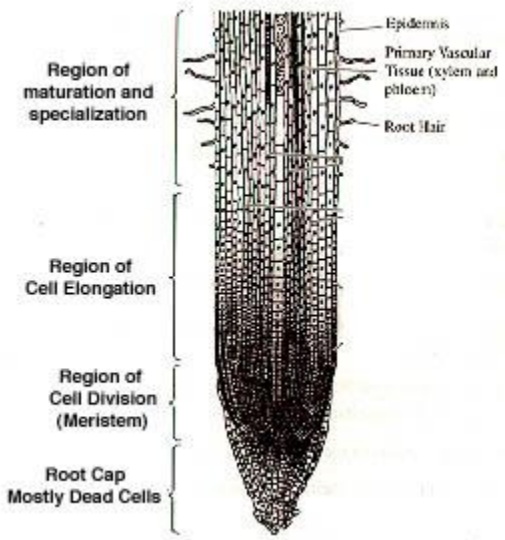
Name: Per:

Mitosis Lab

Introduction:
Things that grow have high mitotic cell activity. You will investigate how many cells undergo mitosis in the tip of an onion root. You will also investigate the duration of the different phases of the cell cycle. The time of each phase is proportionate to the number of cells in each phase relative to the total number of cells in any given section of the onion root or fish blastula.

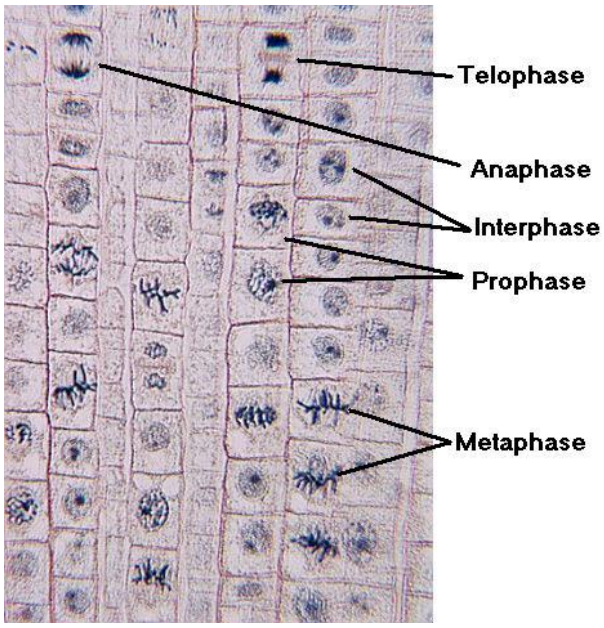
Materials:
Microscopes, onion root tip slide, and fish blastula slide



Procedure:
1. Using the low power objective, look for an onion root (there are usually 2-3 on each slide). Make sure the microscope is in focus before moving on.
2. Move your slide until you have one onion root in the center of your field of view. Find the meristem (the section just above the tip of the root). Increase magnification to the medium power objective. Make sure to focus on the meristem.
3. Continue to the high power objective and refocus.
4. Draw three different cells in three different stages of the cell cycle.
5. Repeat steps 1-4 with a fish blastula.

I. Cell Cycle Identification:
Real cells look different than model cells (the ones you see in textbooks). It is important to identify actual mitotic phases to familiarize yourself with actual cellular division and mitosis. Identify cells in the different phases of the cell cycle. See the descriptions and the picture below.

a.) Interphase: the majority of cells will be in this phase: they have a clear nucleus and nucleolus.
b.) Prophase: the cell has a large nucleus and you can see condensing chromosomal structures within.
c.) Metaphase: the cell will have all the chromosomes at the equator (metaphase plate).
d.) Anaphase: these are easy to see, since their chromosomes are pulled apart.
e.) Telophase/Cytokinesis: chromosomes have reached the opposite poles of the cell sometimes the division of the cytoplasm can be observed.



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II. Duration of each phase of the Cell Cycle

1. Count the cells: Look through your microscope and count how many of the cells you see in your field of view. You have to **count all the cells** in your field of view to get a proper estimate.
2. Next count the number of cells in each phase of the cell cycle and mitosis (i.e. Interphase, Prophase, Metaphase, Anaphase, and Telophase). Record the values in the table below.
3. Check your work. Add up the number of cells counted in each phase and compare that total to the number of cells you originally counted in step 1. They should match.

Phase	**Number of Cells**	**Time in minutes**
Interphase		
Prophase		
Metaphase		
Anaphase		
Telophase		
Total number of cells counted		720 min

4. Now determine the time the cell spends in each phase. Time spent in a mitotic phase and interphase can be calculated if the total time for the cell cycle is known. An onion cell requires 12 hours (720 min) to go from the beginning of one cell cycle to the beginning of the next cell cycle. Consequently the time for each phase can be calculated using the following formula

$$\text{Time for a phase} = \frac{\text{Number of cells in a phase}}{\text{Total number of cells counted}} \times 720 \text{ min}$$

Calculate the time required for each phase of the cell cycle using your data and enter it in the table above. Please round up to whole numbers!

