

EVOLUTIONARY BIOLOGY (LIFE SCIENCES 3500) FALL 2010

Class meetings: Classroom Building 219, 9:35–10:50 a.m., Tues and Thu

Website: http://www.uwyo.edu/buerkle/evol_life3500

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1 DESCRIPTION OF THE COURSE

In this course we will get an overview of modern evolutionary biology and will focus on the genetics and ecology of evolutionary change. A good understanding of the processes and mechanisms of evolution will be our goal.

A significant amount of time will be devoted to reading and discussing material from a good textbook that will serve as the basis for each topic. We will also read and discuss a few articles from the primary literature in evolutionary biology.

While this is an introductory course in evolutionary biology, it is not purely a lecture-based course. In each class meeting I will offer brief lectures, explanations and additional examples to clarify material, but we will also discuss material and perform learning exercises in small groups and as a class. This format may be unfamiliar at first and will require that all of us come prepared to each class. Part of my job will be to make clear what the preparation for each class entails. It should be clear from the outset that this course is built around your regular, active preparation for class meetings.

2 COURSE MATERIALS

1. Freeman, S. and J. C. Herron. 2007. *Evolutionary Analysis*. Fourth Edition. Pearson Prentice Hall, NJ.
2. Readings from the literature (see Section 4) are available from the course website.

3 ASSESSMENT

Your performance will be evaluated based on three exams, eight writing assignments (nine will be assigned and the lowest score will be dropped), and six quizzes. Grading will be on a standard scale (i.e., 90–100=A, 80–89=B, etc.).

Exams	$3 \times 100 = 300$ points	81.1%
Writing assignments	$8 \times 5 = 40$ points	10.8%
Quizzes	$6 \times 5 = 30$ points	8.1 %
total	<hr/> 370 points	

3.1 READINGS AND PREPARATION FOR CLASS

A substantial portion of the work you will do for this class will be reading and preparing for class meetings. In advance of all class meetings you will be expected to complete a reading assignment and to make notes for yourself on the material. In your notes, you will want to highlight questions about material that is unclear to you, requests for additional information or examples, and other issues to raise in our class meetings. You will want to bring your book to class each day.

Additionally, for each class meeting, you will prepare answers to assigned questions from hand-outs and from the end of the textbook chapters. These answers can be written into your notebook, along with your other notes on the reading, and are for your use in class discussions and in your studying of concepts. You will want to have room in your notebook for additional notes that you take in class as we discuss the material together. I expect you to complete these assignments, but the answers to assigned questions will not be collected. I recognize that you will not be able to complete the full assignment for every class meeting, but your classmates and I will expect that assignments are completed regularly so that class time can be used productively and you can participate in learning exercises related to the material.

3.2 WRITING ASSIGNMENTS

In preparation for in-class discussions, on nine occasions over the course of the semester you will write a short piece that responds to an assigned reading or that reports your findings associated with a simple literature research project to find and describe an example of research from the scientific literature.

All writing assignments should be carefully proof-read and typed, and should be no longer than one single-spaced page of text. In grading writing assignments I will look for analysis and questions that make clear that you engaged the material and have written about ideas and questions that integrate with and relate to the current subject matter. When possible, you should incorporate issues that require clarification in class or that would be interesting issues for discussion in small groups or for the whole class.

3.2.1 Think-pieces

The four writing assignments that are associated with and respond to an assigned reading are called think-pieces. Think-pieces contain discussion, analysis, and reasoned opinion, as opposed to a simple factual summary. The purpose of the think-pieces is to give you an opportunity to summarize your thoughts, responses, and questions after reading the materials and in preparation for discussion. These assignments are associated with a topical section of the course and can be used to reflect on the assigned reading and its relationship to the concepts we have been studying. The key concepts, questions, and observations from your think-pieces will provide material for discussion in our class meetings. Think-pieces should address the key concepts associated with the topic, as well as highlight the most important findings or other aspects of the reading, including any questions you have.

