Biology 107 Lab Unit 2 Assignment: **Lab Report for Enzymes lab W21**

This assignment is individual work. Improper collaboration is also a violation of the Academic Integrity Policy.

- Worth 8% of your grade.
- The page limit is 6 pages. Instructors will stop reading text at the end of the 6th page. This page limit does not include your full reference section, figures, or appendix.
- Your instructor will not grade this assignment if you have not uploaded the Academic Integrity Training Certificate (see Module 4 in Unit 2 for details about how to complete this training)
- **Make sure you read the document about how to write a lab report (there is a folder in the left content menu on Blackboard);** it also provides examples of excellent, average, and needs significant improvement lab reports. Reading these will help you model what a good lab report looks like.

Formatting:

- The assignment must be typed, 12pt font -- Arial, Calibri, or Times New Roman, double spaced with 1" (inch) margins.
- Do not include a separate title page
- Include heading titles (ex: Introduction, Results, Discussion, References, Figures, Appendix)
- Formatting errors will result in deductions

To avoid plagiarism, make sure you review the materials from the Academic Integrity folder and remember: Cite! Cite! Cite! Your introduction and discussion should be filled with citations! Also remember: Paraphrase! Paraphrase! Paraphrase! Write everything in your own words! Simply rearranging words, and swapping out a few words is not paraphrasing. Failure to cite or paraphrase will result in an Academic Integrity Violation Report.

Time management and meeting deadlines are important skills to learn while at University. Don't wait until the night before to start your lab report.

Tips:

- Writing is challenging for many students, it will get easier the more you do it (we promise!).
- Written communication is an essential skill for all careers, all students benefit from having more writing assignments (trust us!).
- The handout on Blackboard (left menu item) explains each section of a lab report, be sure to refer to it as you write this lab report.

- If you do not understand the purpose of the experiment, how enzymes work, how pH affects protein folding, etc, it will be very hard to write this lab report. Putting in the time and effort to understand before you even start writing will have a large pay off.
- Don't start your lab report the night before it is due. Lab reports take time and it's a great idea to leave time for many revisions
- Organize ideas into paragraphs! Your intro should not be one mega-paragraph

There are papers posted on Blackboard. Use these to strengthen your **introduction and discussion**. Only use the parts of the paper that you understand. Including information that you do not understand will not make your paper better (in fact, it almost always has the opposite effect!).

Your lab report will contain the following (and be sure to include the headings: Introduction, Results, Discussion, References, Figures, Appendix):

Introduction

- Relevant background information
- Relevance to the "real" world
- Presentation of research
- Hypotheses

Results

- Written results for **<u>both</u>** of the experiments you did in Lab 2 (Refer to lab report guidelines for how to write this section). Don't forget to report your data for Part B as rates (nMol/min)
    - Don't forget to compare your results to the control.
    - In Module 4 you learned how to do Student's t-tests. Use Student's t-tests for your class data for Part A, but you do not need to do t-tests with your data for Part B. Incorporate the statistical results from your t-tests for Part A when you write this section. In terms of which means you compare, think about what you want to say in your results. If you want to say the pH1 is significantly different from the control, support this with a p-value from a t-test. If you think the rates between pH7 and pH8 are not significantly different, support this with a p-value.
        - The Guidelines for Lab Reports has an excellent lab report example that illustrates how stats can be incorporated into the Results.
- Do not paste the graphs in this section, figures are attached at the end of the references section of your report.

Discussion

- Conclusions and **in-depth** biological explanation for the first experiment.
    - Conclusions are an interpretation of results. Recall from the Scientific American article with the stats assignment that p-values are not meant to be the gatekeeper, p-values are not the final verdict, but a tool. If experimental design concerns (ex: large standard deviation in the biological replicates) mean the validity of the p-values or confidence intervals are questionable, it is good to indicate that when you draw conclusions. Ex: Although the difference was not statistically significant, this could be due to …….

      This should include an in-depth explanation with respect to your knowledge of enzymes. Use your knowledge of enzymes and protein folding to explain why pH affects the rate of reaction.
    - Do these findings support or refute your hypothesis?

- Conclusions and in-depth biological mechanism for the second experiment (the experiment you designed).

There are papers posted on Blackboard that you can use to support your discussion.

- Use data from the posted literature to support your results (ex: Smith et al, 2015 also found that…..) There are papers on Blackboard that will allow you to do this.

- Limitations to the study should be a paragraph. When you made confidence interval error bars for Part A, you likely noticed high standard deviation in the class data. This is a good place to discuss issues with the experimental design that could have led to high standard deviation among the replicates (for both experiments). When providing limitations, be sure to explain **how the** limitations affect your ability to draw conclusions.

- Future work: Future work should be a paragraph that proposes a new experiment that would be interesting to follow up on. Future work is not about fixing/improving this experiment, but a new experiment. Provide a rationale for this future work and why this future work is important.

References

- Make sure the reference list is alphabetical and follows the format outlined in the guidelines
- Make sure in text citations are provided in places they are necessary and follow the correct format. When in doubt, cite.

Figures

- Graph (with Figure legend) for the **rate of reaction** for Part A (effect of pH). Your instructor will post the class data with all of the rates, you will need to determine the mean and use your knowledge from Module 4 to determine if the error bars should be standard deviation or confidence intervals (hint: are the replicates technical or biological?) The statement of results in your figure legend should incorporate statistical significance (p values calculated in your t-tests) Don't forget to define the replicates, type of error bar used, and which hypothesis test was used.

- Graph (with Figure legend) that effectively communicates the results of the experiment you designed (Part B- be sure to report your data as rates). Be sure to use the means for your replicates and Include error bars (use your knowledge from Module 4 to determine if the error bars should be standard deviation or confidence intervals (hint: are the replicates technical or biological?) . You do not need to do t-tests for your Part B data. Don't forget to define the replicates and type of error bar used.

Appendix

- The Appendix must include a table that shows your raw data (absorbance values) for Part B. Do not refer to this raw data in your report, it needs to be included because your instructor needs to assess how well you've interpreted your results, based on the data you had.
- Include a table with the p-values you calculated from your t-tests
- Attach the excel sheet (or the link to your Google sheet) that contains your work.