

**ECOL195C: RESEARCH METHODS IN BIOLOGY: HOW TO GET THE MOST
OUT OF YOUR RESEARCH EXPERIENCE
FALL 2020**

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Office Hours (during these times I will be available for your questions without prior appointment): Wednesdays 10-11am, in BSW 235

Students are always welcome to ask questions by email (allow for 2 work days response time) or ask for an appointment outside of office hour times. Or use <https://calendly.com/dornhaus>

Class room and meeting times

The class will take place Wednesdays 8am-9:50am in BSW 302 [note that room may change].

NOTE regarding online instruction/Covid-19: It is possible that sections or the entire class will be offered online. In that case there will be live meetings with the instructor on Zoom in addition to frequent check-ins via messages, likely using 'Slack'. If you are interested in enrolling in the class and have questions about how this will work, please email the instructor (above).

Description of the class

For any STEM major, a university like the UA offers many opportunities to be involved in actual scientific research. But how do you become involved, and how do you make the most of this experience? In this course you will learn about the rules of academia, how to perform rigorous research, how to do statistical analyses in R, and how to graph and present your results to peers and others. You will meet a group of fellow research-active undergraduate students, and we will also discuss possible next steps, such as how to apply for graduate school. This course is intended to be taken alongside your research (we will help you find a research position in the first week if you do not have one yet), so that the data you analyze and present in class will come from your ongoing work.

Course format and teaching methods

This is an active-learning class, which means that there will be only a small amount of 'lecturing' by the instructor. Most class sessions will include a student presentation (on their research); many class sessions will include working in R, i.e. doing data analysis and graphing (you should therefore bring your own computer to class; if this is a problem please discuss alternatives with your instructor). We will also spend some time practicing other scientific skills like literature research. All of the activities will be in relation to your ongoing research project.

Learning goals

The course has two major learning goals: (1) students will learn to defend how science can produce objective answers to questions about the world, unlike other approaches; and (2) explain how their specific research project (in any biology lab at UA) contributes to advancing our knowledge of the world. Students will also practice a series of professional skills, and be introduced to fundamental skills in data science.

Specific Learning Outcomes

At the conclusion of this course, students will be able to:

- contact faculty with professional emails;

- know how to discover options for becoming involved in research from university websites;
- identify and generate an experimental design for a particular research question, and argue how the scientific method is used to rigorously test hypotheses in general and in their specific research project;
- load their data into R (a statistics package), perform basic statistical analyses, and graph their data in R;
- professionally (using PowerPoint) present their study question, results, and implications to a peer audience;
- identify and write about key points from their research experience in the format needed for graduate school applications, and know what it takes to get great recommendation letters.

Course website

Before the semester starts, or if you are not enrolled, you can get information such as this syllabus on the course website <https://socialinsect.lab.arizona.edu/ecol195C>.

The website you will be actively using during the course is located on D2L, at d2l.arizona.edu. You will be able to access it when the semester starts. You should check this site regularly (i.e. before each class) for up-to-date announcements and materials for the class. You can also submit assignments and check your grades there. You can access the site from computers on campus if you don't have one at home. Note that student computer labs also offer printing services if you would like to print out readings. To access your course on D2L you must have a UA NetID and be officially enrolled in the course for at least 24 hours.

Reading

There is no textbook and there will be only a few general articles that the entire class will read. However, you will be asked to find and read several original scientific papers related to your research project; instructions for this will be given in class.

Written assignments

There are four pieces of writing that you will submit, all of which will go through multiple revisions: (1) The worksheet, (2) Your R script, (3) Your talk slides, and (4) Your poster.

(1) The worksheet

You will receive an (electronic) worksheet with some checklist items and some short-answer questions, which will help you structure your activities in your research project throughout the semester. You are free to change your answers on this as the semester progresses, and you will receive written feedback at least twice over the course of the semester.

