BIMM 143: Bioinformatics Syllabus

"Bill and I often have a fun debate about: If you could live anywhere in the world, where would you want to live? We also say: If you were entering any field now and you had your choice, what field would you go in? He and I both would go into the intersection of biology and computer science. When it comes to that field, we are only at the beginning."

- *Melinda Gates*

Welcome to the Course

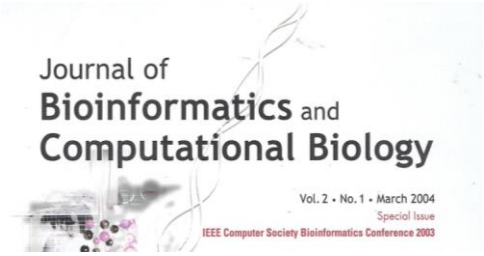
Course Information

Course Description	*This course is about how to harness the power of computation to unlock the secrets of biology. We will cover fundamental computer science concepts and then apply those to bioinformatics projects throughout the semester. The course is project-based and will also require you to work in a team (or pod if you will). You will be assigned to your pod by your instructor based on an entrance survey that is required for you to fill out.*
Credits	*4 credit hours*
Instructor	*Jamie Schiffer*
IA/TA	*Devon Birdseye, Sahana Kuthyar, Hanqing Zhao, & Kritin Karkare*

Course Learning Outcomes

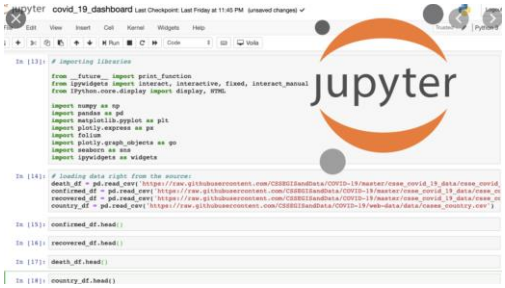
Upon completion of this course, you will be able to:

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 as part of a team.

3. Construct and present a Jupyter notebook that is capable of querying a bioinformatics database, cleaning and analyzing the data from that database, and displaying the data in a way that classmates can interpret and that answers a scientific hypothesis.



Course Format

The format of the course is entirely online. Students are expected to attend the first lecture of the quarter (the only "required" synchronous lecture), attend one discussion section a week (in your POD) engage in learning activities online, schedule and attend weekly sessions with their POD and IA/professor, and visit office hours.

Synchronous Online Discussion Sections:

Join Zoom Meeting
https://ucsd.zoom.us/j/98827317290?pwd=SkxPVkI4RzZZcGN4bG1TclkwNjhGdz09

Meeting ID: *988 2731 7290*
Password: *Python&R*

Asynchronous (Online) Course Elements:
Introductory Material, Projects, Example Projects and Coding Videos.

Where can you find the course: https://canvas.ucsd.edu/courses/24319

Login: UC San Diego Active Directory credentials

What is on Canvas?*: Assignment submissions, discussion forums weekly, Slides, Project Descriptions and video examples.*

This Course Week by Week

Each week you will have part of a project due, and you will need to complete coding assignments in either Python or R, and you will need to attend one of the discussion sections with your POD. To receive credit for the coding assignments, each week you will submit a 4-sentence reflection on the coding assignment in Canvas. For *extra credit*, you can earn an extra 25 pts to your final grade if you complete both the Python Coding work and R Coding work.

