

INVESTIGATIVE BIOLOGY LABORATORY (BIOG 1500) SYLLABUS

WELCOME MESSAGE

Welcome to Investigative Biology Laboratory! This course is designed to provide lab experience with an emphasis on the processes of scientific investigation and to promote collaboration, communication, and literacy in science. The goal of this lab course is to teach skills, especially critical thinking and problem solving, that students can apply in research laboratories during their time at Cornell and after graduation. These skills go far beyond learning how to use particular laboratory equipment. We care about all of our students and are here to help you succeed!

The course introduces students to a laboratory research environment, teamwork, hypothesis formation, experimental design, statistics, and ethics in research. Students gain information and science literacy skills and practice many forms of science communication, from presentations to proposal writing and scientific poster preparation. Students first fill their scientific toolbox and then develop the capacity to solve increasingly challenging problems with greater independence. The expectation is that students finish the course as well-rounded scientists, equipped with all the skills needed in real research environments.

The course employs several student-centered pedagogies including active learning, case studies, formative assessment using a web-based response system (Poll Everywhere), problem-based learning, reflection, role-playing, presentations, peer-teaching, peer-review, and inquiry-based learning.

LEARNING OUTCOMES

By the end of the course, students will be able to:

1. Design hypothesis-based experiments, choose appropriate statistical test(s), analyze data, and interpret results.
2. Demonstrate mastery of lab techniques and scientific methods that can be applied across biological systems and scales.
3. Find and evaluate relevant scientific information using appropriate library tools.
4. Effectively contribute to work within their research groups and reflect on the ethics, benefits, and challenges of collaborative work.
5. Use discovery science to explore patterns in nature, and apply accuracy and precision to the scientific process.
6. Apply fundamental biological information to increasingly novel and complex situations.
7. Author and produce scientific content using digital, oral, visual, audio, and written communication formats.

TESTIMONIALS

"I like how this course really prepared me for my future scientific endeavors by providing me with necessary research skills."

"I liked how engaging, interactive, and applicable this course was in general."

"I liked how the course was really applicable to outside life and got me thinking in a scientific manner."

"The skills learned after completing the course were worth all of the work."

"It was very engaging and I learned a lot. I really liked how the information was applicable to research and to lab techniques. I wished I would have taken the class sooner."

COURSE STAFF

The course instructors, Drs. Mark Sarvary and Joseph Ruesch, are Cornell alumni who are passionate about teaching biology. Lab sections are led by graduate student Lab Instructors who may be assisted by Undergraduate Teaching Assistants. The teaching staff strives to be supportive of our students and welcomes you to approach them for assistance. To learn more about the staff, visit our website (<https://investigativebiology.cornell.edu/>). Staff members can be reached using the biolabs@cornell.edu email address.

Mark A. Sarvary , Director of Laboratories	1140 Comstock Hall
Joseph Ruesch , Course Instructor	1128 Comstock Hall
Irena Raia , Course & Media Coordinator	1130 Comstock Hall
KC Ryan , Laboratory Coordinator	
Chelsea L. Maceda , Asst. Lab Coordinator	

CONTACT INFORMATION

All rooms are located on the first floor of Comstock Hall. The Administrative office is in 1130, and the laboratories are in 1104, 1108, 1112, 1116, and 1120. The phone number for the main office is 607-255-2031. Please visit <https://investigativebiology.cornell.edu/courseinfo/> for fast answers to frequently asked questions (FAQs). If you have other questions, please email our course address (biolabs@cornell.edu) and we will get back to you during business hours. This address should also be used for scheduling issues, reporting excused absences, and any course-related issues.

CLASS MEETINGS

Weekly Lecture: Lectures meet weekly on **Tuesday at 9:05 am in the Statler Auditorium**. Lectures are interactive and include poll questions.

Weekly Lab: All lab sections will be **in-person in Comstock Hall**. See your online course roster for the section times and lab room number.

