**Population Genomics**

BIOL ##L

Spring 2023

Professor Findley Finseth

ffinseth@kecksci.claremont.edu

**Class:** Tuesday & Thursday, 9:35-10:50

**Lab:** Thursday 1:15-5:15

**Office Hours:** TBA and by appointment

**Location:** TBD

**Overview:**

***Population Genomics*** applies large-scale genomic technologies in natural populations towards understanding evolution, demography, and health. With the advent of next-generation sequencing technologies, entire genomes can be sequenced with ease. The size of these datasets presents new opportunities for richer analyses of biological phenomena. However, the sheer volume of the datasets requires an understanding of data science principles to perform even simple analyses.

Students will gain an in-depth introduction to concepts in population genomics, as well as apply analytical and statistical methods towards problem-solving in population genomics. *Population Genomics* will have lectures, as well as computational labs conducted in R. This course is an upper-level biology lab course that counts towards the biology major and/or can serve as a data science capstone course.

**Course Goals:**

*Engage in observation-discovery and hypothesis-driven approaches to solve problems in population genomics.*

*Effectively communicate population genomics content, methods, and thinking.*

*Summarize key computational concepts and their applications in population genomics.*

*Apply statistical and data-analytical concepts to population genomics problems.*

*Design, execute, analyze, interpret, and communicate results from an extensive data-driven population genomics experiment that is related to a real-life problem.*

*Work collaboratively and in teams to design and implement solutions to problems in population genomics.*

*Learn to handle, manipulate, analyze, and visualize genome-scale data in R.*

*Explore the social and ethical responsibilities of a professional working in population genomics.*

**Format:**

This course has two lectures and one 4-hour lab each week. The course will be divided into ~ 1 topic per week. Each topic will often have: one lecture focusing on scientific concepts (usually Tuesdays), a weekly journal club (usually Thursdays), and a lab that allows for hands-on practice with population genomics. Most labs will be in R and will produce complete population genomics workflows using R Markdown. Occasionally, we will engage in wet labs related to the capstone project. Labs will involve data generation and collection, quality control, statistical analyses, and the output of publication-worthy figures. You will also have opportunity to perform a capstone project that uses population genomics to address a real-life problem. For this project, you will perform a sequencing project on a population of wild organisms from data generation through analysis and presentation.

**Textbook:**

A Primer of Molecular Population Genetics, Asher Cutter, Fourth Edition

Additional scientific articles will be assigned weekly.

**Flexibility:**

These are unprecedented, complicated times. If you need additional time, help, or other accommodations, please don't hesitate to ask. I will be generous with deadlines if you let me know **in advance** (or as soon after as possible) of due dates.

**Grading scale:**

Grading will be assigned as follows, and will only be adjusted to increase a student’s letter grade.

|  |  |
| --- | --- |
| 90-100%  | A, A- |
| 80-89.99% | B+, B, B- |
| 70-79.99% | C+, C, C- |
| 60-69.99% | D+, D, D- |
| <60%  | F |

**Point distribution:**

 Lab Assignments: 15%

 Problem Sets: 15%

 Population genomics capstone project: 25%

 Exam 1: 15%

 Exam 2: 15%

 Journal Club: 10%

Participation: 5%

***Lab assignments:***

Each lab will have an assignment due. These will usually take the form of worksheets and may be individual- or group- based. Some lab classes, the assignments will need to be completed as an “exit ticket”. For others, the assignments need to be completed as homework and will be due prior to the beginning of the next lab.

***Problem sets:***

There will be 6 problem sets throughout the course to practice population genetics problems. Your lowest problem set will be dropped, making each worth ~3% of your grade. You are encouraged to work in study groups on problem sets, but please write your answers in your own words. Problem sets are designed to help you study the material and work through conceptual issues without a time limit. Problem sets are due Thursday, at the beginning of class for the weeks posted on the schedule.

