Bob Minckley
Robert Laport
Julienne Ng

BIO 225: LABORATORY IN ECOLOGY & EVOLUTION
COURSE DESCRIPTION AND SYLLABUS FALL 2012

Intended audience: junior and senior EEB B.S. students

Prerequisites: Past or current enrollment in Bio 205 Evolution, or Bio 263 Ecology

Description and goal: This course emphasizes the development of testable questions and implementation of appropriate observations and experiments on a series of topics in ecology and evolution. Many of the mini-studies will be done in the field on non-model organisms native to New York. Students will gain experience in field and lab methods used in ecology and evolutionary biology (including relevant computer applications), sharing and managing data sets, taking field and lab notes, making tables and figures, using basic statistics, reading and critiquing published scientific studies, writing scientific reports, and presenting scientific results.

Comments: Many of these labs will be held outdoors—rain or shine—so come prepared with sturdy shoes, long pants, jacket, rain gear, warm jacket, water, snacks, insect spray, etc. Extremely inclement weather may lead to a change in the schedule, perhaps at short notice. If there is a change, we will email you by noon on lab day so make sure to check your email. If you are unable to do so, have a fellow lab member contact you with any lab changes.

This is an advanced course in which we will learn techniques (theory and practice) and design of studies in ecology and evolution. Along the way, you will also learn how to critically evaluate scientific methods, present your work orally, and write scientific reports.

Expect to spend a substantial amount of time on experimental design, collecting data, writing papers, and completing assignments for this course. This lab focuses on designing experiments, collecting, analyzing, and presenting "real" data. Some aspects may be tedious, others challenging. However, the skills you learn in this lab will provide the foundation for EEB graduate programs and careers.

It is highly recommended that you do not procrastinate with assignments or you may become overwhelmed at the middle and the end of the course.

Be forewarned that some techniques in this lab may be challenging and, as in the real world, some experiments will go as planned and others will not. When procedures do not work as expected, we will think about possible causes and may design new experiments to test some possibilities.

You are expected to attend **all** formal lab sessions. You will need additional time to work on independent projects. At the end of the course you will have a sense of what is involved with conducting ecology and evolution field and laboratory work, performing experiments, and having a career in these fields.

GENERAL INFORMATION

Instructors:

Bob Minckley	Hutchison 446; robert.minckley@rochester.edu
Robert Laport	Hutchison 476; robert.laport@rochester.edu
Julienne Ng	Hutchison 337; julienne.ng@rochester.edu

Teaching assistant:

Emily Dunn	edunn@u.rochester.edu

Office hours: by appointment

Meeting times:

Lab:	CRN 18514 Tuesdays, Thursdays: 2:00-6:05 (Hutchison 222)
Recitations:	CRN 18523, Mondays 3:25-4:40 (Hylan 202)

Course web site:

Blackboard

Required supplies

Flash drive
3-ring binder
Clipboard
Pen and pencil
Lab Notebook

Recitations: Recitation lectures and/or discussions will be held as needed and will be used to provide background or additional information for certain labs.

Grades: Final grades are based on the point total for lab exercises and lab reports, quizzes, and the final project. There are 250 total points for the class, but the lowest quiz score (5 points) will be dropped. Students whose point total is >93% will receive an A, 90-92.9% = A-, 87-89.9% = B+, 83-87% = B, 80-82.9% = B-, 77-79.9% = C+, 73-77% = C, 70-72.9% = C-, 67-69.9% = D+, 60-67% = D, 55-60% = D- and less than 55% = E.

You are expected to be present at **all** formal lab periods and to turn in all lab reports and take all lab quizzes.

Late assignments are marked down 10% per week. If you are not going to be able to do a report (or take a quiz), you should consult with the instructor in advance.

