

BIOLOGY 489
ADVANCED RESEARCH METHODS
Spring, 2019



Welcome to Advanced Research Methods!

This course provides experience in designing biological research questions using primary literature, performing experiments, drawing conclusions from data, and communicating scientific results. Students will work collaboratively to investigate original research questions using a combination of field, laboratory, and analytical approaches. This semester, our efforts will focus on the fields of animal communication and cognition as students collaboratively design and conduct novel research in these fields.

Instructor

Professor: Dr. Christopher Templeton

Office: Strain 203b

Phone: 503-352-3149 (x 3149 if you're on campus)

Office Hours: Monday & Friday 2-3pm

if these times do not work for you, I'm happy to schedule other times via email

E-mail: templeton@pacificu.edu

Course Information

Course name: Biology 489

Course times: T/TH 1:00-4:00pm

Course Location: Strain 220/206

Course Logistics

This course will be run much like a graduate research lab working collaboratively on behavioral research. Be warned: this class will be unlike any other you've taken at Pacific because the main goal isn't for you to simply learn about biology, *it is for you to become a biologist*. You will delve deeply into one particular research question, conducting novel research to answer questions that no one knows the answers to right now. Much of your research will be conducted independently in small groups, both during and outside of class

times, with much of our scheduled class time modeled after a typical graduate “lab meeting.” We will use our time together for general training on core techniques, discussing papers from the primary literature, providing regular progress reports and troubleshooting issues arising during your experiments, providing peer assessments of other students, and presenting preliminary results of your research.

Materials

There is no textbook for this course, but you will read many papers from the primary literature. In addition, you will need to keep careful records of everything you do during your experiments, both in a hard-copy lab notebook and an online electronic lab notebook. You will need:

- Bound notebook or three ring binder with loose leaf paper
- Laptop brought to class each day
- Pen and pencil
- A positive, flexible, and collaborative attitude!

Online Interactions

I will use your **Pacific University e-mail address** to send out occasional but important information. Plan to check this account regularly, or to forward messages to an account you use. Please remember to use only your pacificu.edu email account when contacting me and that professors expect email to be conducted as formal written correspondence, not like text messages.

In addition to using email to communicate with individuals and the group, I will use **Moodle** to post information and readings for the course and **Box/Google Drive** to share data, papers, and keep electronic lab notebooks updated. Links to our shared folders will be provided.

Assessment and Grading

Assessment in this course will be based on your skills and diligence as a researcher in animal communication and cognition, including the proper documentation of work, the management and organization of data, your ability to explain and apply the research and analytical methods used, and your ability to communicate your progress and results. I will assess your progress based on a combination of different course components, with the following relative percentages:

Lab notebooks & data management	25%
Presentations (lab meetings plus final)	25%
Writing and other assignments	25%
Collaboration and engagement	25%

Final grades will be based on your percentage of total points earned. The following scale will be used to calculate final grades: 100 – 93.0% = A, 92.9-90.0% = A-, 89.9– 87.0% = B+, 86.9 – 83.0% = B, 82.9 – 80.0% = B-, 79.9 – 77.0% = C+, 76.9 – 73.0% = C, 72.9 – 70.0% = C-, 69.9 – 67.0% = D+, 66.9 – 63.0% = D, 62.9 – 60.0% = D-, at or below 59.9% = F.

Lab Notebook

Each individual will keep track of their lab work in a lab notebook that you should have with you at all times during your experiments but should otherwise leave in the lab. This lab notebook should include annotated copies of protocols, flow charts, hand-written notes, as well as notes on all lab work completed. Your lab notebook should be organized chronologically with the oldest work first and the most recent work last. All pages must have your name and the date of the work. It is also necessary that you take **detailed** hand-written notes regarding the research you perform each day. This serves as an archive of lab work, fieldwork, data analyses, notes about data organization, etc. It will serve as a detailed journal of your work on your research project. It should include sufficient information for someone outside of the class to recreate what you have done each day, without needing you there to explain it.

Collecting, archiving, and organizing data

As we progress in the semester, you will collect data on your research question(s). These will need to be organized in a logical and transparent manner. We will have a single shared Box/Google Drive folder for the class with sub-folders for your groups. You must keep the cloud version of this folder organized and up-to-date at all times. I will do periodic spot checks (for points) throughout the semester. The organization should be self-explanatory or documented with clear notes in a text file in your folder. Similar to the lab notebooks, I should be able to find documents and files here with minimal explanation from you.

