<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Exercise Number</th>
<th>Cont.</th>
<th>Reports Due/Quiz</th>
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<tbody>
<tr>
<td>Jan 9th/10th</td>
<td>M/T</td>
<td>Ex. 2 Media Preparation</td>
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<tr>
<td>Jan 11th/12th</td>
<td>W/R</td>
<td>Ex. 3 Inoculation Techniques</td>
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<td>Jan 16th/17th</td>
<td>M/T</td>
<td>HOLIDAY</td>
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<td>Jan 18th/19th</td>
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<td>Ex. 4 Colony Morphology</td>
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<td>W/R</td>
<td>Ex. 5 Observing Microbes by Microscopy</td>
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<td>Jan 23rd/24th</td>
<td>M/T</td>
<td>Ex. 6 Measuring Cells</td>
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<td>Jan 25th/26th</td>
<td>W/R</td>
<td>Ex. 7 Cell Counting</td>
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<td>Jan 30th/31st</td>
<td>M/T</td>
<td>Ex. 14 Lactic Acid Fermentation</td>
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<td>Lab Write Up</td>
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<td>Ex. 15 Mixed Acid Fermentations</td>
<td>14.2</td>
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<td>Feb 6th/7th</td>
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<td>Ex. 16 Unknown Culture</td>
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<td>Feb 8th/9th</td>
<td>W/R</td>
<td>Ex. 17, Ex. 18, Ex. 20 Testing for Coliforms</td>
<td>14.4</td>
<td>Quiz 4</td>
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<td>Feb 13th/14th</td>
<td>M/T</td>
<td>Ex.21 Analysis for Salmonella</td>
<td>Unknown, 17.2, 18.2, 20.2</td>
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<td>Feb 15th/16th</td>
<td>W/R</td>
<td>Ex.10 Flagella Stain</td>
<td>Unknown, 21.2</td>
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<tr>
<td>Feb 20th/21st</td>
<td>M/T</td>
<td>Ex. 25 Motility</td>
<td>Unknown, 21.3</td>
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<tr>
<td>Feb 22nd/23rd</td>
<td>W/R</td>
<td>Ex. 24 Exoenzymes</td>
<td>Unknown, 21.4, 25.2</td>
<td>Quiz 6</td>
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<tr>
<td>Feb 27th/28th</td>
<td>M/T</td>
<td>Ex. 13. Microbial Respiration</td>
<td>Unknown, 21.5, 24.2</td>
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<tr>
<td>Mar 1st/2nd</td>
<td>W/R</td>
<td>Ex. 12 Endospore Stain</td>
<td>Unknown, 13.2</td>
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<td>Mar 6th/7th</td>
<td>M/T</td>
<td>Ex.22. Normal Flora of Mouth and Skin</td>
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<td>Mar 8th/9th</td>
<td>W/R</td>
<td>Ex.23 Antibiotic Testing CLEAN UP</td>
<td>22.2</td>
<td>Quiz 7</td>
</tr>
</tbody>
</table>
This syllabus reflects a *proposed* schedule and is subject to change. Your TA will notify you of any changes to the syllabus or to the lab manual.

### Introduction

#### Instructors

Professor Michael Bartlett ([micb@pdx.edu](mailto:micb@pdx.edu)) is the instructor of record for this course but your teaching assistants (TAs) are in charge of the specific laboratory sections. Christine Sislak (sislak@pdx.edu) will be in charge of all aspects of this laboratory.

**TA Info:** Name________________________ Email________________________

#### Course Credits

The BI 235 Microbiology Laboratory course is a 2 credit course that meets for three hours, twice a week between the weeks of Jan 9th and March 16th.

#### Required Materials


Fountainhead Press, ISBN 9781598715750

This textbook is required and can be purchased at the PSU bookstore. Additional resources such as media descriptions, exercise updates and PowerPoints will be offered throughout the term on D2L.

You will also need a separate hardbound lab notebook (see participation).

#### Other Supplies

You will be provided with most of the supplies you will need for this laboratory class, including: sharpie-style marker, labeling tape, lab coat, gloves, and calculators. In addition to the lab manual you will need a separate hardbound lab notebook strictly used for this class (see participation).

#### Statement Regarding Students with Disabilities
It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please register with the Disability Resource Center (DRC) (503-725-4150 or drc@pdx.edu) in order to establish reasonable accommodations. Once you have registered with the DRC, schedule a time to talk to with your TA as soon as possible to discuss your needs for the term.

