

Name: _____

Date/Lab time: _____

Lab 3: Plant Morphology: Roots

Supplies:

Bean sprout (Dicot)	Modified roots; Sweet potato (Dicot), radish,
Corn sprout (Monocot)	carrot, Orchid (Monocot), etc.
Radish sprout (Dicot)	Legume with nodules
	Duckweed

Vocabulary to know: Fibrous root, Mucigel, Mycorrhizal fungi, Radicle, Root cap, Root cap, Root hairs, Root mycorrhizae, Taproot, Area of cell maturation, Area of elongation

Introduction:

Roots are defined by the presence of a root cap and by their growth (they do not have nodes and internodes). All types of roots branch. The way roots branch is very different from the way shoots branch (recall that in shoots, new branches form from axillary buds). Root branches form within the root and burst out through tissue (see the movie “Alien”). More on branch roots later.

Roots can serve several functions for the plant including water and mineral absorption, anchoring the plant and storage.

The Root Tip

We will be examining the microscopic parts of roots in the primary growth lab.

Procedure. Examine young roots of bean, radish and corn:

1. Using a dissection microscope examine the young roots of bean, radish and corn supplied and try to note the following external features (**root cap, area of cell division, area of cell elongation, area of cell differentiation, root hairs**).

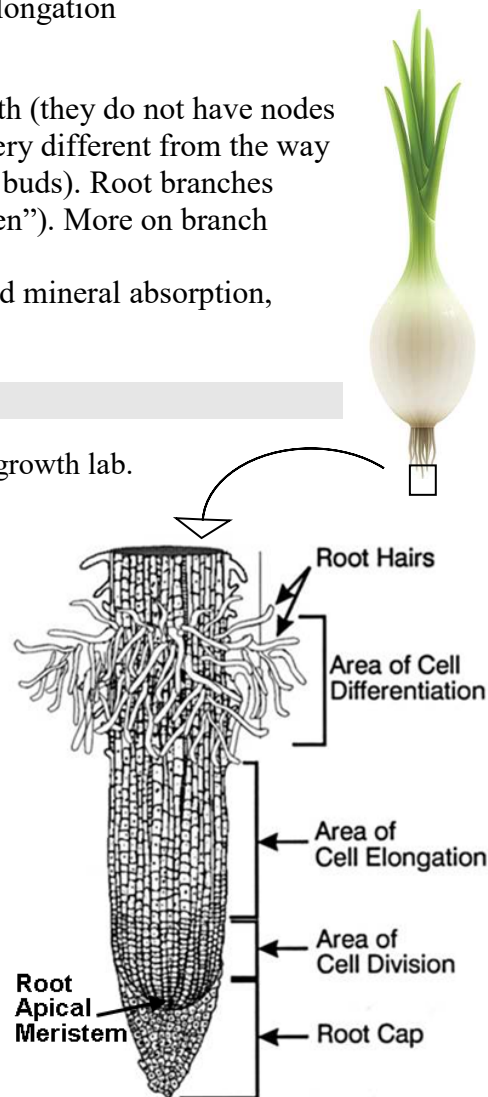
Root apical meristem- tissue found in the root tip that divide and produce the root and root cap. (we will examine meristems in another section)

Root cap- found at the tip of the root and functions to protect the root as it pushes through the soil. The root cap produces a **mucigel** that lubricates the movement of the root as it grows. The root cap is constantly being regenerated as it is abraded off (sort of like your skin). The root cap is sensitive to both light and gravity, both stimulating the root to grow down.

Area of cell division- area of rapid cell division. Gives rise to the root proper.

Area of cell elongation- cell elongation here pushes the root through the soil.

Area of cell differentiation- Cells at this point have stopped elongating and root hairs are seen (root hairs don't form in the area of elongation, if they did they would be sheared off as the root moved through the soil).



Root hairs- are part of the root epidermis (outermost layer of cells). Root hairs function in increasing the surface area for water and mineral absorption. Root hairs are nearly microscopic and are short lived because the root is constantly growing.

