OEB 242: Population Genetics - Spring 2023
Syllabus, assignments, and course overview

Class Website: https://canvas.harvard.edu/courses/116288
Class place and time: MCZ101 Wed 3:00-5:45 EST

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Alief Moulana: By appointment (Please email both Shraddha & Alief!)

Required textbook: D. L. Hartl *Primer of Population Genetics and Genomics,* 4th edition. 2020. Oxford University Press, New York. ISBN: 978â€“0â€“19â€–886230â€–7 (paperback) or 978â€–0â€–19â€–886229â€–1 (hardbound).

Course Description

Mathematical theory, experimental data, and history of ideas in the field, including analytical methods to study genetic variation with applications to evolution, demographic history, agriculture, health, and disease. Includes lectures, problem sets, take-home exams, and (for graduate students) a short original research paper. *Emphasis is on engagement with the material by problem solving!*

Course Objectives

- To understand fundamental concepts in genetics and genomics
- To gain, enhance, and practice problem solving skills
- To relate concepts in genetics to social, political, and personal events and issues outside the classroom
- To understand the, sometimes fallible, practice of scientific inquiry

Course Structure and Expectations

Coursework in OEB242 consists of five components:

- Pre-class reading assignments from the textbook.
- Lectures classes filling in mathematical details and emphasizing the main points of the reading.
- Sections focused on problem-solving going through weekly problem sets.
- Two take-home exams, open book.
- For graduate students, a short (500 word maximum) commentary on a research paper related to course material.

Details are provided in the schedule below.

Course Policies and Expectations

This course requires engagement. The main reason for poor performance in OEB242 is lack of engagement. As a student, you are expected to do the pre-class reading assignments, to solve and turn in problem sets, and to attend lectures and problem-solving sections. We encourage group study and interaction outside class, but when it comes to exams and other individual assessments, we expect all students to adhere to Harvard's honor code (see below).

Course Materials and Readings

- The textbook is L. Hartl *Primer of Population Genetics and Genomics*, 4th edition. 2020. Oxford University Press, New York. ISBN: 978â€“0â€“19â€–886230â€–7 (paperback) or 978â€–0â€–19â€–886229â€–1 (hardbound)..

Assignments and Grading policy
Grading is based on a point score from 0 to 100. Each student enrolled in the course is automatically awarded 3 points and will have the opportunity to increase this to a maximum of 100 points for a final grade. The points will come from problem sets, take-home exams, and class participation. Graduate students are required to propose and write a written commentary on a research paper, which is graded pass/fail. The breakdown of the earned points is as follows:

Problem sets: 33 points
Lecture class participation (and commentary): 13 points
Section class participation: 11 points
Exam 1: 20 points
Exam 2: 20 points

Problem sets (33 points): There will be 11 problem sets, each worth 3 points.

Class attendance and participation (24 points): There will be 13 lecture classes (DH & MD) and 11 problem-solving sections (SL & AM). Participation in each is worth 1 point. The lectures and sections are organized as follows (times are approximate):

75 minutes - Lecture on material in Chapter (lecture notes will be posted online afterward)
15 minutes - BREAK
75 minutes â€“ Review of previous Problem Set.

Take Home Exams (20 points each): There will be two take-home exams. Each take home is worth 20 points for a total of 40 points towards the final grade. They are open book exams.

Take home exam 1 March 8 â€“ March 10
Take home 2 exam 2 April 26 â€“ April 28

Academic Integrity
Discussion and exchange of ideas are essential to academic work. We encourage students to form study groups, do practice problems together, review in-class problems together, and learn from each other as much as possible. **Take-home exams are open book, but collaboration is not allowed**. These exams are expected to be your own work. All participation is expected to be your own; it will be a breach of academic integrity to misrepresent yourself by impersonating another or to allow another to impersonate you. We expect adherence to Harvard's honor code, which reads as follows: "*Members of the Harvard College community commit themselves to producing academic work of integrity â€“ that is, work that adheres to the scholarly and intellectual standards of accurate attribution of sources, appropriate collection and use of data, and transparent acknowledgement of the contribution of others to their ideas, discoveries, interpretations, and conclusions. Cheating on exams or problem sets, plagiarizing or misrepresenting the ideas or language of someone else as oneâ€™s own, falsifying data, or any other instance of academic dishonesty violates the standards of our community, as well as the standards of the wider world of learning and affairs.*"

Accommodations for Students
Students needing academic adjustments or accommodations because of documented disabilities must present their Faculty Letter from the Accessible Education Office (AEO) to one of the faculty instructors by February 15. Failure to do so may result in the instructorsâ€™ inability to respond in a timely manner. All discussions will remain confidential between the instructors, students, and AEO.

Statement of Diversity, Inclusion, and Belonging
We believe academic strength derives from diversity of ideas, experiences, and perspectives. We acknowledge that the field of genetics has not always held these beliefs and has been historically built on a small subset of privileged (and sometimes racist and sexist) voices. As instructors, we strive to articulate how and where injustice was perpetuated by the field and to simultaneously give voice to a diversity of identities including women and people of color who have made significant contributions to the field.

Furthermore, we want to create a learning environment for students that supports diversity of thought and perspectives and honors your identities. As participants in the course, we expect that you will respectfully communicate, supportively collaborate, and actively listen. In case some of the material in class (or section) evokes strong emotions and responses, please be respectful of othersâ€™ reactions and mindful of your own. While we all try to be patient and courteous, unintended interpretations, and covert biases may lead to discomfort or offense. We believe mistakes and misinterpretations in speaking and listening deserve attention and, as instructors, are available to discuss and mediate difficult interactions. We strive for a more diverse and inclusive classroom environment; please contact us, as instructors, if there are ways in which you think we can improve our efforts in this course.

