Biology 102L Syllabus Fall 2020

Introductory Biology Laboratory with Research: Microbial Interactions

(Hunting for Microbes)

Course description: Even though microbes are small, they live everywhere. Although they usually live in mixed populations in the natural environment, it is possible to study them when they are separated from other species from within their habitat. Looking for these microbes can be done using aseptic pure culture techniques and microscopy. One motivation for isolating and studying these microbes in the lab is that humans use natural products produced by bacteria as therapeutic drugs, including antibiotics. In this course bacteria from the soil will be collected, isolated, and analyzed to attempt to discover new natural products they may produce. Students will be able to make their own predictions about how different soil treatments might affect bacteria. Additionally, some microbes identified by students will be further pursued by members of Dr. Elizabeth Shank's microbiology research lab here at UNC. In addition to gaining experience in the scientific process, this course will enhance the topics from Introductory Biology by teaching major microbiology techniques, introducing new scientific skills, and emphasizing the collaborative nature of an authentic research project.

Course Overview

This lab is intended to reinforce the topics covered in the lecture course and to expose you to collaboration and writing in the sciences. Through hypothesis testing, data collection, and discovery, the course focuses on interpretation of data and critical thinking. You will be expected to write a report that apply methods learned in lab to test hypotheses and present your findings at a poster presentation. You will learn to think scientifically through observations and experimentation and work on your own research project.

Course Format

This lab meets weekly for 2 hours and 50 minutes with some "outside of lab" times needed to prepare for or perform certain procedures that cannot be done during regular class time. You will use microbiological tools such as microscopy, Gram Stain, Aseptic technique, pipetting, serial dilutions, pure culture isolation and computer skills throughout the course to use for bacterial identification and your research project. As the semester progresses you will write a lab report on your soil treatment project using the techniques you learned in the previous weeks. The lab also includes a quiz and midterm to assess what you have learned. A poster presentation is done at the end of the semester where you and your group will interpret your results and then showcase your research at the QEP Research and Making Expo.

Course Goals and Learning Objectives

This course will enable you to:

1. Collect data using microscopes, staining techniques, DNA analysis and co-culture screening.
2. Analyze a scientific article and understand the importance of each section.
3. Understand the process of science and generate and test your own hypothesis after collecting and treating soil.
4. Organize and interpret your data in lab notebooks and in a full lab report.
5. Collaborate with other students on your research project and present your findings to others in the scientific community.

Course Expectations

In this course everyone deserves to feel they can work and learn in a safe and caring environment. We all should understand, appreciate and respect varied races, classes, genders physical and mental abilities, and sexualities. Everyone matters. We should all treat each other with respect, dignity and civility and everyone (students and TAs) should share the responsibility for making lab, and the University, a positive and better place to live, work and learn.

Course Schedule

Date: Week of	Experiment/Activity	Assignment Due Before Class
Aug 12 (401) & 13 (402) LAB 1	1) Microbe Physiology & Diversity – Why study microbes? Where are they found? 2) View protists under microscope and compare to bacteria 3) **Stain different bacteria** to identify by shape and color using microscopy 4) Practice the sterile streak technique (if not enough time, do next week)	•Read Chapters 1 & 2 of Microbe Hunters (*Readings*) •Watch video tutorial of Gram Stain under *Videos* and Sterile streak technique under *Sterile Technique*, copy these protocols into your lab notebook •Read Microscopy documents under *Microscopy*
Aug 19 (401) & 20 (402) LAB 2	1) **Group presentations** of historical figures in microbiology with peer feedback 2) Each group discusses a section of the assigned **scientific paper** in class 3) Observe previously streaked plates (if completed) for growth and examine under microscope, record results in your lab notebook including pictures 4) Work in groups to come up with question about a treatment that might affect bacterial function 5) Plate streak practice using bacterial stock plates	• Read article on Bacterial Hand Contamination (link posted in Sakai) and Antibiotics in Nature article under *Readings* • Group presentation to be presented in lab
Aug 26 (401) & 27 (402) LAB 3	1) **Quiz** on material from previous two weeks 2) Do serial dilutions (dilute known bacterial stock and plate, refrigerate for a week and count on Sept 2 & 3) 3) Special talk about Dr. Elizabeth Shank's research 4) Make predictions about treatments and possible effects on bacteria	•Prepare for Quiz •Read information about performing serial dilutions (under *Serial Dilutions*) •Record planned experiment for treating soil including protocols, reagents, descriptions… in lab notebook **Before coming to lab next week let TA know what supplies and materials will be needed for**

