

## INVESTIGATIVE BIOLOGY LABORATORY (BioG 1500) SYLLABUS

This course is designed for biology majors to provide lab experience with emphasis on the processes of scientific investigation and to promote collaboration, communication, and literacy in science. Students gain scientific skills used by biologists to construct new knowledge. Lab topics include genetics, evolution, microbiology, ecology, biochemistry, and molecular biology.

### MAIN OBJECTIVES

The course modules follow the “crawl, walk, run” approach to develop the capacity of students to solve increasingly challenging problems with greater independence. First, the students fill their scientific “tool box” to be able to design and carry out experiments. The first module is a more structured unit (Antibiotic Resistance), followed by a module that provides more freedom (Limiting Nutrient). Lastly, the Human Microsatellite DNA unit emphasizes the importance of accuracy and precision in science.

*The main course objectives are:*

1. To expose students to realistic scientific questions, encourage critical thinking, and teach them how to design hypothesis-based experiments, choose appropriate statistical test(s), analyze data, and interpret results.
2. To fill the students’ scientific “tool box” by demonstrating mastery of modern lab techniques and scientific methods that can be applied across biological systems and scales.
3. To teach students how to find relevant scientific information using appropriate library tools, and to communicate effectively using both written and oral formats.
4. To teach students how to think through a scientific process with their research group while acquiring conceptual knowledge and understanding the benefits and challenges of collaborative work.
5. To teach students how to use discovery science to explore patterns in nature, and understand the importance of accuracy and precision.
6. To provide the students with the opportunity to learn and apply fundamental biological information in the context of the course modules.

### HOW TO REACH US

607-255-2031

[www.InvestigativeBiology.cornell.edu](http://www.InvestigativeBiology.cornell.edu)

[biolabs@cornell.edu](mailto:biolabs@cornell.edu)

Mark A. Sarvary, Director of Laboratories

1140 Comstock Hall

Irena Horvatt, Course and Media Coordinator

1130 Comstock Hall

Lab Instructors (TAs)

1122 Comstock Hall

Martha Lyon, Laboratory Coordinator

KC Ryan, Assistant Laboratory Coordinator

All rooms are located on the first floor of Comstock Hall. The Administrative office is in 1130, and laboratories are located in 1104, 1108, 1112, 1116 and 1120. Students attend one 50-minute lecture and participate in one three-hour laboratory per week.

**Weekly Lecture: Tuesday 9:05-9:55 am. Room: Call Auditorium, 116 Kennedy Hall.**

**Weekly Lab:** See your roster for the section time and lab room.

## FOUR IMPORTANT THINGS YOU WILL NEED IN THIS COURSE

1. *Investigative Biology - a Laboratory Text* (Sarvary, Spring 2018) – **available at the Cornell Store**
2. *Biology For a Changing World*, 2nd edition (Shuster et al., 2014) – **e-book available online**  
Provides custom-made chapters and pages via electronic access. Purchase the access directly from the publisher: <http://tinyurl.com/S18ebook>. If you are not sure whether or not you will stay in the course, sign up for the 21-day temporary access before you purchase the book.
3. *Poll Everywhere* classroom response system – **free and available online at polleverywhere.com**  
Poll Everywhere produces a tool that allows you to interact with your professor(s) through your own mobile devices. The intended goal is to improve student engagement in the classroom through the use of interactive learning. During each lecture you will use Poll Everywhere to answer multiple-choice and short answer questions based on the assigned readings and your understanding of the lecture. **You must log in with your NetID every time!** If you are not logged in, your answers will not count toward your grade!

### *How to register:*

- Go to: <http://tinyurl.com/S18poll>
- You will be asked to provide your name and Cornell email address (other email addresses will not be accepted in the course). Create a unique password.
- If you plan on using your cell phone to text the responses, you must enter and certify your cell phone number in your profile ([www.polleverywhere.com/profile/edit](http://www.polleverywhere.com/profile/edit)) to ensure that you receive credit for responding.
- Check if you are connected to BIOG1500 under settings/voter registration. Follow the instructions for “Register as a Participant” to check if your account is connected to the course. It may prompt you to enter Dr. Sarvary’s email address: [mas245@cornell.edu](mailto:mas245@cornell.edu).
- If you have any questions, please visit the Poll Everywhere User Guide ([www.polleverywhere.com/guide](http://www.polleverywhere.com/guide)).
- Your information is protected and Poll Everywhere will never share emails or phone number with any third party.

