

## Biol. 322: Evolutionary Biology, Fall 2004, TR 9:30-10:45

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*Readings*— We will be reading Freeman and Herron, *Evolutionary Analysis* 3<sup>rd</sup> edition. Certain chapters (1, 2, 16) and sections (often at the end of chapters) may be skipped, as indicated below. This book is rich in examples. Unfortunately, sometimes the principles get lost. Because of this, I will strive to highlight the main concepts during lecture. The book is pretty detailed on genetical evolution (Unit II) and we'll be concerned with boiling it down early in the course. Later in the course, when we deal with speciation and macroevolution (Unit IV), the book is a little sketchy, and I'll need to add some material not in the book. I hope you'll enjoy the book. I think it is an excellent read.

Date and topic	Readings
30 Aug. Go over syllabus. Hear about my research	
1 Sept. Natural selection	Ch. 3 through §3.5
6 Sept. Mutation and genetic variation	Ch. 4
8 Sept. Hardy-Weinberg equilibrium	Ch. 5: through §5.2
13 Sept. Selection and Mutation	§5.3-5.4
15 Sept. Genetic drift, etc.	Ch. 6
20 Sept. Sex to an evolutionary biologist	Ch.7 except you may skip §7.2
22 Sept. Evolution of quantitative traits	Ch. 8 through §8.6
27 Sept. Catch up & Review (you ask questions)	
29 Sept. EXAM 1	
4 Oct. Adaptation	Ch. 9
6 Oct. more on the adaptationist's program	(handout)
11 Oct. Sexual selection	Ch. 10: through §10.4
13 Oct. Sociality	Ch. 11
18 Oct. Life history evolution	Ch. 12 through §12.4
20 Oct. Evolution & human health	Ch. 13
25 Oct. Introduction to phylogenetics	(handout) PAPER 1 DUE
27 Oct. Phylogenetics	Ch 14
1 Nov. Catch up & Review (you ask questions)	
3 Nov. EXAM 2	
8 Nov. Speciation	Ch. 15
10 Nov. more on speciation	no additional reading
15 Nov. Homology, conservatism	no additional reading
17 Nov. Macroevolution	Ch 17 (you can skip Ch. 16)
22 Nov. Key innovations, adaptive zones	(handout)
24 Nov. NO CLASS - THANKSGIVING	
29 Dec. Evolution of development	Ch. 18
1 Dec. Human Evolution	Ch. 19
6 Dec. Evolution of the humanities	no reading - PAPER 2 DUE
8 Dec. Catch up & Review (you ask questions)	
15 Dec. 8:00-10:00 EXAM 3	

*Papers*— You will write two short papers. The paper assignments will challenge you to ponder topics in evolution beyond restating what has been presented in the lecture and readings. This is hard work that is meant to make you grow intellectually. Please try to keep each paper to about 1000 words (3 pages double-spaced) not counting figures, tables, and literature cited. Remember, I have to read a lot of papers, so make every word count. You may discuss the assignments with each other, but your wording should be an individual effort. I will be marking for grammar and prose, as well as my perceptions of

the scientific content of your writing. In general, write something worth reading. You should base each paper on reading three related technical articles (not webpages); be sure to cite your sources, and do not copy other authors' words (except possibly as short quotations).

*Tests*—The exams will be of the so-called "objective" sort. Questions are multiple-choice, fill-in-the-blank, and perhaps some very short answers. I expect there will be 25 questions for each exam. There will be plenty of time. The tests are mildly cumulative, but definitely stress the material since the previous exam.

*Grades*—Each paper is worth 1/5 of your grade. Late papers will be penalized 10% per week. Each test will be worth 1/5 of your grade. Although I do not give you points for attending class, I have noted that those who often miss class or are late to class usually do very poorly. I strongly recommend making punctual attendance a high priority in your life.

