

Where is Mitosis Most Common in the Onion Root?

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Biology

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Problem, Hypothesis, and Prediction

The problem in this lab is: To analyze data to see whether mitosis occurs at the same rate in all the parts of an onion root? A possible hypothesis is: No, mitosis does not occur at the same rate in all parts of the onion root but it occurs more frequently at the tip because this is the part that is growing down into the soil. This hypothesis leads to the prediction that: area X should have more cells in mitosis than area Y. Since the onion root tip used for Area Z is at the tip and will be freshly prepared, it should have more cells in mitosis than Areas X or Y.

Materials:

Area X and Y

- Prepared onion root tip
- Microscope

Area Z

- Microscope
- Onion Root Tip
- HCl
- Carnoy
- Forceps
- Razor blade/scalpel
- Toluidine Blue
- Paper towel
- Water
- Dropper
- Coverslip

Procedure

This is the procedure to find where mitosis is most common. First, remember to put on your safety glasses, to protect your eyes. Next, using the lower power setting for the microscope, find area X near the bottom left side of the onion root tip. After finding area X, switch to the high power setting. Now, identify those cells that are in mitosis and those that are in interphase by comparing their appearance with the illustrations in the Onion Mitosis BioKit instructions provided for this experiment. Count and record the number of cells in interphase, and in the various stages of mitosis, and record on the data sheet.

Area Y is near the top region of the onion root tip, on the right side near the small hair on the root tip. Repeat the same process used for area X to find and record the numbers of cells in interphase and mitosis for area Y.

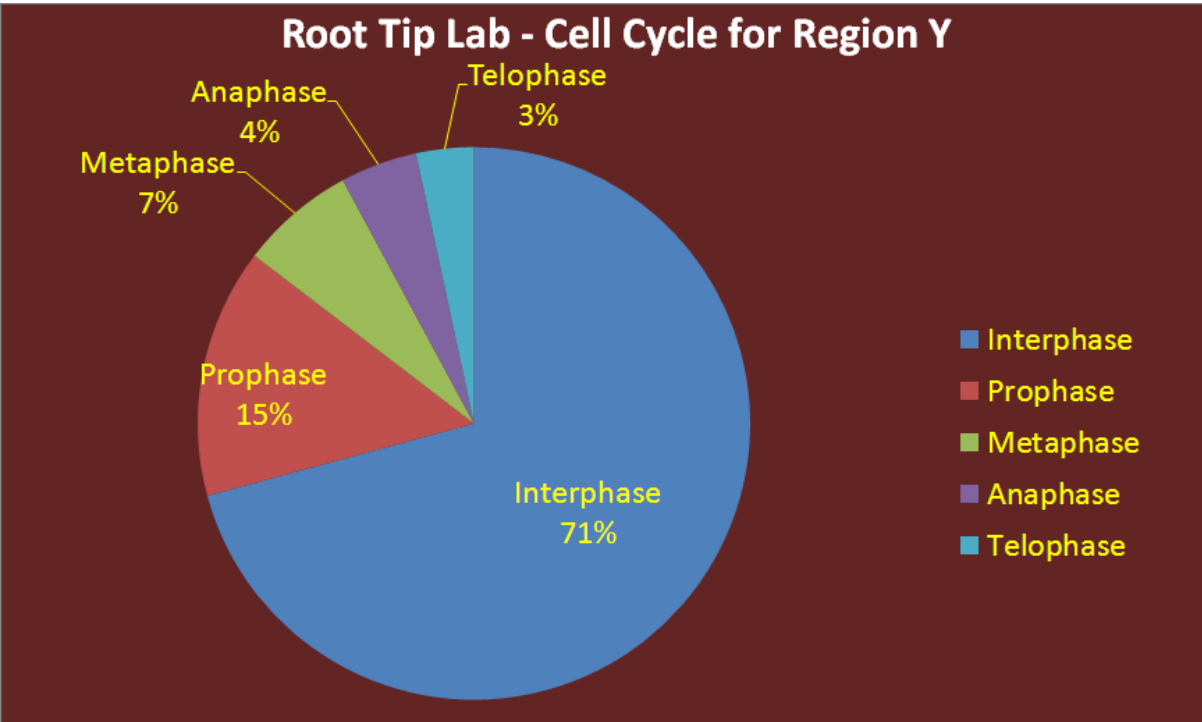
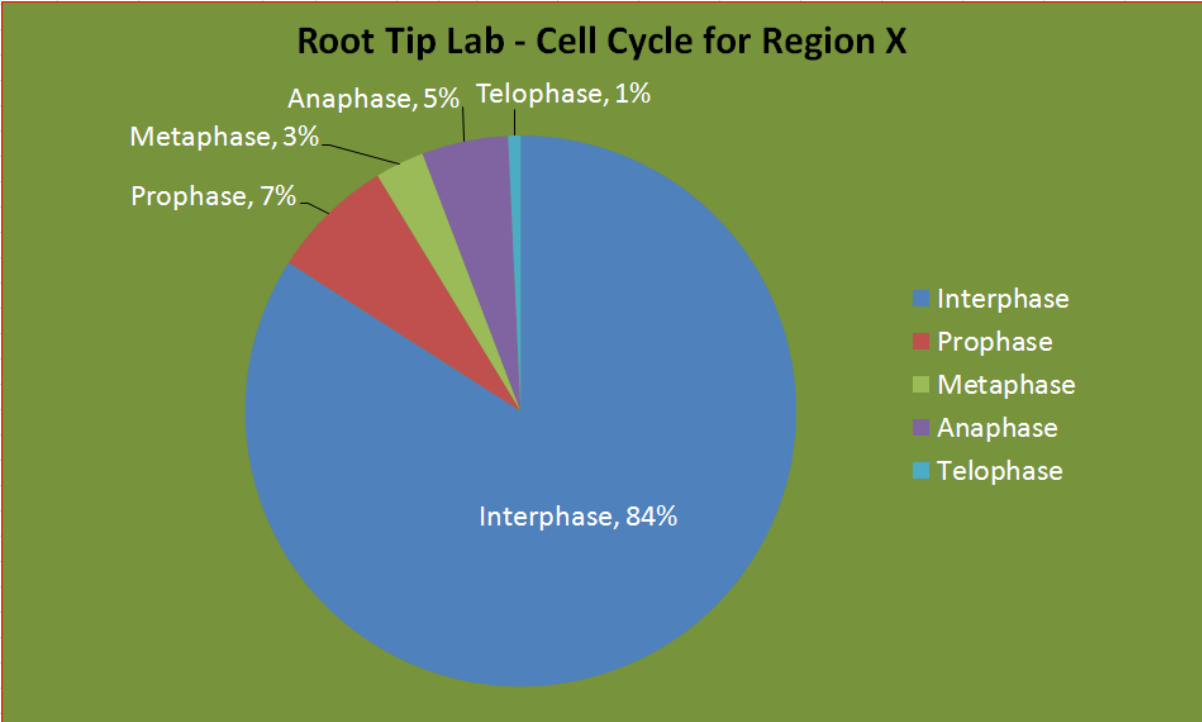
The specimen for area Z is prepared in accordance with the instructions and samples in the Onion Mitosis BioKit provided. In two small cups pour enough of the HCl in one cup and of the Carnoy in the second cup to cover the bottom of the cups. With forceps put the onion root in the HCl for four minutes and then move the tip to the Carnoy for four more minutes. After you have finished soaking the onion root tip use the razor blade to cut off 1-2 mm of root tip and discard all but the tip. Then cover the remaining root tip with toluidine blue for two minutes. After the two minutes are up blot away the stain with a paper towel without touching the onion root tip. After the stain is removed

