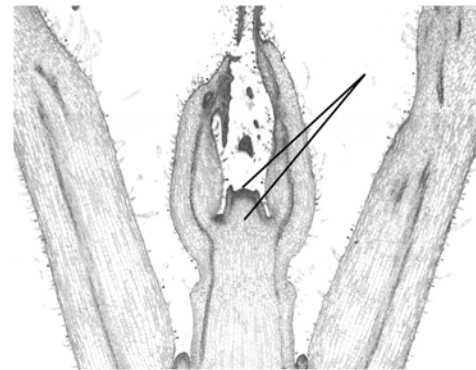


Chapter 9. Mitosis and Cytokinesis

Mitosis is nuclear division. In the process daughter molecules of DNA are precisely segregated into two new daughter nuclei. Mitosis is usually associated with cell division (**cytokinesis**), but in the plant kingdom there are numerous exceptions. In plants, both mitosis and cytokinesis are facilitated by microtubular structures (the **spindle** and the **phragmoplast**). In this lab, we will consider where mitosis and cytokinesis occur in plants. You will observe and draw examples of cells in interphase and in each stage of mitosis; and will undertake an exercise to determine the relative duration of each stage of mitosis in an actively growing tissue.

I. Plant Growth.

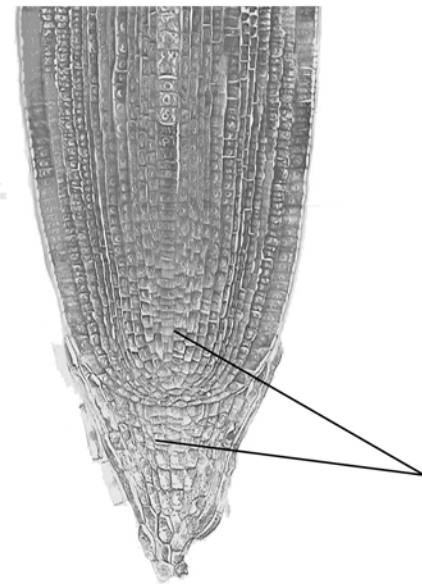
Growth in plants results from a combination of cell division and cell enlargement. In general, growth is confined to apical meristems of the shoot or root (we include lateral buds as examples of apical meristems), or to sheets of cells that increase the girth of stems or roots.



Ia. Growth by Apical Meristems.

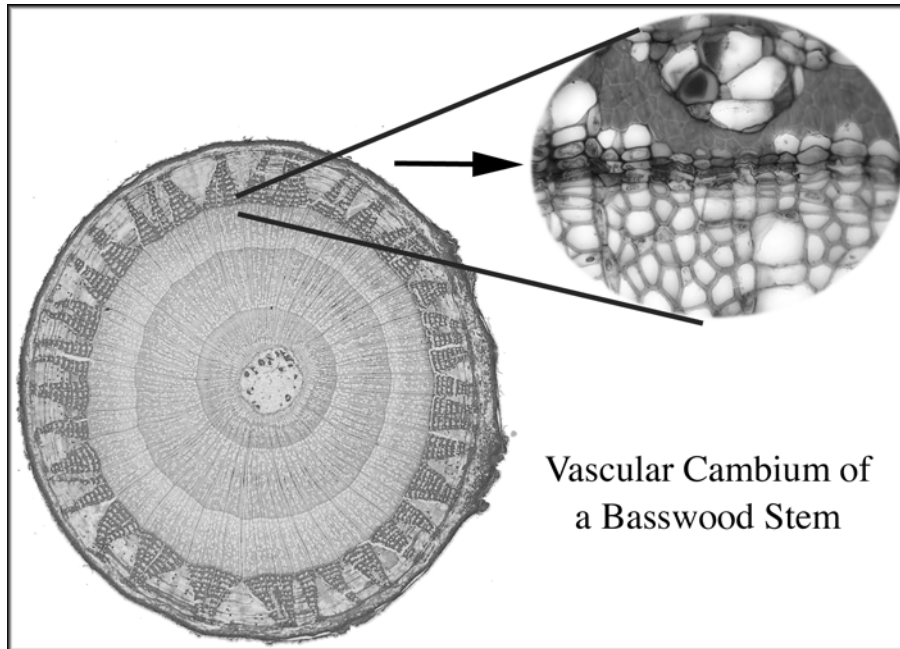
10 days ago bean seedling shoots were marked along their length with equidistant ink marks. Observe these plants to determine where growth occurs.

