

Welcome to Biocore 382 Evolution, Ecology, and Genetics Lab!

Syllabus -Course Goals & Schedule

Biocore Lab Courses Are All About The Process Of Science

You may be familiar with the model for scientific investigations known as the "Scientific Method." The model presents a logical sequence of steps leading from an initial observation to an experiment and interpretation of data. However, few scientists actually carry out investigations according to the rigidly defined linear sequence of steps. What they do is to engage in the following activities:

- 1. Making Observations and Generating Testable Questions:** *Making Observations* takes a careful, keen eye and experience in differentiating subtleties and slight differences in whatever you are sensing (visually — or smell, touch, taste too!). Through careful observation, we notice variations and patterns that provide the basis for developing questions and predictions that can be tested or measured in an empirical way.
- 2. Formulating Hypotheses Supported By A Rationale:** Forming hypotheses requires stating tentative explanations or answers to your testable question based on background knowledge about the system you are investigating. A hypothesis is not simply an 'educated guess'. It must be supported by a substantive rationale (what we will refer to as a *biological rationale*), have explanatory power, and make a prediction that can be tested.
- 3. Designing And Conducting An Investigation:** This process includes planning the methods and procedures for gathering data to answer a question, evaluate a hypothesis, or challenge a theory. You test hypotheses by designing *manipulative experiments* or making careful *systematic observations* that evaluate the actual outcome against the predicted outcome. The type and design of your investigations is based on the questions you ask as an investigator, your knowledge of the study system, AND the general "knowledge" available in the scientific literature. In short, you need to understand the complexity of the system before measuring it.
- 4. Analyzing and Interpreting Data:** Investigators attempt to find patterns and provide meaning in a group of data in a particular context. When working with data in this class, we will emphasize the need to explore *sources of variation* within and between comparison groups, and will help you make connections between your data, the concepts and context underlying the project, and the assumptions you are making in your experiment. Interpretation of data should bring you back to your hypothesis, which you can either support or reject. The analysis and interpretation of data will form the basis for inferring explanations about the natural world.
- 5. Constructing New Knowledge:** If you reject your hypothesis based on the interpretation of your data, you may conclude that the assumptions you made about the system are not valid or that the way you are thinking about your system is incorrect. *Important Note:* You have not failed or made a mistake if your experiment leads you to reject your hypothesis. Nor have you "proven" your hypothesis true if your data supports your prediction. You have simply supported or accepted your hypothesis—under this specific situation. With more precise measurement, different statistical tests, or repeated experimentation in different environmental conditions with different organisms etc... your data may force you to reject your hypothesis. This should lead you to a new, more sophisticated hypothesis as you increase your knowledge about the system. You might even find that the patterns that you see run counter to what you read in the scientific literature, in your

textbooks, or even are in opposition to what your instructors think (gasp!). If that's the case, you have just learned or discovered something new! Now that is exciting and....that is the process of science.

- 6. Communicating your Science:** As you question your analysis/ interpretation, or when you talk about or write about your understanding, you expose your ideas to discussion and debate. This is sometimes uncomfortable but is an essential form of feedback, and it helps to clarify fuzziness in our thinking. Communicating and receiving feedback on your science, and reviewing scientific work of your peers provides essential quality control and expands the knowledge we have collectively as a scientific community. In practice, above and beyond meeting expectations for a grade-- communicating your science clearly and effectively provides a vehicle for sharing and constructing new knowledge with others, and allows the next generation of scientists (AKA next year's Biocore students) to "stand on the shoulders of giants" (Sir Issac Newton).

How this Applies to Biocore 382-Course Goals & Outcomes

As instructors, we are here to help you and to facilitate your learning of biology and your development as a scientist in an active way, but ultimately you bear the responsibility for learning the material, developing skills and taking ownership of your education. We will challenge you to go beyond simple memorization of details, to interconnect concepts, applications and problems; to ask meaningful questions; to test well-developed hypotheses; and to communicate your findings to your instructors and peers within the realm of science. These are lofty goals! We set high standards for you because we expect that you can reach them!

Our overall goals in this course are to:

1. Give you experience applying and expanding upon the concepts discussed in Biocore 381
2. Engage you in the process of science as described above
3. Give you experience working with the tools and procedures of ecology, genetics, and evolutionary biology
4. Improve your scientific communication skills and your capacity to give and receive feedback on your ideas.
5. Improve your capacity to work as a member of a productive, collaborative research team.
6. Give and receive constructive feedback using professional communication and effective interpersonal skills
7. Contribute to a safe, sustainable, socially and ethically responsible research and learning environment

At the end of two (three) semesters of Biocore labs, students should be able to:*

*Students are only required to take two of the three Biocore labs. Many choose to take all three!

