BIOL 3381 Microbiology Lab
Fall 2011
Room D-104 Cherry Emerson
Monday – Section A 12:05-2:55 pm, Section B 3:05-5:55 pm

Instructor

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Required Text

A Student Handbook for Writing in Biology by Karin Knisely

Website

This course makes extensive use of T-square (tsquare.gatech.edu). You are responsible for checking the website frequently for announcements. Experimental procedures and other important information will be posted on the site. Lab reports should be submitted via the assignments tab on T-square.

Overview

You will explore fundamental aspects of microbiology and current methods used in the microbiology laboratory by isolating and characterizing your own prokaryotic microbes throughout the course of the semester. We will be developing Winogradsky Columns to use for our incubation and isolation of bacteria. Throughout the course of the semester, we will use the columns to harvest and test our bacteria to determine answers to the fundamental questions in microbiology– Who are they? Where are they? What are they doing?

Course format

Students will work in groups of 2-3 to initially set up Winogradsky columns which will be monitored and sampled throughout the course of the semester. During May and June, students will conduct a series of testing of the isolated microbes to identify them based on morphology, metabolic traits and genetic sequences. In July, students will perform specific student-driven research to further explore the unique characteristics and differences among their bacteria. Students are expected to keep an accurate laboratory notebook and have the necessary procedures written out in full when they arrive in class the following week. Each week, we will discuss appropriate techniques and current research in microbiology that relate to our experiments. Discussion of the next experiments will also take place at this time. There will be two lab reports based on general characterization of the bacteria and then a final lab report, which will include the student-driven experiments. Additionally, there will be a final presentation given to the lab by each lab group based on their characterization of the bacteria in the student-driven experiments.

Lab Safety and Personal Protection Equipment (PPE)

In accordance with the new Georgia Tech Policy on PPE and appropriate attire (http://www.ehs.gatech.edu/chemical/ppePolicy.php), safety glasses and lab coats must be worn in the lab. These are to be purchased by students. Safety goggles will be worn at all times. Lab coats must be worn when handling chemicals, biologicals or radiologicals. Appropriate lab coats can be purchased at VWR in EST. Long pants and shirts (not tank tops) must be worn at all times, as well as shoes that completely enclose the foot.

Academic integrity

All students should be familiar with their rights and responsibilities under the Georgia Tech Academic Honor Code and are expected to abide by its provisions. Academic dishonesty is not a "victimless" crime; it interferes with instruction, damages the reputation of the Institute, and ultimately harms the perpetrator who fails to learn course material or the value of individual effort. Violations of the Honor Code (http://www.honor.gatech.edu) are taken seriously and can result in severe disciplinary action, up to and including expulsion. Prohibited conduct includes, but is not limited to: copying from another student or allowing someone to copy your work (sharing group data when completing laboratory reports is permitted, but submission of identical written work is not), using notes in any form on a quiz without the express permission of the instructor, requesting a re-grade of an assignment after altering it, submitting someone else's work as your own, or allowing your work to be submitted under another person's name.

Written reports

There will be three lab reports for this lab. Each lab report should include:

- Abstract: concise summary of what happened during the experiment (2-3 sentences per experiment)
- Introduction: to provide adequate background pertaining to the cell line and experiments to give any reader knowledge of why you did the experiment. This should include your hypothesis. This Introduction can be re-used in subsequent reports, but should be built upon to reflect new information.
- Materials and Methods: concise summary of what you did including how the bacteria were cultured and maintained.
- Results: This section will include both figures and written results. Here you state simply what you observed/measured.
- Discussion: In this section you will analyze your results and state why you observed what you did during the experiment. (Conclusions section)
- References: you will need to be looking for *appropriate* references to support your introduction and discussion.

Lab reports will be reduced by 10 points for each day they are late.

Group presentations

On November 28, each lab group will lead the class through a discussion of their student-driven experiments. This will include rationale/background, methods, results and conclusions. The presentations should be ~10 minutes and may use PowerPoint. There will be a brief discussion of progress the week before with only discussion, no Powerpoint, in order to help shape experiments and prepare for the presentations.