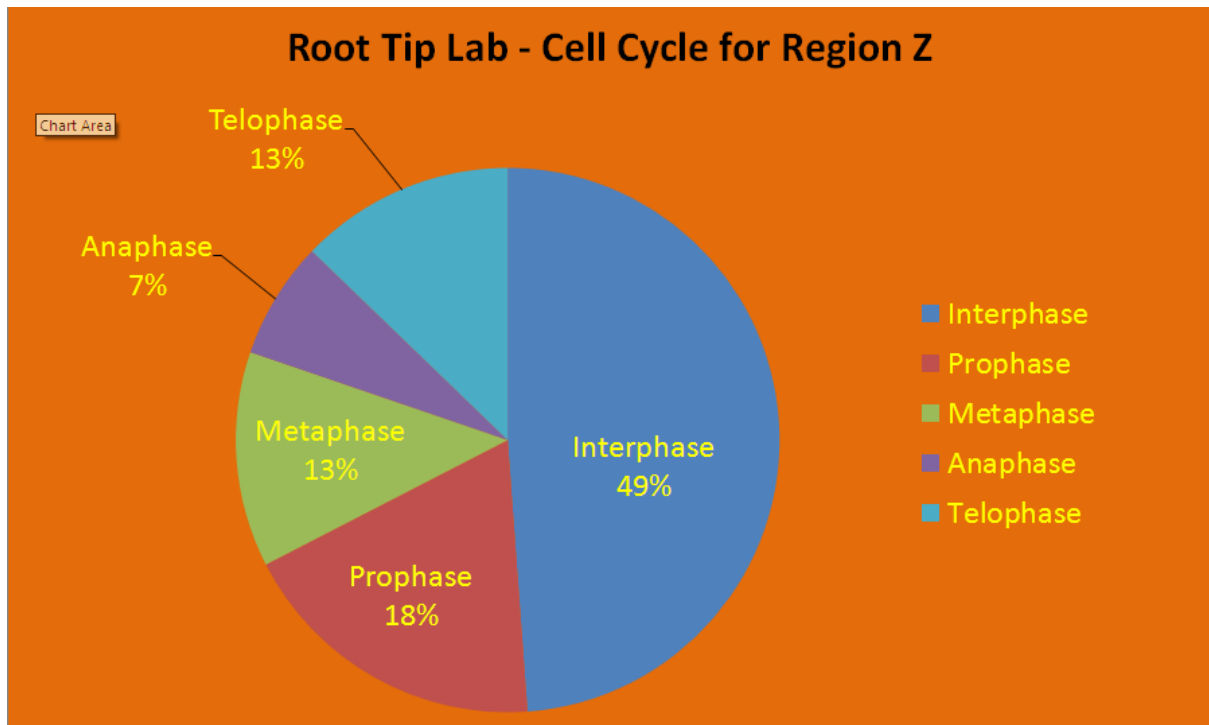
cover the root tip with 1-2 drops of water and gently lower the coverslip without twisting and then cover the slide with a paper towel and press with your finger to squash the cells to a single layer on the slide. Then look at the slide using the low power microscope setting to find the cells and then move to high power and repeat the process used for areas X and Y to find and record the numbers of cells in interphase and mitosis for area Z.