*Listening to the Evolution Report*—As supplemental instruction, I have created a radio-like show that you can access through [www.csun.edu/~hcbio028/EvolutionReport.html](http://www.csun.edu/~hcbio028/EvolutionReport.html); it can be listened to on a computer, or you can download it to an .mp3 player and listen to it while you are commuting, or whatever. While there will be no questions on exams that are solely from *the Evolution Report*, listening to it should make understanding lecture and the book much easier. In other words, there will be questions from *the Evolution Report* that are also covered in the book and lectures.

*Webpage*—The skeleton of the lectures will be posted on the webpage, along with handouts. It is [www.csun.edu/~hcbio028/322.html](http://www.csun.edu/~hcbio028/322.html).

*Office Hours*—An important part of what I do (both from my own selfish point of view and from the point of view of your education) is to talk with students individually. Each one of you has your own developing view of biology. I am interested in seeing you learn whatever it is you can from my course and from me. Please feel welcome to come to office hours. You can also try to catch me at other times. You do not need to have a specific question in mind, although I am happy to try to answer specific questions. Talking about grades is not usually productive. My office is in Live Oak Hall (Science 1), Room 1323.

*Biology Department Withdrawal Policy*—Unrestricted class withdrawals are permitted only until the end of the third week of classes. Thereafter, requests to withdraw will be honored only when a *verifiable* serious and compelling reason exists and when there is no viable alternative to withdrawal. Poor performance is *not* an acceptable reason for dropping a class; in fact, you must be passing in order to withdraw. During the last three weeks of class, withdrawals will not be approved except when a student is withdrawing from *all* classes for verifiable medical reasons.

*Plagiarism and cheating*—You should cite your sources when you write a paper. Provided that you do give the citation, it is perfectly acceptable to relate someone else's argument or findings *in your own words*. When copying figures, you should also be sure to cite the original source. If you use someone else's words, you should surround the passage with quotation marks and cite the reference. In this class, since our papers must be concise, I would advise against quotations longer than a couple of sentences. Copying other people's work without giving credit is the same as stealing their intellectual property, and will be punished as per university policy (see Catalog). Also, I'll consider it a personal insult that you degraded your education when I was trying to provide you with practice at being a genuine intellectual. This is not a rule that it is acceptable to break.

Cheating on tests—for instance, by looking at someone else's paper or looking at your notes—is also completely unacceptable. Don't do it, not even just a little bit in the spur of the moment. Go out of your way to not be tempted and to not tempt anyone else. If you do cheat on a test, you will be punished as per university policy (see Catalog).

**Paper Assignments:** *Information that applies to both papers*

Each paper will be 1000 words. Figures, tables, and literature cited are not included in your word count. You must meaningfully cite and discuss at least three journal articles from real biological journals (not internet hearsay). They should all be scholarly works, such as original research or critical reviews. Journals that I recommend are:

Evolution  
Proceedings of the Royal Society of London, Series B  
Trends in Ecology and Evolution  
Annual Review of Ecology, Evolution and Systematics  
American Naturalist (but be careful – some articles may be mathematical)  
Journal of Evolutionary Biology (not in our library)

You may also be led to journals that are dedicated to particular groups of organisms, like Journal of Mammalogy, Annals of the Entomological Society of America, American Journal of Botany, the Bryologist.

In the text of your paper, cite your sources as the author's name and the date (Wilson 1995; Wilson and Thomson 1996). Give the full citation at the end your paper in a "Literature Cited" section using the following format:

Wilson P, Thomson JD. 1996. How do flowers diverge? Pp. 88-111 *in* D. Lloyd and S. C. H. Barrett (eds.). *Floral biology*. Chapman & Hall, New York.  
Wilson P. 1995. Selection for pollination success and the mechanical fit of *Impatiens* flowers around bumble bee bodies. *Biological Journal of the Linnaean Society* 55: 355-383.

Your paper is a mini-review or essay. It probably will not have the standard sections (Materials and Methods, Results, etc.). You do not have to have sections at all, though you may, in which case you would use section headings that are useful to you.

