

**EEB 135/c235: Population Genetics**  
Spring 2021  
Prof. Lohmueller

*“Nothing in biology makes sense except in the light of evolution.”*  
T.H. Dobzhansky, 1973

*“Nothing in evolution makes sense except in the light of population genetics.”*  
Michael Lynch, 2007

*“Nothing makes sense anymore.”*  
Kirk Lohmueller, 2020

**Course objectives:**

Through this course students will:

1. Gain an understanding of different types of genetic variation and how they can be studied.
2. Develop an appreciation of the different evolutionary forces, like mutation, migration, genetic drift, and natural selection and how they affect genetic variation.
3. Increase quantitative reasoning skills and be able to effectively use quantitative models to make predictions about patterns in data.
4. Be able to think critically about population genetic models and what happens when assumptions of models are violated.
5. Deepen understanding of human origins and genetic variation in different populations.

**Course description:**

Population genetics is the study of genetic variation in populations. It is at the intersection between molecular biology and genetics with population biology. Genetic variation is the raw material on which evolution can act. Thus, population genetics is central for understanding evolution and biology more generally. This course will introduce students to the basics of population genetics. We will study how genetic variation occurs and what happens to genetic variation once it is in a population. Throughout the course, we will use and derive quantitative models, both deterministic and stochastic, to understand different evolutionary forces. Additionally, we will use population genetic models to interpret modern genetic variation datasets. Lastly, we will discuss the genetic basis of complex traits and disease in humans.

## **Instructors:**

### **Dr. Kirk Lohmueller**

Office: Currently at home. Zoom Meeting ID: 771-430-457

**OHs: Friday 1:00pm-2:00-pm, Monday 2:00pm-3:00pm**

e-mail: klohmueller@ucla.edu (**Please put “EEB 135” or “EEB 235” in the subject line**)

### **Jesse Garcia**

Office hours location: Zoom Meeting ID: 936-267-5700

**OHs: Tuesday 11:00am-12:00pm**

e-mail: jessejgarcia562@ucla.edu (**Please put “EEB 135” or “EEB 235” in the subject line**)

### **Chris Kyriazis**

Office hours location: Zoom Meeting ID: 933-4771-0681, password: 464462

**OHs: Thursday 2:30pm-3:30pm or by appointment**

e-mail: ckyriazis@g.ucla.edu (**Please put “EEB 135” or “EEB 235” in the subject line**)

## **Course details:**

**Lecture:** Tuesday and Thursday 12:30pm-1:45pm on Zoom.

Zoom meeting ID: 175-974-068

Class will be held synchronously on Zoom during the times posted. However, lectures will be recorded and videos will be posted on CCLE after class. I will try to post slides at least the night before the lecture.

## **Discussion sections:**

**1A** Fri 8:00-8:50am, **1B** Fri 9:00-9:50am; Zoom Meeting IDs: Discussion A (941-4165 - 4604) and B (943-2323-3660); **Jesse Garcia**

**1C** Fri 11:00-11:50am, **1D** Fri 12:00-12:50pm; Zoom Meeting IDs: Discussion C (995-7087-3957, password: 168028) and D (960-9786-5324, password: 382929); **Chris Kyriazis**

**Final Exam and mid-term Exam:** The final exam and mid-term will consist of questions and problems that you will work on and turn in to us using Gradescope (see below for mechanics of this). The exam will be open book/open notes. You can collaborate with fellow students in the class. However, each student must write their answers in their own words and turn in their own assignments. Further, TAs and I will not provide help for the exam questions (we will for homework though!).

## **Suggested Text:**

Population Genetics by Matthew B Hamilton, 2009 edition

Note, this text is NOT required, but is suggested as a helpful resource.

