

**Open-ended Experiment: Bacterial Diversity in the Environment**  
**150 points (15% of your grade)**

**Entire Lab Report Due Wednesday, July 1, 2020** (submit to the eCampus Dropbox by midnight)

Goals:

1. Determine the number and types of different colonies you have.
2. Does the data support your hypothesis or not? Why?
3. What future experiments do you want to do? What can you do to improve your experiment (conditions, sampling, etc.)? **Note:** See Discussion Guidance in this document

**LAB REPORT GUIDELINES**

**You are not to work with anyone else when writing up your lab report. Also, protect yourself: do not lend your lab report to, or share it with anyone else.**

**General**

1. Must be typed, double-spaced, standard margins, standard white paper.
2. **No collaboration with anyone!** This means that you may discuss your lab report with others, but you are to ensure that no part of the lab report is plagiarized from anyone else.
3. **No plagiarism from an outside source!** Information taken from an outside source (any source other than your brain) must be paraphrased and cited. Do NOT copy word for word from any source, including using quotations. Although quoting is acceptable practice in the humanities, it is not done in the sciences. Instead, content must be paraphrased (without quotes) and cited. A good rule of thumb for paraphrasing is that no three words in a row should be copied from another source. Always check with your instructor if you need clarification, and consult your lab manual (pp 316) for further clarification on plagiarism.
4. **REMEMBER: ACADEMIC DISHONESTY WILL RESULT IN FAILURE FOR THE COURSE!** (ALSO PLEASE NOTE: ELECTRONIC COPIES OF PREVIOUS SEMESTERS' LAB REPORTS FROM ALL SECTIONS ARE KEPT ON FILE AND WILL BE COMPARED WITH THIS SEMESTER'S LAB REPORTS)
5. Make sure you are clear and concise. A lab report is not the place for flowery prose. All information in the lab report must be presented in paragraph form, not outline or bulleted form. Read over a few articles from the primary literature (from scientific journals in the library databases) to get an idea of how a professional scientific paper is written.
6. Refer to your lab manual pp 313 – 322 to help you get started on the lab report.

**Format**

1. Title Page
  - a. Include a descriptive title for the lab report, your name, names of group members, due date, BY109-section#, and the following statement "I certify that this work is solely my own, and any outside source was paraphrased and properly cited" followed by your signature. Refer to pp 318 of you lab manual for advice on selecting a title for your lab report.
  - b. The Introduction, Methods, written Results, and Discussion should be continuous but separated by the titles of the section. In other words, each section should not have its own separate page. However, there should be a title (in bold, underline or larger font) for each section that separates one section from another. Individual Tables are the exception and any individual table should all fit on one page and not continue onto the next.

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- c. All sources are to be cited with author and year of publication. For example, if you were to cite the textbook, cite as (**Campbell and Reece, 2014**) in the body of the paper immediately following the sentence in which you used the information. Follow the formatting in your lab manual pp 322 for more direction.

### 2. Introduction

- a. In the Introduction (pp 318) you are to provide background material on the experiment that you performed. You will need to consult outside sources to find the information necessary to provide the background (consult the library databases for primary literature).
- b. You should go into some depth in the Introduction, so it should be at least a page long (or longer).
- c. It may help to think of an introduction as a telescoping focus, where you begin with the broader context and gradually narrow to the specific problem addressed by the experiment. A typical (and very useful) construction of an introduction proceeds as follows:
  1. Open with two or three sentences of background introducing the subject
  2. Follow with a description of the problem and its history, including previous research. (this should be the bulk of your introduction)
  3. State what information your experiment will address.
- d. The topic of bacteria is a very broad. If your experiment was testing aquatic bacteria then you should ensure you provide background on bacteria found in aquatic environments. (For example, discussing pathogenic bacteria would not be appropriate). Or if your experiment is concerning bacteria on human surfaces, then discussing pathogenic bacteria would be appropriate (but discussing soil bacteria would not be appropriate).
- e. Conclude with stating your hypothesis.
  1. Hypothesis/rationale: What notion, or hypothesis, did you test? What led you to your hypothesis? What was your rationale? *Be specific, did you expect the different environments to affect the **number** or the **diversity** (different types) of bacteria, or **both**.*

### 3. Methods

- a. In the Methods section describe exactly what you did to perform the experiment. The description should be clear and specific so that anyone can reproduce your experiment. This should be balanced with being concise; do not be unnecessarily wordy.
- b. Write professionally! This section must be in past tense. An example of beginning sentences would be "Six tryptic soy agar (TSA) with cycloheximide plates were obtained. The space bar of the keyboard (\_\_ cm X \_\_ cm) was swabbed with a sterile cotton swab and streaked onto the plate." Do **NOT** use the words "I", "We", "Me", "My", etc. **ANYWHERE** in your lab report. Take yourself and any emotions out of your writing. Sentences such as "My lab teacher gave us three agar plates" or "My lab partner then sealed all the plates with parafilm" or giving unnecessary detail such as "I then washed my hands" are **NOT** appropriate.
- c. This section (and all sections) must be written in **PARAGRAPH** form. Do **NOT** write a list of instructions.
- d. Report only the methods, not the results, in this section.