COVID-19 SAFETY

We are fortunate to live in a time when advances in science have led to effective vaccines to combat COVID-19. We are a community and are thus dependent on, and affected by, the actions and precautions each of us takes to mitigate the spread of infection. So far, some of our lives may have been relatively unaffected by the pandemic while others have experienced profound tragedies—please do not make assumptions about others' experiences with the virus. Members of our instructional team, staff, and students in the class, including yourselves, may not be able to vaccinate or may have loved ones in their lives who cannot be vaccinated (e.g., they are too young, are immunocompromised, or have other health conditions). Our classroom provides a direct link between you and them.

As such, we ask that you take reasonable efforts to protect yourselves, our campus, and our broader community from the spread of COVID-19. We have small laboratory sections, where students and teaching assistants work closely in groups to conduct experiments. If a student becomes sick, catching up will be difficult. If a lab instructor becomes sick, the entire lab will fall behind. Masking is a simple and effective way of protecting each other. Lab instructors may wear masks while teaching and students will be encouraged to wear masks. The choice to wear a face mask is a personal one, and no one should be made to feel uncomfortable because of their choice. Investigative Biology will not be providing masks to students. Please pick one up at one of the many distribution sites: <https://covid.cornell.edu/prevention/face-coverings/>.

HELP US PROMOTE AN INCLUSIVE ENVIRONMENT

The staff and instructors of BIOG 1500 are committed to encouraging diversity, inclusivity, and equity, and we urge our students to practice the same habits. Since this course is a collaborative learning environment featuring a diverse group of people, we encourage all of you to engage thoughtfully and respectfully, be generous in listening to each other, and cherish the diversity of thoughts and ideas. We ask for your help in creating and maintaining a learning environment where all feel welcomed, respected, supported, valued, and, therefore, able to participate fully. Please feel free to let course instructors or staff know if any circumstances arise that affect your ability to participate.

ACCOMMODATIONS

We each learn differently, and we want every student to succeed in this course. If you have a learning need or disability, please register as soon as possible with Cornell Student Disability Services (<https://sds.cornell.edu/>) so they can provide us with the appropriate documents and guidance for accommodations. If you have experienced a significant life disruption, we highly encourage you to contact your academic advisor who can guide you and reach out to all your course instructors and ask for accommodations.

FOUR IMPORTANT THINGS YOU WILL NEED IN THIS COURSE

1. **The "Lab Manual":** *Investigative Biology - a Laboratory Text* (Sarvary, Spring, 2024) – available for purchase in the Cornell Campus Store. There is no electronic version and older editions are not acceptable.
2. **Open access books** – free and available online
 - Biology: <https://openstax.org/details/books/biology-2e>
 - Microbiology: <https://openstax.org/details/books/microbiology>
 - Statistics: <https://openstax.org/details/books/introductory-statistics>
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 instructors through your own mobile devices or computers. The intended goal is to improve student engagement and formative assessment using interactive learning. During each lecture, you will use Poll Everywhere to answer multiple-choice and short-answer questions based on your understanding of the lecture and the assigned readings. Questions with correct answers may be graded for correctness, and questions asking for opinions are graded on whether responses are completed and on topic. **You must log in with your NetID every time!** If you are not logged in, your answers will not count toward your grade! You must also register with the course on Poll Everywhere, so that you are able to take all polls and have your responses connected to your name.

How to register:

- Your name is pulled from the Canvas Class roster, so you do not need to complete a separate registration process.
- 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) to ensure that you receive credit for responding.
- If you have any questions, please visit the Poll Everywhere Student User Guide (<https://www.polleverywhere.com/guides/student/getting-started>).
- Poll Everywhere protects your info and does not share emails or phone numbers.

Answering poll questions:

- Questions will appear during lectures on <https://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. Without signing in, you will not receive any credit for your answers, as we will be unable to see them.*
4. “R” is free statistical software that will be needed for data analysis and graphing throughout the semester. Students who come to lab without these installed may fall behind in class. Please try to troubleshoot the installation during office hours before the first statistics lab.
- Download and install **R-project** on your PC or Mac from <https://www.r-project.org/>. Choose one of the USA Mirrors for faster download.
 - Also download and install **R-studio** from <https://rstudio.com/products/rstudio>.
 - Create a folder on your computer where you will store all the datasets used in this course.
 - If you have a Chromebook or tablet, you can use the web-based version: <https://rstudio.cloud/>.