**Grades**

Because the purpose of laboratory classes such as this is to provide you with hands-on experience in the techniques of microbiology, your attendance is essential. You simply cannot gain the same benefit except by actually doing the exercises. It will not be possible to make up missed laboratories, because the materials we use cannot be stored and made available later. Notify your TA as soon as possible in case of an emergency. **After 2 absences you must withdraw from the course or you will receive a failing grade.**

Grades are based on the following:

**Class Participation (25%)**

Class participation is critical and required. Points will be deducted for less than full participation, such as late arrival or early departure, or not applying your attention to the tasks during the lab. Many of the exercises involve groups of two or more – be sure you are doing your share of the work. You should have read the instructions for the day’s exercises **before** the class begins.

In addition, you must arrive with a clear plan written in your notebook for all of the day’s activities. The plan may be in the form of phrases, bullet points, or a flowchart, and should include short descriptions of each step or protocol required for completion of the day’s lab. This plan is not meant to be a direct copy of the lab manual, rather it should be a road map to help you stay on task and finish in a timely manner. The plan will be checked by your TA each day, and points will be deducted for a missing or haphazard plan.

**Quizzes (25%)**

Quizzes will be given at the beginning of the laboratory period. The quizzes will cover aspects of previous and current laboratory exercise(s). If you miss a quiz because you are late or absent, you will not be able to take the quiz later. You will be able to drop one quiz. **No make ups will be given.**

**Lab reports (30%)**

Lab reports are due at the beginning of the lab period (see syllabus for due dates). **No late work will be accepted.** Five lab reports are required. The Introductory Results Report is worth ½ a lab report, Lab Report 4 will be worth 2 lab reports. Guidelines for lab reports are given below.

**Final Examination (20%)**

The final examination is a lab practicum, given in the last week of class. There will be no make up for the practicum.
Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>92%</td>
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<tr>
<td>B+</td>
<td>85%</td>
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<tr>
<td>C+</td>
<td>75%</td>
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<tr>
<td>D+</td>
<td>66%</td>
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<tr>
<td>A-</td>
<td>89%</td>
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<tr>
<td>C-</td>
<td>69%</td>
</tr>
<tr>
<td>D-</td>
<td>60%</td>
</tr>
</tbody>
</table>

The Scoring of the Lab Reports

Each lab report will be scored on a 0-20 points scale (Unknown report worth double). Points can be taken off of the total report for bad grammar, poor spelling, plagiarism (including text from the lab manual), and improper nomenclature. All genus and species names should be italicized and the full genus and species should be spelled out the first time it is written in any single document (*Escherichia coli*). The first letter of the genus, followed by a period and the fully spelled out species name is sufficient in any subsequent mentions in the same document (*E. coli*). When handwritten, genus and species names should be underlined.

Introduction and Objective(s) (4 points)

This section of your lab reports should include a few sentences describing the primary purpose of the lab. The text has to be focused on the essential information the writer wants to convey. Objectives have to be clearly stated. The objective must contain original information, not phrases copied from the lab manual.

Materials and Methods (2 points)

Citing the manual is all that is needed. Any changes in procedures from the manual must be included. ***More detail needed in the final lab report***

Results (6 points)

This section includes:
- Raw data
- Graphs and Tables; Titles on axes and Columns/Rows including the units.

The text must be clear with data that is understandable and informative. Drawings can also be included, and should be clearly labeled. No conclusions should be stated in this section.

Conclusions and Discussion (8 points)

Interpret the meaning of the results. In this section the results should be explained, not restated. Students have to address whether or not the stated objectives have been achieved. Unexpected results should be discussed and plausible explanations for said results included.
**Guidelines for Writing Lab Reports**

Scientific reports are typically divided into four sections: Introduction, Materials and Methods, Results, and Conclusions / Discussion. Each of these sections is different.

**Introduction.** This section should convince the reader that it is reading something that is important. It should not include anticipated results. That’s for later. For example if one studies hospital-acquired *Staphylococcus aureus* infections, he/she might say: “There are 10 million hospital visits each year. Studies indicate that many *S. aureus* infections are hospital-acquired. Identifying the exact source of these infections would save millions of lives each year. Then, objectives have to be clearly stated. For example: “We tested 10 hospitals’ laundry for the presence of *S. aureus*.” Notice that nothing was mentioned about outcomes of the study, but it was only made clear that a phenomenon which affects the public at large is examined. In some introductions (such as in research proposals) objectives are often stated using a separate subtitle.

