Biology 107 Lab Unit 3 Assignment: **Lab Report for Biofuels lab**

- Worth 13% 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.
- **Make sure you read the feedback from your first lab report and apply it to this one**

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

Reminder about extensions: Remember that we have a transparent, universal policy. If you have used your five extension days, then you will not be successful in getting an extension. All students are very busy with midterms, assignments, and commitments outside of school. 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. If you work on your assignment well in advance of the deadline, you will have no trouble handing it in on time.

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!).
- If you do not understand the purpose of the experiment, how fermentation works, why you did the cellulase reaction, 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>your biofuels lab</u>. Make sure you report the average **rate of reaction** using the replicates from your team.
- Compare the results to the controls and incorporate the statistical results from your **t-tests** when you write this section. Although it is true that most of you have technical replicates, for the **purpose of practice, we are asking you to use the Student's t-test to test** for significant differences.
    - For example: the rate of CO_2 production with sawdust that was not treated with cellulase, 2mm CO_2/min, was not significantly different from the no substrate control, p= 0.78.
    - Another example: The rate of CO_2 produced with cellulase treated spinach, 50 mm CO_2/min was similar to the sugar cane control (p= 0.98).
- Be sure to compare the rate of reaction (mm of CO_2/min) for the two substrates you tested to each other, as well as compare cellulase treated to not cellulase treated to identify if the cellulase treatment increased the rate of reaction (but don't explain why, as that is what the discussion is for)
- Do not paste the graphs in this section, figures are attached at the end of the references section of your report.

Discussion

- Conclusions from your experiment
- In-depth biological mechanism to explain these results.
    - This should include (but is not limited to) an <u>in-depth</u> explanation with respect to your knowledge of fermentation, cellulose, and cellulase. (ex: why was there a higher rate of reaction in cellulase treated substrates? Why was there a difference in the rates between the two substrates you tested?). This is the section where you demonstrate in depth understanding of cellulose, cellulase, and fermentation.
- Use data from the posted to literature to support your results (ex: Smith et al, 2015 also found that…..)
- Identify limitations to this study. Ex: Are there weaknesses in the experimental design that limit the conclusions you can draw? Were there weaknesses in the methodology that make it difficult to compare results/draw conclusions? Was the cellulase reaction done under optimal conditions? This is not a place to identify mistakes you made (we assume that if you made human-error type mistakes, you would have re-done the experiment). If you know you made a

technical mistake, you should identify this when you draw conclusions.

- Follow up work that would help fill in the knowledge gaps that result from your work. Propose the next experiment you should do to address the limitations identified above.
- Write one paragraph that compares the substrate supplied by the lab (grass/sawdust/paper) to whatever you brought in from the perspective of being an **ethical, and sustainable substrate** for use in the biofuels industry. Make sure this is supported (and cited) with literature.

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

- Figure 1. Graph (with Figure legend) for the results from the fermentation experiment. For this Figure, please graph the **rate of reaction** (mm of CO_2/min), where the data is the average of your replicates with error bars. If you do not know how to calculate the rate of fermentation from your data, be sure to discuss with your instructor. (To be clear, this is not the graph with mm of CO_2 on the Y-axis, and time on the X-axis. You need to make this graph in order to calculate the rates but do not include it with your lab report. Once you have the rates from each replicate, then you can use the means to create a bar graph with substrate on the X-axis and rate (mm of CO_2/ min) on the Y.

Appendix

Your Appendix must include the following:

- Raw data table (this is the data you collected in lab)
- Descriptive stats table (mean and standard deviation)
- Table with p-values from your t-tests
- Show your calculations for how you determined the rate of reaction. Remember to avoid data points where CO_2 is not being produced (ex: lag, stationary phase) when calculating the rates

Please remember to upload your excel workbook or a link to your Google Sheet so your instructor can access your data if needed.