HOW TO SUCCEED IN THIS COURSE

Prepare, attend, and participate to gain useful lab skills:

Your success in the lab section depends on your preparation for each new lab. A thorough reading of the relevant lab manual chapters, engaging with the lectures, and completing any preparatory assignments should adequately prepare you for each lab section. The lab instructor records your lab presence and your lab participation. Please be on time, as late arrival to the labs results in a participation point penalty.

Please arrive to the lab and lecture on time so you can actively participate. Attendance and punctuality influence your grade.

What happens if you miss a lab?

This is a hands-on laboratory course, so your presence and participation in the labs are the foundation of your education. Since the course includes lots of group work, you must attend your own lab sections.

However, you may get sick, have to go on a professional or personal trip, or have a Cornell-related sports event that makes you miss a lab section. If you need to miss a lab, complete the make-up lab request form on Canvas as soon as possible. This will enable our course staff to assist you better. You can make up to TWO lab sections in the following way: after filling out the request form, you will be assigned a make-up lab on the same week. If you are unable to attend your make-up lab, you must attend the next office hour with your lab instructor to make sure that you received all the course materials and assistance you need. You can make up missed presentations during the make-up labs and office hours, too, and receive participation credit for up to two make-up labs or office hours. The make-up labs are for emergencies only, therefore, after making up two labs, you will not be able to receive participation points for missed labs, regardless of the reason. If you miss more than two labs, please consult your college advisors to find the best solution for your situation.

Actively engage in lectures:

Lectures will contain content knowledge required for the lab sections. Engage with the lectures by answering **Poll Everywhere** questions asked during the lectures. These questions will test whether you have attended the lectures, completed the assigned readings, and acquired the necessary information to complete the lab exercises later that week. The questions are generally multiple-choice or free response.

Questions with correct answers may be graded for correctness, and questions asking for opinions are graded on whether responses are completed and on topic.

What happens if you miss a lecture?

In case you are unable to attend a lecture and cannot complete the poll questions for *any* reason (e.g., you overslept, personal emergency, no internet, forgot to sign into Poll Everywhere, etc.), we will automatically drop a total of 20% of the poll questions. Therefore, you do not need to let us know if you miss a lecture.

Due dates and penalty-free extension due dates:

We focus on your learning and assessing the skills you gained in the course. Therefore, your grade depends not on one or two large exams but on many small stake assignments distributed throughout the semester. We do not believe in “busy work.” We have thoughtfully designed each assignment with the sincere goal of helping you achieve the course’s desired educational outcomes. You will learn the most from them and maximize your grades by following directions, planning ahead, and not procrastinating. *All the assignments have a Tuesday noon due date.* We planned these deadlines to spread out your workload and time assignments to maximize their benefits on your learning. Regularly check the course schedule each week and look ahead to several weeks.

To maintain fairness, *the lab instructor cannot change due dates.* We understand that there can be circumstances when students need more time to complete their assignments. All assignments have ideal due dates, and most of the assignments also have penalty-free extension due dates. We highly recommend that you submit the assignments by their *ideal* due dates to maintain a good rhythm of learning in the class. You can submit assignments by the *extension due date without any penalty.* We are providing the extension due dates so you can use them when you have other exams, sickness, or just need a break and do not want to think about an assignment.

Pressing the Emergency Button:

Life can be unpredictable, and unforeseen circumstances may prevent you from submitting an assignment, even with an extension. In case of an emergency, you can press the *emergency button* for ONE assignment, and you will be allowed to submit that ONE assignment until the beginning of Lecture 12 (April 23rd, 9:05 am). Since the assignment links on Canvas expire on the extension due date, you must submit the emergency button assignment by using the appropriate form on Canvas.