Final project: You will develop your own project relevant to topics in this course. Assistance will be provided, but this is your opportunity to develop and test an idea that you conceive. If you have a question that you have always wanted to explore in depth, talk to Bob Minckley and/or the TAs about how it might be tested. Projects can begin at any time in the semester, but a proposal must be made by 23rd October, so start thinking about what interests you right away. Many studies on animal behavior or annual plants must be done early in the semester before the weather changes. Laboratory or computer-based projects are weather-independent and can be done later in the semester.

Projects require the following; 1) development of a proposal by (23 October), 2) presentation to the class of your hypothesis, experimental design and anticipated results (30 October), and 3) 10-min talk in a scientific format (6 December). *Note that the proposal must be developed and approved by Bob Minckley before you can begin data collection*

Papers & Writing section: This course will have three papers that everyone is required to write. Please note that your writing assignments will be evaluated rigorously—we expect careful, well-crafted responses. The writing assignments are worth a significant portion of your grade. Assessments will be based on style (grammar, spelling conciseness, and clarity) and content. Writing is a skilled craft that is honed by practice. As such, you will rewrite the papers based on comments provided by the instructors and peers:

The first paper will summarize and report the results of the Worm Diversity/Abundance study (Due 2 October).

The second paper will summarize and report the results of the Niche modeling study (Due 25 October).

The third paper will summarize and report the results of the Co-evolution study (Due 13 November).

Structure your laboratory reports as a normal scientific paper. We will read and discuss several scientific papers during the semester. They provide an excellent template of how to structure your reports.

This course also includes an optional 0.5 credit writing section (Bio 225W) that requires additional revision of these papers. Students enrolled in Bio 225W will receive additional feedback from the instructors, and will submit re-writes of their papers.

Field/laboratory notebooks: The field/lab notebook is a "diary" of your activities and observations and is essential in both laboratory and fieldwork settings. A good notebook should be understandable by other workers as well as you. Field/lab books are used to record data as well as your first thoughts on ideas, chance unrelated observations, and your explanations for results. It is essential that the notebook be legible and well organized. You must bring your notebooks to class every day.

Field notebooks will often include, or be composed entirely, of loose data sheets. These should be placed in a 3-ring binder. Original, handwritten data sheets should be kept even after this data is entered into a computer spreadsheet. In this course, all lab instructions, field notes, raw handwritten data sheets, computer spreadsheet printouts, and graded exercises should be organized and placed in a 3-ring binder. In the "real world," a field biologist is likely to have an additional bound waterproof notebook for field notes and some data collection.

While many of the details of what goes into a field notebook is based on individual style, there are certain features we strongly encourage you to include:

1. For each day you collect field data, record the GPS coordinates, location name, date, time, weather conditions, and names of data collectors.

2. Record any notable or interesting observations, even if you aren't sure if they directly relate to your current study. For example, if you are measuring trees and notice a lot of woodpecker

activity, make note of this. Or, if a plot is near a wetland, or looks "odd" in some way, note this. These observations can help interpret your data, and they can provide ideas for future projects.

3. Record data clearly. Be sure the meaning of all abbreviations are clear. Do not mix tick marks and numbers ("II" can be "11" or "2").

4. At the end of every activity, provide a brief summary of questions being asked, what you did, why you did it, and any preliminary results.

Lab notebooks must be bound, much like a diary. A simple method to maintain a lab book is to write your observations sequentially. There are notebooks at the bookstore that have duplicate sheets. This style of notebook is not mandatory, however, and other styles of notebooks can be used.

While many of the details of what goes into a lab notebook is individual style, there are certain features we strongly encourage you to include:

1. At the beginning of each experimental section, there should be a short discussion describing the purpose of the experiment, describing any hypotheses that are being tested and at least one particular result that could disprove the hypothesis. Learn to state your hypotheses, verbally and on paper.

2. Outline the experiment, as a flow chart or cartoon (not necessarily repeating the lab handout!). Note what data is to be collected and what kind of layout you are going to use to record it. What kind of ad hoc analysis can you do in the lab to confirm that things are working? What are the controls?

