

BIOS 3381: Microbiology Lab

Fall Semester 2021 Section A1: Wednesday 12:30-3:15 pm; Section A2: Wednesday 3:30-6:15 pm
Location: Boggs

Instructors

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TAs

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Overview

This lab is designed to explore commonly used microbiological techniques, such as field sampling, enumeration and cultivation of microorganisms, targeted enrichment and isolation techniques, determinations of microbial growth and function, DNA extraction, polymerase chain reaction (PCR), next generation sequencing, and phylogenetic analysis.

Prerequisites

Biological Principles with lab:
[\[BIOS 1107\]](#) and ([\[BIOS 1107L\]](#) or [\[BIOS 1207L\]](#)) or [\[BIOL 1510\]](#) or [\[BIOL 1511\]](#) and
Chemical Principles II with lab [\[CHEM 1212K\]](#)

Corequisite

Intro Microbiology lecture [\[BIOS 3380\]](#)
BIOL 3381 is a "separate course" that cannot be taken independent of lecture.

Course Learning Outcomes

By the end of this course, you will be able to...

- Accurately and safely use tools and equipment common in microbiology and molecular biology labs.
- Interpret data obtained in experiments and express results in the form of a written laboratory report.
- Transfer and culture bacteria in liquid and on solid growth medium using aseptic technique.
- Isolate and identify various bacteria using differential media and biochemical testing, and PCR.
- Perform DNA extraction and PCR amplification of gene sequences from natural samples
- Analyze the taxonomic composition of pure cultures based on DNA sequences.

Resources

- Lab exercises will be made available prior to each lab.
- Additional resources such as research papers may also be posted on Canvas

Evaluation/Grading

- | | |
|--------------------------|-----|
| • In-class proposal | 20% |
| • Project Presentation 1 | 20% |
| • Project Presentation 2 | 20% |
| • Lab Report | 40% |

Absences

If you have to miss class, let your lab group members know and make an effort to email Drs. Kostka/ Hammer and cc your TAs as soon as possible. Drs. Kostka/Hammer will get you instructions on how to make up missed work/assignments. There is no penalty for an excused absence. See the institute's attendance policy <http://www.catalog.gatech.edu/rules/4/>. Specific excused absences are described below:

Illness: If you are ill, and possibly contagious, students are expected to take appropriate action including not coming to class and seeking medical treatment. If you have tested positive for COVID-19 infection, have symptoms compatible with COVID-19 or if a healthcare provider or public health official has told you that COVID-19 infection is suspected because you have been exposed to a person with COVID-19, you must follow the [Georgia Department of Public Health home isolation instructions](#). Students are responsible for providing documentation of illness to the [Office of Student Life](#) where it will be treated and handled confidentially with necessary information being submitted to Drs. Kostka/Hammer.

Medical Emergency: Students missing class because of medical emergencies like a car accident should complete a [Request Assistance Form](#) or call the Dean of Students who will contact Drs. Kostka/Hammer.

Institute Approved Absence: In addition to illness and medical emergencies, students will be permitted to make up the work missed during absences for approved Institute activities such as athletic events, as described by the registrar's Office at [Institute Approved Absences](#). Contact Drs. Kostka/Hammer in advance to coordinate.

Unexcused Absences: There are no make-up labs for unexcused absences. If you miss a lab you are still responsible for completing assignments and getting data from group members.

Research Proposal (20% of final grade):

The first two weeks of the lab you will be responsible for generating a research proposal that has looked into the background information. You will research the topic using outside sources and develop a question and hypothesis based on your findings. You will be given time to work on these in lab but final versions will be due before lab meets the following week.

Lab presentation (2 presentations, each at 20% of final grade):

You will be assigned to complete two presentations this semester. You will present your hypothesis, experimental methodology, results and a discussion of your findings from any lab done during the semester. Presentations should be between 3 and 5 minutes long.

Written Lab Report (one report; 40% of total grade each):

After the completion of each group of experiments indicated in the schedule, each student should prepare a lab report. Grades for reports submitted late will be lowered by 10% for each day past the due date. Rubrics for the proposal and detailed lab report will be provided.

Academic Integrity:

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Safety in Lab:

PPE

Given the rapidly evolving nature of the situation with COVID-19, your safety in our in-person sessions is our number one concern while still providing a productive learning environment. We all agree that the best way for you to learn this material is face-to-face, working on teams. However, we are able to help you learn the course content remotely, if need be. The course modality (in-person versus remote) could change depending upon health status of individuals in classroom. The public health evidence is that everyone who is able to should wear a facemask, correctly covering mouth and nose, and that everyone who is eligible should get vaccinated.

Disposable surgical masks for in-lab use will be made available for those that wish to wear one but have forgotten to bring their own. Our expectation for you as emerging microbiologists is that you will be vaccinated and wear a mask in this laboratory and indoors in general. In addition, while in lab all students will be required to wear all appropriate laboratory PPE including safety glasses/goggles, lab coats, and gloves. Students are responsible for their own lab coats and safety glasses/goggles.

