BIOLOGY 230: Principles of Microbiology, Fall 2018
LAB SYLLABUS

Section 02: Tues 11:00 – 12:50 am, ISC 302
Thurs 11:00 – 11:50 am, ISC 302

Section 03: Tues 2:00 – 3:50 pm, ISC 302
Thurs 12:00 – 12:50 pm, ISC 302

Instructor: Dr. Robert Feissner
Office: ISC 356
Email: feisner@geneseo.edu
Phone: 245-5022
Office Hours: M/W/F (12:00-1:00) or by appointment. Another good time to meet with me is before or after lab.

Course TAs
There will be one course TA – Briana Kubik (bck3@geneseo.edu) and one course prep assistant Grace Song (is10@geneseo.edu). Both students will attend lab, and Briana will hold office hours. If you are struggling with material (either in the lab or the course), I would recommend attending office hours (time and dates TBA). Both students will be available for extra practical help during the semester by appointment.

Course Description
The structure, cultivation, physiology, ecology, and importance of microorganisms (including bacteria, yeasts, and viruses) are studied. Laboratory activity complements lecture material. Prerequisites: BIOL 222 and CHEM 211 or CHEM 223.

Required Texts
None, all laboratory materials are available on Canvas. Students are expected to print our laboratory materials before coming to class, and to check Canvas for materials.

Grading

Lab Notebook	10 pts
Final Presentation	20 pts
Group Lab Reports (3)	75 pts
Lab Practical	25 pts
Biochemical Tests Assignment	5 pts

Make ups are NOT administered except under special circumstances (such as significant medical or family issues). No other excuses (vacations, weddings, travel, etc) will be accepted.

Attendance. Please note: unexcused absences from lab will result in a 10 pt deduction from your overall BIOL 230 grade.

Grade disputes must be initiated within one week from when the assignment was

handed back.

Tips for Success
Laboratory activities will be posted on Canvas and you are required to read over them before coming to lab.

One of the components of success in the lab is keeping a good lab notebook. I will post guidelines for your lab notebooks, and assessment of lab notebooks will be done at random, so you'll need to keep up with your notebook throughout the semester.

