

**BIOG
1500**

**Investigative
Biology**



How to reach us

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Email: biolabs@cornell.edu

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KC Ryan, Laboratory Coordinator

Chelsea L. Maceda, Asst. Lab Coordinator

Lab Instructors (TAs) 1122 Comstock Hall

OUR TEAM



Dr. Mark Sarvary

**Director of
Laboratories**



Dr. Mitra Asgari

**Course
Instructor**



Irena Horvatt

**Course
Coordinator**



KC Ryan

**Laboratory
Coordinator**



Dr. Frank Castelli

**Postdoctoral
Research Associate**

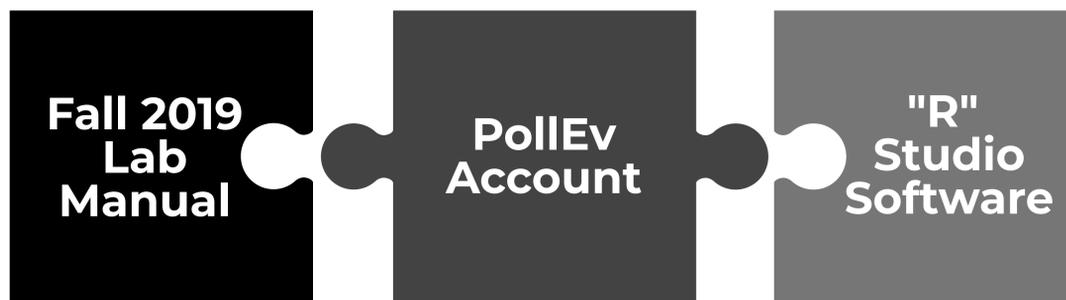


Chelsea Maceda

**Asst. Laboratory
Coordinator**

You can also
find your
TA under the
"Staff" page
of our
website

Course Starter Pack



Lab Manual: Investigative Biology - a Laboratory Text (Sarvary, Fall 2019) – available at the Cornell Store

Polleverywhere: You must log in with your NetID every time! If you are not logged in, your answers will not count toward your grade! Free for BIOG 1500 students @ polleverywhere.com
How to register:

- Go to: <http://tinyurl.com/F19poll>
 - 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) 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.
 - If you have any questions, please visit the Poll Everywhere User Guide (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.
 - 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 & Dr. Asgari will not be able to see your responses.

"R" Studio: 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. Choose one of the US Mirrors. Please also download R-studio from 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.

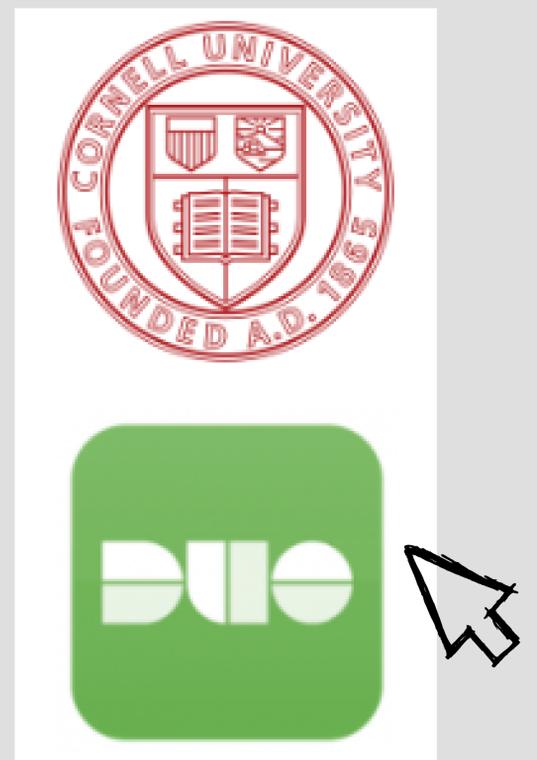
You'll Also Need:

Canvas & Duo Mobile

Log in to Canvas using your NetID.

All assignments will be submitted through Canvas, and course material will be posted there after lecture.

You may need to download the Duo Mobile App to authenticate your login. The app is free and compatible with most devices.