Week	Python Coding Work Due	R Coding Work Due	Project Work Due (Friday @12PM)
1	Introduction to DataCamp Projects Python (1 hr) & Install Anaconda Navigator	Introduction to the R (4 hours) & Install Anaconda Navigator	**Project 1**: Choose an example from scientific media coverage of how bioinformatics has been used to understand any real-world phenomenon. (20 pts)
2	Introduction to Python (4 hours)	Introduction to R (4 hours) & Using R programming language in Jupyter Notebook (optional)	**Project 1:** Outline the video and choose which bioinformatics method you are going to demo. Present this plan to your group and get feedback. (20 pts)
3*	Intermediate Python (4 hours)	Intermediate R (4 hours)	**Project 1:** Draft 1 of video and feedback from your pod (20 pts)
4	Python Data Scientist Toolbox Part 1	Writing Efficient R Code (4 hours)	**Project 1:** Final Video due (30 pts)
5	Python Data Scientist Toolbox Part 2	Parallel Programming in R	**Project 2:** Decide which figures each of you will present. (20 pts) **Project 3:** Draft 1 of your scientific hypothesis that is something that can be researched with bioinformatics tools. (10 pts)
6	Python Programming Assessment	R Programming Assessment	**Project 3:** Upload your refined hypothesis and the source where you are going to pull data in from for your final project. (20 pts)
7*	Chapter 1,4, 7 & 10 in Biopython -EC	Introduction to Bioconductor in	**Project 2:** Draft 1 of Presentation to Dr. Schiffer & IA/TA (30 pts)

		R (4 hours) - EC	
8	Introduction to Data Visualization with Matplotlib (4 hours) - EC	Introduction to Data Visualization with ggplot2 (4 hours) - EC	**Project 2:** Final Presentation. (50% - Project 2) **Project 3:** Draft 1 of your Jupyter notebook – present to your group on some other day this week. (20 pts)
9*			**Project 3:** Draft 2 of your Jupyter notebook – present to your group and TA/IA (20 pts))
10			**Project 3:** Final Draft of your jupyter notebook (presented to the professor & your pod). Upload to github and create your github page (40 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 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.

We will spend the first week of the course getting you prepared to use Anaconda Navigator on your computer.

Assignments, Projects, and Grading

Due Date(s)	*Assignment &/or Project*	*Description*	*Points*
January 8th	*Entrance & Exit Survey*	*There are no "right" answers here. This is just a survey that we will use to match you up into your best #PODlife group.*	*20 pts for entrance, 10 points for exit*
January 8th	*Introductory Videos*	*Watch the videos in the introductory section that will cover (1) Intro to the Course (2) #PODlife (3) What is DataCamp? (4) Discussion sections and Bioinformatics Trivia (5) Downloading Anaconda Navigator and (6) Should I learn python or R?*	*60 (10 pts per video)*
Multiple Dates	*Attend weekly discussion sections* *AND/OR* *Attend weekly POD meetings*	*The first and only synchronous class "lecture" will be worth 20 points. An asynchronous option for attending this course will be made available.* *One of the four offerings of discussion sections each week. If there is a week that you cannot make any of the discussion sections, you can make it up on another week by attending two discussion sections.* *In your POD you can meet up to 9 times over the quarter. The structure, location (virtual, chat, zoom, in person with masks) are up to you. Your POD will need to submit notes/questions/concerns from each of these meetings. Optional prompts will be provided for discussion.*	*Up to 110 (10 points each week for discussion sections, 10 points for each POD meeting)*
*Each Friday (**there will be no late penalties**)*	*Weekly Coding assignments*	*There will be weekly coding assignments due by Friday at 12PM. You can choose to have coding assignments from the Python Track, or the R Track. If you decided to do both tracks, you can earn 50 points of extra credit. There are also other extra credit tracks worth 25 points each!*	*100 (10 points each week)*
Each Week	*Video questions*	*Short videos on bioinformatics topics will be included. Answering questions for credit*	*100 (5 points per video)*
January 29th @ 12 PM	*Project 1*	*Video describing an example of how bioinformatics methods are useful for any*	*100 pts (broken up across 4 due*

		application of interest (human health, agriculture, drug discovery, technology's impact on human health, etc.), and show an example of how this method works.	*dates/project steps)*
February 26th @ 12 PM	*Project 2*	*Critique a scientific article in the field of bioinformatics with your POD.*	*100 pts (broken up across 4 due dates/project steps*
March 12th @ 12 PM	*Project 3*	*Construct and present a Jupyter notebook or a script in R Studio that queries a bioinformatics database, cleans the data, displays the data, & answers a scientific question.*	*100 pts (broken up across 4 due dates/project steps*
TOTAL			*700 pts*

Grading Procedure and Feedback

You all will be graded on an absolute scale. If everyone earns an A, we will be thrilled.