1. Make careful, systematic observations
2. Ask testable, relevant, creative scientific questions
3. Search, sort and gather relevant background information from texts and primary literature
4. Make predictions and formulate clear, testable hypotheses
5. Develop protocols that test hypotheses
6. Evaluate assumptions associated with experimental design and the biological system
7. Analyze data and make logical conclusions utilizing statistical reasoning
8. Communicate effectively about science through writing and oral presentations
9. Do productive group work

In the process, we hope you will begin to see your instructors as people who bring special skills and a vast array of experiences to complement the class rather than as authorities who know all the answers. In addition, we hope you can hone your group work skills given that science is not a solitary process but one that relies heavily on collaboration and teamwork.

Four Strategies for Doing Well in Biocore Labs

- 1. Be prepared.** Do Pre-lab assignments and read the relevant section of the lab manual carefully ahead of your laboratory meeting time and be sure you understand the question(s) the project is attempting to answer and the approach you will be taking to answer these questions. Careful preparation will save you a great deal of time both during lab and in writing assignments. Pre-lab assignments are designed to help in this process.
- 2. Make the most of the time you have in lab.** Collect the necessary data and *make detailed notes* in your lab notebook. In many cases we have allowed time in class for you to begin analyzing and discussing your data, preparing presentations and getting feedback from peers and instructors. Take advantage of this opportunity and resist the temptation to leave early. This is where the most learning takes place.
- 3. Start writing your lab papers well before the deadline and pay attention to the many tips from your instructors, in the lab manual, and *Biocore Writing Manual*.** We emphasize writing in this course not only because communicating your ideas is part of the scientific process, but also because writing about a subject helps you understand more clearly and at greater depth. This takes time. Many times during the semester you will have the opportunity to have your paper reviewed by a peer before turning it in for a grade. This is an excellent opportunity to remedy problems before turning in a final copy. If your peers cannot understand what you have written it is unlikely that your instructor will either.
- 4. Cultivate a relationship with your Biocore peers.** Your peers are an incredible resource and have much to offer you in the way of support and advice in this course. These are the people you can depend on for the next three semesters!

Biocore 382: Ecology, Genetics and Evolution Laboratory - Fall 2016 Schedule

<i>Week & Date</i>	<i>Topic</i>	<i>Activities</i>	<i>Weight Due at start of class</i>
1 Sept. 6-9	Ecology I: Intro Biocore Prairie	<p>Disc None this week</p> <hr/> <p>Lab Field trip to Biocore Prairie (meet at Picnic Point Parking Lot) *Course, People, Prairie Intro</p> <p>✓ By the end of lab- Prairie observations & questions to TA</p> <p style="text-align: center;"><i>Note: Overview of Ecology Unit graded assignments refer to Lab Manual p. 21</i></p>	
2 Sept. 12-16	Ecology II: Testable Questions	<p>Disc Testable questions in ecology activity (abiotic & biotic variable diagram)</p> <hr/> <p>Lab Field work at Biocore Prairie (meet at Picnic Point Parking Lot)</p> <p>Testable Questions Prelab due before lab</p> <p>✓ By the beginning of lab- Tentative testable and relevant abiotic & biotic variable list ✓ By the end of lab- Tentative testable question/hypothesis for prairie project (1/team)</p>	2%
3 Sept. 19-23	Ecology III: Propose Experiment & Solicit Feedback	<p>Disc Peer Review (PR): our expectations *Teams prepare feedback presentation slides (outside of class)</p> <hr/> <p>✓ Before Disc- Experimental design worksheet due</p> <p>Lab Informal Feedback Presentations</p> <ul style="list-style-type: none"> •Focus on biological rationale & hypothesis •Workshop-Sampling, replication, making figures & representing variation <p>Paper review worksheet (1/pair) & Group Effort Analysis (GEA) form due before lab</p> <p>✓ By the end of lab- Materials and schedule sheet (1/team)</p>	5%
4 Sept. 26-30	Ecology IV: Data Collection	<p>Disc Formal Peer Review: Exchange paper drafts with partner and complete review form at least 24h before disc. Meet with peer review partner during discussion to discuss comments</p> <hr/> <p>Lab Field work at Biocore Prairie- Experiment set up and pilot studies</p> <p>Ecology Research Proposal, GEA & Authors Response & Peer Review due 48 h after disc</p>	8% 2%
5 Oct.3-7	Ecology V: Representing & Explaining Variation	<p>Disc Data entry and intro to Excel; Excel Tutorial; focus on sources of variation * Hand out Narcissus bulbs and instructions</p> <hr/> <p>Lab Field work at Biocore Prairie – complete study</p> <p>✓ Sign up: Individual conferences with TA for Ecology Paper outside class (varies)</p>	
6 Oct. 10-14 (Biocore 381 Exam Oct 10)	Ecology VI: Data Analysis, Literature & Scientific Writing	<p>Disc Data visualization & reading literature for scientific writing</p> <hr/> <p>Lab Data Analysis- focus on variation and patterns; Generate and Present results figures for feedback</p> <p>✓By the end of lab- Raw data sheet using data entry template</p> <p>Data Analysis Prelab due before lab</p> <p>✓ Individual conferences with TA for Ecology Paper- outside of class (time varies)</p>	4%
7 Oct. 17-21	Cell Division & Life Cycles: Genetic Variation	<p>Disc Formal Peer Review: Exchange paper drafts with partner and complete review at least 24h before disc; reverse outline and focus on conclusions</p> <hr/> <p>✓ Narcissus bulb data sheet</p> <p>Lab Life cycles, reproduction, flow of genetic information in plants</p> <p>✓ Cell, flower, & fruit drawings and observations; concept map of genetic variation</p> <p>Ecology Final Paper, GEA, Author's response & Peer Review due 48 h after disc</p>	15%; 2%