Follow us on:



<https://twitter.com/CornellBiolabs>

<https://www.instagram.com/cornellbiolabs>

<https://www.facebook.com/CornellBiolabs>

And find us on YouTube by searching for Investigative Biology (BioG1500) at Cornell

An Introduction & Course Objectives:

This course is designed to provide lab experience with 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.

The course introduces students to a laboratory research environment, teamwork, hypothesis formation, experimental design, statistics, and ethics in research. Students practice many forms of science communication, from presentations to paper writing and scientific poster preparation. The course modules follow the “crawl, walk, run” approach to develop the capacity of students to solve increasingly challenging problems with greater independence. Lab topics include genetics, evolution, microbiology, ecology, biochemistry, and molecular biology. First, the students fill their scientific “tool box” to design and carry out experiments and then use that tool box to conduct student-driven investigations.

The course uses three modules to cater to the different interests in biology: a) the antibiotic resistance research module targets those who are interested in a pre-med track, b) the module in algal population growth for biofuel production caters to biological engineers and ecologists, while c) the human microsatellite DNA module is in the interest of those who would like to gain skills in genetics and molecular biology research. 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 a number of student-centered pedagogies and much focus is placed on the “think-pair-share” method. This includes case studies, formative assessment using a web-based response system (poll everywhere), problem-based learning, reflection, debate, role playing, presentations, hands on activities, peer-teaching, peer-review, and inquiry-based learning.

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 modern 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.

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

**Weekly
Lab:**
**Consult
Student
Center**

Diversity Statement

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 professionally, be generous in listening to each other, and cherish the diversity of thoughts and ideas. We hope to create 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.



Assessment & Grading:

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.

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 paper will go through a peer-review process. 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.

Lab skills and Content Knowledge (total 52%)		%
1) Practical exam		10
2) Practical exam # 2		15
3) Statistics worksheet		3
4) Lecture participation		6
5) Mid-semester Lab participation & etiquette (attendance, activity, behavior)		4
5) Lab participation & etiquette (attendance, activity, behavior)		6
6) Understanding Experimental Design & Liebig's Barrel Simbio		4
7) LN & AR & DNA reflection paragraphs		4
Communicating Science (total 48%)		
1) Critically evaluate a scholarly journal article (worksheet)		3
2) Antibiotic Resistance (AR) design mini-seminars		2
3) Antibiotic Resistance (AR) research proposal (Introduction and L Methods)		3
4) Antibiotic Resistance (AR) research proposal (Result and L Discussion)		3
5) Antibiotic Resistance paper for peer-review		3
6) Peer review		3
7) AR paper for publication		10
8) Peer-review rebuttal letter		2
9) Limiting Nutrients (LN) research proposal (Introduction and Methods)		3
10) Limiting Nutrients (LN) design mini-seminar		2
11) LN Poster visuals and content		10
12) LN Poster oral presentation		2
13) LN Poster Supplementary materials		2

Total: 100%

Grading Cont'd & Finding Success:

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 or Dr. Asgari and provide legitimate documentation.

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, 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, as well as 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 Irena Horvatt in the course administrative office (1130 Comstock Hall) 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 two or more labs have been missed, course withdrawal is suggested.

If you are struggling and confused, please feel free to attend Office Hours in 1122 Comstock Hall, or schedule a 1-on-1 with Dr. Sarvary or Dr. Asgari. Office Hours with Graduate TA's will be posted on the course website after Week 2 of class. Don't wait until the day before the exam to prepare!



Don't be shy, speak up! We are here for you!

Health and Wellness:

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 Canvas. 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



Peer Support provided by Empathy Assistance and Referral Service at **255-EARS**



Office of Undergraduate Biology at **255-5233**,
biology.cornell.edu



Student Disability Services (SDS) in 420 CCC building;
phone number is **254-4545**.



The Fine Print:

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.

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 or at the beginning of the lecture. 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.