If you feel shaky on grammar, review my grammar rules at [www.csun.edu/~hcbio028/322.html](http://www.csun.edu/~hcbio028/322.html). Be sure to put the “s” on the end of “species”, to italicize species names, and to use scientific names as proper names without “the”. Aim at making every word the best one. Technical methods should be kept to a minimum: you need not explain how to do multiple regression, just say Grant et al. regressed survivorship on beak length, beak depth, and beak width; you need not explain how to do starch gel electrophoresis, just say variation in allozymes is shown in Figure 1. Strive to have a lucid flow of logic with every detail making sense. Edit. Edit. Edit.

*Paper 1 - Due 25 October*

Evolutionary biologists often study the selection regime and other factors responsible for the evolutionary dynamics in some sort of character in the researcher's favorite group of organisms. Examples include:

the evolution of heterostylous flowers  
the evolution of viviparous reptiles  
the evolution of host specialization in folivorous beetles  
the evolution of hummingbird pollination  
the evolution of the annual life history in plants  
the evolution of extended seed dormancy

the evolution of hibernation in arctic-alpine mammals  
the evolution of selfing in flowers  
the evolution of light-colored pelage on the bellies of mammals  
the evolution of mimicry coloration on the wings of butterflies  
the evolution of the reparatory system in diving mammals and birds  
the evolution of sclerophyllous leaves in arid-land shrubs

And the list could go on for pages. Look for three scientific articles on some such thing. At least one should have original data, but they all may. One or two could be scholarly review papers or chapters in scholarly books. Once you find one article that is really appropriate, it will cite others of interest.

Relate adaptive hypotheses, results, and suggested tests about your topic. Be very explicit about how you suppose natural selection acts; make the reader understand the nature of selection in your system. I will be looking out for the DO-S and DON'T-S of posing ultimate explanations, which I will lecture about on October 6th. Be very careful to only break my rules if you expressly mean to do so. After posing the hypothesis or hypotheses, tell how they have been tested, and if the tests have not been extensive suggest further tests that might be done.

### *Paper 2 - Due 6 December*

Evolutionary biology is often divided into two parts: the study of natural selection with other processes that act within populations and the study of speciation with other processes that effect the diversity of life. A similar but not exactly equivalent dichotomy would be between microevolution and macroevolution. The reason why it is not an exact equivalent is because macroevolution connotes the gross-scale pageant of life. Speciation seems right at the boundary between micro- and macroevolution. In Paper 1, you wrote about adaptation. You may have dealt with several species or a phylogeny as a means of statistical replication, but according to the assignment the differences between the species were not the focus of attention. Now for Paper 2, I want you to work on explaining the origin of diversity. It should be a paper about how diversification occurs. You may write about any of the following:

the origin of reproductive isolating barriers  
the role of diversifying selection  
character displacement  
host shifts  
pollinator shifts  
coadapted gene complexes  
macromutations that kick off evolution to an alternative niche  
the role of sexual selection in speciation  
the role of climate change in causing geographic isolation  
genetic correlations (pleiotropy) causing speciation

Or you may write about any other factor that plays a role in evolutionary diversification. Many of these evolutionary mechanisms involve natural selection but they all involve something more than *just* vanilla-flavored natural selection. Write about that thing that is something more.

You'll need to do this in the context of a particular type of organism. You are allowed to end up writing about any kind of organism (yuccas, song birds, weevils, cichlid fishes, moon jellies, whatever). However, it is likely you'll need to explain how the biology of that kind of organism interacts with your mechanism-of-diversification. What does the organism bring to the evolutionary process? In other words, how might prior evolutionary innovations have affected subsequent diversification? This could be a secondary topic in your paper that you should not shy away from.

The paper is supposed to be on evolutionary mechanisms leading to diversification. One danger to be wary of is that there are a huge number of papers on the patterns of diversification (“Phylogenetic reconstruction of the Abcaceae?”). Don’t waste a lot of time trying to read these articles, at least not until your paper is well on its way to being written and you’re just trying to look up some background information. Many phylogeny articles don’t have much on evolutionary processes, and I want you to write about the processes, only using patterns as evidence and as background. Make sure your paper is about processes. How did your species come to be different and distinct? All the old rules apply. Edit it down to about 1000 words.