### *Answering poll questions:*

- Questions will appear on [www.pollev.com/BioG1500](http://www.pollev.com/BioG1500).
- Make sure you are signed in before answering the questions. This will ensure that you receive credit for responding. Signing in is your responsibility. For take home questions, you must be signed in on the web browser that you are using to answer the questions. Without signing in, you will not receive any credit for your answers.

Without completing the steps above, Dr. Sarvary will not be able to see your responses.

4. “R” is a free statistical software that will be needed for data analysis and graphing throughout the semester.
  - You can download this software for your PC or Mac from [www.r-project.org](http://www.r-project.org). Choose one of the US Mirrors. Please also download R-studio from [www.rstudio.com/ide/download](http://www.rstudio.com/ide/download).
  - Create a folder on your computer called “RBioG1500”, where you may wish to store all the datasets used in BioG 1500.
  - Download this software to your laptop that you can bring to lab when needed.

## HOW TO SUCCEED IN THIS COURSE:

**Participate in the lecture dialogues:** The content knowledge required for the laboratory sessions will be discussed during the lectures. Questions prior to (and during) the lectures will test whether you completed the assigned readings and test whether you acquired the needed information to complete the laboratory exercises. You should complete the assigned reading (posted scientific papers, the e-book, and the Lab Manual) prior to lecture. During each lecture you will answer multiple choice and short answer questions. Choosing the correct answer will earn you full credit; choosing an incorrect answer will not earn any credit. Approximately 20% of the in-lecture polling scores will be dropped, in case you cannot attend a lecture or your device was not working.

Unless poll questions are assigned as homework, answering them outside of the lecture hall (pretending to be in lecture) is considered academic dishonesty and results in the loss of ALL lecture participation points. No exceptions.

**Gain useful lab skills:** Your success in the lab course depends on your preparation for each new lab. A thorough reading of the relevant lab chapter, e-book reading, and attending and actively engaging in lecture should adequately prepare you for each lab session. This is a lab course; therefore lab attendance is mandatory. Please arrive on time so you can actively participate in the lab. If you require special accommodations, or need to miss a lab, providing officially recognized documentation to the course administrator is suggested. This will aid you not only in obtaining those accommodations, but also will enable our course staff to better assist you. In cases where 2 or more labs have been missed, course withdrawal will be necessary.

**Take advantage of the course learning tools:** *Questions to prepare you for each module*, and questions to test your knowledge are in the lab manual. Meet your lab instructor during office hours to discuss the answers to these questions. Worksheets and *apply your skills questions* are designed to help you solve problems related to a lab topic or help you learn a particular skill in science, such as searching for scholarly literature. Some of them will be completed in lab, others outside of lab. Use these questions as smart learning tools! Many of these questions will appear on the practical exams. *Instructional videos* and *Tutorials* were developed or sought out by our staff to help you gain certain lab skills.

**Be on time and don't procrastinate:** Some assignments are due at the beginning of your lab section; while the paper writing assignments are due at 5pm on Friday. Please consult the calendar at the end of the syllabus. *The lab instructor cannot change deadlines.* If you have a valid reason to receive an extension without penalty, please contact Dr. Sarvary. If you cannot finish your assignment by the deadline, you can submit a late assignment. Late assignments carry a 30% reduction of grade per day: for example if you turn in your assignment within 24 hours after its deadline, you cannot receive more than 70% of the maximum score. If you are 24-48 hours late, your maximum score can be 50%. None of the assignments can be more than 48 hours late. Late submissions will also result in late return of the graded assignments. Some assignments (i.e. peer-review, poll questions, etc.) cannot be turned in late.

**Don't be shy, speak up! We are here for you!** Do not wait until the end of the course to raise problems/issues. Come and talk to us! If you are experiencing undue personal or academic stress at any time during the semester or need to talk with someone about a personal problem or situation, please seek support as soon as possible.