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/Date		Activity	Readings <i>Investigative Bio Lab Manual (IB)</i>	Assignments/ To do
Week of September 2	Lecture 1	Course Introduction	None	Watch intro video to become familiar with the course; Answer pre-course questions
	Lab 1	Scientific Skills I: Lab safety and etiquette, Simulation modeling, Microscopy, Preliminary study data collection	<i>IB: Ch. 1.</i>	Bring Laptop
Week of September 9	Lecture 2	Scientific Investigations in Biology; Introduction to the research modules; Statistics	<i>IB: Ch. 1</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 September 16	Lecture 3	Science literacy I: finding and evaluating scientific evidence	http://guides.library.cornell.edu/biog1500	
	Lab 3	Scientific Skills III: Statistics worksheet, Case study: How Scientists Think; TA picked Paper discussion, Practical review; Form research groups	<i>IB: Ch. 1</i> ; read the assigned paper	Bring Laptop DUE: Understanding experimental design simulation
Week of September 23	Lecture 4	ARI: Antibiotic Resistance; Preparing a research proposal, how to write paper	<i>IB: Ch. 2</i>	
	Lab 4	<i>Practical exam I</i> ; Antibiotic Resistance (AR) I: Treatment simulation game; Start writing a research proposal (intro/methods/material)		
Week of September 30	Lecture 5	The responsibilities of a scientist; Responsible Conduct of Research (RCR); Open Science and Science Communication	<i>TBD</i>	
	Lab 5	AR II: Present experimental design; Sterile technique; Set-up Class Project; How to write a good paper	<i>IB: Ch. 2</i>	DUE: Group AR research proposal (materials); Bring AR Experimental Design Seminar Slides; Grade the two student papers posted on Canvas
Week of October 7	Lecture 6	AR II	<i>TBD</i>	
	Lab 6	Mid-semester evaluations; AR III: Collect class data Group experiment set-up; Complete paper discussion worksheet (submit on Canvas)	<i>IB: Ch.2;</i>	DUE: Individual AR proposal: intro & methods & references

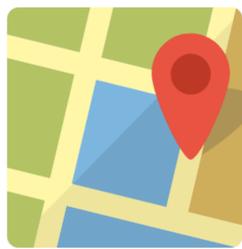
CALENDAR FOR LECTURE AND LAB ACTIVITY

Week of October 14 – Fall Break: no class				
Week of October 21	Lecture 7	Limiting Nutrients (LN) I	<i>IB: Ch. 3</i>	DUE: Liebig’s Barrel Simbio Simulation
	Lab 7	AR IV: Group Data Collection and Analysis; LN I: Learn about algae; Write LN Experimental Design proposal (intro/methods/proposal form); Climate Change Forum Information Gathering	<i>IB: Ch. 2 and Ch. 3</i>	Bring Laptop; Submit Climate Change Forum Literature
Week of October 28	Lecture 8	Limiting Nutrients II		DUE: LN intro & methods & references for peer-review
	Lab 8	The importance of feedback; LN II: Complete peer-review of LN design; Finalize Climate Change Forum Class Statement; Start preparing LN design presentations, Finish LN study proposal	<i>IB: Ch. 3</i>	Bring Laptop; AR Module reflection paragraph
Week of November 4	Lecture 9	Climate Change Forum		
	Lab 9	LN III: Present experimental design; Set up LN Experiment; Climate change forum reflection: what was learned & how it relates to the experiment	<i>IB: Ch. 3</i>	Bring Laptop DUE: AR results and discussion; LN design seminar slides
Week of November 11	Lecture 10	DNA I: Human Microsatellite DNA	<i>IB: Ch. 4</i>	
	Lab 10	Collect LN Data; Data analysis; Poster Examples; DNA I: Student DNA Extraction		
Week of November 18	Lecture 11	DNA II: Population Genetics	<i>IB: Ch. 4</i>	DUE: AR paper for peer-review
	Lab 11	Peer-review in lab; Poster preparation; DNA II: Gel electrophoresis; Electropherogram; Practical review	<i>IB: Ch. 4; Appendix 1; Appendix 2</i>	DUE: LN module reflection paragraph
Week of November 25– Thanksgiving: no class				
Week of December 2	Lecture 12	Review of the semester: Ignite Talks; Evaluations		DUE: AR Peer-review
	Lab 12	Poster presentations; Practical exam 2		Bring Poster to present, Submit Supplementary materials & Poster pdf on Canvas
Week of December 9	No Lecture			<i>Due on Tuesday, December 10 at 10am:</i> AR Paper for Publication and response to the reviewers