Entrance survey *is due January 8th, PERIOD. This is the only really hard and fast deadline of the quarter. This survey is going to be used to put you into your PODs and so it is critical that you get this done by January 8th.*

Introductory Videos *can be completed anytime throughout the course, though it is highly recommended that you complete them in the first week. These are not long videos, or difficult to understand, and if you complete them you earn 60 pts to your grade.*

Your ***coding assignments*** *will not be due technically until the end of the quarter, but the earlier you do the coding assignments the easier the projects will be. I would recommend trying to keep up with the coding assignments each week so that you are not scrambling at the end of the quarter.*

Project 1 *is due January 29th at 12 PM. Every week it is late, a total of 5 pts will be taken off of the final score (out of 100 pts).*

Project 2 *is due February 26th at 12 PM. Every week it is late, a total of 5 pts will be taken off of the final score (out of 100 pts).*

Project 3 *is due March 12th at 12 PM. Every day it is late, a total of 5 pts will be taken off of the final score (out of 100 pts) until March 19th – grades are due the 20th.*

Exit survey *is due March 12th. If you choose not to do it you will not earn an easy 5 points.*

You can expect feedback & grade on each scaffold of your project a week after it's due date.

Attendance and Participation

Weekly participation in discussion sections and/or your POD meetings is how your attendance will be measured. You can make up discussion section absences by attending two discussion sections

the following week, or by attending an office-hours with your POD, or by submitting notes from POD meeting, or by submitting screen shots of POD chats. You have a lot of options here.

Instructional Team: Who Are My Instructors?

Instructor

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 Philosophy

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.

Teaching Assistants

Devon Birdseye
Devon is a third year Biology PhD student in Dr. Steve Briggs' lab, studying the molecular basis of hybrid vigor using proteomics and bioinformatics. After earning her Bachelor's degree from UCSB in 2014, she worked for four years as a Research Associate at the Joint BioEnergy Institute in the Bay Area. Her expertise is in biochemistry and computational biology using R.

Operating System: Mac
Coding Language of Choice: R
Discussion Section: Thurs 9:30 – 10:30 AM
Virtual Office Hours:

Sahana Kuthyar
Sahana Kuthyar is a first-year PhD student. She is interested in how animal-associated microbial contributions are balanced between host energy use and immune function and how these trade-offs change under infection in domestic animals. She completed her B.S. and M.S. in Environmental Science at Emory University, and more recently, she managed a microbiome lab at Northwestern University.

Operating System: Windows
Coding Language of Choice: R
Discussion Section: Tues 9:30 – 10:30 AM
Virtual Office Hours:

Hanqing Zhao

Hanqing is a first year biology graduate student in the BS/MS program. She majored in biology with specialization in bioinformatics for her bachelor's degree. She learned biology, computer science and bioinformatics algorithm courses in my undergraduate study. She is familiar with Python and Java, a bit about R and C++, and working on data analysis in genome study for her master study.

Operating System: Mac
Coding Language of Choice: Python
Discussion Section: Wed 9:30 – 10:30 AM
Virtual Office Hours:

Kritin Karkare

Kritin graduated from UCSD in 2019 with his B.S. in Bioengineering: Bioinformatics and minors in Cognitive Science and Japanese Studies. indeed, he's taking his love for Pokemon even higher this quarter by attempting to memorize all 898 in order (help! - he says - save me!). Alas, he decided to postpone his goal of becoming a Pokemon Master in order to help the Biology Teaching Labs as a staff member, and is on temporary assignment to TA for BIMM 143 and help with upkeep for the Akbari Lab. In the future, he plans to pursue a Ph.D in bioinformatics. On the side, Kritin likes to do science writing and arrange music for the Intermission Orchestra at UCSD.

Operationg System: Windows
Coding Language of Choice: Python or R
Discussion Section: Fri 9:30 – 10:30 AM
Virtual Office Hours:

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*	**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**

Triton Concern Line *Report students of concern:* (858) 246-1111 **Office for Students with Disabilities (OSD)** *Supports students with disabilities and accessibility across campus*	*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**