3.2.2 Examples from the literature

Five writing assignments will be used to give you an occasion to find, review, and write about examples of focal concepts from the scientific literature. I encourage you to find examples that interest you. In each case you will use an electronic database (Google Scholar <http://scholar.google.com> or ISI Web of Knowledge (<http://isiknowledge.com>) to search the recent literature for papers related to our current topic of study. Research articles for your review must have published in 2009 or 2010, have appeared in a scientific journal (rather than in a magazine or newspaper), and should be reports of original research rather than articles that review the scientific literature. Please **attach a paper copy** of the first page of the pdf version of the article to your writing assignment. In your one page of writing, please provide a full citation to the article with the following format (also see citations in Section 4 for citation format): Rodríguez-Muñoz, R, A. Bretman, J. Slate, C. A. Walling, and T. Tregenza. 2010. Natural and sexual selection in a wild insect population. *Science* 328: 1269–1272. In your writing, describe the study in your own words and relate it to the subject of study and reading from the textbook for that subject. For example, you could describe how the research you found contributes an additional example of an evolutionary phenomenon from another organism or provides greater detail about the methods used to obtain a type of scientific data. In class you will report to small groups and to the class about your findings, so you will want to be familiar with the main components of the research and will want to bring a paper copy of the article to class.

Dates and topics for writing assignments

There are nine writing assignments, but your grade will be based only on the eight assignments with the highest score. If you were to hand in the first eight assignments and receive full credit on each, you would not need to turn in the final assignment. This policy is meant to give you some flexibility. Except under reasonable circumstances for an absence (and discussed with the professor), assignments that are not turned in during a class meeting cannot be turned in late.

Assignment	Topic	Date
Example from the literature #1	Evidence for evolution	Sept. 2
Think-piece #1	Bowman 2008	Sept. 9
Think-piece #2	Stolz et al. 2003	Oct. 5
Example from the literature #2	Genetic drift and migration	Oct. 12
Example from the literature #3	Quantitative genetics	Oct. 21
Think-piece #3	Bradshaw and Schemske 2003	Nov. 2
Example from the literature #4	Sexual selection	Nov. 11
Example from the literature #5	Life history evolution	Nov. 18
Think-piece #4	Hendry et al. 2000	Dec. 2

3.3 QUIZZES

As a gauge of your understanding of the material and your preparation for class meetings, in each of three sections of the course (leading up to each exam), there will be two quizzes. Each quiz will have two parts: 1) a question that is answered prior to discussion of the day's material (3 points, graded for completion), and 2) two multiple choice questions that are answered after we have covered and discussed the relevant material (1 point each, of the same type as will be on the exams).

3.4 EXAMS

The three exams will consist of a mix of questions of three different types: multiple choice ($15 \times 2 = 30$ points), fill-in-the-blank ($10 \times 3 = 30$ points) and of short essays ($4 \times 10 = 40$ points, you will choose four of six essays to answer). Exams will be on the material covered in class meetings, as well as readings and assignments. The last exam is not comprehensive (i.e., it only covers the last third of the class).

Below are some sample questions to illustrate the types of questions I will ask. More sample questions will come from assignments and the quizzes.

Sample fill-in-the-blank problems. These typically require recall or application of facts or terminology, and answers are single words, short phrases, or short sentences.

1. How does the definition of narrow-sense heritability differ from that of broad-sense heritability?

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2. What is the population genetic effect of migration between populations?
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Multiple choice questions These typically require recall or application of facts or terminology. Please note that there will be answers that might sound correct or nearly correct, but that are not the best answer. In each case, look for the objectively best answer and fill the neighboring circle.

1. What is a likely explanation for the convergent evolution of traits in distantly related lineages of organisms?
 - (a) similar demands on the function of organisms in distantly related lineages.
 - (b) retention of ancestral character states over long periods of evolutionary time.
 - (c) incorrect inference of the phylogeny of the organisms.
 - (d) unrecognized homology of the character involved.
 - (e) chance.

Sample short essay questions. These require recall, as well application and synthesis of material. Many of these will be similar in style to questions that we discuss each class meeting.

1. How is it possible for males and females of the same species to have different genetic population structures? Give an example of a species that exhibits such a difference.
2. In the study of African elephant species there was evidence of hybridization in the form of three individuals (out of 195) that had a combination of forest and savannah taxon-specific alleles. Why then did the authors conclude that the forest and savannah elephants represent different species? Is this conclusion consistent with the biological species concept?

4 READINGS

The online version (http://www.uwyo.edu/buerkle/evol_life3500) of the list of readings includes links to the electronic versions of the articles.