5. Graph the duration of the cell cycle phases in the provided pie chart. The pie chart is graphically displayed as a circle divided into 22 ½ minute slices. Graph your data from your table using the "time in minutes column". If a section is not 22 ½ minutes or a multiple of 22 ½ minutes then approximate the position of your line on the graph. Color each section of the graph with colored pencils. Identify each phase by shading the same color in a key.

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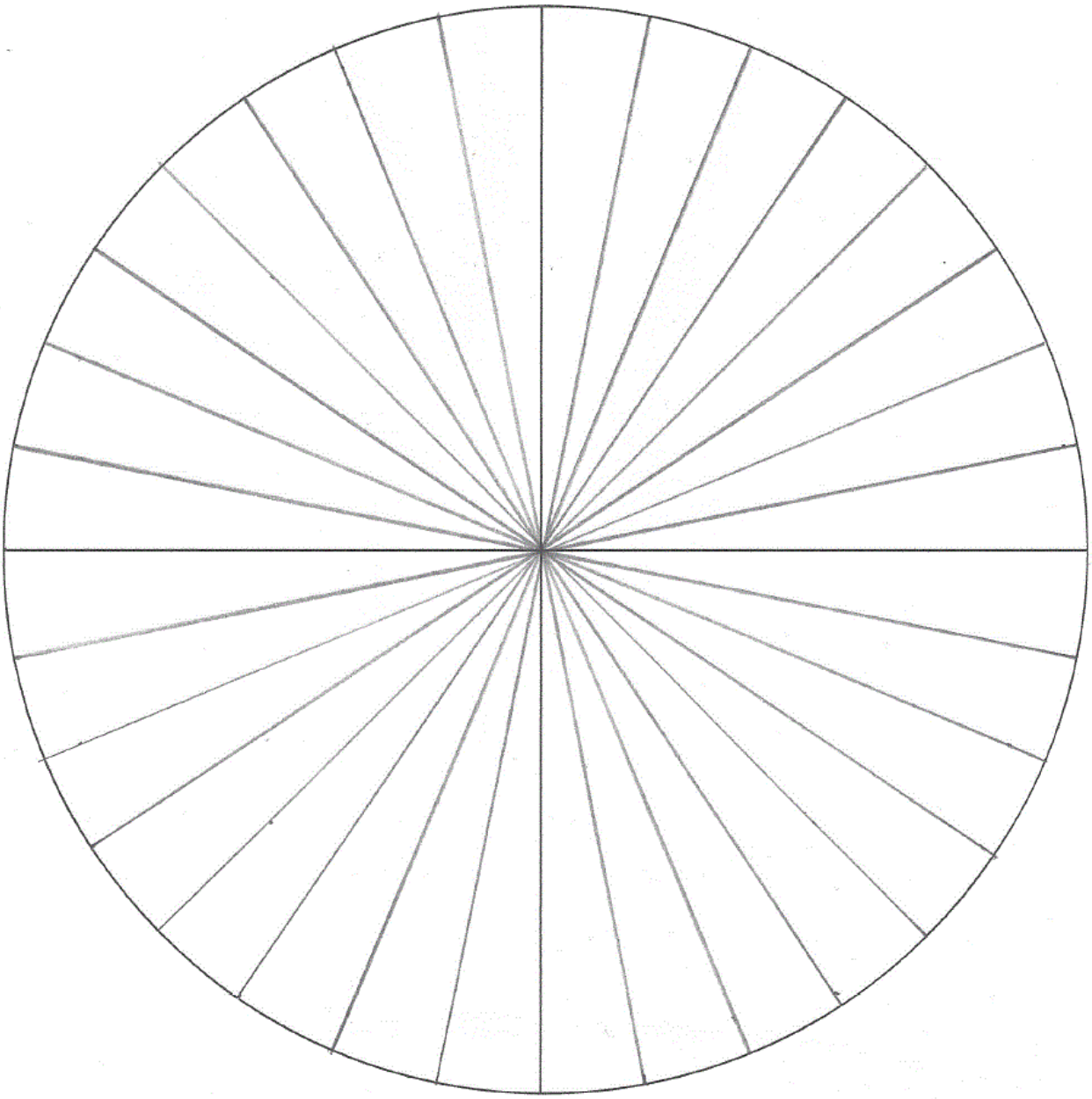
Onion Cell Cycle Time Scale



III. Questions

1. Which phase of the cell cycle had the highest cell count? Explain why this phase is the longest in the cell cycle.

2. Why are so many cells in the onion root undergoing mitosis?

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3. Where do you think is the most mitotic activity in the tip or in the base of the root. Explain why?

4. Explain how mitosis leads to two daughter cells, each of which is diploid and genetically identical to the original cell. What activities are going on in the cell during interphase?

5. How does mitosis differ in plant and animal cells? How does plant mitosis accommodate a rigid, inflexible cell wall?

6. What is the role of the centrosome (the area surrounding the centrioles)? Is it necessary for mitosis? Defend your answer.

7. If your observations had not been restricted to the area of the root tip that is actively dividing, how would your results have been different?

8. Based on your data what can you infer about the relative length of time an onion root tip cell spends in each stage of cell division?