Lab coats are required every week. Safety glasses are required when using chemicals or biologicals. Due to covid, it's suggested that after students arrive they – put on a surgical mask – wash hands – don gloves. If you choose to wear a cloth mask in lab, GT's Environmental Health & Safety Department recommends you wear a surgical mask over it so it doesn't become contaminated during wet lab work. Used gloves and disposable surgical masks go into the biohazard bin as students are leaving. As per usual, no exposed skin below the waist, long pants and shoes that cover the whole foot. Please label lab coats and safety glasses with your name and disinfect your goggles regularly with ethanol.

Disinfecting Surfaces

Students will be asked to disinfect their work areas with 70% ethanol before lab, at the end of lab, and in the event of a spill. Instructors are responsible for disinfecting common work surfaces, and high touch surfaces like interior door handles at the end of each section. Shared equipment does not need to be disinfected between uses if everyone is wearing gloves.

Food/drink

Visible food or drink are prohibited at ALL times from the moment they walk in.

Emergency Equipment

Know the location of the nearest fire extinguisher and fire alarm pull box (both in the hallway). Each lab has a red emergency gas cut-off switch near the support lab. Each lab has a First Aid kit, eyewash stations and emergency shower. AEDs, automated external defibrillators, can shock and restore a heart rhythm during cardiac arrest. These are located on the 2nd floor and basement of Boggs and should be administered by trained personnel.

Failure to bring the required PPE will result in denial of admission to labs with grade penalties for missing lab, no exceptions. In addition, refusal to comply with proper PPE usage will result in grade reduction as well as potential disciplinary action for violating the Georgia Tech Honor Code.

Accommodations for Students with Disabilities:

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Campus Resources for Students:

In your time at Georgia Tech, you may find yourself in need of support. Below you will find some resources to support you both as a student and as a person.

Academic support

- Center for Academic Success <http://success.gatech.edu>
 - 1-to-1 tutoring <http://success.gatech.edu/1-1-tutoring>
 - Peer-Led Undergraduate Study (PLUS) <http://success.gatech.edu/tutoring/plus>
 - Academic coaching <http://success.gatech.edu/coaching>
- Residence Life's Learning Assistance Program
<https://housing.gatech.edu/learning-assistance-program>
 - Drop-in tutoring for many 1000 level courses
- OMED: Educational Services (<http://omed.gatech.edu/programs/academic-support>)
 - Group study sessions and tutoring programs
- Communication Center (<http://www.communicationcenter.gatech.edu>)
 - Individualized help with writing and multimedia projects
- Academic advisors for your major
<http://advising.gatech.edu/>

Personal Support:

Georgia Tech Resources

- The Office of the Dean of Students: <http://studentlife.gatech.edu/content/services>; **404-894-6367**; Smithgall Student Services Building 2nd floor
 - You also may request assistance at https://gatech-advocate.symplicity.com/care_report/index.php/pid383662?
- Counseling Center: <http://counseling.gatech.edu>; **404-894-2575**; Smithgall Student Services Building 2nd floor
 - Services include short-term individual counseling, group counseling, couples counseling, testing and assessment, referral services, and crisis intervention. Their website also includes links to state and national resources.
 - *Students in crisis may walk in during business hours (8am-5pm, Monday through Friday) or contact the counselor on call after hours at 404-894-2204.*
- Students' Temporary Assistance and Resources (STAR): <http://studentlife.gatech.edu/content/need-help>
 - Can assist with interview clothing, food, and housing needs.
- Stamps Health Services: <https://health.gatech.edu>; **404-894-1420**
 - Primary care, pharmacy, women's health, psychiatry, immunization and allergy, health promotion, and nutrition
- OMED: Educational Services: <http://www.omed.gatech.edu>
- **Women's Resource Center:** <http://www.womenscenter.gatech.edu>; **404-385-0230**
- **LGBTQIA Resource Center:** <http://lgbtqia.gatech.edu/>; **404-385-2679**
- **Veteran's Resource Center:** <http://veterans.gatech.edu/>; **404-385-2067**
- **Georgia Tech Police: 404-894-2500**

Statement of Intent for Inclusivity

As a member of the Georgia Tech community, I am committed to creating a learning environment in which all of my students feel safe and included. Because we are individuals with varying needs, I am reliant on your feedback to achieve this goal. To that end, I invite you to enter into dialogue with me about the things I can stop, start, and continue doing to make my classroom an environment in which every student feels valued and can engage actively in our learning community.

