Bi620 Molecular Genetics, Fall 2019

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Office hours: email me for an appointment!

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 Science Library B042
F 1:00-1:50pm Science Library B042
Attendance on all three days is mandatory

Preparing for in-class time (Science Library B042)

Mondays and Wednesdays 11:00-12:20pm: We will spend much of our in-class time working through questions based on the reading that was assigned for that day. For a productive class session, it is HELPFUL to complete the reading beforehand! Many of the Monday/Wednesday readings are from the required textbook (*Genetic Analysis, 2nd edition* by Philip Meneely). Additional readings will be posted on the course site within Canvas (https://canvas.uoregon.edu/).

Fridays 1:00-1:50pm: We will spend most Fridays discussing papers (shaded in the table below) that use techniques or approaches discussed earlier in the week. This will be a true discussion - I will not be giving a presentation. Instead, you should expect to answer and ask questions about the assigned paper. Clearly, you MUST complete the reading beforehand! These readings will be posted on the course site within Canvas (https://canvas.uoregon.edu/).

Practice problems
You will learn best by working through problems. In addition to in-class time, you should spend time on your own working through the problems posted on Canvas. These will not be graded - answer keys will also be posted separately

Mini research proposal
The ability to prepare thoughtful and well-crafted research proposals is key for success as an independent scientist. 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
You will each give a 15 minute oral presentation on a research paper that makes extensive use of the genetic approaches we will have learned about in lecture and discussion. I will provide more guidelines later. But 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:

Midterm: 20%
Mini research proposal 20%
Student presentation: 25%
Participation: 5%
Final exam: 30%

Academic Honesty
Academic dishonesty includes various forms of "cheating" and will not be tolerated. Academic dishonesty includes but is not limited to:

1. Copying another person's answers to exam and quiz questions.
2. Altering an exam for a regrade.
3. Copying problem set answers from other groups or Canvas Set answers from others.
4. Obtaining/distributing previous exams if those exams are not made available by the instructor to everyone in the class.
5. Submitting clicker questions for other students.
6. Misrepresenting circumstances leading to missed classes, exams, or quizzes.

All such activities will be reported to the Dean of Students office and will result in a failing grade in the class if academic dishonesty is confirmed. For further definitions of cheating and its penalties, consult the University of Oregon Student Conduct Code https://policies.uoregon.edu/vol-3-administration-student-affairs/ch-1-conduct/student-conduct-code.

Learning Environment
The University of Oregon and I are working to create inclusive learning environments. Please notify me if there are aspects of the instruction or design of this course that result in barriers to your participation. You may also wish to contact the UO Accessible Education Center in 164 Oregon Hall at 346-1155 or uoaec@uoregon.edu

Reporting
The instructor of this class is a Student-Directed Employee. As such, if you disclose to me, I will respond to you with respect and kindness. I will listen to you, and will be sensitive to your needs and desires. I will not judge you. I will support you. As part of that support, I will direct students who disclose sexual harassment or sexual violence to resources that can help. I will only report the information shared to the university administration when you as the student requests that the information be reported (unless someone is in imminent risk of serious harm or is a minor). Please note the difference between 'privacy' and 'confidentiality.' As a Student-Directed Employee I can offer privacy because I am not required to report certain information to the university. However, I cannot be bound by confidentiality in the same way that a counselor or attorney is. Confidential resources such as these means that information shared is protected by federal and state laws. Any information that I as a student-directed employee receive may still be accessed by university or court proceedings. This means, for example, that I could still be called as a witness or required to turn over any related documents or notes that I keep.

Please note also that I am required to report all other forms of prohibited discrimination or harassment to the university administration. Specific details about confidentiality of information and reporting obligations of employees can be found at titleix.uoregon.edu.

Class Courtesy
Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the quarter (or before) so that I may address you properly.

Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities. Classroom courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Our classroom is a learning environment, and as such should be a safe, inclusive and respectful place. Being respectful also includes using preferred pronouns for your classmates. Disrespecting fellow students as well as combative approaches, tones and/or actions are not acceptable. Please make me aware if there are classroom dynamics that impede your (or someone else's) full engagement.

Course outline: BI620 Fall 2019

Date	Topic	Before class, read:
W 10/2	1. What is modern genetics?	[in-class: Bill & Doug] [afterward: Meneely Chapter 1 if you need a brush-up]
F 10/4	No class	
M 10/7	No class	
W 10/9	2. Sources of mutation; functional consequences of DNA sequence changes	Griffiths 452-456, 461-463; Meneely, section 4.6, and p160-164
F 10/11	Discussion: Lou Gehrig's disease	Wong et al (1995)
M 10/14	3. Model Systems and designing screens: overview	Meneely, sections 4.1-4.3, 4.5, and Chapter 7
W 10/16	4. Designing screens: yeast	Forsburg review (2001); Giaever & Nislow review (2014)
F 10/18	Discussion: a yeast screen to identify genes that regulate aging	Kaeberlein et al (2005)
M 10/21	5. Designing screens: worm	Jorgensen & Mango review (2002)
W 10/23	6. Designing screens: fly	St Johnston review (2002)
F 10/25	Discussion: worm screen paper	Iannacone et al (2017); Huang et al (2017); Stavropoulos and Young (2011)
M 10/28	7. Identifying the causative mutation in a mutant (Part 1)	Meneely, section 4.4 and chapter 5
W 10/30	8. Identifying the causative mutation in a mutant (Part 2)	Meneely, section 4.4 and chapter 5

F 11/1	REVIEW FOR EXAM	your questions & problem set questions
M 11/4	**MIDTERM EXAM!**	in our Science library classroom
W 11/6	9. Identifying genes responsible for human variation	Meneely, chapters 8 & 9
F 11/8	Discussion: using genome/exome sequencing to identify human genes	Ng et al (2008) Roach et al (2010)
M 11/11	10. Reverse genetics	Meneely, Chapter 6 Hsu et al (2014)
W 11/13	11. Manipulating individual cells within a multicellular organism	Xu & Rubin review (2012) Lee & Luo review (2001) Yochem & Herman review (2003) Harno et al review (2013)
F 11/15	Discussion: cell-cell competition	Moreno and Basler (2004)
M 11/18	12. Pathways: epistasis analysis	Meneely, Chapter 12
W 11/20	13. Pathways: suppressors	Meneely, sections 11.1-11.3
F 11/22	Discussion: suppressors of Rett syndrome	Buchovecky et al (2013)
M 11/25	14. Pathways: enhancers	Meneely, sections 11.4-11.5; O'Neil et al (2017)
W 11/27	**STUDENT PRESENTATIONS**	
F 11/29	THANKSGIVING HOLIDAY	No class
M 12/2	**STUDENT PRESENTATIONS**	
W 12/4	**STUDENT PRESENTATIONS**	
F 12/6	**MINI-PROPOSALS DUE!**	MUST submit by email by 5:00pm!
R 12/12 10:15AM	**FINAL EXAM!**	