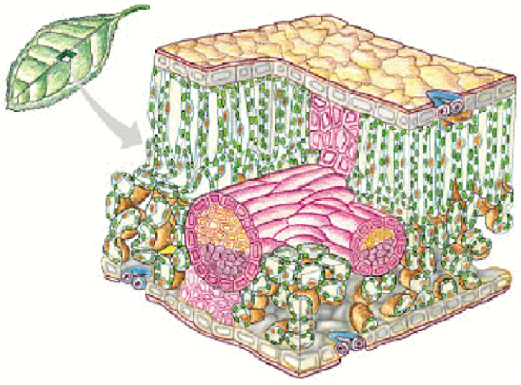
4. How is the organization of tissues in the dicot and monocot cross-sections different?

Part 4: Leaves

Leaves are the organs especially adapted for photosynthesis. The thin blade portion provides a very large surface area for the absorption of light and the uptake of carbon dioxide through the **stomata.** The leaf is basically a layer of parenchyma cells (the **mesophyll**) between two layers of epidermis. The loose arrangement of parenchyma cells within the leaf allows for a great surface area for the rapid exchange of gases. You will examine the structure of a leaf in cross section as well as the surface of leaves and the cells therein.

Leaf anatomy

1. **Identify the following cell types in the adjacent picture of a leaf cross-section:**
    - **Cuticle**
    - **Epidermis (upper and lower)**
    - **Mesophyll (palisade and spongy)**
    - **Air spaces**
    - **Stomata**



2. Look at the cross-sections of *Zea* (corn) and *Ficus* (fig) leaves using the microscope under medium power. Choose either the cross-section for Zea or Ficus and draw what you see in the slide under medium power. **Label the cuticle, epidermis (upper and lower), mesophyll (palisade and spongy), air spaces, and stomates.**

Epidermal Peel

3. **Make an epidermal peel from the lower surface of a living leaf**. **Place it in a drop of water on a clean microscope slide.** Notice how some cells are different from others in the epidermis. These pairs of cells are the **guard cells** of the stomata. The opening between the guard cells is the **stoma** (stomata = plural).

4. Draw what you see in your epidermal peel of the **underside** of the leaf. Label whatever parts you can.

5. **Make a peel from the upper surface of the leaf.** Draw what you see in your epidermal peel of the **upper surface** of the leaf. Label whatever parts you can. Note the position of the stomata and compare that what you observed on the lower surface of the leaf.

6. What is the function of the stomata?

7. Note any internal structures in the guard cells. What might their function be? Speculation is fine.

8. Are there as many stomata in the upper surface as in the lower? Speculate as to why there might be a difference.

Before leaving lab...
Turn in your drawings and complete lab assignment (all questions answered) to your TA.
We cannot give full credit if you do not turn in your assignment before leaving lab.

TOTAL: /10