Please note that this is designed for special circumstances. The penalty free extension due dates and the emergency button are providing the maximum amount of flexibility, and we are unable to address further individual assignment extension requests. If an emergency prevents you from attending the course for so many weeks that the penalty-free extension due dates and the emergency button do not cover all your late assignments, please get in touch with your college advisor and work with them to find a solution.

Take advantage of the course learning tools:

Questions to prepare you for each module, and questions to test your knowledge are in the assigned readings of the lab manual. Meet your lab instructor during office hours to discuss the answers to these questions. *Apply your skills questions in the lab manual* and *worksheets* 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! *Instructional videos* and *Tutorials* were developed or sought out by our staff to help you gain certain lab skills.

We are here for you! So, please ask for help when you need it!

We are here to help you succeed! Each lab section has a Lab Instructor *and* an undergraduate teaching assistant (UTA), and both hold office hours. You can also make an appointment to meet with the main course instructors. Ask questions in class, attend office hours, or send emails.

It is very difficult for us to help you if you wait until the end of the course to raise problems/issues. We welcome you to 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 grades on Canvas. Please look at your graded assignments as soon as they are posted. "*Errare humanum est*", therefore if you notice a grading error on your assignments, please notify your Lab Instructor within 48 hours of the receipt of the grade. Due to the fast-paced nature of this course, we cannot honor re-grading requests after 48 hours. Please always provide a clear and detailed explanation of why you disagree with an answer key or how something was graded.

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 Caring Community (<https://caringcommunity.cornell.edu/get-help/>)
- Cornell Mental Health (<https://health.cornell.edu/services/mental-health-care>)
- Cornell Empathy, Assistance, and Referral Service (EARS, <https://www.earscornell.org/>)
- Student Disability Services (SDS, <https://sds.cornell.edu/>)
- Cornell Learning Strategies Center (<http://lsc.cornell.edu/>)
- Office of Undergraduate Biology (OUB, <https://biology.cornell.edu/>)

Your responsibilities in BioG1500:

- Be familiar with the information in this syllabus.
- Ask for help as soon as needed so we can assist you.
- Check due dates and assignments weekly.
- Communicate your needs to the lab instructors and course staff.
- Inform us about missed labs, SDS accommodation needs, and emergencies so we can assist you.
- Come to lab and lecture prepared and be on time.
- Access all the learning materials from Canvas.
- Take advantage of all the learning support this course offers you.
- Look at graded assignments immediately and contact the lab instructor within 48 hours of receiving the grade if you have any questions about the grades/comments.
- Log into PollEverywhere before answering the questions. If you have technical issues with PollEverywhere, contact the company (see syllabus).
- Behave professionally in class and during group work. Show respect to your classmates and course staff.

The responsibilities of the course staff in BioG1500:

- Provide the education needed to meet the learning goals of the course.
- Use evidence-based pedagogies to deliver laboratory teaching.
- Create an inclusive learning environment.
- Assess student knowledge and skills using assignments and other forms of assessment methods.
- Be transparent: share grading rubrics with students and use the same rubrics to grade assignments.
- Give opportunities to students to ask questions and discuss course-related materials to help their learning process.

HOW TO STAY CONNECTED AND BE INFORMED

1. Course website and social media

You can find valuable course information on our website (<https://www.investigativebiology.cornell.edu/>). Use our social media outlets to receive real-time information about the course, staff and your fellow students. Find @Cornellbiolabs on *Twitter (X)*, *Facebook*, and *Instagram*. Please use #CUintheLab in your posts regarding the course.

2. Canvas.cornell.edu

Instructors and course staff will post announcements and course-related materials on Canvas. Assignments must be submitted through Canvas, and you will use Canvas to view course documents, view slides of course lectures, receive statistical codes for R, and watch online tutorials for statistics, literature searches, and other topics. You can also monitor your grades throughout the semester. Access to Canvas requires that you sign in with your Cornell NetID, which is the first part of your Cornell email address, and your self-chosen password (these are the same credentials you use to check your Cornell email). We suggest adding a profile picture to your Canvas account.