**Materials and Methods.** For short lab reports such as these, we do not require writing out details in this section. Citing the source, for example the Lab Manual, and any corrections made during lab will suffice. For better understanding of the overall structure of a scientific report, we describe it here nonetheless. Typically, materials and methods are described in detail. Relevance of the study and outcomes are not discussed. For example one might say: “Cultures were taken from clean laundry with sterile cotton swabs and the cultures were grown on TSA plates at 37°C for 48 h. Colonies were inspected visually and cells were Gram stained and observed by optical microscopy at 1000x magnification”. Notice that nothing was said about any specific findings. In most scientific reports the source of materials is also given (that should include the name of the company and the state). For example “Pre-sterilized cotton swabs were purchased from Medical Technologics (FL)” or “All chemicals were purchased from Sigma-Aldrich (CA)”.

**Results.** This section contains direct observations, quantitative results, graphs and/or tables, pictures, drawings, etc. Do not interpret what you saw; that will come later. One might say that a microbe is, a rod, appears pink after Gram stained and tests positive for lactose fermentation but may not deduce from this that it is *Escherichia coli*. For example: “Petri dish A bore 37 opaque white colonies with smooth edges. Individual cells appeared as short, purple rods after Gram staining. Petri dish B appeared the same, but also bore one bright red colony with rough edges. We did not Gram stain any organisms from this plate.”

**Conclusions and Discussion.** Here interpretation of results concerning the objective has to be included. Also, any unknown microorganisms in the study have to be mentioned. Results should not be restated. For example one might say: “Colony morphology and Gram stain results from Petri dish A were consistent with *E. coli*, and we conclude that it is likely that the hospital we studied is infecting patients with *E. coli* through its laundry. However, our findings indicate that *S. aureus* is not being transmitted through hospital laundry. This indicates that there must be another vector for hospital-acquired *S. aureus* infections; further investigations should be performed. Petri dish B was excluded from the study because we determined it to be contaminated. Colony morphology of the contaminant was consistent with *Serratia marcescens*, and further studies should be performed to confirm this identity”.

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Common Mistakes in Microbiology Lab Reports
Here is a general description of common mistakes in lab reports. A mistake might not be exactly as described on this list. You should understand what is intended by each item on this list.

a. Introduction:
   - Should explain why an experiment is of interest to biologists or to medical researchers. How does humanity benefit from the ability to do this type of experiment?
   - Should set up the problem, that is, to convince the reader that there is an interesting question to be solved, or puzzle to be resolved.
   - Specifically explain how the procedure answers the question or problem being presented.
   - Should not describe aspects of the procedure. The introduction is not a how-to-do-it manual, or a play-by-play instruction text.
   - Should not say: “In this lab we learned to…” or, “The purpose of this lab is for us to learn …”. You are taking this lab to learn the techniques, but the purpose of each exercise is to learn something biologically interesting or revealing about microorganisms.

b. Results:
   - Should describe exactly what you saw, or give whatever numbers you have obtained by measurements.
   - Should not describe your personal reaction to the exercise such as: “It was very interesting to observe the color change”.
   - Even if you don’t get what you think of as successful results, you still have results which should be written up as if you were submitting for publication.
   - Even if your results are given in figures or tables, you need to start the section with a complete sentence telling the reader what you are presenting.
   - Figures and tables need to have titles and keys.
   - Should not include your opinion on whether the exercise was a success. Do not use expressions such as: “This experiment did not work out”; “Everything went great!”.

c. Conclusions and Discussion:
   - Do not put results in the conclusion section. “E. coli” appeared purple under the microscope” is an example of a result not a conclusion.
   - Should say something of interest about the organism being studied (something unique learned from this exercise), and about the objectives.
   - Should show the logic of how you get to something interesting from the raw data in your results; (e.g. “Because the organism produced ATP in sunlight, I conclude that it is capable of photosynthesis”).
   - Should say something about identifying each of, and differentiating between all of, the organisms used in the exercise. Specifically, for each unknown organism tested in the exercise, you need to rule out those known organisms that it cannot be based on the results.
   - Should not conclude that the methods were useful, or discuss the successes or merits of the exercise. You are studying the organisms, not judging the methods.
   - Again, should not include your opinion on whether the exercise was a success.
   - Should include a discussion of any unexpected results and include plausible explanations for said results.

d. Other:
Introductory Results Report

Morphological Characterization of *Escherichia coli* and *Bacillus megaterium*

Over the course of the next few lab periods, you will learn fundamental microbiology techniques that allow for the morphological characterization of microorganisms. In order to hone your observational and record-keeping skills in a laboratory setting, we will ask you to compile and submit all of the results obtained over the course of these exercises (Ex. 4, 5, 6, 8, and 9) for two microorganisms; *E. coli* and *B. megaterium*.