Presenting data

Throughout the course, you will have opportunities to present information orally to work on improving your oral communication skills. Groups of students will present results from papers you have read to the class in our “journal club” sessions. In addition, you will have the opportunity to present your research progress formally in at least two stages (a ‘research proposal’ towards the beginning of the semester and a ‘final’ presentation towards the end of the semester), and informally through periodic informal updates and brain-storming sessions.

Writing and drafts of methods and results

As this is a research methods course, we will additionally focus on scientific writing – particularly writing of methods and results sections. A major component of research is the ability to clearly communicate what you did and what you found; research without dissemination is equivalent to just playing around in the field or lab. You will leave this course with final drafts of methods and results for your question. You will also participate in and receive peer review on drafts.

Collaboration & Communication

Finally, we will work collaboratively both intensively in small groups, but also as a class as a whole. It is critical that we communicate well so that we can collaborate effectively. You are all conducting novel research and contributing to potentially publishable datasets and research questions. The better we can work as a collaborative research group, the closer we will get to our overall goal for the semester and for these research projects as a whole.

Learning Objectives

The following are learning outcomes for Advanced Research Methods. After successfully completing this course, students will be able to:

- Articulate a research question with testable hypotheses and predictions.
- Detail methods to address the research question in the form of a lab protocol.
- Skillfully collect data to test a scientific hypothesis and perform troubleshooting.
- Manage, organize, and analyze data.
- Interpret findings and relate to previous research.
- Communicate data, results and interpretations.

Biol 489 also provides the following learning outcomes for the Biology major:

- Students will demonstrate deep understanding of five core concepts in biology: evolution; pathways and transformations of energy and matter; information flow, exchange, and storage; structure and function; and biological systems.
- Students will use the standard skills and methodologies of biology to answer scientific questions.
- Students will apply the scientific method, reasoning and appropriate mathematics to describe, explain and understand biological systems.
- Students will use interdisciplinary approaches (applying chemistry, physics, and mathematics to biology) to work on biological problems.
- Students effectively will read, write, speak and understand scientific material.
- Students will collaborate and communicate within biology and across disciplines.
- Students will apply science to issues facing our society

In addition, this course fulfills the Natural Sciences Core requirement. Students completing the Natural Sciences Core requirement will:

- use scientific methods and reasoning within the context of the natural sciences
- recognize the distinctive nature and limits of scientific knowledge: that it is an evolving model of the natural world, discovered and verified through experimentation and observation

Catalog Course Description

Teams of students carry out original research in collaboration with a member of the Biology faculty. Course involves critically reading, analyzing, and synthesizing primary literature in the research area; generating a novel data set (via experiments, studies, or data mining of large public data sets); and analyzing and interpreting the data. Research area will vary, and depends on faculty expertise. Prerequisites: BIOL 312, BIOL 313, BIOL 314, 8 additional upper division BIOL credits and declared biology major. Instructor's Consent required. 2 or 4 credits.

Course Expectations

Research has shown that students learn best when they are active participants in the class. I expect that students enrolled in this course are adults who take responsibility for their own education. I will not take attendance in class, but class attendance is very strongly recommended as participation counts towards your grade. If you know you will miss class (e.g. for an approved university event), please let me know ahead of time and I will do my best to help you. Note that vacations are not considered approved events.

If you miss class, please first talk to your fellow students and try and get copies of notes or handouts. Then, if you have questions after speaking with students and studying their notes, please come talk to me for further clarification.

I will work hard to facilitate your learning, but only you can actually learn the material through focused time and effort within and outside the classroom. **As a reminder, Pacific guidelines state that students should be putting in 2-3 hours outside of class for every credit.** This means that you should expect to work on this course for at least 8-12 hours per week outside of class time to pass the course! In this class, much of your data will be collected and analyzed outside of our formal class periods.

General Expectations of Students (you)

For each class and lab, I expect you to:

- Come prepared and arrive on time
- Avoid distractions (keep phones in your bags during class)
- Actively participate in discussions
- Complete readings and assignments by the specified date and time
- Treat the instructor and each other fairly and with respect

General Expectations of your Professor (me)

In addition to meeting the expectations described above, you can also expect me to be fair and honest with you, return materials in a reasonable time frame, and be available to you outside of class. Office hours are designated times that I will be available for students from this class but I realize that it is impossible to select times that will work with everyone's busy schedules. If those times do not work for you, please contact me and we can set another time to meet. Email is generally the best method of reaching me; please remember to use only your pacificu.edu email account and that professors expect email to be conducted as formal correspondence, not like text messages.