ACADEMIC INTEGRITY

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity (<http://theuniversityfaculty.cornell.edu/dean/academic-integrity>). Any work submitted by a student in this course for academic credit will be the student's own work. For this course, collaboration is allowed for specific assignments (e.g., the poster presentation), but NOT for most others (e.g., the individual research proposal, etc.). If you are unsure about any one assignment, please ask. Work submitted on behalf of a group will be the group's own work.

We value integrity and fairness, and we encourage you too as well. Acts which lack academic integrity like plagiarism and cheating are not fair to other students or yourself. Students tend to be tempted when overwhelmed or stressed, usually close to deadlines. Please plan to avoid this temptation by asking for help as early as possible and not procrastinating. We are here to help you succeed in this course and can work with you to improve your learning or working habits. Helping another student to plagiarize or cheat also lacks academic integrity. We encourage students to learn from each other when a course component calls for it, but if you are approached for inappropriate assistance (e.g., asked to cheat on an individual assessment or assignment), the fair thing to do would be to decline. If you have participated in an act of academic dishonesty and later feel regret, we welcome you to come forward and explain.

Using text written by a generation system as one's own (e.g., entering a prompt into an artificial intelligence tool and using the output in an assignment) will be considered plagiarism. Completing any part of an assignment using AI instead of a student's own writing is considered academic dishonesty. You may use simple word processing tools to update spelling and grammar in your assignments, but you may not use AI tools to draft your work, revise, or paraphrase it. Academic dishonesty will be penalized according to Cornell's Code of Academic Integrity. For additional valuable information, read "The Essential Guide to Academic Integrity at Cornell":

<https://provost.cornell.edu/files/faculty-resources/essential-guide-academic-integrity.pdf>.

HOW WE WILL ASSESS YOUR KNOWLEDGE AND SKILLS

We use various assessment techniques to form a realistic picture of your understanding of the course content and the scientific skills you gained in this course. Your grade does not depend on one or two large assignments, so even if you did not perform well on an assignment, you could still receive a good grade in the course. All assignments are due on Tuesdays at noon unless stated otherwise.

Lab Skills, Content Knowledge, Participation (total 55%)

	%	Due date	Penalty free extension	Emergency Button
PollEverywhere Questions	6	In Live lecture, recorded lecture, or survey questions	No extension for live lecture questions.	No
Lab attendance, participation, & etiquette (First half of semester)	6	Labs prior to the week of March 18.	None	No
Elephant Communication Study Report	2	January 30, noon. Submit on Canvas.	February 13, noon. Submit on Canvas.	Yes
Critical Thinking module completion	6	January 30, noon. Submit on Canvas	February 20, noon. Submit on Canvas.	Yes
Statistics worksheet 1.	6	March 5, noon. Submit on Canvas.	March 19, noon. Submit on Canvas.	Yes
Practical Exam	15	Week of March 4. In lab.	None, unless received special permission from Dr. Sarvary. Emergency Button cannot be used.	No
Lab attendance, participation, & etiquette (Second half of semester)	6	Labs starting on the week of March 18.	None	No
Statistics worksheet 2.	6	April 9, noon. Submit on Canvas.	April 16, noon. Submit on Canvas.	Yes
Critical Thinking Reflection	2	Week of April 29. In lab.	May 7, noon. Submit on Canvas.	No

Communicating Science (total 45%)

	%	Due date	Penalty free extension	Emergency Button
Paper dissection worksheet	6	February 6, noon. Submit on Canvas.	February 20, noon. Submit on Canvas.	Yes
Grading 3 example proposals	6	March 12, noon. Submit on Canvas.	By the beginning of Lab 7. Submit on Canvas. If the lab is missed due to valid reasons, then in the make-up lab or office hour.	No
First draft of proposal	4	March 19, noon. Submit on Canvas.	By the beginning of Lab 8. Submit on Canvas. If the lab is	No