2. Using the dissection scope, examine a root from the water plant duckweed. Note the root cap.

⇒ Are there individual root hairs?

⇒ Look over the function of root hairs. Why do you think duckweed would NOT have root hairs?

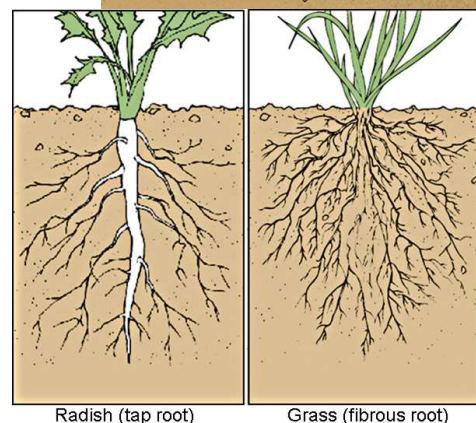
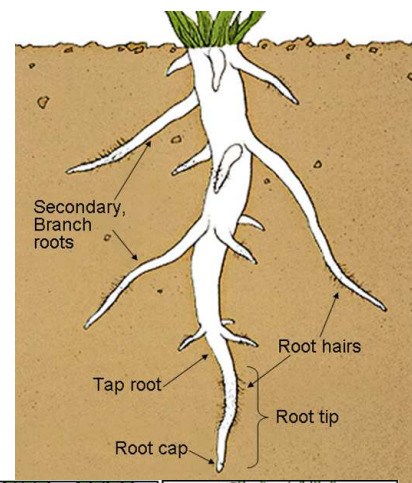
Root Growth

The root formed during seed germination is called the **radicle** (primary root).

Examine the radicals on the germinating seeds you started during the first lab. **Note any differences between them into your Plant Forms table.** Recall: corn is a monocot, bean and radish are dicots.

In many Dicots (carrot is an extreme example) the radical persist and forms a long **taproot** from which **branch roots** form (secondary roots). In many Monocots (like grasses) the radicle does not persist and is soon replaced by numerous less branched roots. This formation is called a **fibrous root**.

Examine the various roots available noting first if they are Monocots or Dicots and whether they have fibrous or tap roots. **(again put your observation into the Plant Forms table)**



Modified roots

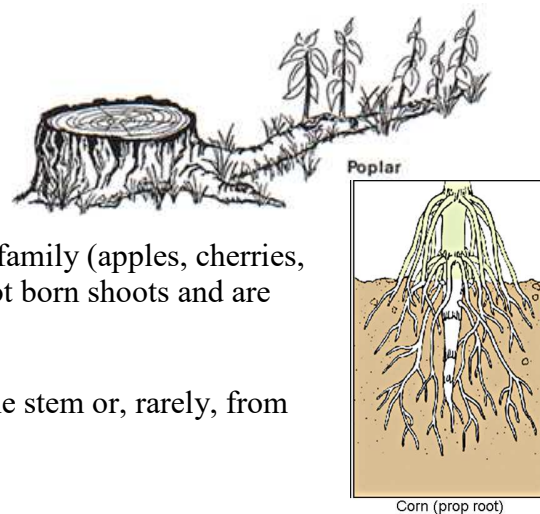
Modified roots are often involved in storage, propagation and/or parasitism (in parasitic plants). Note some of the root modifications in the samples available.

1. Storage roots

A. Starch storage- turnip, radish, dandelion, carrot

B. Sugar storage- sweet potato

2. Propagation roots (root-borne shoots, sucker shoots, basal shoot, root sprout, adventitious shoot, water sprout or sucker)- these are roots that produce shoots. Ex. lilac, black walnut, rose family (apples, cherries, blackberry), (large stand of poplar trees are often the result of root born shoots and are thus all clones)