Lab Notebooks and pre-lab questions

You need a bound composition-style notebook for this course. Lab notebooks are the single most important tool in any research lab. Each experiment should begin with a hypothesis. Detailed protocols should be written in your notebook by the experiment day for that experiment. You should be using your handwritten protocols during the lab session. During the lab, you should note any changes to the protocol, clarification, etc. You should write down observations and finish up with conclusions. If the lab results were not ideal, include a sentence or two about trouble shooting – this will help with your final experiments and your lab reports. Graphs or other data should be assembled and pasted into your notebook by the beginning of the discussion day for that experiment. At 2 times during the semester, your lab notebooks will be picked up and graded. Lab notebooks should only be written in using black or blue ink, you may make a correction by drawing a single line through an entry and then correcting – no white out.

Attendance and Participation

All students are expected to be present each week in lab. (This includes being on time.) If you do not provide the instructor with a valid Georgia Tech excused absence or tardiness (see the bylaws) within 24 hours of missing a lab, it will count against you. Participation will be based both on contribution to class discussions and cooperation during lab activities. During the discussion sessions, participation will be scored based on the quality (not correctness) of answering questions and if you ask questions that allow for forward movement of the discussion. During lab activities there will be incubation times and other periods where you may not be actively conducting an experiment. This is still considered lab time. The participation grade will be a collaborative grade between the TAs and the instructor.

Grading

Lab notebooks and assignments/take home quizzes	10%
Lab reports	30% (15% each)
Attendance and Participation	10%
Proposal	10%
Final Presentation	10%
Final cumulative report	30% (Covers labs 1-5)

Final scores will be rounded to the nearest whole number, and grades will be assigned according to the following scale: 90-100% A; 80-89% B; 70-79% C; 60-69% D; <60% F

SCHEDULE OF LABS

(subject to change)

August 22: **Discussion: Introduction to Microbiology lab/Goals of the semester**
What is a Winogradsky Column?
Contaminants??
Experiment: Set up Winogradsky Column

August 29: **Discussion: How can we use the Winogradsky Columns to isolate bacteria of interest?**
What is the goal of different plating techniques?
Experiment: Add potential contaminants – if called for, paper discussion, set up lab notebooks

September 5: **Official school holiday, no lab**

Sept 12: **Discussion: What makes bacteria appear different in morphology?**
Experiment: Learn plating techniques – *E. coli* and unknowns
Sample columns – spread plating

Sept 19: **Discussion: Basic, but key characteristics of bacteria that are good for characterization**
Experiment: Observe columns and plates
Identify unknowns – Gram and spore staining, oxidase and catalase tests
Streak purify column bacteria

Sept 26: **Discussion: How to identify your column bacteria**
Experiment: Gram staining, Spore staining, oxidase and catalase tests on column bacteria
Basic morphology characterization
Set up cultures (2ml)

October 3: **Discussion: What does the carbon and nitrogen utilization of a microbe tell you?**
What is the difference between transforming and metabolizing a substrate?
Experiment: As needed – Streak purify, passage bacteria on plates
Based on previous data, check for growth on minimal media with distinct carbon and nitrogen sources (SIM/motility test, nitrate reduction, Simmons citrate, TSI, MR-VP, varied nitrogen sources with auxanography)
LAB REPORT DUE – COLUMN SET UP THROUGH BASIC CHARACTERISTICS (experiments from 9/26/11)

Oct 10: **Discussion: Genetic code vs. Activity in a microbial ecosystem. To check the DNA or not to check the DNA**
Bioinformatics – what can it tell you?

Experiment: Colony prep 16s PCR (sequencing)

October 17: **Official School Holiday – Fall Recess**

Oct 24: **Discussion: What makes up a microbial ecosystem – a return to the Winogradsky column?**
Proposals – what are they good for?
Antibiotics – what are THEY good for?
Bioinformatics – who are your microbes and who are they related to?
Experiment: Antibiotic sensitivity and production – plating pure culture with sensitivity discs and with samples from the columns

Oct 31: **Discussion: Proposals –relevancy, feasibility and funding**
PROPOSALS DUE
Experiment: Check and discuss antibiotic assays

November 7: **Discussion: Progress checks**
Experiment: Student-led experiments
LAB REPORT DUE – C/N TESTING THROUGH BIOINFORMATICS AND ANTIBIOTIC SENSITIVITY (experiments conducted through 10/31/11)

Nov 14: **Discussion: Progress checks**

Experiment: Student-led experiments, brief chalk talk about progress to lab

Nov 21: **Discussion: Progress checks**
Experiment: Student-led experiments

Nov 28: **Discussion – Student-led final presentations and clean up**

December 8: ***Final (cumulative) lab report due (by noon)***