Your write up should be in the same format as a full lab report, as described in the introductory handout (e.g., typed, 12 pt. font, 1” margins, etc.), but will only include the results section. It should include tables and pictures (hand-drawn images are acceptable) as appropriate to adequately present all pertinent observations.

Your write up should include the following results/observations for *E. coli* and *B. megaterium*:

- Exercise 4: Colony morphology observations
- Exercise 5: Cell morphology and motility observations
- Exercise 6: Cell size measurements
- Exercise 8: Cell morphology observations
- Exercise 9: Gram stain results and observations

The objective of this assignment is to encourage you to keep careful records of the observations you make during lab, and also to prepare you for what will be expected from you with the formal lab reports later in the term.

This write up is due on Wednesday/Thursday, January 28th/29th. No late reports will be accepted.
PSU’s Statement of Expectations for Student Conduct:

http://www.pdx.edu/dos/psu-student-code-conduct

PSU Writing Resource Center

Plagiarism

What is plagiarism?

Plagiarism is the use of someone else’s words or ideas without properly attributing them to their original source. Acknowledging the original source when borrowing ideas or words from others is called “citing sources.” Whether you work with sources or not, you should be aware of the following forms of plagiarism, all of which carry serious consequences in academic and professional settings:

- Quoting, paraphrasing or summarizing without giving the author credit.
- Copying word for word whole pieces of writing and passing them off as your own.
- Mixing your own writing with segments of word for word copying that is unquoted and uncited. This is known as Mosaic Plagiarism.
- Having another person, such as a friend or family member, write a paper for which you claim credit.
- Turning in a paper for an assignment in one class that was originally written for a different class. It is possible to do this, but you must first obtain the consent of both instructors; otherwise it is considered plagiarism.

What is considered “common knowledge” and should it be cited?

When a piece of information is considered common knowledge it does not need to be cited. However, it’s not always easy to determine what common knowledge actually is. Especially in the areas of history and science, there is a wide range of facts that could be considered common knowledge. “George Washington was the first president of the United States of America” is common knowledge. If, however, you read somewhere that Washington’s favorite writer was William Shakespeare, this idea would need to be cited. Similarly, in science, a statement such as, “Hydrogen is an element which, combined with two molecules of oxygen, produces water,” is common knowledge, but if you were discussing postulations about hydrogen that you found in someone else’s research, you would need to cite the information. When in doubt, use citation.

What if I don’t know I’m plagiarizing?

Not all plagiarism is an intentional act of direct copying. Quite often, it is an unintentional mistake. Differing cultural norms for composition can sometimes account for unintentional plagiarism. Different cultures have different ideas about the proper documentation of sources. In any culture, people sometimes assume that ideas concerning intellectual property are worldwide, when, in fact, attitudes about using source material vary widely. Rigidly upheld notions of plagiarism are actually new even in Western culture and only began to blossom with the invention of the printing press a few hundred years ago. Western ideas about intellectual
property are already changing as a result of information disseminated via the Internet. Even in light of these varied norms, plagiarism is still considered a serious offense.

**What do instructors know?**

Plagiarism is generally extremely easy for instructors to spot. Instructors develop a sense of their student’s written voices, and when plagiarism is attempted – whether intentionally or not – it is easy to see the difference between the writer’s own voice and the voice of copied material. If instructors suspect a case of plagiarism, they can turn to the Internet, which has equipped instructors with highly effective tools for discovering plagiarism. Do not assume that your instructor will not notice your plagiarized material.

**What are the consequences of plagiarism?**

The Western perspective is that plagiarism is no different than stealing. Each institution has its own protocol for dealing with cases of plagiarism, so it is in your best interest to familiarize yourself with the plagiarism rules at your university. PSU dictates its policy on plagiarism and academic dishonesty in the student code of conduct. Generally, cases of plagiarism can be expected to result in anything from a failing grade to academic suspension. A scholar accused of plagiarism may lose his or her job and will certainly lose the respect of other scholars in the community. In short, it is not acceptable to remain ignorant of the possibility of plagiarism in your own writing or to attempt to consciously deceive your reader about the source of your material – it is simply not worth it.

http://www.writingcenter.pdx.edu/resources/library.php?step09_detail_5.html