Monitor your assignments and the posted grades on Blackboard. Please look at answer keys as soon as they are posted, and your graded exam as soon as they are returned to you! "*Errare humanum est*", but if you notice a grading error on your graded exam, don't wait! Notify your TA within 48 hours of the receipt of the grade. Due to the fast pace nature of this course, we cannot honor re-grading requests after 48 hours. Please always provide a clear and detailed explanation of why you find an answer incorrect.

The BioG 1500 Staff is available to talk with you about stresses related to your work in this class. Additionally, we can assist you in reaching out to any one of a wide range of campus resources:

- Cornell Learning Strategies Center at 255-6310, <http://lsc.sas.cornell.edu>
- Gannett Health Services at 255-5155, [www.gannett.cornell.edu](http://www.gannett.cornell.edu)
- Peer Support provided by Empathy Assistance and Referral Service at 255-EARS
- Office of Undergraduate Biology at 255-5233, [biology.cornell.edu](http://biology.cornell.edu)
- Student Disability Services (SDS) in 420 CCC building; phone number is 254-4545.

## HOW WE WILL ASSESS YOUR KNOWLEDGE AND LABORATORY SKILLS:

We use a wide variety of assessment techniques to form a realistic picture of your understanding of the course content and the laboratory skills you gained in this course.

**Lab Practical Exams:** This is a biology laboratory course; therefore your scientific skills will be tested in a laboratory setting. Two **lab practical exams** will be held in lab during regular lab time, in *lab 4* and *lab 12*. They will cover the practical skills of instrumentation, statistics, and methods in science and communication.

**Lab Participation:** Your lab participation grade will be partially based on an evaluation of your **lab etiquette**, which includes your working habits, responsibility, cooperation, and preparedness. **Pre-lab questions** will test whether you are prepared for the laboratory.

**Communicating Science:** We want to prepare you to tackle the challenges of scientific publishing, so you will go through the same writing process as scientists, who submit their papers to a scientific journal. To help improve your writing skills, your lab instructor will review these drafts. You will receive points if you submit a reviewable assignment. As a final, graded assignment, you will individually write a **complete scientific paper** on the antibiotic resistance experiment, and present a **scientific poster** on the limiting nutrient experiment.

<u>Component</u>	<u>Percent of Grade</u>
LAB SKILLS AND CONTENT KNOWLEDGE (total 51%)	
Practical exam 1	12
Practical exam 2	15
Statistics worksheet	3
Lecture participation	8
Lab participation & etiquette (attendance, activity, behavior)	8
Pre-lab questions	5
COMMUNICATING SCIENCE (total 49%)	
Dissect a scholarly journal article (worksheet)	3
<u>Publishing your research:</u>	
Antibiotic Resistance (AR) design mini-seminars	2
<i>First submission:</i> Antibiotic Resistance paper for peer-review	3
Peer review and self-review	3
Peer-review rebuttal letter	3
<i>Back to the editor:</i> AR paper for publication	13
<u>Going to a conference:</u>	
Limiting Nutrients (LN) design and results mini-seminars	4
LN Poster visuals and content	12
LN Poster oral presentation	3
LN Poster Supplementary materials	3
<b>Total:</b>	<b>100%</b>

**Final letter grades:** your final performance in the course *will not* be based on the performance of other students (e.g. no curve). The general guidelines for letter grades: 90-100%: (A+, A, A-); 80-90%: (B+, B, B-); 70-80%: (C+, C, C-); 60-70%: (D+, D, D-); below 60% is F. Exact cut-off points will not be known until the day of letter grade assignment. We do not offer extra/bonus assignments.

*Incompletes:* Cornell policy dictates that an incomplete be arranged only when a student has substantial passing equity in the course (e.g. all requirements for the course have been completed satisfactorily except for a term paper or final exam) and the reason for failure to complete all course requirements is convincing to the instructor and beyond the student's control. If you feel that you deserve an incomplete, you must contact Dr. Sarvary and provide legitimate documentation.