		treating your soil. Let your TA know by Aug 31st.
Sept 2 (401) & 3 (402)  **LAB 4**	1) **Lab notebooks will be collected (#1)** 2) Count serial dilution plates from Aug 26 and 27 3)**Bring in soil, TREATMENT DAY!**	•Work on lab report outline for experiment to be done on Sept 2 & 3 (Outline of lab report format under *Writing Your Lab Report*) Read information about calculating CFU/mL on Sakai under *Workbook*
Sept 9 (401) & 10 (402) **LAB 5**	**1) Lab Report Outline Due** 2) Make cfu dilutions of treated soil, streak fresh soil on plates for lab report 3)Learn how to streak from frozen stocks 4)Learn how to use fluorescence microscope	Use the information on Sakai under Resources/Writing Your Lab Report to help write your outline
Sept 10 (401) & 11 (402) (Sign up on Sakai)	Count CFUs from dilution plates of frozen aliquots, send counts to your TA	
Sept 16 (401) & 17 (402) **LAB 6**	1) Repeat serial dilutions of treated and untreated soil 2) Make practice co-culture plates by mixing soil and provided reporter. 3) Re-plate mixed co-cultures and unmixed control plates for picking tomorrow during lab 4) Record ideas and experimental procedure in Lab notebook, 5) **Notebook check (#2)** 6) Review midterm material	•Read protocol for setting up screen plates (under *Protocols*) •Be prepared to begin co-culture screen experiment
Sept 17 (401) & 18 (402) (Sign up times on Sakai) **LAB 7**	1) Count CFUs from dilution plates from previous day 2) Examine co-culture plates and look at ratios of reporter colonies to soil colonies 3) Identify inducing soil organisms on co-culture plates by observing fluorescence using dissecting scopes	Work on Lab Report
Sept 23 (401) & 24 (402)	**Midterm** Make co-culture plates	Prepare for midterm
Sept 24 (401) & 25 (402) (Sign up times on Sakai)	1) Record results of secondary screen 2) Pick possible inducing colonies from Oct 2 & 3 plates. Pick a maximum of three each from untreated and treated plates. 3) **Photos**	

Sept 30 (401) & Oct 1 (402) LAB 8	Make glycerol stocks of possible inducer populations	**Rough Draft of Lab Report Due, Peer edits**
Oct 7 (401) & 8 (402)	Read about 16S identification and bacterial phylogeny	**Final Lab Report Due Tuesday, Oct 13th, submit through Gradescope**
Oct 14 (401) & 15 (402)	1) Take 6 glycerol stocks of possible inducer strains and streak the strains	
Oct 21 (401) & 22 (402) LAB 9	1)Set up another screen using a lawn of reporter and spot inducer for both untreated and treated soil, incubate 24 hours **2) Notebook check (#3)**	
Oct 22 (401) & Oct 23 (402) (Sign up on Sakai)	1) Do a fluorescence viewing (yes or no fluorescence)	Read about BLAST under *BLAST* in Sakai
Oct 28 (401) & Oct 29 (402) LAB 10	1) Streak soil isolates you want to pursue	
Nov 4 (401) & 5 (402) LAB 11	1) Examine secondary screen from new hits 2) Do PCR of new hits 3) Examine DNA sequencing results from first round of co-cultures 4) Do BLAST of hits 5) Build phylogenetic tree (individual and combined for class? Map on treatments to see if trends?)	Need laptops for DNA analysis
Nov 11 (401) & 12 (402) LAB 12	1) Send for DNA sequencing 2) Discuss what posters are and how to put one together 3) Clean up the lab	Bring in lab notebooks
Nov 18 (401) & 19 (402) LAB 13	**Group poster presentations in lab**	

Attendance: Instructions and demonstrations begin on time, so plan to get to lab early. It is expected that you read through the lab activities in the lab manual before coming to lab so you are better prepared to work on the assignments and understand what you will be doing in lab. You are required to print the lab manual from Sakai and bring to lab each week.