8 Oct. 24-28	Genetics I: Intro to Quantitative and Mendelian Genetics with <i>Brassica rapa</i>	Disc Group work check-in; GEA feedback; Mid-semester evals Lab Intro to <i>Brassica rapa</i> (FastPlants), life cycle, plant breeding, phenotypes, and genetics FastPlants/ Genetics pre-lab due before lab ✓ By the end of lab- F1 phenotypic measurements (1/team) & Tentative independent variable to investigate <i>Note: refer to Lab Manual p. 67 for Genetics Unit schedule of graded assignments</i>	4%
9 Oct. 31- Nov 4	Genetics II: Proposing and Starting Experiments	Disc Teams prepare feedback presentation ✓ Before Disc- <i>Brassica rapa</i> experimental design worksheet (1/team) Lab <i>Brassica rapa</i> proposal informal feedback session *Begin <i>Brassica rapa</i> experiments outside of lab time ✓ By the end of lab- Materials and schedule sheet (1/team)	
10 Nov 7- 11 (<i>Biocore 381 exam Nov 9</i>)	Genetics III: Collecting Preliminary Data	Disc Poster writing workshop and informal peer review ✓ Before disc- draft of poster Lab Preliminary data collection ✓ By the end of lab- Data Analysis Practice Worksheet Brassica proposal posters (mini-posters) due Friday Nov. 11	13%
11 Nov 14-18 (<i>Biocore 381 draft paper Nov 17</i>)	Genetics IV: Data Analysis Evolution I	Disc Complete <i>Brassica</i> data collection Lab Discussion/ Conclusion Activity for <i>B. rapa</i> ; Generate and Present results figures for feedback Introduction to the Galapagos and finch evolution – field trip to the Zoology Museum <i>Note: refer to Lab Manual p. 82 for Evolution Unit schedule of graded assignments</i>	
12 Nov 21-23	Evolution II: Using Data to Develop Questions	Disc Evolution activity Informal peer review final posters- outside of class Brassica final posters (mini-posters) & GEA due before disc THANKSGIVING- NO Labs	17%
13 Nov. 28-Dec 2 (<i>Biocore 381 final paper Dec 1</i>)	Evolution II: Using Data to Develop Questions	Disc Experimental design worksheet Evolution pre-lab due before disc. Lab Introduction to historic data on Galapagos finches; Group Time- work on research question, gather literature, analyze historic data, prepare to share progress in lab ✓By the end of lab- Tentative research question for evolution grant proposal (1/team)	4%
14 Dec 5-9	Evolution III: Developing Hypothesis & Rationale	Disc Teams prepare feedback presentation Lab Finch evolution proposal Powerpoint feedback session	
15 Dec. 12-15	Evolution IV: Presenting Proposal	Disc Practice presentation in discussion (group peer review) Lab Formal Grant Proposal Presentations (1/team) & GEA forms due in lab	15%
16 Finals Week	Evolution V: Response to Reviewers	Response to Reviewers Online Essay Custom set of questions based on proposal	6%
Team work, class participation, and check assignments			3%