2 days ago pea seedling roots were marked along their length with equidistant ink marks. Observe these plants to determine where growth occurs.



Apical meristems of the shoot and root.

Ib. Growth by Lateral Meristems: Observe the section of oak log at the front. The increase in girth of this stem is due to a layer of actively dividing cells that represents the innermost layer of the bark. Also note the demonstration slide of vascular cambium of a basswood stem next to this oak section.



II. Non-mitotic Tissue.

Plant tissues such as those in a mature leaf, typically don't have mitotic cells. In this activity we will take another look at *Elodea* leaf cells where all cells are in interphase. Make a wet mount of a leaf cell and draw an interphase cell with an obvious nucleus.

Diameter fov = _____ mm

III. The Mitotic Tissue of the Onion (*Allium*) Root Tip.

Get a prepared slide of a longitudinal section of an *Allium* (Onion) root tip from your slide box at the front. Using the 10x objective quickly survey the section. Note that the cells at the top are larger than those at the bottom. Remember that plant growth consists of both cell division and cell enlargement.

Where do you find the greatest concentration of mitotic cells?

Draw cells in the region of cell division in interphase and in each stage of mitosis. In your drawings label all of the following observable for each cell: **nucleus, nucleolus, chromosomes, spindle, phragmoplast, cell plate.**

Diameter fov = _____ mm

Interphase

Prophase

Diameter fov = _____ mm

Metaphase

Anaphase

Diameter fov = _____ mm

Telophase

IV. Preparing and Observing a Root Squash of *Narcissus* Root.

Procedure

1. Using your forceps take a *Narcissus* root from the bowl of aceto-carmin at the front and place it on a microscope slide.
2. Using two teasing needles cut off all of the root except for the terminal 2 mm.
3. With the root tip in the stain (there should be enough adhering to the surface of the root without adding more for this), tease the tissue apart with needles as much as possible, and at least for 90 seconds.
4. Firmly but gently squash the tissue by applying pressure with the wooden handle of your needle.

After preparing your slide place it on your microscope, and search for mitotic cells. If you were unable to find specific stages of mitosis with the *Allium* slide, find them here and draw those cells as instructed earlier.

V. Determining the Relative Duration of Each Stage of Mitosis.

By randomly sampling and tallying the frequency of mitotic cells, we can determine each stage's relative duration. To do this properly you should choose an area of your *Narcissus* root squash that is mitotic - that is an area where you have already viewed mitotic cells. Record your frequency counts on your section's master data sheet. Someone in your section should then add up each count and record these sums on the master sheet taped to the front bench. By next week, we will have a total of all counts that will be posted on our course page.

Procedure: Using your 40x objective locate an area of tissue where at least one mitotic cell can be viewed. Consider every cell in that field of view, and make a

tally of the numbers of cells found in each of the stages on the table on the last page of this topic. Repeat this process four more times using different views of your slide. Submit your data sheet to your TA for credit before leaving lab.

Duration of Stages of Mitosis Tally Sheet

	Count 1	Count 2	Count 3	Count 4	Count 5	Total
Interphase						
Prophase						
Metaphase						
Anaphase						
Telophase						

Fill in the information below when your TA returns your data sheet.

	Frequency in this section	Frequency in all sections
Interphase		
Prophase		
Metaphase		
Anaphase		
Telophase		

VI. Mitosis Observed with the Transmission Electron Microscope.

Observe the electron micrographs on the side bench carefully: one question on the lab exam will come from this material! Be sure you recognize the various stages of mitosis represented by each. Also you should recognize the following structures when encountered: **spindle, chromosome, phragmoplast, cell plate, nuclear envelop.**

