UC San Diego

BIMM 143: Bioinformatics Syllabus

Welcome to the Course

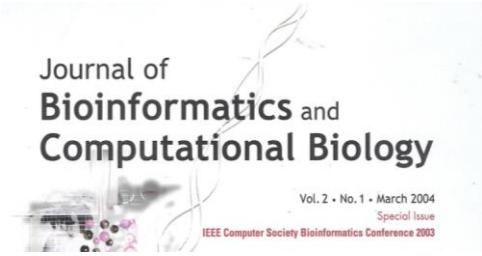
Course Information

Course Description	*This course is about learning to harness the power of computation to unlock the secrets of biology. We will cover fundamental computer science concepts and then apply those to 2 bioinformatics projects throughout the quarter. The course is project-based and will also require you to work in a team (or POD if you will). You will also get access to DataCamp, where you will get hands on practice with coding in either python or R.*
Credits	*4 credit hours*
Code of Conduct	*All material will be reviewed through Turn-it-in. While actual code can be copied and pasted from any source on the internet, sources must be referenced, and all comments in code must be your own. You will also be working in PODs during the course, please identify which PODmate contributed what to the joint notes on DataCamp and the Challenge Problem each week. If a PODmate gives you a lot of feedback on your project, please cite them as a source.*
Instructor	*Jamie Schiffer*
IA/TA	*Ugbad Farah & Kelly Flander*

Course Learning Outcomes

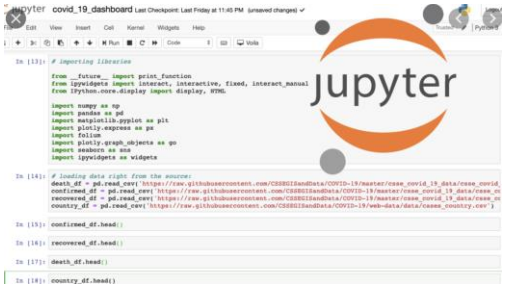
Upon completion of this course, you will be able to:

1. Create a video describing an example of how bioinformatics methods are useful for any application of interest (human health, agriculture, drug discovery, technology's impact on human health, etc.), and show an example of how this method works.



2. Examine and critique key literature in the field of bioinformatics .

3. Construct and present a Jupyter or R notebook that queries a database, cleans and analyzes the data from that database, and displays the data in a way that classmates can interpret to confirm or reject a scientific hypothesis.



Course Format

The format of the course is entirely online. Students are expected to:

- *Attend the lab-sessions on Mondays from 4:30-6PM*
- *Attend Challenge Problem Reviews on Wednesdays from 4:30-5:45 PM*
- *Attend meetings with your POD*
- *Engage in learning activities online.*

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Synchronous Lab Sections: Mondays 4:30-6 PM

Join Zoom Meeting: https://ucsd.zoom.us/j/92688804125

Where can you find the course: Canvas

Assignments, Projects, and Grading

The course is out of a total of 1000 points. Below is the breakdown:

- **Challenge Problems & Lab Assignments** – 300 points

Each week there will be video lectures with accompanying challenge assignments. There will be a total of 300 points of challenge problems/lecture video questions available.

- **DataCamp** – 100 points

For weeks 2-6 you will need to complete coding courses in DataCamp in R or python 20 points/course. For each course, you will upload your notes collated with your PODmates and answer some lab related coding questions on your own (or through collaboration with labmates). For a total of 25 points of EC you can do the other track & additional courses for 10 pts per course.

- **Project 1** – 350 points

Create a video about a scientific journal article and code that executes a specific bioinformatics method.

- **Project 2** – 250 points

Come up with a scientific question & hypothesis, that you can answer with a bioinformatics method, and write a jupyter or R notebook describing your project.

This Course Week by Week

Each week you will have to work on part of a project that will be due the following Monday, you will need to complete coding assignments in either Python or R due every Friday, and you will need complete a challenge problem with your PODmates due every Wednesday. For *extra credit*, you can earn an extra 25pts to your final grade if you complete both the Python Coding work and R Coding work, along with an extra challenge problem done in both languages.