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4. Results - includes both tables and/or graphs as appropriate **AND** a written Results section
  - a. Refer to your lab manual, pp 319-320. Record your results in a table that appropriately reflects your data. The table should clearly communicate your results. Replicates and different conditions should be clearly marked. See sample Table on pg 4 as an example.
  - b. **Include a written Results section** that begins with clearly stating which environment had the greatest number of colonies and which had the greatest diversity of colonies. It should also state if your plates for the same environment varied and if so, what major differences you saw on replicate samples of the same environment or which were shared in the two different environments.
  - c. Reference your Table(s) but do NOT try to interpret any of the results (such as, this happened because of that, and so on – that should be left to the Discussion section).
  - d. Do **NOT** write out the descriptions of each colony in your written Results section. The reader can easily see your Tables that describe the colony characteristics.
5. Discussion
  - a. Refer to your lab manual, pp 320-321. Provide an in-depth discussion of your results, in light of the material you presented in the Introduction. What is the relevance of your results? Were your results what you expected? How do you explain your results given what you have learned in your background research?
  - b. If your results were not as you expected, why not? Did errors in the experimental procedures affect the results? Discuss some possible sources of error.
  - c. Specifically address the following:
    1. Does the *number* of colonies on your plate accurately reflect the number and variety of bacteria in your sample? Identify at least three different additional reasons why the number you recorded may not accurately reflect the number of bacteria in the environment you sampled. Explain whether this leads to under- or overestimating.
    2. Is it reasonable to assume that in your experiment one colony came from one initial bacterium? Why?
    3. Given your results and analysis (as in previous questions), does the data you collected support or refute your hypothesis/hypotheses? Explain why. *It is highly desirable that you phrase your statements carefully, framing them within the uncertainty based on the limited nature of your experiment.*
    4. Given your results and analysis (as in previous questions), how can you improve your experiment if you are to do it again? Identify at least three different improvements, and link to your considerations from above.  
*- When you talk about improving your sampling (as you should), please discuss what amount of sampling would be satisfactory – how should you sample and how will you know when to stop? Imagine that you have sufficient resources and time. Also, think about different ways to increase sampling.*
6. Literature Cited

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- a. You must cite a minimum of three references from primary literature.
- b. When citing a work by three or more authors, refer to them as “et al.” in your paper. For instance: (Cohen, Bills, Cocquyt, and Caljon 1993) should be cited as: (Cohen et al., 1993). In the literature cited section, you should list every author.
- c. Follow the formatting in your lab manual pp 322.

**Example Citation:**

O’Shea, M. L. and Brosnan, T.M. 2000. Trends in indicators of eutrophication in Western Long Island Sound and the Hudson-Raritan Estuary. *Estuaries*. **23**: 877.

**Example Tables (Create a total of 6 Tables – one for each plate)**

**Table 1: Diversity and abundance of microbial colonies on a TSA plate from a Lysol treated surface, Replicate 1**

Colony ID	# of Colonies	Form (Shape)	Color	Texture	Margin	Elevation
1						
2						
3						
4						
5						
6						
7						
8						

**Table 2: Diversity and abundance of microbial colonies on a TSA plate from a Lysol treated surface, Replicate 2**

Colony ID	# of Colonies	Form (Shape)	Color	Texture	Margin	Elevation
2						
3						
7						
9						
10						

**Table 3:....**

**Table 4:...**

**Table 5:....**

**Table 6:.....**

You should then summarize your results in **Table 7** and state in your written Results section if you found the same colony types or if colony types differed on each plate with each variable and between

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the two variables being tested (see Results section above). For ease in reviewing your tables, if you have the same colony type on two different plates then you should give them the same colony number. (Example: the smooth, yellow, raised colony is listed as Colony Type 1 on all plates).

**Table 7: A summary of diversity and abundance of bacteria on TSA plates from surfaces treated with Lysol versus surfaces treated with tea tree oil**

Treatment	Total # of Bacterial Types	Average # of total colonies	Number of Plates
Lysol			
Tea Tree Oil			

**GRADING**

You will be graded as:

**Introduction** – 30

**Methods** – 20

**Results (Tables/Graphs)** – 20

**Written Results** – 15

**Discussion** – 30

**Literature Cited** – 15

**Proper Citations** - 10

**Format/Language** – 10 (followed guidelines, grammar, professionalism)

**Total** – 150 pts

**Note:** Any tardiness in submission of the entire Lab Report will be penalized by 10 points. An additional 10 points will be taken for each day late. The entire Lab Report must be uploaded to eCampus by the due date.