Steps 1 and 2 should be done BEFORE the lab period; we will occasionally check your lab books to see that this happens.

3. During the lab period, everything you write should be in the notebook (notes and tables of results, including ad hoc figures that you might use). Do <u>not</u> record on paper towels and then recopy to obtain a neat notebook. <u>Think before</u> you write. Your lab notebook should also contain additional notes about the experimental details so that you could use your notebook and the handout to reproduce the experiment with much less supervision and with greater security about its success than in your first run-through. For example, a lab handout might indicate only that a gel should be run until the dye reaches about 2/3 of the way to the bottom. By recording the % gel, voltage/amperage, and running time, you can compare results from experiment to experiment.

4. After the lab, initial analysis: the rough figures and calculations that you might do when you start your analysis of the results.

5. Any time, ideas for repeating the experiment to get better results …or, if the experiment was unsuccessful, repeating the experiment to make it work.

Date	Instructor	Lab	Description	Papers to Read	Assessments	Points
29 Aug	BM, RL, JN	Class introduction	Introductions, woodlands walk	Syllabus		
3 Sep	RL	Forest Ecology	Plot location & surveys, tree ID	Fine et al. 2004	Tree ID quiz	15
5 Sep	RL	Forest Ecology	Independent plot location & surveys			
10 Sep	RL & JN	Forest Ecology	Forest data analysis - ordination			
12 Sep	RL	Worm Abundance/Diversity	Worm questions & writing a paper	Hale et al. 2006	Worm paper quiz	5
17 Sep	RL	Worm Abundance/Diversity	Worm collections, soil collections			
19 Sep	RL & JN	Worm Abundance/Diversity	Worm data analysis - regressions/ANOVA			
24 Sep	RL	Worm Abundance/Diversity	Worm project presentations		Worm analyses R scripts due	5
26 Sep	BM	Species Richness (Bees)	Malaise Trap, bee netting			
1 Oct	BM	Insect-plant interactions	Floral resources and insect visitation	Orchid paper (Schiestl et al., 1999)	Orchid paper quiz Worm Project Paper Due	5 50
3 Oct	BM	Species Richness (Bees)	Bee sorting/ID (malaise & net)			
8 Oct	BM	Species Richness (Bees)	Species richness estimation			
10 Oct	JN	Niche Modeling	Choose species/question, natural history download museum records	Niche paper (Roura-Pascual et al., 2004)	Niche paper quiz	5
15 Oct	JN	Niche Modeling	DIVAGIS, modeling			
17 Oct	JN	Phylogenetics	Tree thinking & evolutionary lineages	Phylogenetics paper (Baum et al., 2005)	Phylogenetics paper quiz	5
22 Oct	JN	Phylogenetics	Tree thinking & evolutionary lineages		Independent project proposals due	15
24 Oct	JN	Phylogenetics	Tree thinking & evolutionary lineages		Niche paper due Phylogenetics exercise	50 5
29 Oct	BM	Independent Project Proposals	Independent Project proposal presentations		Independent project proposal presentation	5
31 Oct	BM	Co-evolution	Moran Paper, GENBANK *Drosophila* & *Wolbachia* sequences, phylogeny	Co-evolution paper (Moran et al., 1993)	Co-evolution paper quiz	5
5 Nov	Guest	Mating behavior	Behavioral experiment			
7 Nov	Guest	Mating behavior	Behavioral experiment			
12 Nov	BM	Match.com	Database experiment		Co-evolution paper due	50

14 Nov	BM	Match.com	Database experiment			
19 Nov		Thanksgiving - no class				
21 Nov		Thanksgiving - no class				
26 Nov		No class	Independent Project preparation			
28 Nov		No class	Independent Project preparation			
3 Dec		No class	Independent Project preparation			
5 Dec		Independent Project presentations			Independent project presentation	30
10 Dec		No class				
					TOTAL:	**250**