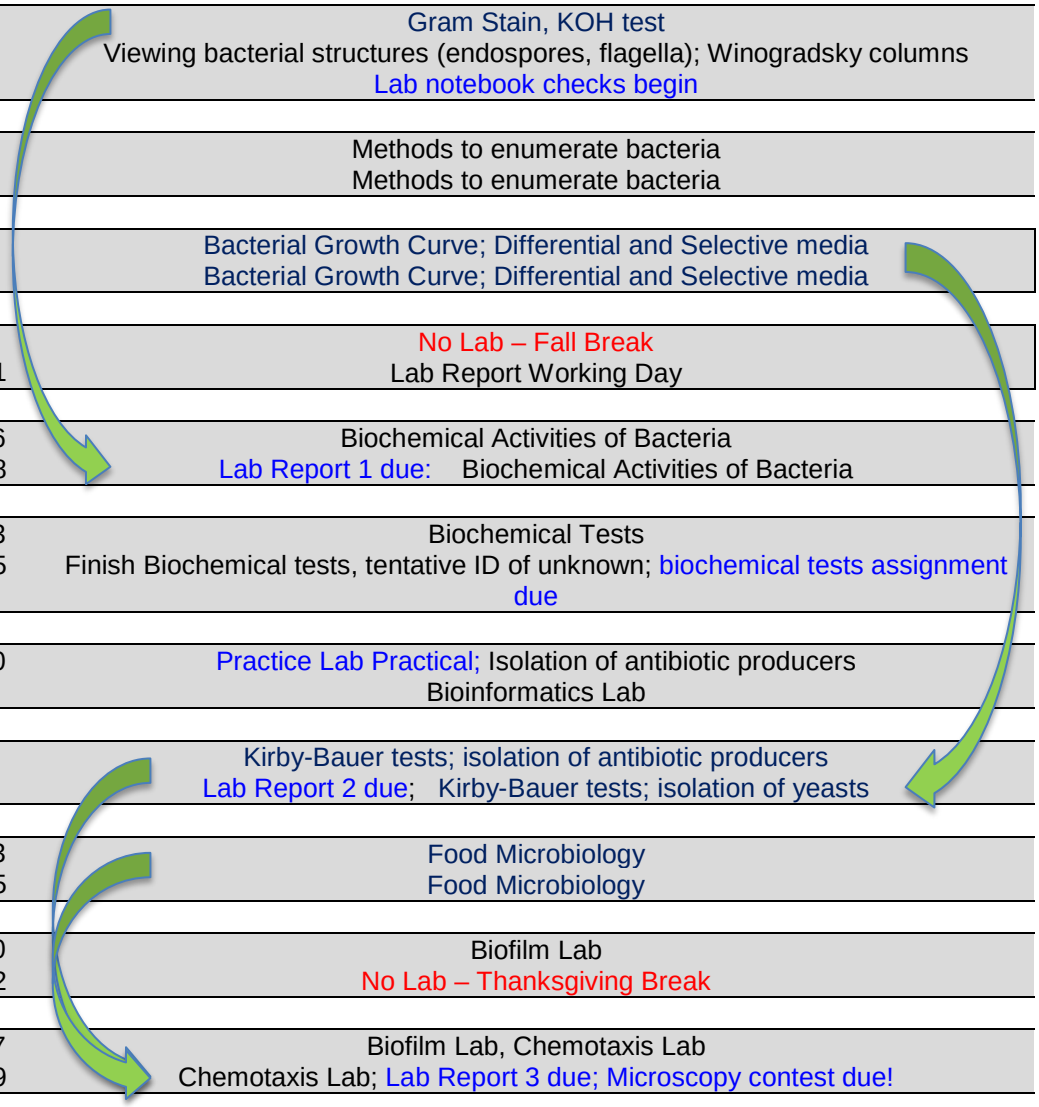
To be a good microbiologist, there are some basic skills (aseptic technique, media making, plate streaking, microscopy, etc) that you need to learn, and these skills will be necessary in almost any microbiology or molecular biology lab. You'll have two opportunities to demonstrate your mastery of these skills in a lab practical. The first lab practical we do will be shorter, and will not be graded. This is meant to be a learning experience, and to help you prepare for the second lab practical, which occurs at the end of the semester. If we have any down time in lab, use this time to practice skills, or you can schedule some extra time outside of lab (for example during office hours) to practice.

Students with Disabilities
SUNY Geneseo will make reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities. Accommodations will be made for medical conditions related to pregnancy or parenting. Students should contact Dean Buggie-Hunt in the Office of Disability Services (tbuggieh@geneseo.edu or 585-245-5112) and their faculty (Dr. Hutchison) to discuss needed accommodations as early as possible in the semester.

Academic Dishonesty & Plagiarism
Students are expected to adhere to the University's policy on academic dishonesty and plagiarism, located in the student handbook. Academic dishonesty and plagiarism have serious consequences, and if you're struggling in class, please ask for help rather than resort to academic dishonesty! Academic dishonesty will result in a zero on the assignment or exam. In addition, a report will be filed to the department chair and Dean of the College, and a record of academic dishonesty will be placed in the student's file at the Dean of Students Office.

Tentative Schedule (subject to change at instructor's discretion) - It is expected that you check Canvas at the beginning of each week for lab materials and instructions).

Week	Date	Subject
1	(T) 8/28 (R) 8/30	Check-in and Intro; Aseptic Technique; Making Media Enrichment cultures (Winogradsky, Purple Nonsulfurs)
2	(T) 9/4 (R) 9/6	Isolating pure cultures; isolation of unknown bacterium Isolating pure cultures
3	(T) 9/11 (R) 9/13	Introduction to Microscopy & Staining Isolation of unknown; PCR
4	(T) 9/18 (R) 9/20	Gram Stain, KOH test Viewing bacterial structures (endospores, flagella); Winogradsky columns Lab notebook checks begin
5	(T) 9/25 (R) 9/27	Methods to enumerate bacteria Methods to enumerate bacteria
6	(T) 10/2 (R) 10/4	Bacterial Growth Curve; Differential and Selective media Bacterial Growth Curve; Differential and Selective media
	(T) 10/9 (R) 10/11	No Lab – Fall Break Lab Report Working Day
7	(T) 10/16 (R) 10/18	Biochemical Activities of Bacteria Lab Report 1 due: Biochemical Activities of Bacteria
8	(T) 10/23 (R) 10/25	Biochemical Tests Finish Biochemical tests, tentative ID of unknown; biochemical tests assignment due
9	(T) 10/30 (R) 11/1	Practice Lab Practical; Isolation of antibiotic producers Bioinformatics Lab
10	(T) 11/6 (R) 11/8	Kirby-Bauer tests; isolation of antibiotic producers Lab Report 2 due; Kirby-Bauer tests; isolation of yeasts
11	(T) 11/13 (R) 11/15	Food Microbiology Food Microbiology
12	(T) 11/20 (R) 11/22	Biofilm Lab No Lab – Thanksgiving Break
13	(T) 11/27 (R) 11/29	Biofilm Lab, Chemotaxis Lab Chemotaxis Lab; Lab Report 3 due; Microscopy contest due!
14	(T) 12/4 (R) 12/6	Lab Practical Unknown Presentations