(2) Your R script

This is a file on your computer written in the 'R' language, i.e. a short program that will be executed on your computer. We will teach how to do this and in fact do most of the work on the R script during class time. The end goal will be for your R script to use data you collected in your research project and to generate a p-value from a statistical test as well as a graph illustrating your results (at least one, may be multiple).

(3) Your talk slides

All students will present their research project and ongoing challenges and/or results in class. Before the date of your presentation, you will submit and receive feedback on your talk slides (in PowerPoint or Adobe pdf; discuss alternative formats with instructor).

(4) Your final presentation slide/poster

By the end of the semester, you will submit an electronic version of a 'poster', i.e. essentially a single, large slide (in PowerPoint or other format) that summarizes your project, including question, hypotheses, predictions, results, and implications. If you have the opportunity to

present your research as a poster at a conference, which is highly recommended, this can serve as this assignment instead of the final ‘lightning talk’.

Grading

Your final grade will be determined from the four written assignments listed above in addition to attendance. You can check your current grade status at any time on the website (d2l.arizona.edu). If you have questions about your grade, please contact the instructor immediately; we are happy to provide advice on calculating or improving your grade. All of the written assignments can be revised any number of times (before the final deadline) until you receive the grade/quality of outcome that you desire.

There are no other exams or quizzes and no final exam.

Grade calculation	Points	
Attendance	40	A: 90-100 %
Worksheet	20	B: 80-89.9 %
R script	10	C: 70-79.9 %
Talk & slides during semester	15	D: 60-69.9 %
Final slide/poster	15	F (fail): 0-59.9 %
Total points	100	

Honor’s contract

Honors College students can take this course with an additional honors contract. All such contracts will include the following additional requirements: (a) Actually presenting your final poster at a conference, either a professional meeting or an undergraduate conference at UA (discuss your options with instructor at the beginning of the semester); (b) getting your research mentor to give as short (10 min) presentation in class on a topic of their choice (either broader research background or career-relevant topic); (c) presenting your talk in a lab meeting after having presented in class (eg. typically this will be in the lab where the research is performed, but if that is not an option we will discuss alternatives).

The student is responsible for discussing their plan for an Honor’s contract with the instructor within the first 3 weeks of the semester. Honors contract information is available at <http://www.honors.arizona.edu/future-students/honors-credit-across-campus>.

Class schedule

Note that the class schedule is subject to change during the semester; such changes will be announced in class. The up-to-date version can always be found on Google Drive, as a read-only file; the link to this file can be found on D2L.

NOTE: a draft of your talk slides is due one week before your talk date; the final version is due on the date you are scheduled to talk.

Class	Assignments due	Topic & Activities	Goal of the class – learn about/how to
	[note each student will also present on their project, on different dates]		
1 Aug 26	Read syllabus, website: https://socialinsectlab.arizona.edu/undergrads	Introductions; how does academia work; where to find research experiences; logistics for the class	Your peers, their expectations and goals; How to find research: read faculty websites, email profs, what to look for

			<p>Jobs and titles in academia, what do profs do all day, who else works here</p> <p>Calendaring and communication tools; sign up for presentation day</p>
2 Sep 2	Submit 1 st draft of 1 st part of worksheet – Setting up your research experience	The Scientific Method and what you need to know about your research project	<p>(more help with finding a research project if necessary)</p> <p>Learn the difference between hypotheses and predictions and why you need them</p> <p>Recognize science when you see it; peer review; strong inference</p>
3 Sep 9		Experimental design	<p>Software: Google Sheets and Excel, csv</p> <p>Data sheets and what information to record; backing up your files; sharing data & info with your team, and getting feedback early; how to handle failures; know your organism; have a written protocol for Methods</p> <p>Reading & planning graphs, types of graphs</p>
4 Sep 16	Submit revised version of 1 st part, and 1 st draft of 2 nd part of worksheet – Setting up your specific project & experimental design	<p>Learning R</p> <p>Continue working on worksheets: do you know your experimental design?</p> <p>Student talks 1 & 2</p> <p>Presentation skills</p>	<p>Using RStudio Cloud</p> <p>How to talk so people listen; what to include in a scientific talk, and what not to include; graphics matter; being detailed & specific matters</p>
5 Sep 23		<p>Student talks 3 & 4</p> <p>Good habits</p> <p>R practice</p>	Where is your data (going to be)? Data formats, how to read your actual data into R.
6 Sep 30	Submit 3 rd part of worksheet, as well as revised earlier parts	Student talks 5 & 6	Understand p-values and power, and the role of noise in