Assignment Workflow

Week of Week #	Reading this week	Tuesday before lecture	Tuesday-Thursday before lab	Reminders 
Sept 2 1	<ul style="list-style-type: none"> Lab Manual: Chapter 1 	<ul style="list-style-type: none"> Watch course intro video Answer pre-course questions 	<ul style="list-style-type: none"> None 	Bring your laptop to lab this week!
Sept 9 2	<ul style="list-style-type: none"> Lab Manual: Chapter 1 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Download "R" Complete Serial Dilution tutorial 	Bring your laptop to lab this week!
Sept 16 3	<ul style="list-style-type: none"> http://guides/library.cornell.edu/biog1500 Lab Manual: Chapter 1 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Read the assigned paper Due: Understanding experimental design simulation 	Bring your laptop to lab this week!
Sept 23 4	<ul style="list-style-type: none"> Lab Manual: Chapter 2 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None 	<i>Practical Exam I in Lab this week!</i>
Sept 30 5	<ul style="list-style-type: none"> Lab Manual: Chapter 2 TBD 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Group AR research proposal AR Exp. Design Seminar slides Grade student papers on Canvas 	
Oct 7 6	<ul style="list-style-type: none"> Lab Manual: Chapter 2 TBD 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Due: Individual AR proposal: Intro, Methods, & References 	
Oct 14	Fall Break: No lecture or lab!			
Oct 21 7	<ul style="list-style-type: none"> Lab Manual: Chapters 2&3 	<ul style="list-style-type: none"> Due: Liebig's Barrel Simbio Simulation 	<ul style="list-style-type: none"> Submit Climate Change forum literature 	Bring your laptop to lab this week!
Oct 28 8	<ul style="list-style-type: none"> Lab Manual: Chapter 3 	<ul style="list-style-type: none"> Due: LN Intro, Methods, & References for peer-review 	<ul style="list-style-type: none"> AR Module reflection paragraph 	Bring your laptop to lab this week!
Nov 4 9	<ul style="list-style-type: none"> Lab Manual: Chapter 3 	<i>Climate Change forum in lecture</i>	<ul style="list-style-type: none"> Due: AR Results and Discussion Due: LN design seminar slides 	Bring your laptop to lab this week!
Nov 11 10	<ul style="list-style-type: none"> Lab Manual: Chapter 4 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None 	
Nov 18 11	<ul style="list-style-type: none"> Lab Manual: Chapter 4, Appendices 1&2 	<ul style="list-style-type: none"> Due: AR paper for peer-review 	<ul style="list-style-type: none"> Due: LN module reflection paragraph 	
Nov 25	Thanksgiving: No lecture or lab!			
Dec 2 12	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Due: AR peer-review 	<ul style="list-style-type: none"> Poster for presentation Poster PDF & supplementary materials submitted to Canvas 	<i>Poster presentations & Practical Exam II</i>
Dec 9 No lecture!	<ul style="list-style-type: none"> Due Tuesday Dec. 10th at 10am: AR paper for publication and response to the reviewers 			<i>Enjoy the winter break</i> ❄️ ❄️

Welcome to BIOG 1500



You are here!

- * Lecture in Call Auditorium
- * Labs in Comstock Hall
- * Purchase lab manual

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 # 5

- * AR group proposal due

Lab # 4

- * Practical Exam #1

Lab # 3

- * Experimental Design Simulation



Final Paper Due

Lab # 6

- * AR individual proposal/intro/methods/references due

Lab # 9

- * AR results & discussion/LN design seminar slides

Labs # 12

- * Poster Presentation,
- * Practical Exam 2,

All poster materials submitted to Canvas



Dec. 10th, 2019
@ 10am

Useful Course Links:

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

Investigative Biology