Plant Biology/iBio 849, Evolutionary Biology, Spring 2021
Detailed Syllabus: Basic concepts in microevolution

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https://msu.zoom.us/j/94937752126

Meeting ID: 949 3775 2126; Passcode: 954191 (longer Zoom invite at end of this doc)

Jan 19	Introduction, Brief History	Futuyma 2009 chapter 1
Jan 21	Hardy-Weinberg, Inbreeding	Conner and Hartl ch. 1&2 (skim pp. 13-22); Problem 2.3
Jan 26	Changes in allele frequencies	Conner and Hartl pp. 47-77; Problems 3.5, 3.7a
Jan 28	Discussion	Hori 1993; Barrett et al. 2008
Feb 2	Population genetics synthesis	Conner and Hartl pp. 77-89
Feb 4	Discussion	Taylor et al. 1995; Eckert et al. 1996
Feb 9	Genetic variance, GxE, Local adaptation	Conner and Hartl 97-150; 163-170 optional Problems 4.3 and 5.1
Feb 11	Discussion	Wiggins 1989; Kruuk et al. 2000
Feb 16	Correlations among traits, Natural selection on phenotypes	Conner and Hartl 150-163; 189-218 Problems 6.3 and 6.4
Feb 18	Discussion	Grafen 1988; Brodie 1992
Feb 23	Response to selection, QTL mapping	Conner and Hartl 170-180; 216-224 Problems 5.4a&b; 6.2
Feb 25	Discussion	Berenbaum et al. 1986; Bradshaw et al. 1995
Mar 4	Evolution and Development	Futuyma 2009 Chapter 21
Mar 9	Discussion	Nijhout and Emlen 1998; Shapiro et al. 2004

Text: Conner, J. K. and D. L. Hartl. 2004. *A Primer of Ecological Genetics*. Sinauer Associates, Sunderland, MA. Email Jeff if you can't get access to this, as this part of the class is based on it. Outdated? Yes and no – the book focuses on concepts, which haven't changed, but certainly there are new techniques to address these concepts that aren't included. There is almost nothing in the book that is no longer true (please let me know if you find something!), except for a few things about techniques. Page 22 says we can't use sequencing for studying genetic variation within populations, but now sequencing is now how population genetics is done. Skim the sections on older techniques, but this material is still useful for reading older papers.

Grading: 50% Class assignments

All assignments and readings (except the text) will be on D2L, and all assignments are handed in and handed back using D2L. For each Tuesday class you need to submit one question about something you didn't understand in the readings for that day; these are due by 9PM the night before and are worth 2 points each. I won't answer or hand these back, but you should ask these questions if that topic comes up in class, and I will use some of them for discussion.

Tuesdays will be semi-flipped; all the concepts I want you to know are in the reading, and class time is to clarify/solidify the most important of these using active learning as well as my .pptx. I will frequently pose questions on the readings to the class; please answer using private chat to me in Zoom. I will allow time for folks like me that need more time to think, and this will also give us a range of independent answers without the first one altering subsequent responses. I will also use polls, which will always be anonymous; note that none of your grade is determined by in class participation, but your ability to do the Thursday assignments should be improved by your engagement on Tuesdays.

Thursdays are discussions of two papers that focus on the key concepts for that week. On most Thursdays there will be an assignment of one question to answer briefly (one paragraph) for each paper, worth 7 points. While not required, I strongly encourage you to **work on these in pairs**; if you do, both members of the pair hand in the same exact .docx on D2L with both names in the filename.docx. If you are having trouble finding a partner, email me and I will try to play matchmaker. Thursday assignments should be MS Word.docx, **12-point font, 1 inch margins minimum, and one-page total maximum** (you should be able to answer the questions very well with less than one page). **Please be support your points with actual data from the papers (not just what the authors claim), and be very specific about where the data you are citing is coming from in the paper, e.g. what table or figure the data or results were actually in.**

The **problems assigned from the book are not to be handed in** (answers are on D2L), but should help you understand the material better. In the same vein, the readings questions on D2L are designed to guide your reading, and usually our class discussions will use them, so try to answer them as you read.