11 Nov 18		Student talks 15 & 16 Discussion: challenges in your project, what have you learned so far Applying for grad school	How to search for and read scientific papers How to frame your question broadly Your own career plans and the role of research; what is a research career like Grad school applications: where, when, what do you need? Contacting potential mentors, getting good recommendation letters. Trouble-shooting R script as necessary
12 Nov 25	Submit 6 th part of worksheet, as well as revised earlier parts	Student talks 17 & 18 Another poster tour: extracting broad relevance	Working on improving your poster Broad relevance: what makes an impactful project?
13 Dec 2	Submit final presentation slide	Lightning talks #1	Reflect on the research experience and the class
14 Dec 9	Submit 7 th part and final version of complete worksheet (all pages)	Lightening talks #2 Review of class/semester/lab experience	Discuss your next steps & goals

General issues

Professional Communication

If you have any questions for the instructors or the TA, feel free to ask them before or after the class period, or email the instructor at dornhaus@email.arizona.edu. I will attempt to answer as soon as I can, however you should never assume an email will be answered in less than 3 days.

If you send any emails to the instructor or TA, make sure to mention the name of the class (ECOL280) in the subject line. Also, start your email by addressing the recipient, and end it with a greeting. A professional way to address persons with a PhD is, for example, “Dear Dr Dornhaus”; in this class, you may address the instructor with their first name, e.g. “Dear Anna”. Always end the email with your full or first name (e.g. “Best wishes, Julia Cordero”, or “Best wishes, Julia”; however make sure your last name is mentioned in the text of your email). Yes, that’s also good form for replies in email chains. Re-read your email to check for spelling and grammar errors. Not adhering to these rules will mean that the addressee will get the impression that you are unused to professional communication, and this will probably result in them focusing on your communication style instead of your actual message; this is very detrimental in emails to future employers or mentors, so you should start practicing good habits now.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

For this class, use of a laptop is encouraged, both for taking notes or checking online resources relevant to class discussion and for R exercise and work on projects. However, I expect the laptop to be used almost exclusively for the current class-relevant task. If I notice that your laptop is distracting to other students, I will ask you to shut it down.

This course supports elective gender pronoun use and self-identification; rosters indicating such choices will be updated throughout the semester, upon student request. As the course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect.

Absence Policies

Generally, you will lose 5 points out of the 40 points given for attendance for every unexcused missed class. Absences due to illness are excused, but please notify the instructor asap.

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

If you are absent for any other reason, this may have negative effects on your grade both directly and indirectly: you will be graded on attendance, and you will miss the instruction provided in class as well as your opportunity to actively engage with the material. If you are sick, send the instructor an email immediately (ideally before you miss class).

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>.

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences preapproved by the UA Dean of Students (or dean's designee) will be honored. See <http://policy.arizona.edu/employmenthuman-resources/attendance>.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Accessibility and Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability

Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. The use of the internet or published works to help you solve problems in the assignments completed at home is also encouraged. Otherwise, graded work/exercises must be the product of independent effort. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog.

See <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See

<http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>.

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>.

Confidentiality of Student Records

<http://www.registrar.arizona.edu/ferpa/default.htm>

Subject to change

Please note that the information contained in the course syllabus, other than the grade and absence policies, may be subject to change with advance notice, as deemed appropriate by the instructor. This is particularly true of the details in the course schedule. The most up-to-date version of the class schedule (including assignment due dates) can always be found on D2L.