You must be excused by your lab instructor within 48 hours of any absence. Permission to make up the lab missed is granted for:

1. Your own illness, or illness or death in your family with a written note from you.
2. Official university function with written excuse from the official in charge.

If you know you need to miss a lab, you should immediately contact your TA (you should write down your TAs email as soon as you get it in lab). Do not assume an email has been received unless you receive a reply. You may only attend another lab to make up the one you missed if your TA has excused you. An **unexcused** lab deducts 10 points from your final grade and counts as a zero on any missed work.

Coronavirus Safety in the Lab: It is expected that all students wear a face mask upon entering lab and the duration of lab. Face masks will be provided each week. You are also required to keep your distance (6 feet) from other students and the TA while working in lab. It is recommended that you wash your hands frequently in lab and use hand sanitizer. If you do not feel well, have a fever or cough, contact your TA through email and do not come to lab. Call your doctor.

Absolutely **NO FOOD or DRINK** is permitted in the laboratory rooms. Some lab exercises use dyes, stains and chemicals that might damage clothing. Pay attention to the lab you are doing each week so that you wear the appropriate clothing. You are encouraged to wear closed shoes. No visitors are allowed in the lab.

Lab Meetings: Section 401 Wednesdays, (9:20am-12:10pm), **Section 402** Thursdays, (1:15pm-4:05pm).

Outside of Lab Meetings: Some weeks require you to come in and count bacterial colonies on plates, make calculations from your data, streak pure cultures or frozen stocks, or prepare plates in advance of class or after class (these 'off-class' obligations are noted in red above and will have sign up times on Sakai so you can plan around your class schedule).

Instructor: Barbara Stegenga, Coker 211, bstegenga@bio.unc.edu

TA: Aimee Deconinck, Coker 418, adeconinck@live.unc.edu

Sakai site: The syllabus, lab manual, assigned reading, schedule, links to videos and announcements will be on the Sakai site. Please check this site regularly. Most of the assignments will be submitted to or completed on Gradescope.

Credit hours: 1

Meeting times: 3 hours per week

Co-requisite: BIOL101

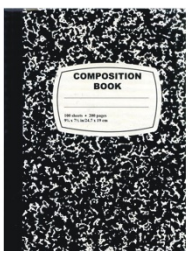
Room: Coker 214 (for both sections)

Text: There is no required text for this course. Assigned readings will come from primary literature, a book and news and will be posted on Sakai. The lab manual is on Sakai.

Lab Exercises: Assignments related to the readings and your research will be submitted to Gradescope or collected in class. In-lab assignments and quizzes will be given. You are required to participate each week in discussions and lab work in addition to keeping a lab notebook.

Mid-term: One exam for the course will focus on the assigned readings, PowerPoint slides, homework, learning outcomes, quizzes, lab reports, and in-class assignments. Test materials to study: lab notebook, lab exercises, reading, slides, and learning outcomes.

Presentation: The presentation will replace a final exam. You will present your findings to the rest of the class which includes a poster presentation.



Items to bring to class each week: Lab notebook (composition book), printed lab manual from Sakai, computer, writing utensils, creativity.

Grading

All written assignments are turned in to and graded by the TA. Each of these written assignments is to be your own creative work and no collaboration outside of lab in writing these is allowed. Students do a peer review of the soil experiment draft that the TA then collects and grades. Drafts that are revised and graded are handed back to the student for use in writing the lab reports. The lab report is to be no more than 10 pages of text in length and no less than 5 pages of text. The outline should be 1-2 pages in length and the draft should be 2-3 pages in length. All written assignments are typed and include the Honor Code Pledge. The lab TAs grade lab reports from other sections to rule out any biasness.