Biology 230 Lab – Introduction

Activities done in the laboratory are meant to teach you the basic skills of microbiology such as: aseptic technique, making and using dilutions, plating, and using a microscope, among others. The basic skills are not only useful for microbiologists, but most are useful to molecular biologists in general. Even if you don't end up in the microbiology field, hopefully this lab teaches you a lot about a group of organisms that you can't usually see, but that play a huge role in our day-to-day lives and are highly important in the medical field.

Preparation for lab: Similar to other labs you've taken in the biology department, it is expected that you will carefully read the lab materials before coming to class, and will answer any pre-lab questions for each lab. Not only will your experiments run more smoothly and you'll make fewer mistakes, you'll probably get done a lot faster with the lab if you know what you're doing ahead of time.

Attendance: Laboratory attendance is required. It's very difficult to make up a lab, and there simply isn't a substitute for actually being in the lab and doing experiments. **Please note: students with two or more <u>unexcused</u> absences from lab will not pass the course. For each unexcused absence from the lab, you will lose 10 pts from your final lab grade.** If you have a problem with attending a laboratory, please let me know in advance. It is may be possible to attend the other lab section that week.

Group work: In lab you will work in groups of 3-4 students, and groups are randomly assigned. It is the expectation that all group members will actively participate. There will be a lab practical at the end of the course, so it will put you at a great disadvantage if you do not participate in the lab activities.

Safety: Most of the microbes we work with are harmless, but some are opportunistic pathogens. It's very important that you follow aseptic technique protocols that we learn in lab, and that you wear personal protective equipment (lab coat, close-toed shoes, gloves when necessary). In addition, at the end of each lab, your group is expected to wipe down your lab bench with disinfectant, and the last thing you do before leaving lab should be to wash your hands. No food or drink is allowed in the microbiology lab at any time, for your safety. In addition, we often work with Bunsen burners in the lab, and care must be taken to (1) always turn off the Bunsen burner+gas before you leave, (2) make sure to turn the Bunsen burner off if you're not using it to prevent burns, and (3) tie back long hair.

Finally, and most importantly, microbiology should be fun! Many of the techniques we learn do require a bit of practice (streaking plates, microscopy, etc) in order to master them, so hang in there. Microbiology is a broad, vast field, and we only have 1 semester in which to cover it. So, if there's something you're really interested in, or something you'd like to bring in to lab and check out under the microscope or on a plate, just let me know and we can try to work it in with our other experiments.

Biology 230 - Laboratory Notebook

Keeping a laboratory notebook is an essential skill for scientists. Notebooks are used not only to record your data, but they're a place to organize your notes and ideas about what you're working on. There are as many ways to organize your notebook as there are scientists who keep a notebook! Below I'll list some basic requirements for your notebook, but other than that you can organize it however you'd like (as long as it IS in fact organized).