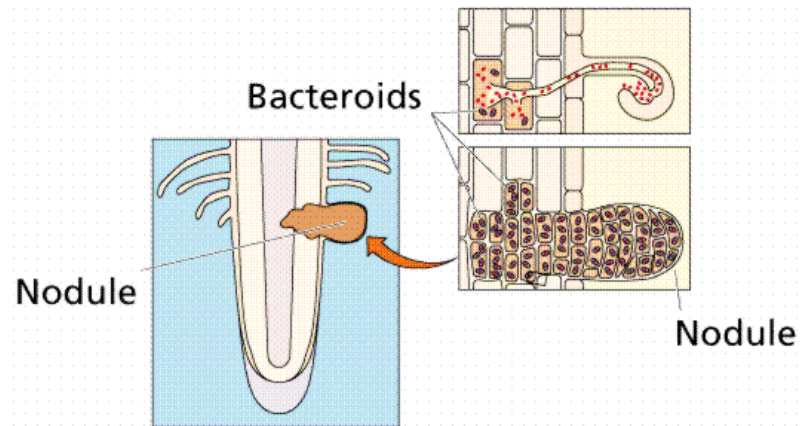
3. Adventitious roots (shoot-borne roots)- roots produced from the stem or, rarely, from leaves. Ex. corn prop roots, from iris rhizomes, ivy, etc.

4. Photosynthetic root- some roots are photosynthetic (orchid)
5. Movement- contractile roots (cells shorten and pull root into soil) (dandelion)

6. Nutrition uptake

A. Parasitic- mistletoe. Roots modified for host penetration and fusing with host tissues (transfer cells)

B. Nitrogen fixation- most roots interact with nitrogen fixing bacteria in one way or another. In the Fabaceae (bean/pea family), nitrogen fixing *Rhizobium* bacteria are housed in structures called root nodules.

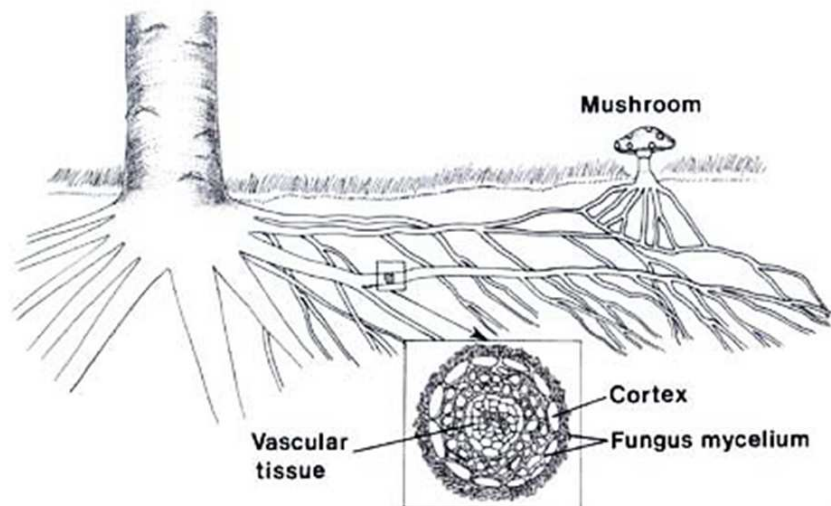


Examine the root nodules on the legume in lab.

C. Mycorrhizae- fungal association at rhizosphere (region around the root that it influences)

Although root hairs are common in lab-raised seedlings, they are less often seen in nature. Here **mycorrhizal fungi** replace the role of root hairs. Many of the mushrooms you find have extensive underground mycorrhizal associations with surrounding plants. These associations are mutualistic (both organisms benefit). The fungus increases the surface area for water/mineral uptake for the plant in exchange for plant released vitamins, carbohydrates, amino acids, etc.

Note: Some of fungal associations are parasitic to the plant.

