QBIO 401 Introduction to Computational Analysis of Biological Data
Units: 4
Fall 2023 Semester
Lecture: Mondays and Wednesdays, 2:00 – 3:20pm
Location: KAP 147
Discussion: Thursdays, 3:00 – 3:50pm (CPA 210) or Thursdays, 4:00 – 4:50 (CPA 255)

Instructor: Peter Calabrese
Office: RRI 404B
Office Hours: TBD,
        or by appointment
Contact Info: petercal@usc.edu, 213-740-2434
For office hours, I will be in my office and I will also be on Zoom (https://usc.zoom.us/j/4898518195). It is up to you if you want to meet in person or online.

Teaching Assistant: TBD
Office:
Office Hours:
Contact Info

This syllabus is prelimnary. I will issue an updated syllabus closer to the beginning of classes.

Course Description
This projects-based course is intended for students who are interested in computational biology. This course will integrate the biology, computer science, and statistics training in the QBIO major. We will do this by analyzing genomic datasets.

Learning Objectives
In lecture, students will be introduced to the general programming language Python (no prior knowledge of of this language is required). Students will use Python when doing weekly computing assignments and an end-of-the-semester project. There will be an emphasis on writing original code and not using off-the-shelf programs. In both the weekly assignments and the end-of-the-semester project, students will "get their hands dirty" by analyzing genomic datasets. The assignments and project will be based on topics covered in lecture. Topics will include: gene prediction, sequence alignment, phylogenetic trees, next generation sequencing, RNA-seq, multiple testing, dimension reduction, population genetics, GWAS, meta-genomics, structural biology, systems biology, and machine learning.

Prerequisite(s): none
Co-Requisite(s): none
Concurrent Enrollment: none
Recommended Preparation: There are no prerequisites or co-requisites for this course. Experience writing computer code (or a willingness to learn) will be helpful.

Course Notes
This course can be taken either for a letter grade or for credit/no credit. Homework assignments and lecture slides will be posted on Blackboard.

Technological Proficiency and Hardware/Software Required
Students will need access to a computer. It will be helpful (but not required) if students have a laptop that they can bring to class.

Required Readings and Supplementary Materials
There is no textbook for this course. Lectures will be supplemented by readings posted on Blackboard.

Description and Assessment of Assignments
There will be weekly computing assignments. There will be a take-home midterm exam. There will also be a project. Students will write the results of their project in a 3 to 5 page written report due at the end of the semester.

Grading Breakdown

Assessment Tool (assignments)	% of Grade	
Weekly computing assignments	70	
Mid-term take-home exam	15	
End-of-semester project and written report	15	

Assignment Submission Policy

Weekly computing assignments will be submitted on Blackboard due Wednesdays before midnight (California time). The project will be submitted on Blackboard by the end of the semester.

Grading Timeline

Assignments will be graded within one week of submission. Grades will be entered on Blackboard.

Additional Policies

Late assignments will not be accepted without prior approval. You can work together on the assignments (every student must submit their own assignment). The professor reserves the right to make changes to the syllabus; these changes will be announced as early as possible so that students can adjust their schedules.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings/Preparation	Deliverables
Week 1	Introduction to Python	Posted on Blackboard	(none)
Week 2	Gene Prediction	Posted on Blackboard	Assignment
Week 3	**Labor Day (no class)** Sequence Alignment	Posted on Blackboard	Assignment
Week 4	Phylogenetic Trees	Posted on Blackboard	Assignment
Week 5	Next Generation Sequencing	Posted on Blackboard	Assignment
Week 6	RNA-Seq	Posted on Blackboard	Assignment
Week 7	Multiple Testing Dimension Reduction	Posted on Blackboard	Assignment
Week 8	More advanced Python	Posted on Blackboard	Assignment
Week 9	Population Genetics GWAS	Posted on Blackboard	Mid-term Take-home Exam
Week 10	Meta-genomics	Posted on Blackboard	Assignment
Week 11	Machine Learning: Regression	Posted on Blackboard	Assignment
Week 12	Machine Learning: Classification	Posted on Blackboard	Assignment
Week 13	Machine Learning: Neural Networks	Posted on Blackboard	(none)
Week 14	Machine learning: Trees **Thanksgiving (no class)**	Posted on Blackboard	(none)
Week 15	Structural Biology (guest lecturer) Systems Biology (guest lecturer)	Posted on Blackboard	(none)
FINAL	Final Project and Written Report due Friday, Dec. 8		

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.