Week	Python Coding Work Due Mondays	R Coding Work Due Mondays	Challenge Problem and Videos Due Wednesdays	Project Work Due (Fridays @12PM)
1/03-1/07 *One-on-one meetings*	Install Anaconda Navigator	Install R Studio		**Project 1A**: Choose an example from scientific media coverage of bioinformatics. (25 pts)
1/10-1/14	Introduction to Python –(20 pts)	Introduction to R (20 pts)	Reading Science (5 pts), Project 1D rubric (5 pts) & Introductory Videos (30 points) **Challenge Problem #1:**(15 pts)	
1/17-1/21	Intermediate	Intermediate	**Challenge Problem #2:**	**Project 1B:** Review

	Python (20 pts)	R (20 pts) -	Bioinformatics Databases & Working with Sequences (20 pts)	Article, Describe Figures, Present Code. (50 pts)
1/24-1/28	Streamlined Data Ingestion with Pandas (20 pts)	Introduction to Importing Data in R (20 pts)	**Challenge Problem #3:** From Dot Plots to BLAST (45 pts)	**Project 1C:** Draft 1 of video and Self-Assessment (50 pts)
1/31-2/4	Python Toolbox Part 1 (20 pts)	RNA seq with Bioconductor (20 points)		**Project 1D:** Final Draft of Bioinformatics Video (100 pts)
2/7-2/11			**Challenge Problem #4:** RNAseq analysis and differential RNA expression (40 pts)	**Project 1E:** Review your Peer's Project 1D (125 points)
2/14-2/18	Unsupervised Learning in python (20 pts)	Unsupervised learning in R (20 points)	**Challenge Problem #5:** Unsupervised Learning on Biopsy Data (40 pts)	**Project 2A:** Draft 1 of your scientific hypothesis that is something that can be researched with bioinformatics tools. (25 pts) – **Due 11/8**
2/21-2/25			Project 2 Example Review(15 pts) **Challenge Problem #6:** Proteomic Profiling & PCA (40 pts)	**Project 2B:** Upload refined hypothesis and annotated bibliography. (75 pts)
2/28-3/4			**GitHub & README files** (5 pts) and **Challenge Problem #7:** Searching the PDB and Viewing Protein Structures (30 pts)	**Project 2C:** Draft 1 of your Jupyter notebook and self-assessment. (50 pts)
3/7-3/11			**Exit Survey** (10 pts)	**Project 2D:** Final Draft of your jupyter notebook Upload to github and create your github page (100 pts)

1. Please read UC San Diego's Policy on Integrity of Scholarship and take the integrity pledge!

Course Materials and Tools

In this course, you will need to install Anaconda Navigator or R Studio on your computer.
What is Anaconda Navigator you ask? Here is what they say on their website:
Anaconda Navigator is a desktop graphical user interface (GUI) included in Anaconda® distribution that allows you to launch applications and easily manage conda packages, environments, and channels without using command-line commands. Navigator can search for packages on Anaconda.org or in a local Anaconda Repository. It is available for Windows, macOS, and Linux.
What is R Studio you ask? Here is what they say on their website:
An integrated development environment for R and Python, with a console, syntax-highlighting editor that supports direct code execution, and tools for plotting, history, debugging and workspace management.

Grading Procedure and Feedback

You all will be graded on an absolute scale. If everyone earns an A, we will be thrilled. Here is how many points account for different grades in this course

A+	*>1000*	*B-*	*795 – 824*
A	*925 – 1000*	*C+*	*765 – 794*
A-	*895 – 924*	*C*	*725 – 764*
B+	*865 – 894*	*C-*	*600 – 724*
B	*825 – 864*	*D*	*400 – 599*
		F	*< 399*

Entrance survey *is due January 3rd, PERIOD. This survey is going to be used to put you into your PODs and so it is critical that you finish it in the first week.*

Introductory Videos *can be completed anytime throughout the course, though it is highly recommended that you complete them in the first week. They are 35 pts to your grade.*

Your DATACAMP ***coding assignments*** *will be due every Monday at 12PM as a POD & graded for accuracy. Challenge Problems are due every Wednesday at 12PM as a POD and graded for effort. You can resubmit these assignments as many times as you'd like to earn a perfect score.*

Project 1A, 1B & 1D *are due at 12 PM on Friday in weeks 1, 3 and 5 respectively. Every day it is late, a total of 5 pts will be taken off from the final scores (out of 100 pts).*

Project 2D *is due at 12 PM on Friday or week 10. Every day it is late, a total of 20 pts will be taken off of the final score (out of 100 pts).*

Exit survey is due December 12th. If you choose not to do it you will not earn an easy 10 points. You can expect feedback & grade on each scaffold of your project a week after it's due date.