Syllabus change policy:

Syllabus changes substantially affecting the grading of the course will not be made. ****Other syllabus changes may be made and will be announced.****

Tentative Schedule- 13 total class periods, not including Week 1

Dates	Experiment
Week 1 Aug 25	Class will not meet
Week 2 Sept 1	Lab introduction, Rules, and Safety Choose Lab Partners
Week 3 Sept 8	Introduction to Plant Microbiomes. Proposals due on Friday Sept 10
Week 4 Sept 15	Lab 1 - Field sample collection. Class meets outdoors on Georgia Tech campus. Please be prepared in case of rain.
Week 5 Sept 22	Lab 2 - Enumeration of microorganisms in rhizosphere. Prepare serial dilutions of bacteria from soil samples.
Week 6 Sept 29	Observe and record results from week 5. Count colonies for enumeration of microbial abundance in soils; Isolation of soil bacteria. Transfer and purification of bacteria from liquid enrichments onto solid media; Begin Lab 3- Soil Ecosystem Function (wet to dry weight determination)
Week 7 Oct 6	Lab 3 - Soil Ecosystem Function- Exoenzymes. Observe and record results from week 6; Transfer and purification of isolated bacteria on solid media. Transfer cultures to fresh media
Week 8 Oct 13	Transfer pure cultures from plates to broth cultures. Calculate rates of exoenzyme activity. Students prepare presentation.
Week 9 Oct 20	Student project presentation 1
Week 10 Oct 27	Lab 4 - Extraction of DNA and PCR amplification of 16S from pure cultures
Week 11 Nov 3	Lab 5 - gel electrophoresis and gel purification of PCR product
Week 12 Nov 10	Lab 6 - PCR product quantification and sending off for sequencing
Week 13 Nov 17	Lab 7 - Sequence analysis
Week 14 Nov 24	Thanksgiving holiday, no lab
Week 15 Dec 1	Student project presentation 2
Dec 15	Lab Report due December 15 by 10:50AM. This Lab Report will cover all lab activities.

Rubric- Proposal

Title: _____(2.5)
Summarize your investigation of hydrocarbon-degrading bacteria

Authors: _____(2.5)
Include your name and name of virtual lab assistant

Include the following information:

Introduction/ Rationale (1 paragraph): _____(40)

Provide at least one question about hydrocarbon-degrading bacteria that you would like to answer. This question should differ substantially from that provided by instructor.
Give a rationale or explanation for why you think this question should be answered?
How will your study contribute to our knowledge of this group of microorganisms?
Where and what type of soil sample do you plan to collect on Georgia Tech campus?
What makes you think that this would be a good place to find hydrocarbon-degrading bacteria?

Example:

Are hydrocarbon-degrading bacteria concentrated in soils near portable toilets? Human waste may leak out of the tanks underlying the toilets. Hydrocarbon-degrading bacteria thrive on elevated levels of soil carbon and thus human waste would provide a large amount of carbon substrate for growth. Elevated levels of human waste lead to an enrichment of hydrocarbon-degrading bacteria in soils.

Hypothesis (1 sentence): _____(15)

Provide at least one hypothesis about hydrocarbon-degrading bacteria that you would like to test. In other words, formulate a testable hypothesis that addresses your question.

Example:

Hydrocarbon-degrading bacteria enriched in soils surrounding the men's restroom at Piedmont Park will metabolize hydrocarbons under anaerobic conditions.

Experimental Approach (2-4 paragraphs): _____(35)

How will you answer the above question? The lab will involve the enrichment, isolation, and purification of hydrocarbon-degrading bacteria. What procedures can you use within the allotted time to interrogate the hydrocarbon-degrading bacterium that you isolate? We are obviously limited in time and resources here. Think about a simple experiment that you can do with a pure culture. For example, think about the controls of hydrocarbon degradation in the environment. These controls may be manipulated in a simple pure culture experiment.

Style: _____(5)

For those who went above and beyond the rubric, demonstrated by superior insight or by a document that was exceptional

Ways to Lose Points

Excessive grammatical errors (automatic -5) _____(-5)

Extra Credit:

Early Turn in: _____(+5)

1 point for each day turned in early

TOTAL _____(100)

Rubric- Detailed Lab Report

Title:

summarize experiments

Authors:

include your name first and partners names (formatted like a research paper)

Include the following information:

Abstract (7-12 sentences):

_____ (10)

- i) Overview of the problem and your hypothesis (2 sentences)
- ii) Methods (1-3 sentences)
- iii) Results and outcomes (2-4 sentences)
- iv) Discussion (1-2 sentences)
- v) Implications (1 last sentence)

Introduction (~2-3 pages)

_____ (10)

A description of the problem, purpose, and scope of your investigation. It should also include a description of your hypothesis.

Materials and Methods (~2 pages):

_____ (20)

Briefly describes the materials, equipment and procedures used

Results (~4-6 pages):

_____ (35)

A written presentation of the data collected, with tables and figures as needed. Use correct units. Refer to figures and tables in text. Figures need legends

Discussion (~2-3 pages):

_____ (20)

Explains and analyzes your results and suggests the significance of the results to a reader. If you developed and tested an hypothesis, this would be where you explain how your results relate to your expectations. If your experiment were inconclusive or you experienced challenges, explain them here too.

References:

_____ (5)

ARE necessary

Cite references in text

Some examples of ways to lose points:

No Title or Authors' names

_____ (-5)

Excessive grammatical errors

_____ (-5)

Potential bonus points:

CIOS 5-point bonus for 90% section response rate?

_____ (5)

TOTAL _____ (100)