## **STAY CONNECTED AND BE INFORMED:**

### 1. Course website and social media

You can find valuable course information on our website ([www.InvestigativeBiology.cornell.edu](http://www.InvestigativeBiology.cornell.edu)). Please check back frequently for updated instructional videos on our YouTube channel, science news, blog posts, and event announcements.

Use our social media outlets to receive real-time information about the course, staff and your fellow students. Find **@Cornellbiolabs** on *Twitter, Facebook & Instagram*. Use **#CUintheLab** in your posts.

### 2. BLACKBOARD™ 9.1

Instructors and course staff will post course related materials to Blackboard™ 9.1. Assignments must be submitted through Blackboard. You will use Blackboard to view course documents, to view slides of course lectures, to receive statistical codes for R, to watch online tutorials for statistics, literature searches and other topics. You can monitor your grades throughout the semester. Access to Blackboard 9.1 requires that you use your net ID, which is the first part of your Cornell email address, and your self-chosen password.

## **DISCLAIMERS:**

**Plagiarism:** According to the Cornell University Code of Academic Integrity, a student shall be guilty of violating the code of academic integrity if she/he knowingly represents the work of others as her/his own [or helps another student to do so]. For additional information, refer to <http://cuinfo.cornell.edu/Academic/AIC.html>. If you are accused of plagiarism, a primary hearing is scheduled at which the evidence is considered and a decision rendered. If you are found guilty, the academic integrity officer of your college is notified.

**Using pedagogical data for publications:** Instructors of this course seek out new, modern pedagogical methods to improve the education of our students. Instructors may use data from exams or from poll questions in aggregate form (without identifiers of any sort) to evaluate our pedagogy. These exam question or poll question evaluations may be published in pedagogical journals. We always maintain our students' confidentiality, but students can request verbally or via email (mas245) to opt out if they have concerns. Please do not hesitate to contact the instructors if you have specific questions.

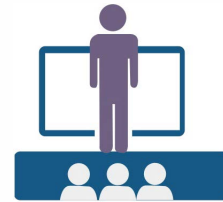
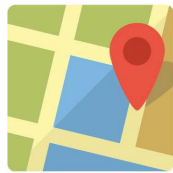
**Lost and Found:** Items left in the lab room may be turned in to and retrieved from the Course Coordinator Irena Horvatt in 1130 Comstock Hall. Items left in the lecture room may be retrieved from the Call Auditorium staff.

### CALENDAR FOR LECTURE AND LAB ACTIVITY

Week of	Activity	Readings and Assignments <i>E-book (BCW), Investigative Bio Lab Manual (IB)</i>
Week of January 29		
Lecture 1	Course Introduction; Pre-course questions	
Lab 1	Introductions, Scientific Skills I: Lab Safety and Etiquette, Microscopy, Simulation modeling, Preliminary study data collection	<i>IB: Ch. 1</i>
Week of February 5		
Lecture 2	Scientific Investigations in Biology; Using the skills you learn in this course; Statistics	<i>BCW: Lecture 2</i>
Lab 2	Scientific Skills II: Importing data in "R", Spectrophotometry, Full-scale study, Statistical Methods, Pipetting; Serial Dilutions	<i>IB: Ch. 1;</i> Download "R" and Bring Laptop; Complete the Serial Dilution Online Tutorial
Week of February 12		
Lecture 3	Communication in Science; Literature search tools; Scientific skepticism	<i>BCW: Lecture 3</i>
Lab 3	Scientific Skills III: Statistics worksheet, Case study: How Scientists Think; Paper discussion, Practical review	<i>IB: Ch. 1; Bring Laptop and read the assigned paper</i>
Week of February 19. February Break – No lecture or lab all week		
Week of February 26		
Lecture 4	Spontaneous Mutations and Antibiotic Resistance	<i>BCW: Lecture 4</i>
Lab 4	Practical exam I; Antibiotic Resistance (AR) I: Treatment simulation game; Paper grading and common errors in writing	Submit the Statistics Worksheet on BlackBoard
Week of March 5		
Lecture 5	Darwin and Natural Selection	<i>BCW: Lecture 5</i>
Lab 5	AR II: Set-up Class Project; Design AR experiment; AR paper discussion (jigsaw)	<i>IB: Ch. 2, Read AR paper for discussion</i>
Week of March 12		
Lecture 6	The responsibilities of a scientist; Responsible Conduct of Research (RCR)	<i>BCW: Lecture 6</i>
Lab 6	Mid-semester evaluations; AR III: Frequency calculation, mini-seminar on AR experimental design; Group experiment set-up;	<i>IB: Ch. 2</i> Submit the Paper Discussion Worksheet; Bring AR Experimental Design Seminar Slides

