Advanced Evolutionary Biology
BSC5675 Sec 01
Fall 2014
MWF 9:05-9:55
King 1058
David Houle

The course gives a quantitative introduction to population genetic, quantitative genetic, and optimality or phenotypic approaches to the study of evolution. The format of the course will be lectures and discussions, plus sessions where students will work through the assigned problems after they are handed in. The best way to learn the quantitative and analytical skills necessary for research in evolutionary biology today is to use them, so students will be assigned problem sets to develop these skills. I will de-emphasize phylogenetic, comparative and macroevolutionary approaches, as these are covered in Dr. Steppan's macroevolution course. The topics covered will include:
Population Genetics: Natural selection as a process, ecological models of selection, estimating natural selection on genotypes, mutation, gene flow, balance of evolutionary forces, neutral theory, coalescents, levels of selection.
Quantitative genetics: Selection at multiple loci, the quantitative genetic model, response to selection, estimation of quantitative parameters, multivariate selection response, QTL studies in evolutionary biology, maintenance of genetic variation, the genomic challenge.
Phenotypic studies: Optimality models, detecting departures from expectations, models of adaptation, constraints and how to detect them, relationship of population-level processes to macroevolution.

Text: Charlesworth, B., and D. Charlesworth. 2010. Elements of Evolutionary Genetics. Roberts and Company, Greenwood Village, Colorado. It is listed on the publisher's web site (http://www.roberts-publishers.com/) at 20% off, or $80.00, and is slightly more on Amazon.com. There are also a few used copies available. A useful book for those with particular interest in quantitative genetics is Falconer, D. S., and T. F. C. Mackay. 1996. Introduction to Quantitative Genetics. Addison Wesley Longman, Essex. This book is NOT required, but is a useful, basic reference to some of the material covered.

Course web site: I will furnish most materials and information about the course through a Blackboard web site**.** A pdf version of the lecture notes will be posted on this site after every lecture, so you can think in class, rather than just copy things down.

Location: The class will meet mostly in King 1058, a computer lab. We will occasionally be displaced to inferior quarters. Part of the course will be exploring basic programming in R and use of Maple mathematical software.

COURSE WORK

Students will be required to complete problem sets and present problems sets, participate in class discussion, write a proposal for research on an evolutionary topic of your choice, and to evaluate the proposals of two other students.

Reading: Readings in the course textbook and classic and current papers will be assigned. These will help you gain a familiarity with the issues and approaches taken to the study of evolution, and help you to solve problem sets, and to motivate your research proposals. In addition, your problem presentation will be informed by these readings, and your participation grade will reflect this.

Problem sets*:* Problem sets will come in two flavors 'Group' and 'Individual.' For group problem sets, I encourage you to work together on them in groups, although you may work on your own if you wish to. Students can learn a great deal by pooling their knowledge. This is the way that much science is done as well. For each problem, you may either sign on to a solution with other students (if you are satisfied that it is correct) with all signers sharing in the grade on that problem, or submit your own solution. Unfortunately, groups sometimes get on the wrong track, so be sure to question the apparently confident ones among you. When you have doubts about the wisdom of a solution promulgated by one of your partners, work out your own solution, and hand it in too.

The down-side of group work is that one can miss out on key concepts if one is not diligent. After each problem set, I will call on members of the class to present their solution to the problems at the board, so you will need to be on top of whatever your group did to solve each problem. In addition, on the two individual problem sets, I will ask you NOT to work together, and for each student to hand in their own version. These are primarily intended as a way for me to judge the variance in knowledge among students.

Grading: In problem sets, I will look both for the correct answer and for evidence of the process by which you arrived at that answer. Nearly complete credit will be given if your approach is sound, even if the answer is in some way incorrect. The lowest score you receive on a problem set will be dropped in calculating your final grade. A part of your grade will also be whether you are prepared to present a problem when I call on you.

Paper: The paper for this course will take the form of a Doctoral Dissertation Improvement Grant proposal to the US National Science Foundation for novel work in evolutionary biology. For instructions on the format of the proposal, see the links at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5234
This may be on any subject in evolution that you choose (maybe a potential thesis topic?), and need not be limited to material covered in this course. The only exception to this is that it should be a piece of work that is new to you, or a substantial advance over a paper on a similar topic, and not just a minor revision of something you have already written. A successful proposal reviews the background of the area of study, then proposes novel work that extends our knowledge in some important way. It is important to convince your readers that your approach is practical as well as interesting. I have furnished example NSF proposals by FSU faculty (see the Resources section of the course web site) to give you a sense of the standard to shoot for. You should be sure to look at these as you begin to shape your project.

For first year students, I encourage you to abstract a two-page version of your project, and use it to apply to the Graduate Research Fellowship Program http://www.nsfgrfp.org/ by November 4, 2014. More senior students are ineligible for this program. If you are a student who has already advanced to candidacy, you can actually apply for the Doctoral Dissertation Improvement Grant, and this year's deadline is Oct. 9.

