THE DROSOPHILA MODEL SYSTEM
ECOL/MCB 451/551
SPRING 2008

Website: **http://www.eebweb.arizona.edu/courses/ecol451_551/**

Dr. Therese A. Markow
Phone: 621-3323
Office: Bio Sciences West 416
Office Hours: TR 11:00am-12:30pm (or by appointment)
Email: tmarkow@arl.arizona.edu

Dr. Carlos A. Machado
Phone: 626-8155
Office: Bio Sciences West 320
Office Hours: TR 3:00-4:00pm (or by appointment)
Email: cmachado@email.arizona.edu

Overall course objectives and expected learning outcomes

Research over the past century has established *Drosophila melanogaster* as the premier model system for understanding basic processes important to genetics, developmental biology, neurobiology, and medicine. However, this species is only a single member of a diverse genus known to contain approximately 2000 species. While *D. melanogaster* is an ecological generalist, other species in the genus have a diversity of different ecologies, having specialized on fruit, mushrooms, cacti, flowers, and even the excretory pores of land crabs. The genus *Drosophila* has proven itself as an unprecedented model for comparative experimental research with many species having been the focus of studies of genome evolution, morphological variation, physiological adaptation, behavioral evolution, ecological specialization, phylogenetic systematics, and species differentiation. In fact, no other group of organisms is characterized by such a well-defined phylogeny and an extensive literature on genetics, genome content, evolutionary history, ecology, and behavior.

In this course you will learn the most important aspects of what is currently known about the ecology, genetics and evolution of Drosophila. You will also learn basic and advanced concepts in basic and applied biology research that have been greatly influenced by research done in Drosophila. Finally, you will learn basic laboratory and field techniques used in Drosophila research, and will learn basic computer methods used in functional genomics research.

Course Overview

1. A historical overview of *Drosophila* genetic and evolutionary research
2. Phylogenetic relationships of *Drosophila* species (including an introduction to the use of different approaches to phylogenetic reconstruction), *Drosophila* systematics and identification (hands-on activity)
3. Polytene chromosomes and their uses (hands-on activity)

4. Ecology (field trip to desert and to baits)
5. Behavior: Non-reproductive behaviors like pupation site, photo and geotaxis (hands-on activity)
6. Behavior: Reproductive behavior (hands-on activity)
7. Speciation, sexual isolation, male sterility (hands-on activity)
8. Adaptation, quantitative genetics
9. Molecular evolution, population genetics (computer activity)
10. Genome projects (computer activity)
11. Genome evolution (computer activity)
12. *Drosophila* as a model for human disease (Guest speaker)
13. Transcriptome evolution, Functional genomics (computer activity)
14. Symbionts, parasites, parasitoids (hands-on activity)

Exams

There will be two exams (mid-term, final). The final exam will cover the second half of the course.

Readings

Each week one to three papers will be assigned for you to read and discuss during the class period. Participation in discussion of the papers will contribute to your grade for the course. We will assign one or two discussion leaders per week.

Readings will be posted online in the class website:
http://www.eebweb.arizona.edu/courses/ecol451_551/

Paper

A 10 page paper (18 pages for grad students) will be required, due by the last day of classes (one week before the final). The paper will be a review. We will provide a list of subjects you can choose from. You are also welcome to choose a subject you would rather write about.

Textbooks and Suggested reading

There is not a single text that covers all the subjects included in this course. Below is a list of useful books. Relevant articles for each of the topics will be made available as pdfs in the course website.

Ashburner, M. The Genetics and biology of Drosophila (3 volume series)
Coyne, J & Orr, HA (2004) *Speciation*. Sinauer Associates
Gibson, G. & Muse, S.V. (2002) A primer of genome science. Sinauer Associates
Markow, T.A., and O'Grady, P.M. 2006. Drosophila: A guide to species identification and use.
Li, W-H & Graur, D (1991) *Fundamentals of Molecular Evolution.* Sinauer Associates
Powell, J. (1996) Progress and prospects in evolutionary biology : the Drosophila model. Oxford University Press.

Grading

Your final grade will be determined by the percentage of the total number of points accumulated from the exams, quizzes, assignments, and class participation.

Undergraduates	**Points (and %)**
Mid-term exam	30
Final exam	30
Readings and discussion	20
Paper	20
Total	**100**

Graduate Students	**Points (and %)**
Mid-term exam	25
Final exam	25
Readings and discussion	20
Paper	30
Total	**100**

A: 90-100 %
B: 80-89 %
C: 70-79 %
D: 60-69 %
E (fail): 0-59 %

Students with Disabilities

If you anticipate the need for reasonable accommodations to meet the requirements of this course, you must register with the Disability Resource Center and request that the DRC send me official notification of your accommodation needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Classroom Behavior

From the Student Code of Conduct: "The educational process is ideally conducted in an environment that encourages reasoned discourse, intellectual honesty, openness to constructive change and respect for the rights of all individuals. Self discipline and a respect for the rights of others in the university community are necessary for the fulfillment of such goals." Please review this section of the Student Code of Conduct at
http://studpubs.web.arizona.edu/policies/studcofc.htm

"The University seeks to promote a safe environment where students and employees may participate in the educational process without compromising their health, safety or welfare." Please review the university's Policy on Threatening Behavior by Students at http://policy.web.arizona.edu/~policy/threaten.shtml.

Academic Integrity

From the Student Code of Conduct: "Integrity is expected of every student in all academic work. The guiding principle of academic integrity is that a student's submitted work must be the student's own." Please review this section of the Student Code of Conduct at http://studpubs.web.arizona.edu/policies/cacaint.htm.

Absence Policies

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.

ECOL/MCB 451/551: Tentative schedule for Spring 2008 (order or content of some lectures may change)

Date	Topic	Instructor	Activity	Reading/Resources
January 16	Introduction, overview	TAM, CAM		
January 23	History of *Drosophila* research	TAM	Paper discussions	Crow 1988 Wagner and Crow 2001
January 30	Evolutionary relationships of Drosophila	TAM, CAM S. Castrezana	Species identification and examination	Markow and O'Grady C1,2,3
February 6	Polytene chromosomes	TAM, L. Matzkin	Chromosome preparations	TBA
February 13	Ecology	TAM	Field collecting trip	TBA
February 20	Nonreproductive behavior, neurogenetics	TAM	Non-reproductive behaviors lab	TBA
February 27	Reproductive behavior	TAM	Reproductive behavior lab	TBA
March 5	Speciation	CAM	Paper discussion/hybrid male sperm observation	Coyne and Orr 1989, Orr 2005
March 12	**MIDTERM**			
March 19	**SPRING BREAK**			
March 26	Adaptation, Quantitative genetics	TAM	Paper discussion	ffrench-Constant et al 2004
April 2	Molecular evolution, Population genetics	CAM	Computer lab, paper discussion	Kreitman 1983
April 9	Genome projects	CAM	Computer lab, Homework	Adams 2000
April 16	Genome evolution	CAM	Computer lab, Homework	Zdobnov et al. 2002
April 23	Transcriptome evolution Functional genomics	CAM	Computer lab, paper discussion	Ranz and Machado 2006
April 30	Transposable elements, symbionts	TAM	Paper discussion	Lerman and Feder 2004
May 7	TBA	TBA	TBA	TBA
May 14	**FINAL EXAM**			