UNIVERSITY OF CALIFORNIA, MERCED
ES / QSB XXX: Ecological Genetics (3 units) – Syllabus
Fall 2018

Class Meeting Time: M 9:30-11:50 AM
Location: COB2 265

Instructor: Professor Jason Sexton (jsexton2@ucmerced.edu)
Science and Engineering Bldg. 1, Rm. 231; Office Phone: (209) 228-2426
Office hours: TBD

I. Course Description

This course reviews theory and experimental methods in quantitative genetics and molecular ecology to infer ecological, evolutionary, and genetic processes. Topic areas include natural selection and biological adaptation, the analysis of quantitative traits, landscape genetics—including estimating gene flow and population size—inferring past processes—from bottlenecks to radiations—and conservation genetics among other topics. The course includes a review of techniques to generate genetic and genomic data, from DNA extraction to PCR, to types of genetic markers, to DNA fragment and whole-genome sequencing methods. Topics covered include common methods for analyzing datasets, genetic diversity statistics, assessing population genetic structure, inferring past population processes by using coalescent theory, Bayesian inference, graph theory, and other methods. The course utilizes directed readings and discussion of classical and current literature in ecological genetics. Students are expected to have completed college-level courses in ecology and evolution before taking this course. *Normal Letter Grade only.*

Some Suggested Books: *Ecological Genetics*, Andrew Lowe, Stephen Harris, and Paul Ashton; A *Primer of Ecological Genetics*, Jeffrey Conner, Daniel Hartl; *Genetics and Analysis of Quantitative Traits*, Michael Lynch and Bruce Walsh; *Population Genetics*, John Gillespie; *Introduction to Quantitative Genetics*, D. Falconer and Trudy Mackay; *An Introduction to Ecological Genomics*, Nico van Straalen and Dick Roelofs.

II. Course Goals and Outcomes:

a. ***Course Goals:***

- Critically read and discuss both classical studies and contemporary hot topics in ecological genetics
- Develop an appreciation of how classical studies have influenced current thinking
- Develop the skills for writing an excellent research proposal incorporating ecological genetics
- Improve communication skills when discussing scientific concepts

b. ***Learning Outcomes:*** At the end of the course, students should be able to:

- Name the researcher(s), cite the publication, and explain the general objectives/hypotheses and conclusions in several classical and contemporary papers in ecological genetics. Clearly articulate the contributions of these

studies to the advancement of the field (ES PLOs 1, 2; QSB PLOs 1, 4).
- Identify a research topic in need of study in ecological genetics, conduct a thorough literature search, formulate and describe research questions, objectives, and hypotheses, and write a clear, ethical, and compelling research proposal (ES PLOs 1, 2, 3; QSB PLOs 1, 2, 4, 5).
- Communicate orally about complex ecological and evolutionary information with clarity of thought and be able to support and defend positions on concepts, methods, interpretations, and inferences made in ecological genetics (ES PLOs 1, 2; QSB PLOs 1, 3, 4, 5).

c. ***Relation to Program Learning Outcomes:*** The course supports program learning outcomes (PLOs) of the Environmental Systems and Quantitative and Systems Biology graduate programs at UC Merced. Relevant PLOs for each graduate program are listed below.

- ***ES PLOs addressed (paraphrased below):***
    1. Core Knowledge - Students will be knowledgeable, skillful and self-directed in the observation and analysis of environments systems in terms of their capacity to independently identify important research questions, formulate experimental plans, data analysis and formulation of conclusions in the context of a thesis or dissertation.
    2. Communication Skills - Students will be adept at oral, written and visual communication of research results to peers and non-technical decision makers.
    3. Ethics, Community, and Life-long Learning - Students will understand the importance of research and professional ethics, engagement in the needs of their community and life-long learning.
- ***QSB PLOs:***
    1. Knowledge and understanding of quantitative (statistical, computational, and model-dependent) and high-throughput experimental systems approaches to biological problems, and demonstrated ability to conceive, plan, execute and/or interpret the applications of these approaches to research questions.
    2. Knowledge and understanding of ethical standards in proposing and executing professional scientific research.
    3. Ability to effectively assist in the teaching of science in a classroom environment, and engage in effective communication of original and existing scientific inquiry and results orally and in writing.
    4. Ability to undertake and demonstrate original graduate-level scholarship in specialized areas of biology, including integrative command of historical and current literature and broader scientific context, and identification of open research problems.
    5. Ability to propose and defend a feasible research plan to apply scientific techniques to open research problems and execute, complete and defend original research that advances scientific knowledge.