Week of March 19		
Lecture 7	Limiting Nutrients (LN) I	<i>BCW: Lecture 7</i>
Lab 7	LN I: Learn about algae; Design LN Experiment; Climate Change Forum Information Gathering; AR IV: Group Data Collection and Analysis; How to explain a figure	<i>IB: Ch. 2, Ch. 3, Bring Laptop; Submit Climate Change Forum Literature</i>
Week of March 26		
Lecture 8	Limiting Nutrients II	<i>BCW: Lecture 8</i>
Lab 8	The importance of feedback; LN II: Present design and Set up LN Experiment; Finalize Climate Change Forum Class Statement	<i>IB: Ch. 3; Bring Laptop Bring LN Experimental Design Slides Due on Friday by 5pm: Submit AR Paper for Peer-Review</i>
Week of April 3. Spring Break – No lecture or lab all week		
Week of April 9		
Lecture 9	Climate Change Forum	<i>BCW: Lecture 9</i>
Lab 9	LN III: Poster Examples; Data Collection and Analysis; Peer-review in lab	<i>IB: Ch. 3; Bring Laptop Due on Friday by 5pm: Submit Peer- and Self-Reviews</i>
Week of April 16		
Lecture 10	Human Microsatellite DNA (DNA) I.	<i>BCW: Lecture 10</i>
Lab 10	DNA I: Student DNA Extraction; Peer-review rebuttal letter writing; Present LN results; Poster preparation	<i>IB: Ch. 4, Bring LN Result Seminar Slides Due on Friday by 5pm: Submit the corrected AR paper, and address the reviewers' comments</i>
Week of April 23		
Lecture 11	DNA II: Population Genetics; Post-course questions	<i>BCW: Lecture 11</i>
Lab 11	DNA II: Student DNA Results; Gel Electrophoresis; Lab Evaluation; Practical Review; Poster preparation	<i>IB: Ch. 4</i>
Week of April 30		
Lecture 12	Review of the semester: Ignite Talks; Evaluations	<i>BCW: Lecture 12</i>
Lab 12	Poster presentations; Practical exam 2	Bring Poster to present, and Submit the Supplementary materials & Poster pdf on BB
Week of May 7		
No lecture No lab		<i>Due on May 9<sup>th</sup> by 5pm: AR Paper for Publication</i>

# Welcome to BLOG 1500



## You are here!

- \* Lecture in Call Auditorium
- \* Labs in Comstock Hall
- \* Purchase lab manual & e-book.

## Connect

- \* Download required software
- \* Register for Polleverywhere.com
- \* Connect to course social media

## Know Your Staff!

- \* Check the course website for office hours
- \* READ and RE:spond to e-mails promptly



## Lab # 8

- \* Antibiotic Resistance Paper by Friday 5:00pm.

## Lab # 6

- \* Mini-Seminar Paper Discussion Worksheet

## Lab # 4

- \* Practical Exam # 1 Statistics Worksheet



## Lab # 9

- \* Provide Peer & Self Review by Friday 5:00pm.

## Lab # 10

- \* Paper Submitted & Comments addressed by Friday 5:00pm.

## Lab # 12

- \* Poster Presentation, Practical Exam 2, All poster materials submitted to Blackboard

## Lab # 13



Final Paper  
May 9th @ 5pm

## Useful Course Links:

facebook.com/CornellBiolabs  
twitter.com/@CornellBiolabs  
investigativebiology.cornell.edu  
instagram.com/cornellbiolabs

Investigative Biology