Spring 2012 BIOL 327: Evolutionary Genetics and Genomics

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Overview and Goals

The completion of the first organismal genomes and recent rapid advances in sequencing and other genomic technologies have transformed the field of evolutionary genetics, allowing us to answers to long-standing questions, while opening up entirely new avenues of inquiry. The primary goals of this course are:

- to explore the questions and topics of evolutionary genetics, both from a contemporary and historical perspective.
- to appreciate how the tools of genomics are being applied to gain new insights into evolutionary questions.
- to develop the ability to read, discuss, and write about scientific papers from the primary literature.

Course Description

The content of the course will primarily consist of readings from the primary literature, including both classic papers from evolutionary genetics and modern applications of those ideas to genomic data. Topics covered will include the roles of selection and drift in molecular evolution and population genetics, the evolution of gene expression, genomic approaches to the study of quantitative variation, the evolutionary history of humans, and its relevance to the study of human disease.

This will be a seminar style class, with most of the class time spent on discussions, with short lectures to introduce new topics and give background information as necessary. One discussion each week will be led by a student or group of students. Three times during the semester, we will break from our routine to have a class debate on some of the more controversial topics in the evolutionary genetics. At the end of the course, you will write a final paper reviewing a topic in evolutionary genetics and genomics of your choice.

Prerequisites

Two quarters of BIOL 110-133, and either BIOL 201 (Genetics), BIOL 236 (Evolution), or permission of the instructor.

Meeting Time and Location

Tuesday and Thursday, 11:15AM-12:45PM
227 Park Science Center

Office Hours and Contact info

Tuesday & Thursday 2–3:30PM, and by appointment.

Feel free to email me any time I will generally answer emails fairly quickly during the day, but less quickly in the evenings and weekends (possibly not until the next day).

Readings

There is no textbook for the class; all reading will come from the primary literature. Two to three papers will be posted on Moodle for each week's discussions, along with topics for the weekly summary paper.

The following books will be placed on reserve in Collier Science Library, and may be helpful for additional background:
A Primer of Population Genetics Hartl, DL.
Molecular Evolution Li, W-H

Evaluation and Grading

Weekly responses (10).....15%
Position papers (3).....15%
Class presentations (3).....15%
Review paper 30%
Class Participation.....25%

Weekly responses

Before the Thursday class each week, you will write a single page (~300 word) response to the question or topic posted on Moodle, using information from the week's readings. *No late papers will be accepted*.

Position papers

On debate weeks, instead of the standard weekly response, you will submit a 3 page (~1000 word) paper, due the day of the debate, that lays out the argument for your side. Your paper should include clear statements about how readings for the week support your argument, and you are encouraged to include additional references that you find useful to support your cause.

Class presentations

The second class of most weeks will be a paper discussion led by a group of students (group size will depend on the number of students enrolled). The students will begin with a short presentation summarizing the paper and relevant background, then lead the class for questions and discussion. On days that you are presenting, you are expected to have clear mastery of the paper content; if you are confused or uncertain of your understanding, you should arrange to meet with me at least **24 hours** before class. *Do not wait until the night before to read the paper!*

Review Paper

The final project for the class will be a 5-7 page (1500-2000 word) paper on a topic of your choice. This will be in the format of a literature review, and should reference at least five experimental papers from the primary literature (not other reviews). This should not be a simple summary of the papers, but should include your own thoughts and judgements about the papers you cite, along with your thoughts on possible future experiments. I will meet with each of you near the middle of the semester to discuss your topic and the papers you have chosen to use in your review.

Accommodations

Students who think they may need accommodations in this course due to the impact of a learning, physical, or psychological disability are encouraged to meet with me privately early in the semester to discuss their concerns. Students should also contact Stephanie Bell, Coordinator

of Access Services (610-526-7351 or sbell@brynmawr.edu), as soon as possible, to verify their eligibility for reasonable academic accommodations. Early contact will help to avoid unnecessary inconvenience and delays.

Tentative Schedule

(Reading list is not final: see Moodle for updates and paper downloads)

Week	Dates	Topic	Reading
1	Jan 17 19	Introduction	Darwin 1859, Chapter IV
2	Jan 24 26	Natural selection	Grant & Grant 2002 Blount, Borland & Lenski 2008
3	Jan 31 Feb 2	Molecular evolution	Kimura & Ohta 1974 Turner, Chuong & Hoekstra 2008
4	Feb 7 9	The Neutral Theory of Molecular Evolution	Kimura 1968 Fay, Wycoff & Wu 2002
5	Feb 14 16	More on the neutral theory **Debate**: Are there neutral mutations?	Kreitman 1996 Hahn 2008 Fay 2011
6	Feb 21 23	Human Evolution	Cann *et al.* 1987 Green *et al.* 2010
7	Feb 28 Mar 1	Human Variation **Guest lecturer Mar 1**: Sarah Tishkoff	Sabeti *et al.* 2007 Tishkoff 2007
8	Mar 13 15	Population Differentiation & Local Adaptation	Begun and Aquadro 1993 Yi *et al.* 2010
9	Mar 20 22	Genomics of human disease **Debate**: Where are the disease alleles?	Reich and Lander 2001 Zhu 2010
10	Mar 27 29	Gene Duplication	Lynch & Conery 2000 Nehrt *et al.* 2011
11	Apr 3 5	Whole Genome Duplications	Lynch & Conery 2003 Semom & Wolfe 2007
12	Apr 10 12	QTL Mapping and GWAS	Lander & Botstein 1989 Colosimo *et al.* 2004
13	Apr 17 19	Evolution of Gene Expression	Brem et al. 2002 Khaitovich *et al.* 2006
14	Apr 24 26	Evolution of Development **Debate**: Structure or regulation?	King & Wilson 1975 Hoekstra & Coyne 2007