BZ 346 POPULATION AND EVOLUTIONARY GENETICS
Fall 2007

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Office hours:

- TBA

Lecture: Tuesday / Thursday 11:00 – 12:15 PM; 214 Yates Hall

Required Text:
Hedrick, P.W. (2004) Genetics of Populations, 3rd Ed., Jones and Bartlett Publishers, Sudbury, MA

ALSO: You will need to have access to a computer with Microsoft Excel and with the ability to run Windows applications. The Biology Department has a large number of PC's in the computer lab in room E-100.

RamCT: All course materials, other than your text book, are being provided to you via RamCT. If you have any questions about access, please ask me.

Course Description

This is an introduction to population genetics, the branch of evolutionary biology that concerns the distribution of genes in space, and how that arrangement is changed through time by natural selection, mutation, genetic drift, and migration. Population geneticists worry about the rules that govern the transmission of heritable variation between generations, between populations, and even between genomes. This includes understanding how lineages change (or remain the same) and a general feeling for the history of life. Some see population genetics as the core discipline in evolutionary biology because changes in the genetic composition of populations provide the basis for all other evolutionary change within lineages.

There are two aspects of this course that sometimes cause students problems.

1. Geneticists think differently than most other biologists (and most other human beings, for that matter). They think about how progeny of two different parents might turn out, how genes are arranged on chromosomes, what's expressed, and what controls expression. Population geneticists are even worse. They like to explain things that we can see easily, like phenotypic variation, using abstractions like additive genetic variance (which no one can actually see, but can you *feel* it?). By the time you finish this course, you will not only have had a good review of basic Mendelian genetics (and even a little bit of molecular genetics), you'll be familiar with a bunch of new genetic concepts and you will be able to feel the stream of life's history pulsing under your fingertips, much like feeling your own heart beat.
2. Population genetics involves a fair amount of mathematics. That's because the key to population genetics and evolution is variation, which is measured in terms of gene and

genotype frequencies in populations. The phenomena of Mendelian genetics are themselves inherently statistical, thus it should not be surprising that when we apply these principles to a whole population, the problems become even more mathematically involved.

That's the bad news. The good news is that the math we need is (mostly) quite simple: some basic algebra, some probability theory, and a little calculus. When we need things that are more advanced, I'll explain them in class. The other good news is that I expect that you've lost previous familiarity with genetics, so we'll be doing all the genetics from scratch. The last bit of good news is that I'll try to emphasize how to apply the basic principles of population genetics, not the math involved in deriving those principles. We will be making some use of computers and statistical methods for analysis of data encountered in population genetics. So if you haven't had a statistics course before (or even if you have), you're going to be learning some statistical principles that you're likely to find useful in many other applications. (As an aside, the field of statistics was partly invented by Sir Ronald Fisher, who was a geneticist trying to understand the properties of genes in populations).

The problem sets and exams in this class will evaluate your ability to *use* the principles and methods, not your ability to derive them.

Grading:

Two preliminary exams	50 (each)
Cumulative final exam	80
Problem sets	120 (total)
Total:	**300 points**

A	=	greater than 90%;	**Absolutely great**, the zenith!
B	=	between 80% and 89.9%;	**Beautiful**, you can be proud of yourself!
C	=	between 70% and 79.9%;	**Crummy**, mediocre at best.
D	=	between 60% and 69.9%;	**Desecration**, you've embarrassed yourself!
F	=	less than 60%;	**Fulmination**! (if your life is in shambles, spare no time or expense in finding out who failed to step forward and take responsibility).

Problem sets:

There will be 13 problem sets for you to complete. These problems will be examples to work through, and will be similar to some exam questions. These are to be turned by 5 PM on Tuesdays. You may work in groups to complete problem sets, but remember that each of you is individually responsible for knowing the material for the exams. Also, please use your own words. If I find exact replicas of answers on several students' papers, they will be returned without a grade. To allow for missed problem sets for various reasons that are likely to arise, the lowest score among the 13 problem sets will be automatically dropped.

Lecture/Reading Schedule (I reserve the right to change this whenever I wish! I'll let you know in class how we're doing!).

Week 1 (Aug 21):	Introduction: Genetic variation and genomes (Chapter 1, Antolin and Black 2007), some aspects of distributions. **[problem set 1 due Thursday]**
Week 2 (Aug 28):	Hardy-Weinberg Principle and the genetics of populations (Chapter 2) **[problem set 2 due]**
Week 3 (Sept 4):	Measuring genetic variation with molecular markers (Chapter 1, pp 27-58 **[problem set 3 due]**
Week 4 (Sept 11):	Mutation (Chapter 7, pp 357-367) **[problem set 4 due]**
Week 5 (Sept 18):	Population genetics and molecular methods (Chapter 3, 4) **[problem set 5 due]**
Week 6 (Sept 25):	Fitness and adaptation (Chapter 4, pp 173-176) **FIRST EXAM Sept 27 (on material from August 21 – September 25)**
Week 7 (Oct 2):	Natural selection: single-locus models of large populations **[problem set 6 due]**
Week 8 (Oct 9):	More natural selection: various forms of balancing selection **[problem set 7 due]**
Week 9 (Oct 16):	Frequency-dependent selection, sexual selection (Chapter 4, pp 221-227) **[problem set 8 due]**
Week 10 (Oct 23):	Finite populations: inbreeding and genetic drift (Chapter 5, 6) **[problem set 9 due]**
Week 11 (Oct 30):	More inbreeding, including pedigrees, Kin selection **[problem set 10 due]**
Week 12 (Nov 6):	Finite populations: effective population size and selection (Chapter 6) **SECOND EXAM Nov 8 (on material from October 2 – November 6)**
Week 13 (Nov 13):	Gene flow and population structure (Chapter 9) [**problem set 11 due]**
November 19-23	Thanksgiving Break
Week 14 (Nov 27):	Selection, inbreeding, and migration **[problem set 12 due]**
Week 15: (Dec 4):	Neutral theory of molecular evolution **[problem set 13 due]**

FINAL EXAM: **Monday, Dec. 10, 3:40-5:40p**