Instructors- Open Door policy

Janet Batzli (course chair) 363 Noland Hall, 263-1594

Seth McGee (lab manager) 339 Noland Hall, 262-6189

Lab	Disc Time	Lab Time	Teaching Assistants / uTAs
1	Mon 12:05	TUES AM (8:50-11:50)	Paul Senner psenner@wisc.edu Jake Nelson jbnelson5@wisc.edu Katie Ness kness2@wisc.edu
2	Mon 1:20	TUES PM (1:20-4:20)	Heidi Horn hhorn@wisc.edu Maria Kalambokidis mkalambokidi@wisc.edu
3	Mon 3:30	WED PM (1:20-4:20)	Carly Ziter ziter@wisc.edu Nick Hoppe nwhoppe@wisc.edu
4	Tues 4:35	THURS AM (8:50-11:50)	Michael Falk mfalk4@wisc.edu Matt Beilfuss mabeilfuss@wisc.edu Jennifer Umhoefer jmumhoefer@wisc.edu

Course Guide- How we Do Things

Class Attendance and Time Management

Each week you will attend a 50-minute discussion section and a 3-hour lab. You should also plan to spend time outside of regular class hours to do lab readings (READ Lab Manual!), work on literature searches, project development, some data collection, data analysis, PowerPoint and poster preparation, paper writing, and peer review.

Lab Etiquette

For use of 341 and 334 lab rooms: Access and use of lab rooms outside of class time is a key component of our Biocore learning environment and community, but it comes with responsibility. You may use 341 for group or quiet study when no classes or meetings are in session. Use 334 for doing experiments and meeting with lab research teams. Both 341 and 334 lab rooms have key lock boxes that you will be given access to after the start of the semester. If there is any misuse or suspected misuse of the rooms, if the rooms are not cared for or left untidy or down right dirty, or if equipment/ books/ furniture are out of place or missing we will no longer be able to allow student access to these rooms outside of class time hours. In short, be good Biocore citizens and take care of your lab rooms!

Use of computers: You will have access to PC laptops. The laptops are in a locked cabinet in 341 and can be checked out (with your student ID) upon request. Do not download applications to these computers and do not store your valuable files on the hard drive (the drives are wiped clean regularly).

During presentations and discussions: Your presence and participation in class is extremely important for your learning and the establishment of a positive, effective learning environment for everyone (students and instructors). With this in mind, we ask that you DO NOT have your computers open, use electronic devices or study for other courses during our class meeting time.

Group work & Participation Learning to work as a *productive* collaborative member of a team is an essential skill for all professionals. Collaboration increases the number of perspectives focused on a complex problem, and it increases creativity and capacity for productive work! Unfortunately, group work can sometimes be unproductive if team members do not value or invest in the team or shared goal or if one or two students dominate over others. We consider collaboration a skill that needs practice to become competent. Throughout the semester you will be assigned to different groups by your instructors so that you have an opportunity to practice working with different personalities and perspectives. Part of your work as a good team member is your *independent accountability* for the knowledge you gain & the work you do while respecting and encouraging the work of others. Although we expect you to discuss ideas and work through problems and analyses with your teammates, you need to demonstrate your accountability for the project by writing proposals and final papers individually- on your own. Note that the first assignment (paper review) and the final evolution presentation are both group grades, and so **20%** of your final semester grade results from "Team" efforts. Your team & class

participation grade will be based on the quality of your check assignments, attendance and participation in class discussions and research team efforts. This grade is determined by input from both your instructors and from your teammates' with a 'Group Effort Analysis' (GEA) form and weighted as **3%** of your final semester grade.

Creating an inclusive classroom.

In Biocore, we strive for the utmost equity for all students, TAs, and faculty/ staff, regardless of race, ethnicity, gender, sexual orientation, (dis)ability, socioeconomic status, country of origin, or religious affiliation. Our community and our science depend on engaging and embracing different perspectives and this starts with each of us understanding and recognizing our own biases. It takes a great deal of awareness and self-work to recognize bias. Most of us stumble at times, so we all need to practice.

If you experience or notice bias

Share when you first experience or notice bias. If you are further offended and continue to experience bias, do not hesitate to bring this to your instructor's attention and/or report the case through UW Madison's [Bias Incident Reporting system](#)

If you mistakenly say or do something you wish you hadn't—apologize, say 'I'm sorry' and take ownership when you have offended someone, even if it was unintentional.

Discrimination and bias are not OK. Saying nothing perpetuates inequality. Speaking up reminds us of our inclusive classroom goal. It takes everyone to create a safe, supportive and productive learning environment. If even one of us feels stifled or unaccepted, we all lose out.