***Population Genomics Project:***

The course will culminate in student research projects where students design, execute, analyze, interpret, and present a population genomics experiment that has relevance for society. Students will develop a question based on a framework they will be introduced to in the lab. Students will then perform a sequencing project on a population of wild organisms from data generation through analysis and presentation. Lab projects will be highly collaborative and group work is encouraged. We will start with guided activities and build to you being the scientists by developing your own questions and analyses. These projects will be presented during the final lab section in a conference-style symposium. The project will also have written components due throughout the final module.

***Exams:***

There will be two exams. Exams will focus on the scientific principles covered in the course.

***Journal Clubs:***

Most weeks you will be expected to do assigned reading of one peer-reviewed scientific article. In order to have meaningful discussions, everyone will need to participate and engage, while being respectful of others. Readings will be accompanied by short assignments. We will use several different discussion formats during the class. For example, you may be given a short quiz, asked to present a topic, construct a one-slide response to a pre-assigned question, fill out a review rubric for a given paper, or evaluate the contributions of your peers to the discussion through peer review. As we gain skills in population genomics, you will practice writing abstracts or short critiques of papers we read later in the semester.

***Participation:***

Class participation points are awarded to encourage your active class participation and engagement. Participation will be assessed holistically by three self-assessments, as well as my input. Both frequency and quality of participation will factor into your score. Because the class may be interrupted due to COVID-related disruptions, there are numerous ways to participate. You do not need to do all of them to receive full credit. This includes:

* *Attending and engaging in class*
* *Participating in group discussions and journal clubs*
* *Participating in a lab group*
* *Spotlight Scientists*
* *Attending and engaging with office hours*

**Spotlight Scientists:** Science and society benefit greatly from a community that approaches problems from a variety of creative ways, with each scientist bringing their own unique background and experience to the table. Throughout the semester, we will hear stories related to topics covered in class from different scientists representing a range of identities. After listening, you will be asked to complete a short response and it will count towards your participation grade.

**Late work**

Assignments are expected to be turned in on time. However, I understand that situations beyond our control can sometimes cause delays. Therefore, each student is allowed two freebies, where they can turn assignments in up to three days late with no penalty. If you need to use a freebie, please alert me and I will mark it down. After your two freebies have been used, a grade penalty will apply for every 24 hours late (-10% day 1, -25% day 2, -50% day 3, no credit day 4+).

**Office hours and communication policy**:

I am happy to answer your questions or just talk during the scheduled office hours and by appointment. Office hours are a great chance to ask questions, discuss your grant ideas/frustrations, or just chat about things in the class you are finding interesting. Just stop by to hear what your colleagues are thinking about! Bring a friend in the class with you to ask questions as a group. At the beginning of the semester, we'll do a poll to find the most useful time for the scheduled office hours.

Please communicate with me via email. I will do my best to respond to you within 24 hours (weekdays), or by mid-day Monday if contacted over the weekend.

**Inclusivity and equity**

We aim to build a climate of inclusion, equity, and respect where we welcome the contributions of all students in order to build an effective learning space. We strive to establish an environment where every student can feel comfortable wrestling with new and challenging concepts. We also recognize that science is a human endeavor and is greatly improved by working collaboratively with scientists from diverse backgrounds and expertise. We do not tolerate acts of harassment or discrimination conducted by anyone. Please contact me and/or your college’s Dean of Students or Student Affairs Office if you have any concern.

**Disability accommodations:**

Students seeking to register to receive academic accommodations must first contact their home institution to formally establish accommodations. Once accommodations for this class have been formalized, it works best if we have an early-semester chat about ways to adjust the class to meet your needs (sign up via Calendly).

CMC: AccessibilityServices@cmc.edu

HMC: access@g.hmc.edu

Pitzer: gabriella\_tempestoso@pitzer.edu

Pomona: disability@pomona.edu

Claremont Graduate University: disabilityservices@cgu.edu

Keck Graduate Institute: student.accessibility@kgi.edu

**Academic honesty:**

Academic misconduct and dishonesty will not be tolerated, and violations will be reported to your Dean of Students. Please ask for an extension if you find yourself stressed and contemplating plagiarism – the college’s penalties are severe and I am bound to them, so please ask for help instead.