Every student will have their own notebook and is expected to keep track all of the experiments we do in lab. The best practice is for your lab notebook is for it to be a single bound volume. However, in this lab we have both instructions from Canvas and your own notes. Rather than re-copying everything into one notebook, it's much easier for you to use a loose-leaf binder to organize your notebook. This way it's easier to add in pages from Canvas and other materials, in addition to your own notes on loose-leaf paper.
Please organize your lab notebook in the following manner:

a. The outside of your notebook should be labeled with your name, your section, the course name, and the date (Fall 2018)
b. The first page or two of your notebook should contain a table of contents.
c. Throughout your notebook, number each page sequentially in the upper right hand corner of the page. *Even if you make a mistake, DO NOT remove pages. You will not be penalized if you need to cross something out or you need to re-draw something. If you make a mistake, simply draw a line through it (neatly) – never use white out or other corrective materials.
d. Please write the date at the beginning of each lab, so that you have a clear record of the chronology of your experiments.
e. Overall organization: you can organize your notebook in one of two ways. You can organize it by chronology, or by experiment. Either way, please use some type of tabs to separate these sections in your notebook.
f. Organize and manage your lab notebook such that a student continuing your work would easily be able to figure out when you performed an experiment, how you set it up, and what your results were. There should be enough information that any scientist could repeat your work.
g. Even though work is done in groups, EACH lab member must keep their own individual notebook.
h. All microscopy images should have some indication of scale. Either you write the magnification (good) or you draw a scale bar for each image (better).
i. Still unclear? Feel free to shown me your lab notebook at any point, and I can provide you with feedback.

<u>Lab Notebook Grading:</u> Beginning Week 4, each Thursday I will randomly collect notebooks for grading. You must keep up with your notebook throughout the semester. Just because your notebook has been collected once before doesn't mean you're off the hook for the rest of the semester– if you are randomly selected twice, your notebook grade will be an average of the two grades.

Lab Notebook Grading Rubric

_____a. (1 pt) The outside of your notebook should be labeled with your name, your section, the course name, and the date (Fall 2018)

_____b. (1 pt) The first page or two of your notebook should contain a table of contents.

Table of contents titles should be descriptive, for example instead of "week 1," or just the date, the title should tell you something about the experiments being done that week.

_____c. (1 pt) Throughout your notebook, number each page sequentially in the upper right-hand corner of the page. *Even if you make a mistake, DO NOT remove pages.

_____d. (1 pt) Please write the date at the beginning of every section you work on at different times so that you have a clear record of the chronology of your experiments.

_____e. (1 pt) Overall organization: you can organize your notebook in one of two ways. You can organize it by chronology, or by experiment. Either way, please use tabs to separate these sections in your notebook.

_____f. (2 pts) Methods: do you include enough detail/info in your notebook that another student could repeat your work?

_____g. (3 pts) Results: do you record your results in detail? Do you include pictures or descriptions of results when necessary? If an experiment didn't work, do you record why? Are your results recorded in an easy-to-read way, that other scientists could interpret? Do you have scale bars on each microscopy image that you have in your notebook? Do you answer all of the questions in the lab manual pages and enter all appropriate pre-lab data required?

Instructions for Lab Reports and the Presentation

Throughout the semester, you will work in groups of 3-4 students. I know that many of you prefer to work individually, but the ability to work in a group is an essential lab skill, just as important as learning how to use a microscope or how to isolate single colonies. We'll have 3 group projects that are due during the semester: two are written lab reports, and one is a presentation. The first lab report is written individually.

Lab reports (worth 25 pts each); 1 individual, 2 group

The topic for each lab report is indicated on the syllabus (and listed below). Lab reports will be done as a group. The presentation will be done as a group as well. The final report must be typed. There is not required/expected length for the report. Depending on how your experiments worked, you may have more or less data than other students, and this is fine.

Due dates

Group Lab Report 1 (25 pts): Thurs Oct 18 (gram stain & KOH test)
Group Lab Report 1 (25 pts): Thurs November 8 (growth curve)
Group Lab Report 2 (25 pts): Thurs November 29 (food microbiology or Kirby Bauer)

Grading Rubric for Lab Reports (25 points total)

_____ (2 pts) **Title**: Descriptive title that gives the reader an overview of the report. The title should tell me something about your experiment. For example: "Identification of an unknown bacterium" is vague. "Identification of a gram positive bacterium, *Bacillus cereus*, from soil" is a good title. "Identification and characterization of a gram positive soil bacterium, *Bacillus cereus*, using molecular and biochemical methods" is better.

Scale:

1-2 pts: Title is descriptive and clearly states the purpose and results of the experiment

0.5-1 pts: Title is descriptive but is too general and leaves out important info regarding the experiment..