Papers & Posters

Written assignments (except final essay) will be done in the form of a scientific research proposal or final paper, poster, or grant proposal and are graded using the rubric criteria described in the Biocore Writing Manual. Collaborators must be listed on all papers and posters submitted individually (highlight author) or by the research team.

Presentations

As a Writing Intensive/ ComB course, Biocore 382 provides a number of opportunities for you to improve your oral communication skills about your science. You and your research teams will prepare and present three informal, PowerPoint 'feedback' presentations in the format of a research proposal when you are planning your research projects (similar to what graduate students do in their research labs). These presentations are not graded, but will allow you to receive essential and valuable feedback from your instructors and peers prior to you doing your experiment AND prior to writing a research proposal. Although not graded, feedback presentations are where a great deal of learning happens- for both the presenters and the audience. You and your team will also give one formal presentation at the end of the semester to summarize your evolution grant proposal project. This presentation is graded and requires presenters to focus on both the scientific rigor of the project as well as how it is presented to the audience. (See the 2016 Biocore Writing Manual for our expectations.)

Peer review

You will have 3 formal opportunities to be a peer reviewer (as well as to have your work reviewed) this semester. Formal peer reviews (listed in the syllabus) are done in discussion and require partners to exchange draft papers at least 24h before discussion to allow time for thorough review. You will turn in a copy of the review you received with each assignment, along with an *author's response form* that briefly explains major revisions as well as what advice you took and did not take from your reviewer, and why. Your peer review grades will be based on the rubric on p. 40 of the Biocore Writing Manual. Even when not required, we strongly encourage you to use the peer review process before turning in papers or posters.

Late Assignment Policy

Papers & assignments must be handed in at the specified/ place time unless you have contacted your TA *ahead of time* to request an extension due to emergency or extenuating circumstances. Otherwise, we will deduct one grade per day it is late from the grade you would have received (e.g., A->AB for one day late). Note that even

an F paper (one week late) counts more than 0 (not handed in at all) when we total the final grades at the end of the semester. Late papers should be given directly to your TA or Janet Batzli (NOT put in a mailbox or submitted electronically). If you know of a religious observance or other commitment this semester that will keep you from attending class, let your TA and Janet Batzli know as soon as possible.

Honor and Honesty, Ethics and Social Responsibility is essential

The validity and accuracy of scientific findings are open to review. Your data are NOT PERSONAL, nor are they correct/incorrect or good/bad. Therefore, data are not to be associated with a personal value judgment. We have had some problems in labs with students fabricating or changing data. We consider this a serious violation not only of the Biocore Honor Code but also of scientific principle more generally. You are not graded on your results but rather on how you analyze your data. **It is absolutely essential that you report your data honestly and accurately.** In addition, we have had several instances where students have copied and pasted segments and whole sections of their classmate's papers, changed the wording/order a little, and claimed the work as their own, either in drafts for peer review and final papers or in pre-lab assignments. Not only is this plagiarism, claiming credit for the intellectual work of others is highly disrespectful and erodes trust within our Biocore learning community. If you find yourself tempted (especially late at night just hours before a paper is due—we've all been there) JUST DON'T DO IT. It is much better to ask for an extension, receive a slightly lowered grade for a late paper, or even receive a zero for a missing assignment than to plagiarize your classmates or someone else's work. You agreed to this when you signed the Biocore Honor Code during the first week of Biocore 381 and will be held accountable for violations according to UW Academic Code of Conduct 14.03 <http://students.wisc.edu/doso/acadintegrity.html>.

How you earn your final grade

We use an absolute grading scale in 382 (**no curves!**)- >90=A; 80-89=B; 70-79=C; 60-69=D. You will be participating in both individual assignments (80%) and group assignments (20%). Assignments, due dates, and assignment weight in percent are detailed in the schedule above. Pre-lab assignments are graded on a point percentage basis. Papers and posters are graded using rubric criteria described in the *Biocore Writing Manual* and reported to you as a letter grade (A+, A, A-, AB, B+, B, B-, BC, C+...). Letter grades are converted to numeric values when final grades are tallied at the end of semester (e.g. AB=89, B+=87, B=85). Check (✓) assignments are scored simply adequate or inadequate and contribute to your general 3% participation grade.

Your final percentage score will be converted to a final letter grade as follows:

<u>Final Assignment %</u>	<u>Letter Grade</u>
90-100	A
80-89	B
70-79	C
60-69	D

*For those few individuals that are on the borderline at the end of the semester, we will assign intermediate grades (AB and BC) based on graded assignments and our evaluation for your participation (in both lab AND discussion).