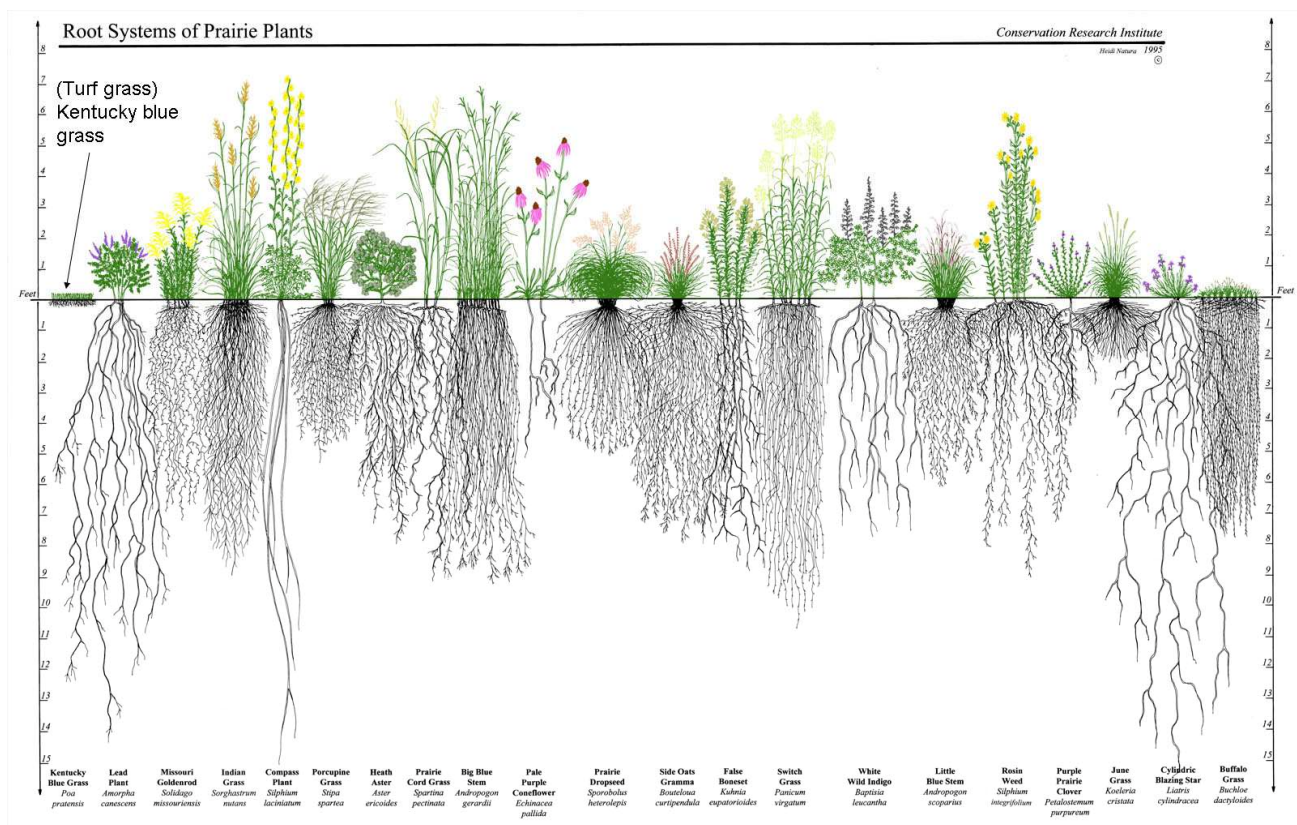


Taxonomy using roots: (taxonomy- the science dealing with the identification of organisms)
Although roots vary in different species, they are rarely used for plant identification. (why?)

Questions:

1. Some plants live in areas with quick but heavy rainfall, some live in areas with sandy soils, some live in areas of clay soils. Most plants live in areas with a variety of soil types and layers. Even within one area there are some plants adapted to obtain deep water, and others adapted to rapid uptake of shallow water.

- Look over the table showing root systems of native prairie plants. Find and circle the Kentucky blue grass. Does it look like Kentucky blue grass (the main grass used in lawns) does a good job of taking up deep water?
- What does that mean as far as watering lawns?



2. Why do you think root hairs occur only in the area of maturation and not within the area of cell elongation? i.e. What would happen to root hairs if they were produced in the region where the root was getting longer?