Problem sets: *There will be a problem set (PSet) almost every week.* ***PSets must be handed in and will be graded credit/no credit. PSets are due at the beginning of class on the same day as they are discussed; no credit if turned in late.*** *You may consult with your classmates, but make sure that you can work through the problems yourself.*

Paper (for graduate students only): *During the semester, each graduate student should review an original peer-reviewed research paper related to the material of the course, and prepare a short (400â€“500 word, maximum) "News & Views" style article written for a general audience introducing the topic, its background, importance, essential findings, and significance of these findings. You may discuss your chosen topic with your peers, but any written work you submit for evaluation must result from your own research and writing, reflect your own approach, and adhere to standard citation practices. Grading of the paper is SAT/UNSAT. The purpose of the paper is to give you a chance to look into some topic in PopGen in greater detail than we can cover in class.* ***A brief (50 word maximum) description of the subject and explanation of why it is important should be emailed to the TFs (please send to both) by 6 PM Wednesday Feb 22. Finished papers must be sent via email to the TFs (please send to both) by 6 PM Wednesday May 4 (end of reading period).***

Reading assignments. You are strongly encouraged to read prior to class time

Jan. 25:	Ch 1 Genetic polymorphisms & random mating part 1	pp. 1â€“28
Feb. 1:	Ch 2 Random mating part 2 & linked genes	pp. 28â€“42
Feb. 8:	Ch 3 Inbreeding and population structure	pp. 48â€“70
Feb. 15:	Ch 4 Mutation, gene conversion, and migration Part 1	pp. 75â€“94
Feb. 22:	Ch 4 Mutation, gene conversion, and migration Part 2	pp. 94â€“104
Mar. 1:	Ch 5 Natural selection in large populations	pp. 110â€“140
Mar. 8:	Ch 6: Random genetic drift in small populations	pp.147â€“173
Mar. 22:	Ch 7: Molecular population genetics Part 1	pp. 180â€“206
Mar. 29:	Ch 7: Molecular population genetics Part 2	pp. 206â€“216
Apr. 5:	Ch 8: Population genetics of complex traits	pp. 225â€“256
Apr. 12:	Ch 9: Complex traits in natural populations	pp. 263â€“278
Apr. 19:	Ch 9: Complex traits in natural populations	pp. 278â€“284
Apr. 26:	Ch 9: Complex traits in natural populations	pp. 278â€“284

Lecture schedule (3:00â€“4:15 PM) and availability of problem sets and take-home exams

Jan. 25:	Introduction, organization, and overview DH & MD	
Feb. 1:	Ch 1 Genetic polymorphisms & random mating part 1 DH	PSet 1
Feb. 8:	Ch 2 Random mating part 2 & linked genes DH	PSet 2
Feb. 15:	Ch 3 Inbreeding and population structure DH	PSet 3
Feb. 22:	Ch 4 Mutation, gene conversion, and migration Part 1 MD	PSet 4
Mar. 1:	Ch 4 Mutation, gene conversion, and migration Part 2 MD	No PSet 5
Mar. 8:	Ch 5 Natural selection in large populations MD	PSet 6 & Exam 1
	NOTE: Exam 1 does NOT include Chapter 5 or PSet 6	Exam 1 Key
	Exam 1 to be returned no later than 6 PM Friday March 12	
Mar. 22:	Ch 6: Random genetic drift in small populations MD	PSet 7
Mar. 29:	Ch 7: Molecular population genetics Part 1 MD	PSet 8 [Due 4/12]
Apr. 5:	Ch 7: Molecular population genetics Part 2 MD	[Combined w/above PSet]
Apr. 12:	Ch 8: Population genetics of complex traits Appendices DH	PSet 10
Apr. 19:	Ch 9: Complex traits in natural populations DH	PSet 11
Apr. 26:	(Notes included in April 19 handout)	Exam 2
	NOTE: Exam 2 focuses primarily on Chapters 5-9	Exam 2 Key
	Exam 2 to be returned no later than 6 PM Friday April 30	

Review and discussion of problem sets (4:30â€“5:45 PM)

Feb. 8: PSet 1 Key Genetic polymorphisms & random mating part 1 SL & AM
Feb. 15: PSet 2 Key Random mating part 2 & linked genes SL & AM
Feb. 22: PSet 3 Key Inbreeding and population structure SL & AM

Mar. 1: PSet 4 Key Mutation, gene conversion, and migration Part 1 SL & AM
Mar. 8: Some general problems of interest (No PSet 5 this year!) SL & AM
Mar. 22: Review Exam 1 and PSet 6 Key SL & AM
Mar. 29: PSet 7 Key Random genetic drift in small populations SL & AM
Apr. 5: Discussing methods from Prufer et al. 2017 (paper & SI; Slides)SL & AM
Apr. 12: PSet 8 Key Molecular population genetics Part 2 SL & AM
Apr. 19: PSet 10 Key Population genetics of complex traits SL & AM
Apr. 26: PSet 11 Key Complex traits in natural populations SL & AM

April 27-May 3 Reading period
May 4-May 13. Exam period

- **Email papers to BOTH TFs by 6 PM Wednesday May 4!**