Course description

Evolution is a powerful and central theme that unifies the life sciences. My intent in this course is to help you understand and appreciate the dynamic process of organic evolution. To this end, we will explore various aspects of evolutionary biology, including topics related to both the pattern and the process of biological evolution. Lectures will emphasize the history and development of evolutionary thought, microevolutionary mechanisms of change in populations, evolution at the molecular level, speciation, and large-scale macroevolutionary phenomena (e.g., the evolution of life, sex, and death). Readings from the primary literature will focus on experimental studies of evolution, and will be integrated into lecture and discussed during class. Laboratories will offer hands-on experience with evolutionary processes including artificial selection, simulation studies of population and higher-level processes, and a semester-long experiment connecting mating phenotypes to analyses of the genes underlying these phenotypes.

Professor

Jill S. Miller, 224 McGuire Life Sciences, 542-2168, jsmiller@amherst.edu
Office hours: Wednesdays 10:00am-12:00pm

Meeting times & locations

Lecture: Tuesdays & Thursdays 11:30am-12:50pm, Merrill 315
Laboratory: Thursdays 2-6pm, 146 McGuire Life Sciences Building

Expectations

The most basic of my expectations is that you realize that you are responsible for what you learn and the grade you obtain. To do well, you must consistently put in a large effort. Be prepared to allocate sufficient time to reading your textbook and the supplementary assignments, solving problems, reviewing your lecture notes, and maintaining laboratory experiments. Note that you will not be given lecture notes – this is your responsibility. Each week you should plan to spend several hours out-of-class for review and study, depending on your study habits and your understanding of the material.

Your goal is to understand and synthesize the material to the point where you can articulate concepts clearly and in your own words. In this course you will need to master information from a number of different sources, acquire new vocabulary, and develop your skill in data interpretation and hypothesis discrimination.

Course format

Lecture will meet from 11:30am-12:50pm on Tuesdays and Thursdays. Please be courteous – this means be on time and turn off your cell phones. Lab will meet from 2-6pm on Thursdays in 146 McGuire Life Sciences. Attendance at all class meetings is mandatory. If you anticipate a scheduling conflict, please talk with me as soon as possible.

Textbook and Readings

The textbook for this course is *Evolutionary Analysis*, 4th edition (2007) by S Freeman and JC Herron. I recommend purchasing a copy; however, two copies are on reserve in the science library. Additional required readings from the primary literature are available on the course website (see *Supplementary Readings* handout; https://www.amherst.edu/academiclife/departments/courses/0910S/BIOL/BIOL-32-0910S/ereserves).

Required assignments

There will be two in-class exams (February 25 and April 13) plus a comprehensive final exam. Collectively, the first two exams will count for 40% of your final grade and the final exam will be 25%. The exams will evaluate not only your ability to restate factual information, but also your ability to apply information in a different context. The format of these will be variable (e.g., some definitions, fill in the blank, short essays, calculations, data interpretation). In general, make-up exams will not be given; however, accommodations may be made if there is a legitimate, documented excuse and you let me know prior to the scheduled exercise.

There will be four problem sets (5% of final grade). The problem sets are designed to help you practice concepts covered in your readings and lecture and will help prepare you for exams.

During most weeks, supplemental readings (in addition to your textbook) will be assigned. You are responsible for submitting responses to a selected set of these readings (5%). Be prepared to see the concepts and data in these papers again. For example, I may ask you to interpret data from a paper you read, or contemplate the relevance of the paper in a different context. In addition, you will also critique a paper of your choice, which will count for 10% of your final grade.

Finally, 15% of your course grade will depend on your participation and performance in the laboratory. There will be one short assignment dealing with computer simulations of population processes, as well as two longer experiments. Students will conduct artificial selection experiments, and undertake a semester-long project that seeks to characterize phenotypic breeding relationships among individuals and integrate these results with analyses of molecular sequence variation for genes contributing to mating patterns. Because we are working with real organisms, expect that you will spend some amount of time outside of class with your organisms.