Your grade will be determined by a quiz, midterm, daily grades, grade on the lab report, poster presentation and on cleanup/group participation. Extra credit assignments are not allowed. If you are having trouble with assignments during lab, talk to your instructor first. You may also use tutoring services on campus for understanding concepts and the **Writing Center** for help with your written assignments. The Writing Center offers help with writing your lab report however, they can get very busy with appointments. They are unable to address the science but can give you feedback on the formatting and presentation of the content. For more information, visit https://writingcenter.unc.edu/

Grade Appeals

Any grading concerns (appeals) must be submitted within a week after the assignment is handed back in lab. The appeal must be typed and attached to the original assignment when turned in to the TA. Appeals do not guarantee points back, however, the TA will read your comments and make changes if necessary.

Any assignment that is turned in late will have 10% of the value deducted for each day it is late. Grades are no longer negotiable as of the final presentation day. Computer problems are not acceptable excuses for late work therefore, you should always save your work frequently and in more than one location. Do not wait until the last minute to print your work.

Lab Report: The lab reports is based on the experiment performed in lab and should be written completely in your own words. Quotations should be cited. Reports should be comprehensive descriptions of the hypotheses of interest, experimental methods designed to test those hypotheses, results of the experiments, and interpretations of the results. Guidelines for writing a lab report are in the laboratory manual and include:

- Limitation of 10 pages of text exclusive of title page and graphs, charts and tables. Lab reports should not be less than 5 pages of text.
- All text should be double-spaced
- All margins should be 1 inch
- Written in past tense and in paragraph form with the following sections: Introduction, Materials and Methods, Results and Discussion.

To help you write a full scientific lab report, Biology 102L requires students to write an outline (1-2 pages long), a partial draft (2-3 pages long and typed) and critique another student's draft report of the experiment. The outline should be written in standard hierarchical outline format using numbers and letters to identify sections and major points. The partial rough draft of the lab report should include the Introduction and Materials and Methods sections. The partial rough draft will then be critiqued in lab by your lab partners.

Exams: Biology 102L has one exam. The midterm is one hour and covers material from the first lab through the material covered just before the midterm. Leaving the lab during an exam is not permitted unless excused by the TA. Cell phones and smart watches must remain in the lab if leaving to use the restroom. Exams are practical and the format includes short answer, true/false, multiple choice and calculations.

Studying for the exam: In addition to studying terms throughout the manual and understanding the Learning Outcomes for each lab, it is important to know what you did in lab and why it is important. Ask yourself what was the goal of today's lab? How does it relate to what you studied in lecture? What was the purpose of using specific equipment? Peer tutoring is available in Dey Hall (either in online format or drop-in) for students struggling with biological concepts.

Understanding the UNC Honor Code

The Biology 102 Lab course upholds the Honor Code within the University of North Carolina's Honor System. Academic progress in this course is determined by all graded work, therefore, no collaboration on any written work is allowed. We do encourage students to study together and collaborate on assignments that are not collected for grading or on assignments where permission to collaborate is given (Historical Microbiologist and Poster Presentation). Information about the Honor Code can be found at https://studentconduct.unc.edu/instrument.

So that there are no misunderstandings about academic integrity, we have provided examples of honor code violations below. In this course, students often work in pairs or groups to collect data. Students should not collaborate on any written assignments after leaving lab. Submitting work from other sources that is not properly referenced is also a violation of academic integrity. All work submitted must be your own independent written work. If you ever have trouble with an assignment, you should see your TA or instructor for help instead of asking help from your peers.

Possible honor code violations:

- Unauthorized collaboration on written assignments – all written work must be your own and written in your own words. Emailing, texting or using any other form of communication to discuss the writing of the assignment is prohibited.
- Plagiarism – practice of taking someone else's work and passing them off as one's own
- Cheating – Unauthorized behavior to gain an advantage (as on exams)
- Violation of procedures pertaining to the academic process (providing materials such as lab reports, exams, essays, quizzes and outlines) for others to use

Honor Code Pledge below should be included on the title page of LAB REPORTS.