			missed due to valid reasons, then in the make-up lab or office hour.	
Present experimental design (chalk talk)	3	Week of March 18. In lab.	If the lab is missed due to valid reasons, then in the make-up lab or office hour.	No
Write and Self-grade the proposal	6	March 26, noon. Submit on Canvas.	April 9, noon. Submit on Canvas.	Yes
Poster supplementary materials	4	April 16, noon. Submit on Canvas.	April 23, noon. Submit on Canvas.	No
Poster and Self-grading of the poster	8	April 23, noon. Submit on Canvas.	April 30, noon. Submit on Canvas.	No
Poster presentation	3	Week of April 22. In lab.	If the lab is missed due to valid reasons, then in the make-up lab or office hour.	No
Mock email to a professor	2	April 30, noon. Submit on Canvas.	May 7, noon. Submit on Canvas.	No
Climate change forum presentation	3	Week of April 29. In lab.	If the lab is missed due to valid reasons, then in the make-up lab or office hour.	No
Total:			100%	

Final letter grades:

We do not grade on a curve, i.e., we do not lower individual grades based on the class average nor do we limit the number of students that receive high grades. The cutoffs for letter grades are: F (< 60.0), D- (60.0 - 62.999), D (63.0 - 66.999), D+ (67.0 - 69.999), C- (70.0 - 72.999), C (73.0 - 76.999), C+ (77.0 - 79.999), B- (80.0 - 82.999), B (83.0 - 86.999), B+ (87.0 - 89.999), A- (90.0 - 92.999), A (93.0 - 98.999), A+ (99.0 - 100). This is a large enrollment class, so grades are often distributed very smoothly with no large gaps. That means no matter where the cutoffs are drawn, there will commonly be students who are close to them. We recognize that it may be disappointing to narrowly miss a cutoff, but please understand that we must set cutoffs somewhere. While you may be excited to know your final grade, please be patient and wait to see it in Student Center. We do not offer extra/bonus assignments if you are unhappy with your grade. It is very possible to earn a high grade in this course. We suggest making yourself a personal calendar with your plan to complete the readings and assignments for all your classes.

Try to leave yourself time to seek help before submitting assignments. Please see the Learning Strategies Center for more advice: <https://lsc.cornell.edu/managing-time-and-stress/>.

Incompletes:

We understand that sometimes it is not possible to complete a course. Please be aware that according to university policy, incompletes can only 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 not completing all course requirements is reasonable to the instructor and beyond the student's control. If you feel that you are eligible for an incomplete, you must contact Dr. Sarvary at biolabs@cornell.edu and provide supporting documentation when appropriate.

SCHEDULE FOR LECTURE AND LAB MEETINGS

Week of	Activity	Readings and Assignments
<i>OAB = Open access book, IB = Investigative Bio Lab Manual</i>		
<i>All lab sections are in-person in Comstock Hall. Lectures are held in Statler Auditorium at 9:05 am on Tuesday. All the assignments have a Tuesday noon due date.</i>		
Week of Jan 22		
Lecture 1	Intro to the course	Register for Poll Everywhere
Lab 1	No Labs. Complete the Critical Thinking Canvas Course Watch the Lab intro and safety video Complete the "Understanding Experimental Design" SimUText simulation Read the paper assigned by your lab instructor. Primary literature library tutorial (http://guides.library.cornell.edu/biog1500),	DUE: VIDEO INTRODUCTION TO CLASSMATES Get a head start by installing software needed for the semester (R, R-studio, SimUText, Zotero) Install Zotero standalone program and browser extension. Installation instructions are on Canvas.
Week of January 29		
Lecture 2	The scientific process	Read OAB: Biology 1.1 The Science of Biology DUE: ELEPHANT COMMUNICATION STUDY REPORT
Lab 2	Where does scientific information come from? The scientific process, How to become a science prosumer, Paper reading discussion Zotero Start Paper dissection worksheet	DUE: READ THE ASSIGNED PAPER BY THE BEGINNING OF THE LAB SECTION Read: IB: Ch. 1
Week of February 5		
Lecture 3	Experimental design <i>Recording:</i> Watch assigned lab skill videos	DUE: PAPER DISSECTION WORKSHEET
Lab 3	Tools to test a hypothesis 1: Lab safety and etiquette, Design a simple experiment. Pipetting, spectrophotometry, serial dilutions, Set up LN test tubes	Read IB: Ch. 2 DUE: COMPLETE SERIAL DILUTION TUTORIAL BY THE BEGINNING OF THE LAB SECTION (answer questions in IB) http://tinyurl.com/dilutiontutorial

