Description of the class content
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.

Learning goals
The course has two major learning goals: (1) students will learn to defend that, and explain how, science can produce objective answers to questions about the world, unlike other approaches; and (2) students will be able to 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:
#1 Find a lab
- contact faculty with professional emails;
- know how to discover options for becoming involved in research from university websites;

#2 Define a project
- identify what their own research is about and explain some of its broader context
- identify what makes a promising project, namely impact and feasibility, and what aspects of a project affect them

#3 Generate or understand their experimental design
- 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;
- define specific hypotheses and predictions for their project and the relationship between them and the method used

#4 Methods
- practice communication with their peers, senior lab mates, and research advisor/PI
- identify sources of help for troubleshooting
#5 Data and Analysis
- load their data into R (a statistics package), perform basic statistical analyses, and graph their data in R;

#6 Posters and Papers
- 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 format and how to achieve the learning goals above**
Learning takes place through (guided) practice with feedback. This class in particular is a learning-by-doing class with no ‘lecturing’ by the instructor. This is also an online class and you will be able to participate in all activities asynchronously, i.e. on your own time schedule. Your main activities will be to look at your own project in the framework of the 6 areas above, and to discuss other students’ projects through the same lens. This will enable you to see a diversity of approaches, but also, through group discussions (which will largely take place in text form) with both peers and experts, you will get a lot of ideas and feedback and sharpen your own understanding of how to achieve an elegant, rigorous, and impactful research outcome. I highly recommend that you take the time to read this syllabus in its entirety during the first week of class.

**Key assessments and requirements**

### Software and technical tools
You’ll need to use three different softwares/tools:
- **D2L**: The course website on D2L [https://d2l.arizona.edu/d2l/home/915047](https://d2l.arizona.edu/d2l/home/915047) will provide you with the reading materials, your current grade, a weekly graded ‘quiz’, and a place to submit written assignments, such as your worksheet.

- **Slack**: We will use this free software as a discussion board. It is similar to Discord for those who know that. It is ideal if you can download the free Slack app (click on the three horizontal lines on the top right of [https://slack.com/](https://slack.com/), then choose ‘download’). Alternatively, you can always launch Slack from a browser window (same horizontal lines, click on ‘Sign in’ or ‘Launch Slack’). When signing in, your workspace is ‘ecol195cresea-tmt4357.slack.com’. To join our specific class ‘workspace’, here is an invitation link: [https://join.slack.com/t/ecol195cresea-tmt4357/shared_invite/zt-got4x1y9-lZas0QXYc2YVjgzwQIIMqA](https://join.slack.com/t/ecol195cresea-tmt4357/shared_invite/zt-got4x1y9-lZas0QXYc2YVjgzwQIIMqA). This link will remain active until Sept 10, 2020. If you are joining the class after this date, please contact the instructor.

- **RStudio**: The easiest way to use this is to make a free account on the website [https://rstudio.cloud/](https://rstudio.cloud/), which you can open from any browser. The code for our joint work and practicing R will be in this project: [https://rstudio.cloud/project/1517537](https://rstudio.cloud/project/1517537). ONLY if you have used R before or have some programming/scripting experience do I recommend that you install R and RStudio on your computer (from [https://rweb.crmda.ku.edu/cran/](https://rweb.crmda.ku.edu/cran/) and [https://rstudio.com/products/rstudio/download/](https://rstudio.com/products/rstudio/download/)).

*What will happen every week*
It is critical for online courses that, as much as possible, you set a regular time in your schedule to work on course material. For this course, your activities will be reading (either provided texts/papers or presentations or information from/about your classmates’ projects), planning/designing your own research project, and coding in R. The instructor will be available every Monday and Wednesday from 11am-12pm for answering your questions via the discussion boards on Slack.
Specifically, each week, you should
(a) work on your ‘worksheet’, adding or revising an answer, and submitting your current version to the respective Assignments folder on D2L by Wednesday 11am;
(b) work on your R script, first running the provided script line-by-line, then writing your own answers for the ‘activities’ in the script, then ultimately writing your own script for your own data; you will be answering/submitting a quiz on D2L by Monday 11am;
(c) participating in discussions, by both reading contributions by others and posting your own replies; each week by Wednesday 11am you should have posted at least one question, comment, or reply on Slack.

My suggestion is to dedicate one hour a week to readings on D2L and revising your worksheet, one hour to R practice, and one hour to engagement with the instructor and peers on Slack – if you can make it happen, the weekly engagement on Slack would ideally be either Mondays or Wednesdays 11am-12pm to facilitate quick answers.

Written assignments
By the end of the semester, you will be submitting three pieces of writing: (1) The worksheet, (2) Your R script, (3) Your poster.
However, all of these will go through multiple revisions, and you will be required to repeatedly submit partially completed versions, in addition to filling out quizzes on D2L.
(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. 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 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’.

Your lightning talk
At the end of the semester (by November 30th), you will submit a 3-4 minute video in which you show your final presentation slide and explain the question and answers gained in your research project. We will talk in more detail about how to make this talk; the simplest version is to generate a PowerPoint slide show (use ‘record slide show’ in the ‘Slide Show’ menu) while just showing that single slide. You are free to include other video or image material, but your final slide must be visible at least once and the experimental design explained.

Grading
Your final grade will be determined from the weekly contributions, the three written assignments listed above, and your final talk. 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 and no final exam.

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<tr>
<th>Grade calculation</th>
<th>Points</th>
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<td>Weekly submission of</td>
<td>14</td>
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<td>worksheet</td>
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<td>Weekly quiz</td>
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<td>Weekly engagement on Slack</td>
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<td>R script</td>
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<td>Lightning Talk</td>
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<td>Final worksheet</td>
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A: 90-100 %
B: 80-89.9 %
C: 70-79.9 %
D: 60-69.9 %
F (fail): 0-59.9 %

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.

Reading
Required readings are posted (and available) on D2L. You do not need a textbook.

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.

General issues
Professional Communication
If you have any questions, feel free to 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. It may be more efficient for you, and helpful for everyone else, to post questions on Slack, so that other students can also contribute answers.

If you send any emails to the instructor or TA, make sure to mention the name of the class (ECOL195C) 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.

Class 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, re-read all your discussion contributions to check that they are kind and productive, i.e. helpful for the task at hand. 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**
The class is asynchronous so there should generally be enough time for you to complete assignments even if you are sick or have other obligations for a couple of days. If you are ill for longer so that this causes you to miss submission dates, please inform the instructor and discuss any possibilities for make-up activities or generally catching up. Participating in the course every week is vital to the learning process. If you do not, you will lag behind other students and not be able to productively learn from and contribute to class discussions; in addition, your learning will be more effective if it includes sufficient time to internalize new information and practice the skills we use in the class.


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](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](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](http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete) and [http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal](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](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](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.

**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.

In particular, research is nowadays typically a very collaborative enterprise: often, several people may be involved both in the design and execution of a project. In practice, what this means for the
course, is that the answers on the worksheet should be stated in your own words, but you may show the answers to and discuss the answers with your advisor or other lab members, in particular those concerning the research project. You are also encouraged to discuss them with other students in the class. However, quizzes on D2L should be answered independently by you.

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](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](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](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](http://catalog.arizona.edu/policies). Student Assistance and Advocacy information is available at [http://deanofstudents.arizona.edu/student-assistance/students/student-assistance](http://deanofstudents.arizona.edu/student-assistance/students/student-assistance).

**Confidentiality of Student Records**

[http://www.registrar.arizona.edu/ferpa/default.htm](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.