"I pledge that no unauthorized assistance has been given or received in the completion of this work. Experiments described were performed by me and/or my lab group and this write-up is entirely my own creative work." Signature: _____

For ALL OTHER WRITTEN ASSIGNMENTS, use the Honor Code pledge below:

"I pledge that I have neither given nor received unauthorized assistance on this assignment and it is entirely my own creative work." Signature: _____

COPYRIGHT POLICY
All course materials including your class notes and in-class assignments are covered by University Copyright Policy, @http://www.unc.edu/campus/policies/copyright%20policy%2000008319.pdf. This means it is illegal and an honor code offense to share your notes or any other course materials with anyone not directly affiliated with this particular class, (i.e., no uploading materials to non-class sharing sites).

Resources

For students who register through **Accessibility Resources and Service (ARS)** https://ars.unc.edu/ for different types of disabilities, you will be given accommodations such as extended time on exams or help in the lab if needed. Please note that lab exams can only be taken in the lab and not at a specific testing location through ARS. The lab exams have a practical component to them which ARS cannot provide.

The Department of Biology values the perspectives of individuals from all backgrounds reflecting the diversity of our students. We broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. We strive to make this lab and this department an inclusive space for all students.

Counseling and Psychological Services

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

Technology Use

Computers are allowed in lab since several assignments will be completed during lab time. When using your lap top, you are expected to use it only for the lab activities, which means no e-mail, no Facebook, no Twitter, no ESPN or any other online social media.

Gradescope will be used to grade the midterm and the lab report in this course, in addition to several other assignments. It allows for providing consistent feedback to students on assignments quickly.

If your instructor gave you the entry code for the course, you will be able to add yourself as a student. To do this, if you already have a Gradescope account, log into that account and navigate to your **Account Dashboard** by clicking the Gradescope logo in the top left corner, then click **Add Course** in the bottom right corner. If you don't have a Gradescope account yet, go to their homepage, click **Sign Up** in the upper right corner, select Student, and put in your entry code in the sign-up form. If the entry code doesn't work, please email your instructor for details on how to access the course.

If you don't have an entry code, your instructor must add you to the course. Once you're added into Gradescope or an email with a link to the course if you already have an existing account. If the set password link in this email expires, you can request a new link from the Reset Password page.

Biology 102L Assignments

Topic	Assignment Due
Microbes, Microscopy, Identifying Bacteria	Gram Stain and Sterile Technique protocols written in Lab Notebook – **2pts**
Scientific Paper Analysis, Microscopy continued, Graph Sample Data	Historical Microbiologist Presentations – **4pts** Scientific Paper Section Discussions – **4pts**
Serial Dilutions, Practice Plate Streaking, Special Talk	Quiz - **10pts** Meet with B. Stegenga/Aimee Deconinck to discuss research experimental design. Bring hypothesis. – **2pts**
Treatment of Soil	Lab Notebook Checked – **5pts** Lab Report Outline Due – **4pts**
Midterm	Midterm – **30pts**
Pick and Streak Practice, Fluorescence Microscopy, Begin Co-culture Plate Practice	Lab Notebook Checked – **5pts** Peer Edit of Rough Draft – **2pts**
Revise Lab Reports, Re-plate mixed co-cultures	Complete Soil Collection Form **2pts**
Lab Work	Lab Report Due – **20pts** Lab Notebook Checked – **5pts**
Lab Work	Participation – **5pts**
Final Day	Poster Presentation – **50pts**

The final exam will be replaced by the presentation the last week of the lab.

Grade Scale:							
93-100	A	87-89	B+	77-79	C+	67-69	D+
90-92	A-	83-86	B	73-76	C	60-66	D
		80-82	B-	70-72	C-	<60	F

Final grades will be assigned on the total number of points at the end of the semester.

Course Goals: The lecture and the reading material will provide the basic content. You will gain hands on experience with techniques in microbiology and molecular biology, learn how to formulate testable hypotheses, and design experiments to test them. You will read scientific literature and learn to take notes and write like a scientist.

Doing the Science will allow you to acquire basic laboratory techniques and skills needed to identify and screen for microbes. You will hopefully discover new small molecules secreted from soil microorganisms through co-culture screening. PCR and DNA sequencing will be performed to determine the species identity if time permits.

Sharing the science involves writing about your findings and giving a talk with your lab partners to the class and members of the scientific community about your science.

Understanding and communicating the relevance of the science includes reading and discussing articles on interactions within species of microorganisms and understanding how these interactions relate to human health.