Bi610 Molecular Genetics, Fall 2016

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Course description

This course aims to teach you how to use genetic techniques to analyze gene function. We will illustrate the use of model organisms including yeast, *Caenorhabditis elegans* (worms), *Drosophila melanogaster* (flies) and mice. We will cover both forward genetics (function-driven gene discovery) and reverse genetics (gene-driven functional analysis).

Learning outcomes

By the end of this course, students will be able to:
1. design and interpret experiments that distinguish how DNA sequence variations affect proteins and thereby phenotypes
2. design forward genetic screens in yeast, worm, and fly
3. identify the DNA sequence changes responsible for the phenotypes of mutants identified in screens
4. understand approaches used to identify DNA sequences responsible for human traits
5. design reverse-engineered gene disruptions
6. design and interpret experiments that distinguish in which cells a gene is necessary or sufficient
7. use epistasis analysis, suppressors, and enhancers to define genetic pathways

In-class time

MW 11:00-12:20pm LSIB 217
F 11:00-11:50pm LSIB 217
Attendance on all three days is mandatory

Preparing for in-class time

You will spend most of your in-class time working through questions based on the reading that was assigned for that day. For a productive class session you MUST complete the reading beforehand! Many of the Monday/Wednesday readings are from the required textbook (*Genetic Analysis, 2nd edition* by Philip Meneely), but additional readings -- including primary papers for our Friday sessions -- will be posted on the course site within Canvas (https://canvas.uoregon.edu/).

Practice problems

You will learn best by working through problems. We will spend considerable in-class time in this pursuit. Additional problems will be posted on Canvas for you to work through on your own - they will not be graded (answer keys will eventually also be posted).

Mini research proposal

The ability to prepare thoughtful and well-crafted research proposals is key for success as an independent scientist. Many of you will prepare such proposals for Chem 610 next quarter, your qualifying exam in the second year, and for fellowship and grant

applications throughout your career. For this class, you will not prepare a full proposal. However, you will individually come up with a genetics-based project that follows from the paper you select to present (see below). You will outline the elements of a strong proposal in a 2-page document. Details will be provided midway through the course.

Student presentations
In groups of 2 or 3, you will give a 30 minute oral presentation on a research paper that makes extensive use of the genetic approaches we will have learned about in lecture and discussion. You will be expected to analyze the paper as though it is the result of research proposed in a grant proposal. I will provide more guidelines later. But do keep in mind that your mini research proposal will be expected to follow up (at least loosely) on the paper you choose to present.

Final grades
There will be one midterm exam and a final exam. All exams will be closed book.
Your final course grade will be calculated by:

Participation in class: 25%
Midterm: 20%
Mini research proposal 15%
Student presentation: 15%
Final exam: 25%

Course outline: Bi610 Fall 2016

Date	Topic	Before class, read:
M 9/26	1. What is modern genetics?	nothing!
W 9/28	2. Sources & types of mutation	Griffiths 452-456, 461-463.
F 9/30	Discussion 1 of ASSIGNED PAPER(s)	the directed mutation controversy
M 10/3	3. Functional consequences of mutations, part 1	Meneely, section 4.6, and p160-164
W 10/5	4. Functional consequences of mutations, part 2	
F 10/7	Discussion 2 of ASSIGNED PAPER(s)	Lou Gehrig's disease
M 10/10	5. Designing screens: overview	Meneely, sections 4.1-4.3, 4.5, and Chapter 7; Winston and Koshland Review
W 10/12	6. Designing screens: yeast	Model organism pdf, Art & Design of Genetic Screens: yeast
F 10/14	NO CLASS; (Work on/Read cumulative exam material)	
M 10/17	7. Designing screens: worm	Art & Design of Genetic Screens: worm

W 10/19	8. Designing screens: fly	Art & Design of Genetic Screens: fly
F 10/21	Discussion 4 of ASSIGNED PAPER(s)	worm screen paper
M 10/24	9. Identifying the causative mutation, part 1	Meneely, section 4.4 and chapter 5
W 10/26	10. Identifying the causative mutation, part 2	worm Piwi-piRNA screen
F 10/28	REVIEW FOR EXAM	your questions & problem set questions
M 10/31	**MIDTERM EXAM!**	
W 11/2	11. Identifying genes responsible for human variation	Meneely, chapters 8 & 9
F 11/4	Discussion 5 of ASSIGNED PAPER(s)	genome/exome sequencing
M 11/7	12. Reverse genetics	Meneely, Chapter 6 CRISPR review
W 11/9	13. Manipulating individual cells within a multicellular organism	Mosaic analysis reviews
F 11/11	Discussion 6 of ASSIGNED PAPER(s)	cell competition
M 11/14	14. Pathways: epistasis analysis	Meneely, Chapter 12
W 11/16	15. Pathways: suppressors	Meneely, sections 11.1-11.3
F 11/18	Discussion 7 of ASSIGNED PAPER(s)	Suppressors of Rett syndrome
M 11/21	16. Pathways: enhancers	Meneely, sections 11.4-11.5
W 11/23	optional REVIEW FOR EXAM	your questions & problem set questions
F 11/25	THANKSGIVING HOLIDAY	
M 11/28	**STUDENT PRESENTATIONS**	
W 11/30	**STUDENT PRESENTATIONS**	
F 12/2	**STUDENT PRESENTATIONS**	
M 12/5 10:15AM	**FINAL EXAM!**	
W 12/7 5:00PM	**MINI-PROPOSALS DUE!**	submit by email