0-0.5 pts: Title contains incorrect info and/or is extremely vague

_____ (3 pts) **Abstract**:

Scale:

2-3 pts: Abstract is a short paragraph that gives readers an overview of methods, results, and conclusions. Good abstracts should be descriptive but very concise, and give the reader a complete overview of the report.

1-2 pts: Abstract leaves out minor details, and is too short. Abstract provides excessive detail and is too long. Example – methods need to be overviewed in the abstract, but you do not want to give specific experimental details, such as pipetting details or incubation temperatures.

0-1 pts: Abstract is largely incomplete/missing major details. Abstract is not in the correct format, & fails to give a general overview of the experiment.

_____ (4 pts) **Introduction:**

Scale:

3-4 pts: Introduction is detailed and cites references when appropriate. Intro places experiment into context, and describes the purpose of the experiment to the reader. Should be written such that an intro biology student could understand your overall purpose & experimental design.

2-3 pts: Intro is not detailed enough, and leaves out minor details that are

important for understanding experiments. Introduction cites few to no references.

0-2 pts: Intro is vague and does little to help reader understand your experiments. Introduction is not written in a clear and logical manner, and is disorganized. No references are cited, or references are cited incorrectly. Intro contains incorrect information.

_____ (4 pts) **Methods:**

Scale:

3-4 pts: Methods are detailed enough that another student could repeat experiments, & methods are described exactly as carried out in the lab (including any deviations from given protocols).

2-3 pts: Methods leave out minor details and are too vague, but overall are complete. Methods do not indicate where actual lab experiments deviate from given protocols.

0-2 pts: Methods are largely incomplete and leave out major details that are necessary for conducting the experiments.

_____ (5 pts) **Results:** Results can be combined with conclusions, either way is fine.

Scale:

4-5 pts: All figures and tables have a title and legend (for figures). Images have a scale bar or magnification listed. Results are presented in a clear and logical order, and give a complete overview of all results from your experiments, even negative ones.

2-4 pts: Results are missing minor pieces of data, and/or presentation of data is incomplete or unclear. Most results are described, but description is vague and/or unclear.

0-2 pts: Major components of results missing, and/or description is very unclear. Format for data presentation (graph, table, image, etc) is poorly executed.

_____ (5 pts) **Conclusions & analysis of your data.** Your conclusions should be supported by your data, and you should discuss any inconsistencies in your results. If you discuss results being "significant," make sure to do appropriate stats to back up these statements. Also, the conclusions section should include a discussion about a follow-up experiment(s).*

Scale:

4-5 pts: conclusions supported by data, interpretation is logical, and statistical analysis is completed when applicable. Follow-up experiment is well thought out and clearly described.

2-4 pts: conclusions supported by data, but some small interpretation errors. Statistics used when appropriate. Follow-up experiment mentioned, but not described in detail.

0-2 pts: Overall, conclusions not supported by data, data misinterpreted, no statistics where appropriate, and/or no follow-up experiment

_____ (2 pts) **Typed, well-written**. Reports are a group effort, so I'm expecting them to be polished.

Scale:

1-2 pts: References correctly cited, 0-1 grammar and/or formatting errors

0.5-1 pts: Minor reference errors, 1-3 grammar and/or formatting errors

0-0.5 pts: More than 3 grammar and/or formatting errors, references not cited where appropriate, major errors in citation formatting

Presentation (20 pts)

The group presentation is due December 6th, and presentations should be 8-10 min in length. The topic of your presentation should be the identification of your unknown bacterium.

Your group will prepare an 8-10 minute presentation on the identification of your unknown bacterium. Each group member should participate, and be prepared to answer questions from myself and the rest of the class. You should use powerpoint (or other similar program) to prepare your slides. If you'd like to use a different format this is likely fine, just let me know beforehand and we can discuss whether it would be a good option. Usually presenters spend ~1 min per slide, so your total number of slides should be ~8-12, and likely not more than 15. I am expecting that your group will practice the presentation beforehand, so you should have an idea if you have the appropriate number of slides/info.