Data:

The following data tables and graphs are imported from the Excel spreadsheet file for this lab.

Cell Cycle Name	Number of Cells		Number of Cells	
	Region X	Region Y	Region Z	
Interphase	116	63	42	
Prophase	10	13	16	
Metaphase	4	6	11	
Anaphase	7	4	6	
Telophase	1	3	11	
Total Cells	138	89	86	





Calculations:

Example – Percentage of cells in interphase for region X = number of cells in interphase in region X divided by total number of cells counted in region X times 100.

Cell Cycle Name	Number of Cells			Formulas Example (A=Percent of cells in each phase - Reg X)	% of cells in each phase		
	Region X	Region Y	Region Z		Region X	Region Y	Region Z
Interphase	116	63	42	$A=C7/C13*100$	84.05797	70.78652	48.83721
Prophase	10	13	16	$A=C8/C13*100$	7.246377	14.60674	18.60465
Metaphase	4	6	11	$A=C9/C13*100$	2.898551	6.741573	12.7907
Anaphase	7	4	6	$A=C10/C13*100$	5.072464	4.494382	6.976744
Telophase	1	3	11	$A=C11/C13*100$	0.724638	3.370787	12.7907
Total Cells	138	89	86				

Analysis and Conclusions

This lab involved looking at two areas of a prepared slide of onion root tip tissue under a microscope to count the number of cells undergoing mitosis. A count was made of cells under the microscope for each region and the appearance of each cell was compared with the illustrations in the textbook so the cells in the various stages of mitosis could be identified and counted. The data was recorded and an Excel spreadsheet was made to graph the data as to percentage of cells in each region that were in mitosis. Finally a fresh sample was prepared using the BioKit provided and data from the newly prepared slide was also analyzed.

The data showed that region X had the least percentage of cells in mitosis with region Y having a larger percentage of cells in mitosis and the largest percentage of cells in mitosis was in the freshly prepared slide of the root tip.

The data was not in complete accord with the original hypothesis that the cells closer to the root tip would have a greater percentage in mitosis but there are several sources of possible error. Upon looking up data on the internet <http://www.marietta.edu/~biol/introlab/Onion%20root%20mitosis.pdf> it appears the area of maximum cell division in the root tip is above a protective cap at the very tip. It may be possible that our selection of cells for region X was actually in the area of the protective cap instead in the area of maximum cell division. The increased level of cell division in the freshly prepared slide

could be because we sliced the root tip in the area of greatest cell division which would then make the results compatible with the original hypothesis. This error would be an experimental error. We could also have made a human error in making a wrong hypothesis or we could have made mistakes in identifying the cells in various stages of mitosis. The chance for equipment error is probably small in this simple experiment.

Questions and Answers

1. Which area, X or Y, had the greatest percentage of cells undergoing mitosis? Which area had the lowest percentage?

Our data showed that area Y had the greatest percentage with 26 of the 89 cells counted being in some stage of mitosis. Area X had only 22 of the 138 cells observed being in mitosis.

2. If mitosis is associated with rapid growth, predict which area is the location of the most rapid root growth.

Our data showed area Y to be the area with the most rapid growth because a larger percentage of the cells in this area were in mitosis.

3. Where in the human body might you look for cells that are undergoing mitosis?

All cells in the human body undergo mitosis but the skin and the intestines are probably the areas of fastest cell division.

4. Assume that you were not able to observe cells in every phase of mitosis.

Explain why?

Telophase is the shortest phase of mitosis and cells that are dividing more slowly might not have many cells in this phase at any given time.

5. What factors might cause misleading results? How could you avoid these problems?

Incorrect counting of the cells or incorrectly identifying the state of the cells could cause errors. Also damage to the cells could cause more rapid growth to repair the damage which is only a temporary condition and not representative of the normal conditions. These types of errors could be avoided or minimized by being more careful when conducting the experiment or by repeating the experiment several times to get consistent results.