d. Format and Procedures:

Each class period, the instructor will introduce a new topic in ecological genetics and we will discuss several thematic papers. During the first half of the course the instructor will select classic papers to be discussed from the primary literature. During the second half of the course, the students will also select papers to be discussed from contemporary studies within various sub-disciplines of current interest.

Students will be required to have read the papers thoroughly before each class. Two students will be in charge of leading the discussion of the papers for each class period. Facilitators are encouraged to meet with the instructor to discuss the readings prior to their assigned week. Each student will be required to facilitate two or more class periods depending on course enrollments.

By the fourth week of the course, students will need to have selected a topic for their research proposal; all proposals must be approved by the instructor.

III. Course Requirements & Grading Procedures:

a. ***Class Attendance and Participation Policy***:

Given that this course is based on discussion, attendance is mandatory. Missing more than three classes during the semester without a written medical excuse or without prior instructor approval will result in a decrease in one letter grade for the course. If more than six classes are missed, the student's grade will be lowered by two letter grades. A student that misses more than nine classes will be given a grade of "F."

Class participation accounts for 30% of the student's final grade in the course. Participation will be evaluated by: 1) how well the student directs the discussion when they are presenting a paper to the class; and 2) the quality of the comments and questions posed to the discussion leader and other discussion participants when the student is not leading the discussion (i.e., comments that clearly indicate that the student has read the papers and prepared for the discussion).

b. Course Assignments and Projects:

Late assignments (i.e., the research proposal) will not be accepted.

The student's final grade in this course will be based on their combined performance in two separate areas: class participation, which includes leading at least two class discussions (the exact number depends on the size of the class), and a research proposal. Exactly how the student leads a class discussion is up to her or him; however, the discussion leader is expected to engage the rest of the class in the topic. The research proposal can be on any topic in the field of ecological genetics. The target length for the proposal should be 15 double-spaced (12-point font) pages, not including references.

Format of these proposals should follow actual proposal call guidelines, which students can model based on their grant program of choice.

Students will be encouraged to use this course as a real exercise in preparing proposals related to their dissertation or thesis.

c. ***Grading***:

Class Participation:	30%
Proposal:	70%

Grades will be given using the approximate framework: A: 90 - 100%, B: 80 - 90%, C: 70 - 80%, D: 60 - 70%, F < 60%.

IV. Academic Integrity

The following is a generic commentary on Academic Integrity. Not all of these points are applicable to this course.

Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty.

a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy (http://studentlife.ucmerced.edu/what-we-do/student-judicial-affairs/academicy-honesty-policy). Any work submitted by a student in this course for academic credit will be the student's own work.

b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.

c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

d. Examples of academic dishonesty include:

- receiving or providing unauthorized assistance on examinations
- using unauthorized materials during an examination
- plagiarism - using materials from sources without citations

- altering an exam and submitting it for re-grading
- fabricating data or references
- using false excuses to obtain extensions of time or to skip coursework

e. The ultimate success of a code of academic conduct depends largely on the degree to which the students fulfill their responsibilities towards academic integrity. These responsibilities include:

- Be honest at all times.
- Act fairly toward others. For example, do not disrupt or seek an unfair advantage over others by cheating, or by talking or allowing eyes to wander during exams.
- Take group as well as individual responsibility for honorable behavior. Collectively, as well as individually, make every effort to prevent and avoid academic misconduct, and report acts of misconduct which you witness.
- Do not submit the same work in more than one class. Unless otherwise specified by the instructor, all work submitted to fulfill course requirements must be work done by the student specifically for that course. This means that work submitted for one course cannot be used to satisfy requirements of another course unless the student obtains permission from the instructor.
- Unless permitted by the instructor, do not work with others on graded coursework, including in class and take-home tests, papers, or homework assignments. When an instructor specifically informs students that they may collaborate on work required for a course, the extent of the collaboration must not exceed the limits set by the instructor.
- Know what plagiarism is and take steps to avoid it. When using the words or ideas of another, even if paraphrased in your own words, you must cite your source. Students who are confused about whether a particular act constitutes plagiarism should consult the instructor who gave the assignment.
- Know the rules --- ignorance is no defense. Those who violate campus rules regarding academic misconduct are subject to disciplinary sanctions, including suspension and dismissal.

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

The instructor will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please speak with the instructor during the first week of class regarding any

potential academic adjustments or accommodations that may arise due to religious beliefs during this term.

V. Tentative Course Schedule

See the following pages for an example course schedule.

Course Schedule [from Fall 2015]
(Lecture and discussion topics and dates subject to change)

Date	Day	Topic	Plan/Readings
		****QUANTITATIVE GENETICS****	
26 Aug	W	Syllabus/class introductions	
31 Aug	**M**	***No class***	***No class***
2 Sep	W	Introduction to Ecological Genetics /Summary of Class Interests	
7 Sep	**M**	***Labor Day – no class***	***Labor Day – no class***
9 Sep	W	Mazer Discussion	Sent by Susan Mazer
14 Sep	M	Intro Concepts Continued	
16 Sep	W	Adaptation to Climate and History of Adaptation and Speciation Views	Davis et al. 2005; Lowry 2012; led by XX and XX
21 Sep	M	***No class***	
23 Sep	W	*Sara Bisbing guest discussion on landscape genomics!*	Kort et al. 2014; Sork et al. 2013
28 Sep	M	Understanding Evolution: Mutation, Migration, Drift, Selection; **Proposal topics due**	Connor and Hartl 2004
30 Sep	W	Discussion	Schemske and Bierzychudek 2007; Hoekstra et al. 2004; led by XX and XX
5 Oct	**M**	***Sarah Brown!***	Brown et al. 2013
7 Oct	W	Drift, Selection	Connor and Hartl 2004
12 Oct	M	Q-genetics: Heritability and Continuous Traits	Agrawal et al. 2002; Connor and Hartl 2004
14 Oct	W	Student-chosen Discussion Papers	Ashman and Majetic 2006; led by XX and XX
19 Oct	M	Q-genetics: Plasticity, G X E, Correlated Traits, QTL Mapping	Mckay and Latta 2001; Peichel et al. 2001; Bradshaw and Schemske 2003; Ghalambor et al. 2007
21 Oct	W	Student-chosen Discussion Papers	led by XX and XX
		****POPULATION GENETICS****	

Date	Day	Topic	Plan/Readings
26 Oct	M	Markers for Ecological Genetics	Pearse and Crandall 2004; Anne 2006
28 Oct	W	Student-chosen Discussion Papers	led by XX and XX
2 Nov	M	Genetic Diversity, Differentiation, and Distance	Hamrick and Godt 1996;
4 Nov	W	Student-chosen Discussion Papers	led by XX and XX
9 Nov	M	Gene Flow	TBD
11 Nov	**W**	***Veterans Day – no class***	***Veterans Day – no class***
16 Nov	M	Phylogenetics and Phylogeography	TBD
18 Nov	W	Student-chosen Discussion Papers	led by XX and XX
		****ECOLOGICAL GENOMICS****	
23 Nov	M	Genomics Terminology; Case Studies	TBD
25 Nov	**W**	***Non-Instruction Day – no class***	***Non-Instruction Day – no class***
30 Nov	M	Stress, Variation, and Adaptation Genomics with **Molly Stephens!**	Franks and Hoffmann 2012; Savolainen et al. 2013
2 Dec	W	Student-chosen Discussion Papers	led by XX and XX
7 Dec	**M**	Community Genomics with **Dana Carper! PROPOSALS DUE**	**TBD**
9 Dec	W	Last class - Student-chosen Discussion Papers	led by XX and XX