The assignment points are all of equal weight, and will be summed for the 50% of your grade from my part of the class. Note that this course is certainly graded on a curve, so any given percentage right or wrong does not translate into a particular grade. We give mostly 3.5 and 4.0 grades in this course; typically the only people that get 3.0 are those that don't hand in assignments or miss class frequently.

The **readings** are chosen to illustrate key concepts for each topic, without introducing concepts that have not been covered; thus, many are not current, but they are not outdated, and they are carefully chosen to support the learning objectives of the class. They do build through the class, so that later papers add new concepts while also addressing previous ones, to build integration of the concepts. These points are also true for the textbook, including the examples.

Barrett, R. D. H., S. M. Rogers, and D. Schluter. 2008. Natural selection on a major armor gene in threespine stickleback. Science 322:255-257.

Berenbaum, M. R., A. R. Zangerl, and J. K. Nitao. 1986. Constraints on chemical coevolution: Wild parsnips and the parsnip webworm. Evolution 40:1215-1228.

Bradshaw, H. D., Jr., S. M. Wilbert, K. G. Otto, and D. W. Schemske. 1995. Genetic mapping of floral traits associated with reproductive isolation in monkeyflowers (*Mimulus*). Nature 376:762-765.

Brodie, E. D., III. 1992. Correlational selection for color pattern and antipredator behavior in the garter snake *Thamnophis ordinoides*. Evolution 46:1284-1298.

Eckert, C. G., D. Manicacci, and S. Barrett. 1996. Genetic drift and founder effect in native versus introducted populations of an invading plant, *Lythrum salicaria* (Lythraceae). Evolution 50:1512-1519.

Futuyma, D. J. 2009. Evolution. Sinauer, Sunderland, MA.

Grafen, A. 1988. On the uses of data on lifetime reproductive success. Pp. 454-471 *in* T. H. Clutton-Brock, ed. Reproductive Success. University of Chicago Press, Chicago.

Hafner, M. S., P. D. Sudman, F. X. Villablanca, T. A. Spradling, J. W. Demastes, and S. A. Nadler. 1994. Disparate rates of molecular evolution in cospeciating hosts and parasites. Science 265:1087-1090.

Hartl, D. L. 2000. A Primer of Population Genetics. Sinauer, Sunderland, MA.

Hori, M. 1993. Frequency-dependent natural selection in the handedness of scale-eating cichlid fish. Science 260:216-219.

Kruuk, L. E. B., T. H. Clutton-Brock, J. Slate, J. M. Pemberton, S. Brotherstone, and F. E. Guinness. 2000. Heritability of fitness in a wild mammal population. Proc. Natl. Acad. Sci. U. S. A. 97:698-703.

Natarajan, C., F. G. Hoffmann, R. E. Weber, A. Fago, C. C. Witt, and J. F. Storz. 2016. Predictable convergence in hemoglobin function has unpredictable molecular underpinnings. Science 354:336-339.

Nijhout, H. F., and D. J. Emlen. 1998. Competition among body parts in the development and evolution of insect morphology. Proc. Natl. Acad. Sci. U. S. A. 95:3685-3689.

Shapiro, M. D., M. E. Marks, C. L. Peichel, B. K. Blackman, K. S. Nereng, B. Jonsson, D. Schluter, and D. M. Kingsley. 2004. Genetic and developmental basis of evolutionary pelvic reduction in threespine sticklebacks. Nature 428:717-723.

Taylor, M. F. J., Y. Shen, and M. E. Kreitman. 1995. A population genetic test of selection at the molecular level. Science 270:1497-1499.

Wiggins, D. A. 1989. Heritability of body size in cross-fostered tree swallow broods. Evolution 43:1808-1811.

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