**BIOS 3381: Microbiology Lab**

Fall Semester 2018 Section A: Tuesday 12:00-1:45, Thursday 12:00-1:00 Location: CE 330

**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, phylogenetic analysis.

**Prerequisites**

Biological Principles ([BIOL 1510](https://oscar.gatech.edu/pls/bprod/bwckctlg.p_display_courses?term_in=201408&one_subj=BIOL&sel_subj=&sel_crse_strt=1510&sel_crse_end=1510&sel_levl=&sel_schd=&sel_coll=&sel_divs=&sel_dept=&sel_attr=) or BIOS 1107 and (BIOS 1107L or 1207L)) or Honors Biological Principles ([BIOL 1511](https://oscar.gatech.edu/pls/bprod/bwckctlg.p_display_courses?term_in=201408&one_subj=BIOL&sel_subj=&sel_crse_strt=1511&sel_crse_end=1511&sel_levl=&sel_schd=&sel_coll=&sel_divs=&sel_dept=&sel_attr=)) is required background, as well as undergraduate semester level [CHEM 2311](https://oscar.gatech.edu/pls/bprod/bwckctlg.p_display_courses?term_in=201408&one_subj=CHEM&sel_subj=&sel_crse_strt=2311&sel_crse_end=2311&sel_levl=&sel_schd=&sel_coll=&sel_divs=&sel_dept=&sel_attr=).

**Corequisite**   
Microbiology lecture ([BIOS 3380](https://oscar.gatech.edu/pls/bprod/bwckctlg.p_display_courses?term_in=201408&one_subj=BIOL&sel_subj=&sel_crse_strt=3380&sel_crse_end=3380&sel_levl=&sel_schd=&sel_coll=&sel_divs=&sel_dept=&sel_attr=)).

BIOS 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
* Carry out next generation sequencing of genes from natural samples
* Analyze the taxonomic composition of pure cultures and natural bacterial communities 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 at T-square
* T-square (http:www.tsquare.gatech.edu)

**Evaluation/Grading**

* In-class proposals, assignments 40%
* Lab reports 60%

**Written Lab Reports**

After the completion of each group of experiments indicated in the schedule, each student should prepare a lab report.

For Kostka portion of the class:

Lab reports will consist of 3 short reports for Labs 1-3, each representing 3.33 % of your grade, and 1 long report for Lab 4 that comprises 30 % of your grade. The proposal will represent 10 % of your grade. 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 (Lab 4- Hydrocarbon-degrading bacteria) are provided below.

**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.

**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**](http://www.womenscenter.gatech.edu)**; 404-385-0230**
* **LGBTQIA Resource Center:** [**http://lgbtqia.gatech.edu/**](http://lgbtqia.gatech.edu/)**; 404-385-2679**
* **Veteran’s Resource Center:** [**http://veterans.gatech.edu/**](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- first half of class**

|  |  |
| --- | --- |
| Dates | Experiment |
| Week 1  Aug 21-23 | Tuesday-Lab introduction, Rules, and Safety  Lab 1- Effectiveness of Hand Washing, p. 7 Cappuccino and Sherman (Experiment 1)  Thursday-Observe and record results for Experiment 1, Prep for Lab 2, Introduction to Soil Microbiology and Oil Degrading Bacteria |
| Week 2  Aug 28- 30 | Tuesday-**Proposals due at class time.** Field trip to Piedmont Park.  Thursday- Lab 2 Enumeration of Microorganisms in Soil, p. 345 Cappuccino and Sherman (Experiment 51). |
| Week 3  Sept 4-6 | Observe and record results from Lab 2;  Lab 3 Characterization of soil ecosystem function  Prep for Lab 4, Prepare liquid enrichment cultures of hydrocarbon-degrading bacteria from soil samples |
| Week 4  Sept 11-13 | Lab 4 – Enrichment and isolation of oil-degrading bacteria. |
| Week 5  Sept 18-20 | Tuesday-Continue Lab 4. Transfer and purification of isolated bacteria.  Observe and record results from lab 3; transfer cultures to fresh media.  Thursday-Growth on oil as the sole substrate. |
| Week 6  Sept 25-27 | Lab 4 – DNA extraction and PCR amplification of SSU rRNA genes from pure cultures  Prep for taxonomic analysis of pure cultures |
| Week 7  Oct 2-4 | Lab 4 – Verification of PCR product, taxonomic analysis of SSU rRNA gene sequences |
| Week 8  Oct 9-11 | NO LAB – FALL BREAK (OCT 8 – 9)  **Lab Report 1 due Oct 12. This Lab Report will cover lab activities from Sept. 11th to October 4th.** |
| Weeks 9-16 | See detailed schedule on T-Square (Oral\_microbiome\_BIOS3381.pdf) |

**Rubric- Proposal**

**Title**: \_\_\_\_\_\_\_(2.5)

Summarize your investigation of hydrocarbon-degrading bacteria

**Authors**: \_\_\_\_\_\_\_(2.5)

Include your name

**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 at Piedmont Park?

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 restrooms in the park? Human waste may leak out of the septic systems underlying the restrooms. 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**: \_\_\_\_\_\_\_(2.5)

summarize experiments

**Authors**: \_\_\_\_\_\_\_(2.5)

include your name first and partners names

(formatted like a research paper)

**Include the following information:**

**Abstract (2-4 sentences)**: \_\_\_\_\_\_\_(15)

Why you did the experiments/exercises?

What you did?

What were your findings?

**Materials and Methods (2-3 paragraphs)**: \_\_\_\_\_\_\_(20)

Describe the approaches that you used to enrich, isolate, and purify your hydrocarbon-degrading bacterial strain. Describe how you determined growth on oil and performed taxonomic analysis.

**Results (2-4 paragraphs)**: \_\_\_\_\_\_\_(15)

statement of what you observed, with figures

use correct units; refer to figures and tables in text

**Figures/Tables:** \_\_\_\_\_\_\_(15)

With appropriate **legends** (use published papers as examples)

At least one per lab; some labs may need more

Use correct units

**Discussion (2-4 paragraphs)**: \_\_\_\_\_\_\_(20)

Explain and describe important implications of your results.

Describe the strengths and weaknesses of methods used in each lab.

Explain how you would improve the experimental approach in the future, if you were to repeat the experiments.

Refer back to your proposal. Was your question answered or your hypothesis sufficiently tested? If so, how? If not, why not?

Discuss your results in the context of soil microbiology and ecology of hydrocarbon-degrading bacteria.

**References:** \_\_\_\_\_\_\_(5)

ARE necessary

Cite references in text

**Style:** \_\_\_\_\_\_\_(5)

For those who went above and beyond the rubric,

Demonstrated by superior analysis, figures,

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)