Academic Integrity

I expect students to know and adhere to the university's "Code of Academic Conduct" policies; please carefully read them in the College of Arts and Sciences catalog. The bottom line: you must do your own work on all exams and class assignments including lab reports and pre-lab assignments. Academic honesty does not preclude discussing ideas with other students, working together on homework, studying together for exams, or providing

feedback on lab write-ups as long as all text is in your own words. In addition, everyone is expected to contribute equally to group work (seminars, lab reports, research projects)

Pacific University has no tolerance for academic misconduct/cheating. It is university policy that all acts of misconduct and dishonesty be reported to the Associate Dean for Student Academic Affairs. Sanctions that may be imposed for such misconduct range from an “F” for the assignment, an “F” for the course, and suspension or dismissal from the university. Forms of academic misconduct include but are not limited to plagiarism, fabrication, cheating, tampering with grades, forging signatures, and using electronic information resources in violation of acceptable use policies.

Please talk to me before you turn in assignments if you have a question about what constitutes dishonesty. As a reminder, here are some examples of academic dishonesty and plagiarism:

- Copying the work of another student on an exam or a written assignment
- Having notes or crib sheets accessible during exams or quizzes
- Cutting and pasting phrases or sentences from textbooks, articles, or websites
- Re-using an assignment from another class
- Insufficient attribution for ideas and information from published resources

College Resources

There are many free services available at Pacific to help you succeed in your courses. I encourage you to take advantage of them! Some of these services are listed below.

Tutoring Services CLASS (Center for Learning and Student Success) is located on the 2nd-floor of the Tran Library. The center focuses on delivering one-on-one and group tutoring services for foreign languages, math and science courses, and writing skills in all subjects. Students should consult with the center’s director and look for campus advertisements regarding tutoring available for other subjects. Day and evening hours.

Student Counseling Center The counseling center offers individual counseling, crisis services, referrals, and workshops. They also have information on-line or in their office about issues such as stress management and sleep. 503-352-2191, Mon-Fri 9 a.m. – 5 p.m., <http://www.pacificu.edu/studentlife/counselingcenter/>

Learning Support Services for Students with Disabilities If you have documented challenges that will impede your learning in any way, please contact our LSS office in Clark Hall (ext.2717; lss@pacificu.edu). LSS staff will meet with students, review the documentation of their disabilities, and discuss the services that Pacific offers and any appropriate ADA accommodations for specific courses.

Unauthorized Recordings Students are prohibited from making audio and/or visual recordings of lectures or presentations without prior consent of the instructor or presenter.

Possible Course Schedule

The exact duration of topics and timing of activities will depend on the progress of each group

Week/Dates	Topic	Activities
Week 1 Jan 29 & 31	Primers to the fields of animal cognition and communication	Intro to field tools for behavioral science (binoculars, audio recorders)
Week 2 Feb 5 & 7	Locating scientific papers in databases and conducting a literature review	Intro to lab data analysis (extracting and analyzing acoustic and behavioral data from recordings and videos)
Week 3 Feb 12 & 14	Experimental Design and Statistical Analysis	Creation of playback stimuli and playback experimental design
Week 4 Feb 19 & 21	Data Collection and Proposal Writing	Field and laboratory research Paper presentations
Week 5 Feb 26 & 28	Data Collection and Proposal Writing	Field and laboratory research Proposal presentations & peer review
Week 6 Mar 5 & 7	Data Collection and Analysis	Field and laboratory research
Week 7 Mar 12 & 14	Data Collection and Analysis Writing experimental methods	Field and laboratory research Paper presentations
Week 8 Mar 19 & 21	Data Collection and Analysis Representing data with figures	Field and laboratory research
Week 9 Mar 25 & Mar 27	Spring Break	
Week 10 Apr 2 & 4	Data Collection and Analysis Writing experimental results	Data analysis and results Paper presentations
Week 11 Apr 9 & 11	Data Collection and Analysis	Data analysis and results
Week 12 Apr 16 & 18	Data Collection and Analysis	Data analysis and results
Week 13 Apr 23 & 25	Putting it all in context	Peer review
Week 14 Apr 30 & May 2	Communicating science	Peer review
Week 15 May 7 & 9	Wrap-up	Final presentations