Week of February 12		
Lecture 4	Lab Instructor Research 1 <i>Recording:</i> Watch assigned lab skill videos	DUE: <i>CRITICAL THINKING MODULE</i>
Lab 4	Tools to test a hypothesis 2: Microscopy Collect data from test tubes Conversion factor Download R and start Swirl lecture 1	<i>Read IB: Ch. 2</i> Install R-project and R-studio software on your computer before lab. Canvas has an installation video and TAs are available in office hours
Week of February 19		
Lecture 5	Statistics	<i>Read:</i> OAB: Biology 1.1 The Science of Biology OAB: Statistics 1.1: Definitions of Statistics 2.1: Stemplots, Line Graphs, and Bargraphs 2.4: Box plots 9.1: Null and alternative hypotheses 9.2: Outcomes and the Type I and Type II errors 9.4: Rare events, the sample, decision and conclusions
Lab 5	Analyzing results: Statistical methods, Intro to R Analyze results from last week Start Stats 1 worksheet	<i>Read IB: Ch. 3 & 4</i>
Week of February 26 (February break; no classes)		
Lecture	No lecture	
Lab	No labs	
Week of March 4		
Lecture 6	Scientific Communication	<i>Read IB: Ch. 5</i> DUE: <i>STAT 1 WORKSHEET</i>
Lab 6	Test your skills: Practical exam	
Week of March 11		
Lecture 7	Introduction to limiting nutrients	DUE: <i>GRADING 3 PROPOSAL EXAMPLES</i>
Lab 7	Design your own experiment 1: Mid-semester evaluation Best practices of scientific writing Discuss the grading of 3 proposal examples Form groups, Design experiments	<i>Read IB: Ch. 7</i> OAB: Biology 14.4 DNA Replication in Prokaryotes, 25.2 Green algae

Week of March 18		
Lecture 8	Lab Instructor Research 2.	DUE: <i>FIRST DRAFT OF PROPOSAL</i>
Lab 8	Design your own experiment 2: Present experimental design (chalk talk) Self-grade first draft Discuss challenges of proposal writing TAs submit request sheets	
Week of March 25		
Lecture 9	Lab Instructor Research 3.	DUE: <i>PROPOSAL AND SELF-GRADING</i>
Lab 9	Set up your experiment: Poster examples Experiment set up	<i>Read IB: Ch. 7</i>
Week of April 1st (Spring Break; no classes)		
Lecture	No lecture	
Lab	No labs	
Week of April 8		
Lecture 10	Data analysis and conclusion drawing: revisiting statistical analysis	DUE: <i>STAT 2 WORKSHEET</i>
Lab 10	Analyze the data of your experiment: F-letter test Collect data, Complete supplementary materials sheet, Most common errors in R Poster preparation	<i>Read IB: Ch. 3, 4 & 5</i>
Week of April 15		
Lecture 11	Lab Instructor Research 4. <i>Recording: Biology research at Cornell</i>	DUE: <i>SUPPLEMENTARY MATERIALS</i>
Lab 11	How to use the skills you gained: Interrupted case study Find a research lab at Cornell Transferable skills discussion Mock email writing Finalize poster	
Week of April 22		

Lecture 12	Responsible Conduct of Research	DUE: <i>POSTER AND SELF-GRADING</i>
Lab 12	Present the results of your experiment: Poster presentations Climate change forum preparation	
Week of April 29		
Lecture 13	<i>Recording:</i> Understanding climate change	DUE: <i>MOCK EMAIL</i>
Lab 13	The greater impact of your experiment: Climate change forum Critical thinking reflection End of semester evaluations Create memes	
Week of May 6		
Lecture 14	No lecture	
Lab 14	No labs	