1. Bowman, K. L. 2008. The evolution battles in high-school science classes: who is teaching what? *Frontiers in Ecology and the Environment* 6: 69–74.
2. Bradshaw, H. D. and D. W. Schemske. 2003. Allele substitution at a flower colour locus produces a pollinator shift in monkeyflowers. *Nature* 426: 176–178.
3. Hendry, A.P. et al. 2000. Rapid evolution of reproductive isolation in the wild: evidence from introduced salmon. *Science* 290: 516–518. (plus correspondence)
4. Stolz, U. et al. 2003. Darwinian natural selection for orange bioluminescent color in a Jamaican click beetle. *PNAS* 100: 14955–14959.

5 ADDITIONAL ITEMS

- The schedule of topics, assignments, and all other details in this syllabus are subject to change with fair warning.
- The professor should be informed of an absence from a scheduled exam or quiz in advance and we will accommodate absences for legitimate reasons and administer an exam or quiz at another time. If an emergency causes an absence from an exam or quiz, please contact the professor at your earliest convenience.
- Any student who has a disability and is in need of classroom accommodations should please contact the professor and the University Disability Support Services.
- Students whose religious activities conflict with the class schedule should contact the instructor at the beginning of the semester to make alternative arrangements.
- Cheating and other forms of academic dishonesty are listed in University Regulation 802, Revision 2. If you are found to be engaged in academic misconduct, at a minimum you will receive no credit for that exam or assignment. Repeat or serious offenders can expect more serious consequences.
- Many electronic devices are distracting in the classroom, to the user, other students and the instructor. This includes laptops, which clearly can be useful for taking notes but their web access often is a distraction. I ask that students are conscientious about their electronic devices and do their best to keep distractions outside the classroom. The simple guideline is that laptops should be used for note-taking only and not for any internet access. Mobile phones should not be used at all.

6 SCHEDULE OF TOPICS

Date	Topic	Assignment
24 Aug.	Course overview & introduction	
26 Aug.	Evolutionary thinking	Chpt. 1 FH (1–1.2)
31 Aug.	Evolutionary thinking	Chpt. 1 FH (1.3–1.5)
2 Sept.	Evidence for evolution	Chpt. 2 FH, EXL-1
7 Sept.	Natural selection	Chpt. 3 FH (3–3.6), quiz 1
9 Sept.	The social context of evolution	Chpt. 3 FH (3.7) Bowman 2008, TP-1
14 Sept.	Phylogenetics	Chpt. 4 FH, quiz 2
16 Sept.	Genetic variation	Chpt. 5 FH (5.1–5.3)
21 Sept.	Genetic variation	Chpt. 5 FH (5.4)
23 Sept.	Exam I	
28 Sept.	Selection and mutation	Chpt. 6 FH (6–6.2)
30 Sept.	Selection and mutation	Chpt. 6 FH (6.3–6.4)
5 Oct.	Selection and mutation	Stolz et al. 2003, TP-2
7 Oct.	Genetic drift and migration	Chpt. 7 FH (7–7.2)
12 Oct.	Genetic drift and migration	Chpt. 7 FH (7.3–7.5), quiz 3, EXL-2
14 Oct.	Sexual vs. asexual reproduction	Chpt. 8 FH (8.3)
19 Oct.	Quantitative genetics	Chpt. 9 FH (9.1–9.2)
21 Oct.	Quantitative genetics	Chpt. 9 FH (9.3–9.5), EXL-3
26 Oct.	Quantitative genetics	Chpt. 9 FH (9.6–9.7), quiz 4
28 Oct.	Analysis of Adaptation	Chpt. 10 FH (10–10.5)
2 Nov.	Adaptation – Trade-offs and constraints	Chpt. 10 FH (10.6) and Bradshaw and Schemske 2003, TP-3
4 Nov.	Exam II	
9 Nov.	Sexual selection	Chpt. 11 FH (11–11.2)
11 Nov.	Sexual selection	Chpt. 11 FH (11.3–11.4), EXL-4
16 Nov.	Life history evolution	Chpt. 13 FH (13–13.2), quiz 5
18 Nov.	Life history evolution	Chpt. 13 FH (13.3–13.6), EXL-5
23 Nov.	Speciation	Chpt. 16 FH (16–16.2)
25 Nov.	Thanksgiving Break	
30 Nov.	Speciation	Chpt. 16 FH (16.3–16.5), quiz 6
2 Dec.	Speciation	Hendry et al. 2000, TP-4
9 Dec.	Exam III – 10:15–12:15 (Thursday of Finals week)	