Note that there will be an automatic 10% decrease (per day) for assignments not turned in on time, and assignments more than 3 days late will not be accepted. See me sooner rather than later if you anticipate a conflict.

Intellectual Responsibility

Academic dishonesty will not be tolerated and will be reported to the Dean of Students. This includes incorrectly citing sources of information, presenting the work of others as your own, or falsifying data. My view is that it is equally dishonest (and unfair) to allow someone to copy your work, as it is to plagiarize the work of another. If you are not already, make yourself aware of the College's *Statement of Intellectual Responsibility*.

WK	DATE	DAY	LECTURE TOPICS	READINGS / ASSIGNMENTS	LAB (meet in LSB 146 unless noted below)
1	Jan 26	T	Course mechanics	37-60, 90-105; Angier 2007; Baum et al. 2005a	***No lab first week of classes***
	28	Th	Evolutionary thinking		
2	Feb 2	T	Genetic variation; Mutation	***Problem set 1***; 143-50; 152-66; 169-82; 210-12	Artificial selection 1 – Characterize traits, Phenotypic variation, Experimental set-up
	4	Th	Population genetics		
3	Feb 9	T	Selection	***Problem set 2***; 73-89; 182-207; 212-18; Freeman & Byers 2006; Hori 1993; Mullen & Hoekstra 2008	Mating systems 1 – Introduction to project; Tissue collection; Crossing design
	11	Th	Selection		
4	Feb 16	T	Selection; Gene flow	223-31; Storfer & Sih 1998; Harper & Pfennig 2008	Microevolutionary simulations (meet in Seeley-Mudd 002)
	18	Th	Gene flow		
5	Feb 23	T	Finish up weeks 1-4; Review	–	Mating systems 2 – RNA extraction; cDNA synthesis; PCR of *S-RNase* gene
	25	Th	***Exam 1***		
6	Mar 2	T	Genetic drift	***Problem set 3***; 232-49; Bouzat et al. 1998; Ingvarsson 2002; Miller et al. 2008	Mating systems 3, 4* – Electrophoresis of *S-RNase*; Product purification & cloning*
	4	Th	Genetic drift		
7	Mar 9	T	Nonrandom mating	264-77	Mating systems 5 – PCR screen of colonies
	11	Th	Population substructure		
8	Mar 16	T	***Spring break***		
	18	Th			
9	Mar 23	T	***No class***	249-64; Sharp 1997; Dorus et al. 2007	Mating systems 6 – Electrophoresis; Product purification & preparation for sequencing
	25	Th	Neutral theory; Molecular evolution		
10	Mar 30	T	Linkage	***Problem set 4***; 281-95; 319-32; Schemske & Bradshaw 1999	Artificial selection 2 – Measure traits & assignment instructions
	Apr 1	Th	Quantitative traits		
11	Apr 6	T	Measuring selection, Heritability	333-50; Coltman et al. 2003	Artificial selection presentations
	8	Th	Finish up weeks 6-10; Review		
12	Apr 13	T	***Exam 2***	605-34; Hoskin et al. 2005; Pennisi 2006; Pryke & Griffith 2009	Mating systems 7 – Download & process sequences (meet in Seeley-Mudd 002)
	15	Th	Species, Speciation		
13	Apr 20	T	Phylogenetic inference	111-37; Gilbert et al. 2007; Feldman et al. 2009; van Kleunen et al. 2008	Mating systems 8 – Selection analyses (meet in Seeley-Mudd 002)
	22	Th	Phylogenetic comparative biology		
14	Apr 27	T	Evolution of sex	302-12; 401-38; 621-23; Ridley 1993; Lively & Dybdahl 2000; Zuk et al. 2006; Velando et al. 2008	Mating systems 9 – Assignment instructions (meet in Seeley-Mudd 002)
	29	Th	Sexual selection		
15	May 4	T	Life-history evolution	483-517; ***Critique due (Tuesday, 4 May)***	***No lab last week of classes***
	6	W	Finish up weeks 12-15; Review		