You should plan your proposal to connect with and take on large issues in evolutionary biology. A proposal for work on the foraging of squirrels would not be successful if the rationale you present is that we don't know enough about squirrels. It might very well be successful if it tests a particular theory about foraging, or gains knowledge about an understudied behavior known to be widespread, etc. Similarly, you should plan a program of experiments that will justify funding over several years. Of course, it is also a mistake to claim that one will suddenly solve mysteries of the universe when this is not justified. My experience with unsuccessful student proposals is that they are more likely to be small, safe projects of little general interest than overly ambitious ones. Note the NSF length limits and format restrictions on these proposals. Staying within strict limits is all part of the game.

Each student should pick a topic early in the term, and discuss it with me. An electronic copy of your proposal will be due in mid-October.

You will receive comments on your papers from me, as well as from three other students in the class. Each student will therefore read the proposals of three other students, and submit a page or two of written comments to the author, through me. I will read your comments, and then pass them on anonymously to the paper's author, unless I judge them to be unfair to the author. These reviews should identify both positive and negative aspects of the proposed work, and recommend ways to improve the proposal. If a proposal is bad, I expect you to say so, but in a way that is helpful, not insulting. Similarly, unstinting praise of a good proposal is not much help. Explain your reasoning, suggest alternative approaches, etc.

Normally in science one would revise a proposal in light of any comments they receive, and you should read the comments in this vein. I will not ask you to actually do this, but imagine what you would do if you were actually going to submit it. A hard thing to deal with in science is criticism. If you reread your proposal carefully, you will often find that, even if the exact criticism leveled against your proposal is mistaken, the way you presented the material left you open to it.

Grading: I will look for originality, evidence of critical thinking, mastery of the appropriate background, appropriate connections between the background and your project, a good experimental plan and the clarity of your presentation. I also expect the proposed work to be practical to perform, and to be capable of producing the answers you claim for it. The work proposed should have a good shot at yielding a real advance in some area of evolutionary biology.

Your reviews will be graded on how constructive they are, and the care with which you have read the proposal.

I expect all both your proposal and reviews to be clearly written and minimize continuity, grammatical and spelling mistakes. Nothing turns a reviewer off faster than a lack of attention to these details! Sloppiness will be reflected in your grade.

Late work: Graduate student schedules are often complex, so I will be happy to grant extensions if arranged in advance. For problem sets if no extension is arranged I will take off 10% of your grade if I do not receive it by the time I start grading. After I have handed back the problem set, I will not grade late papers at all.

Final grade: Overall, the grade will weight your work as follows:

Group problem sets	41%
Individual problem sets	15%
Discussion/Problem presentation	10%
DDIG proposal	25%
Comments on three grant proposals	9%

Graduate School grade standards: It is very important to realize that the standard for grading at the graduate level is different from that at the undergraduate level. At FSU, a grade of C is frequently given in undergraduate courses, and is considered enough to pass the course. At the graduate level, a grade of C is a failing grade, and only grades of B- and above are passing. You must maintain a GPA of 3.0 (B) or better to continue as a graduate student. Students in our program have ended up on academic probation by getting just one C and some Bs in their first semester. The result is that they must then usually take additional courses and do well in them to restore their academic standing. Please don't let this happen to you!

To prevent this happening, I have two tips that together should go a long way towards ensuring a passing grade:

Talk talk talk. Whenever you are uncertain you understand the material, talk to somebody about it. Ask questions in class, discuss things with your fellow students, and finally come and see me to clear up problems - and come early. Yes, I am busy, but don't be shy. My job is teaching you in this course. Take advantage!

Hand in your work on time, or arrange for exceptions in advance.

Getting help

My office is King 4063, E-mail dhoule@bio.fsu.edu, Phone 645-0388. Initially, my office hours will be after class. I will arrange another time once I know your schedules. I will also be happy to arrange another meeting time with you. Alternatively, when my door is open, you are welcome to come in and speak with me.

Please help each other out! With the exception of the individual problem sets, I encourage you to work together on everything in this course, even if you are not in the same group. The more feedback you get on your proposal, the better it will be in the end.

Honor Code

- I expect you to be familiar with and adhere to the university's academic honor code as described in the FSU Student Handbook. Any claim of ignorance of the honor code is unacceptable. The Academic Honor System of The Florida State University is based on the premise that each student has the responsibility to:

- Uphold the highest standards of academic integrity in the student's own work,
- Refuse to tolerate violations of academic integrity in the University community, and
- Foster a high sense of integrity and social responsibility on the part of the University community.

The full Academic Honor Code is linked to the online syllabus.

The most likely academic honesty issue that may arise in this class is plagiarism. Plagiarism is when you present the work of another person as your own. If you are in any doubt about what constitutes plagiarism, please discuss this with me before handing in your work. Plagiarism is a very, very serious offense in academia. If I discover plagiarism in your work, your grade on that assignment will be drastically reduced, perhaps even to 0, and I reserve the right to assign a failing grade in the course solely because of plagiarism.