EXERCISE 4 - Postlab

1. Prepare a **table** that shows the number of µm per r.u. when using the 4X, 10X, and 40X objectives on your microscope.

2. Use the Internet or other reference to look up the size of the following bacterial types: coccus, bacillus, spirillum. Indicate where you found your information, and then compare your average value for the size of each bacterial type with the value found in your reference.

3. Do the following calculations using standard units (e.g. µm), and make sure your final answers have the correct number of significant digits and appropriate units:

   a. Calculate the mean and standard deviation for the length of the 6 *Paramecium* cells that you measured.

   b. Calculate the mean and standard deviation for the width of the 6 *Paramecium* cells that you measured.

   c. Calculate the mean and standard deviation for the length of the 6 *Euglena* cells that you measured.

   d. Calculate the mean and standard deviation for the width of the 6 *Euglena* cells that you measured.

4. Do a t-test (using a spreadsheet program such as Excel) to test the null hypothesis that there is no significant difference in the length of *Paramecium* and *Euglena* cells. Be sure to show your p value and explain your conclusion.

5. Look up the lengths of *Paramecium* and *Euglena* using the Internet or another reference source (be sure to indicate where you found your information.) Compare your average value for the length of each organism with the value found in the reference.

6. Based on the 6 *Euglena* cells you measured:

   a. Calculate the approximate volume (V) of an "average" *Euglena* cell. For this calculation, use the volume of a cylinder ($\pi r^2 h$) to approximate the volume of a *Euglena* cell (where the radius is approximated by one-half the average width, and the height is approximated by the average length of the cells.) Make sure your answer has the correct number of significant digits and appropriate units.

   b. Calculate the approximate surface area (S) of an "average" *Euglena* cell. For this calculation, use the surface area of a cylinder ($2\pi r h + 2\pi r^2$) to approximate the surface area of a *Euglena* cell. Make sure your answer has the correct number of significant digits and appropriate units.

   c. Calculate the surface-to-volume ratio (S/V) of an average *Euglena* cell. Make sure your answer has the correct number of significant digits and appropriate units.

7. Based on the 6 *Paramecium* cells you measured, calculate the approximate volume (V), surface area (S), and surface-to-volume ratio (S/V) of an "average" *Paramecium* cell. Use a cylinder to approximate the shape of the cell. Make sure your final answers have the correct number of significant digits and appropriate units.

8. Based on your calculations for *Euglena* and *Paramecium*, as a cell gets larger, while its shape remains constant, what happens to its volume (V)? What happens to its surface area (S)? What happens to its surface-to-volume ratio (S/V)?

9. Based on your answer to question 6, explain how the surface-to-volume ratio might act to limit the size of cells.

10. Using your textbook or other references, briefly describe the function of the following cell structures:

    cell wall
    cell membrane
    cytoplasm
    nucleus
    nucleolus
    nuclear membrane
    DNA
    vacuoles and vesicles
    ribosomes
    endoplasmic reticulum
    Golgi apparatus
    lysosomes
    mitochondria
    chloroplasts

11. In this lab, you examined 7 cell types under the microscope: bacteria, *Anabaena*, protozoans, green protists, onion bulb, *Elodea*, and human cheek. Prepare a table with 7 columns and 14 rows. At the top of each column, write the name of one of the cell types you viewed. On the left side of each row, write the name of one of the cell structures listed in the previous question. In each cell of the table, place a check if the cell structure listed at the left of the row is usually or always present in the cell type listed at the top of the column. Leave the cell empty if the structure is usually or always absent.

12. Briefly describe the main similarities and differences between prokaryotic and eukaryotic cells.

13. Briefly describe the main similarities and differences between plant and animal cells.