Tips for preparing your presentation:

(1) We did many experiments on your unknown bacterium, and it won't be possible to include every piece of data that you collected. Focus on data that helped you identify your unknown, and on summarizing what you know. You do not have to explain each biochemical test in detail. For example, instead of going through each individual test, you could say what you learned about the capability of your unknown to ferment different sugars, and summarize the results from multiple biochemical tests.

(2) Make sure your slides are not too text heavy, and do not simply read your slides to the audience. Use bullet points and brief sentences to convey info. Whenever possible, use a picture instead of words.

(3) Minimize use of animation unless it is helpful to understanding the material (having text or pictures zoom in and around the slides can be distracting and rarely adds value).

(4) Whenever possible use your own images. If you do use outside images, be sure to provide a citation for those.

(5) Structure your presentation loosely as follows: Introduce your subject/unknown, talk about Results (can mention methods here, but not necessary to go into detail on all of the methods/biochemical tests), Conclusions, and Future Directions.

(6) For the presentation, similar to the lab reports, make sure to describe in detail at least 1 follow up experiment ("future directions) that your group would like to do to find out more about your unknown.

(7) One of my main suggestions is to work on the presentation throughout the semester as you get data. This will make it much easier at the end of the semester to put the presentation together. This way you can collect pictures and prepare data beforehand, and as it gets closer to the due date you can focus more on preparing the presentation (rather than data analysis).

Grading Rubric for Presentation

I will grade your presentation, but a portion of your grade will be an average from evaluations by your peers. You will be expected to evaluate the presentations from other groups, and to provide *constructive* criticism.

_____ (4 pts) **Information and Data** – Are data in the presentation clearly presented and described? Do your data support your conclusions? Do all images have scale bars? Do all graphs have labeled axes?

_____ (4 pts) **Organization** – is the information presented in a logical way? Is there a clear flow to the information in your presentation? You want to order your slides so that there's a clear progression of information and ideas for the audience .

_____ (4 pts) **Visual Impact** – do the slides have too much text? Are they readable? Do slides use too much/too little color? Keep in mind that no color or images can be boring, but too much color, or colors that don't complement each other, can be distracting

_____ (4 pts) **Verbal Explanation** – Each group member should participate in the presentation, and be able to answer questions about the experiments. Speak loudly and clearly and make sure to talk towards the audience (not towards the presentation screen). Your presentation length should be 8-10 min.

_____ (4 pts) **Peer evaluation** – Your peers will rate your poster on a scale of 1-4 (1=poor, 2=needs work, 3=average, 4=excellent), and will provide feedback on your poster.

*Note, you will write your name on the peer evaluations you complete. You are expected to listen to the presentations, and to spend time at the end of the presentation period evaluating them. If you provide little to no feedback, I may deduct points for you from this section.

Biology 230 - Microscopy Contest

Microscopy is one of those microbiology skills that takes a lot of practice to master. Taking a great picture of a microorganism takes skill, patience, and time. To encourage you to practice getting good pictures, we're going to have a semester-long microscopy contest. Throughout the course, if you've got something interesting/weird/pretty under the microscope, take a picture! If you want to practice getting microscopy pictures outside of class, feel free to let me know and we can set up a time. As a class, we'll vote on the best image at the end of the semester, and the winner gets a prize (typically a few bonus points on the final exam and a giant microbe).

Rules:

1. A digital copy of all images or videos must be submitted by **November 29th.**

2. Please include a short (<100 word) description of your image, and what kind of microscope and camera you used to take it.

3. Your image must include a scale bar

4. I will also accept submissions of pictures of colonies on a plate, or plate art (https://www.asm.org/index.php/public-outreach/agar-art)

If you need any inspiration, check out these sites for microscopy contests - these images are truly amazing!

http://www.nikonsmallworld.com/
http://www.olympusbioscapes.com/gallery/year/2014

Some tips and suggestions:

Images can be cropped/re-sized (as long as you correctly add your scale bar), to focus in on interesting features. For example, see below:

1. for this image, there's a lot of blank space. Cropping it would help.

2. The image below looks much better, and I was able to zoom in on the microbe of interest better.

3. Next I should add a scale bar. I know that between each of the eyepiece lines is 2.5 uM (since I took this at 40X), so I can add an appropriate scale bar by putting in a line with a known distance (this line spans 4 eyepiece micrometer lines, so it's 2.5*4=10 um).