Instructional Team: Who Are My Instructors?

Instructor

I believe that online education can democratize learning for people of all socioeconomic and cultural backgrounds. While it requires instructors to be creative, online education opens up a world of possibilities for what students can achieve if they are given support and community.

Jamie Schiffer A computational chemist that works in the pharmaceutical industry. Before joining Pharma, she worked for Schrödinger, where she designed and created an online course in computational chemistry software. Her PhD thesis was focused on long-timescale dynamics of proteins and the role of protein motions on their function and ligand-binding. She has expertise in python, machine learning, virtual screening, and molecular dynamics.

Virtual Office Hours: Every Wednesday at 8 AM
Discussion section: Every Wednesday at 7 PM
Email: jmschiffer@ucsd.edu

Teaching Assistants

Ugbad Farah

Ugbad is a second year PhD student in Biological Sciences. She graduated from Cal State LA in 2020 with her Master's in Environmental Science and Sacramento State in 2017 with a B.S. in Biochemistry. Her current research interests include studying eco-evolutionary dynamics and issues related to sustainability.

Operating System: PC
Coding Language of Choice: R
DataCamp Review: Mon 5:15-6:00 PM

Virtual Office Hours: Mon/Fri TBD

Kelly Flanders

I am currently a fourth-year PhD student in the Division of Biological Sciences, where I am studying the ecological role of killer whales as marine predators. Previously, I completed my Master's degree in Marine Sciences from the University of New England in Maine. My project there focused on the diets of seals in Cape Cod by analyzing fish DNA in scat, and I relied heavily on bioinformatics to process genomic data.

Operating System: PC

Coding Language of Choice: R

Challenge Problem Review: Wed 5:15-6PM
Virtual Office Hours: Wed/Fri TBD

Resources for Support and Learning

There are a variety of resources available to students at UC San Diego, if you need help in any capacity during this difficult time, please reach out to any of the references below.

Support for Well-being and Inclusion	
Basic Needs at UCSD *Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live is encouraged to contact:* foodpantry@.ucsd.edu | basicneeds@ucsd.edu | (858) 246-2632 **Counseling and Psychological Services** *Confidential counseling and consultations for psychiatric service and mental health programming* **Triton Concern Line** *Report students of concern:* (858) 246-1111 **Office for Students with Disabilities (OSD)** *Supports students with disabilities and accessibility across campus*	**Community and Resource Centers** **Office of Equity, Diversity, and Inclusion** *As part of the Office of Equity, Diversity, and Inclusion the campus community centers provide programs and resources for students and contribute toward the evolution of a socially just campus* (858).822-.3542 | diversity@ucsd.edu **Get Involved** *Student organizations, clubs, service opportunities, and many other ways to connect with others on campus* **Undocumented Student Services** *Programs and services are designed to help students overcome obstacles that arise from their immigration status and support them through personal and academic excellence*

Campus and Course Policies

Course Policies

Health and Well-Being Statement

All students are deserving of a non-threatening and supportive classroom environment.

Subject to Change Policy

Information in the syllabus is subject to change should it improve the student experience and aid in student learning throughout the quarter.

Letter of Recommendation Policy

I am happy to write letters of recommendation for students that pass my courses. Please give me at least a month lead-time, and provide me with a CV or resume along with some bullet points about why you are interested in the position.

Campus Policies

Please see the below UC San Diego policies and statements:

- **UC San Diego Principles of Community**
- **UC San Diego Policy on Integrity of Scholarship**
- **Religious Accommodation**
- **Nondiscrimination and Harassment**
- **UC San Diego Student Conduct Code**