**Other Useful texts:**

An Introduction to Population Genetics: Theory and Applications by Rasmus Nielsen and Montgomery Slatkin, 2013

Principles of Population Genetics by Dan Hartl and Andrew Clark, 2006

Molecular Population Genetics by Matthew Hahn, 2018

**Web Materials (this will have the pre-recorded lectures, assignments, slides, etc):**

Distributed via the UCLA CCLE system

<https://ccle.ucla.edu/course/view/20S-EEBIOLC135-1>

**Other Potentially Useful Websites:**

<https://qcbias.org/2016/09/21/population-genetics-undergrad-class/>

<https://qcbias.org/population-genetics-notes/>

**EEB 135 (Undergraduate student) Grading:**

Homework	200 pts
8 homeworks (with some extra credit)	
Midterm	100 pts
Final	100 pts
<b>Total</b>	<b>400 pts</b>

**EEB 235 (Graduate student) Grading:**

Homework	200 pts
8 homeworks (with extra questions)	
Midterm	100 pts
Journal Club participation	50 pts
Final	100 pts
<b>Total</b>	<b>450 pts</b>

**Re-grading policy:** If you find a mistake with a grade on an assignment, please return the assignment to the TAs or to me within three weeks after the assignment was handed back to you. Only exams or assignments completed in ink can be submitted for a re-grade. Midterms will only be re-graded if it may potentially affect your final grade. When you return the assignment, please write a short description of the error that was made in the original grade.

**Attendance:** We are in a very weird time right now. I know many of you probably have lots on your mind and many responsibilities beyond this course. Therefore, I do not have a strict attendance policy. Please do the best you can to attend online class and keep up with the material. Part of the reason for posting lectures on CCLE is to provide some flexibility for when you prepare for class. If you cannot make it to class, you will still have access to what was discussed.

Attendance at Discussion section is encouraged, but not required.

**Assignments:** One assignment will be given each Tuesday in lecture. It will be due one week later before lecture and should be turned in on Gradescope before the start of class. Gradescope can be accessed through CCLE and we will provide specific instructions on how to submit your work using Gradescope. Homework assignments and questions will be discussed during section as well as class time. You should try to do the homework questions prior to your section. You can work in groups, if you wish, but each person must individually write up and understand the material. If homework is late, the penalty will be 5% per assignment per day that it's late.

**Academic Integrity:**

It is my true goal to help you all do super-well in this course. I also recognize that life is crazy in ways that it has never been before. Thus, if you are having problems keeping up with the material, speak to me and/or the TAs. We will do our best to help you in this situation. Please do not cheat or engage in dishonest conduct. It is not worth it. Cheating has severe consequences. Please review the Dean of Student's Student Conduct Code (<https://www.deanofstudents.ucla.edu/Individual-Student-Code>).

**You are NOT permitted to post any of the assignments or course materials to Course Hero or any other websites outside of CCLE.**

**Course schedule:**

<b>Date</b>	<b>Topic</b>	<b>Suggested (not required) Reading from Hamilton 2009</b>
Tu, March 30	Introduction; Start allele and genotype frequencies	Chapt 1
Th, April 1	Allele and genotype frequencies & intro to inbreeding	Chapt 2, 9-28
Tu, April 6*	Finish Inbreeding	Chapt 2, 28-40
Th, April 8	Linkage and linkage disequilibrium	Chapt 2, 41-51
Tu, April 13*	Genetic drift	Chapt 3, 53-87 (skim diffusion sections)
Th, April 15	Coalescent theory and genealogies	Chapt 3, 87-103
Tu, April 20*	Coalescent and mutation	Chapt 5, 178-183
Th, April 22	Mutation	Chapt 5, 154-183
Tu, April 27*	Measures of population structure and gene flow	Chapt 4, 105-131
Th, April 29	Models of population structure	Chapt 4, 131-141
Tu, May 4*	Catch up/midterm review (pass out mid-term after class)	
Th, May 6	Midterm (no class)	
Tu, May 11	Natural Selection I (Mid-term due)	Chapt 6, 185-206
Th, May 13	Natural Selection II	Chapt 7, 208-221
Tu, May 18*	Natural selection III (drift & selection; multiple loci)	Chapt 7, 222-226; Chapt 5 164-166
Th, May 20	Selection & polymorphism I	Chapt 8, 265-277
Tu, May 25*	Selection & polymorphism II	
Th, May 27	Population genomics	
Tu, June 1*	Evolutionary quantitative genetics	Chapt 9
Th, June 3	Catch Up/Final Review	
Thursday (11:59PM PST), June 10	Final exam due	

\*Due date for homework assigned one week prior.