# BIMM 143: Bioinformatics Syllabus

## Welcome to the Course

### Course Information

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|---|---|
| **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 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** | *Hanqing Zhao & 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.
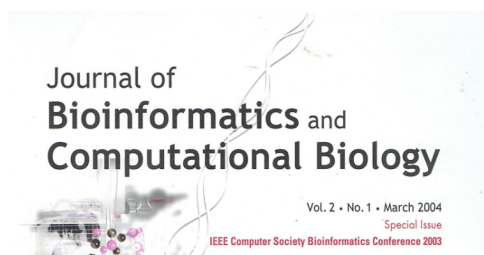


2. Examine and critique key literature in the field of bioinformatics.

3. Construct and present a Jupyter or R notebook that 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.
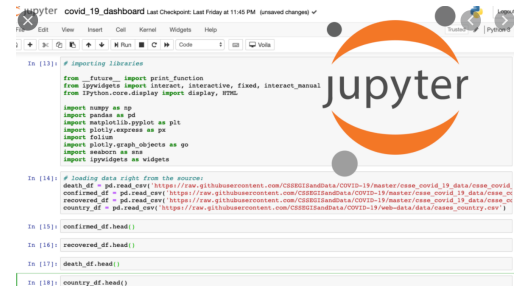


## Course Format

*The format of the course is entirely online. Students are expected to attend the first lectures of the quarter (the only "required" synchronous lecture), meet with your POD, and engage in learning activities online. There will be optional synchronous lectures throughout the quarter that will cover key concepts in bioinformatics coding & project reviews. 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.*

*Find our class page at:* piazza.com/ucsd/fall2021/bimm143b

**Synchronous Online Lectures:** Wednesdays 6:30-7:30 PM

***Join Zoom Meeting:*** https://ucsd.zoom.us/j/92939441833

**Asynchronous (Online) Course Elements**: (see below)

**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 & Intro Videos**  – 200 points

Each week there will be video lectures with accompanying challenge assignments. There will be a total of 200 points of challenge problems 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 questions. For a total of 50 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**  – 350 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 50 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 | Challenge Problem | Project Work Due (Monday following @12PM) |
|---|---|---|---|---|
| 9/23-9/24 | Install Anaconda Navigator | Install R Studio | Introductory Videos & Entrance Survey (30 points) – **Due 9/26** | **Project 1A**: Choose an example from bioinformatics scientific media coverage (25 pts) – **Due 9/27** |
| 9/27-10/1 *one-on-one meetings* | Introduction to Python – (20 pts) **Due 10/1** | Introduction to R (20 pts) - **Due 10/1** | | |
| 10/4 – 10/8 | | | How to Read Science (5 pts) & **Challenge Problem #1:** (10 pts) – **Due 10/6** | **Project 1B:** Video Outline. Present this plan to your group and get feedback. (50 pts) – **Due 10/11** |

| 10/11-10/15 | Intermediate Python (20 pts) - **Due 10/15** | Intermediate R (20 pts) - **Due 10/15** | **Challenge Problem #2:** Sequence analysis (10 pts) – **Due 10/13** | **Project 1C:** Draft 1 of video and feedback from your pod & Jamie (75 pts) – **Due 10/18** |
|---|---|---|---|---|
| 10/18-10/22 | Python Toolbox Part 1 (20 pts) – **Due 10/22** | Intro to Bioconductor (20 pts)– **Due 10/22** | **Challenge Problem #3:** From Dot Plots to BLAST (40 pts) – **Due 10/20** | **Project 1D:** Final Video due (100 pts) – **Due 10/25** |
| 10/25-10/29 | | | **Challenge Problem #4:** Sequence Alignments and Heat Maps (20 pts) – **Due 10/27** | **Project 1E:** Review Your Peer's Final Videos (100 pts) – **Due 11/1** |
| 11/1-11/5 | Python Toolbox Part 2 (20 pts)– **Due 11/5** | Introduction to Writing Function in R (20 pts) – **Due 11/5** | | **Project 2A:** Draft 1 of your scientific hypothesis that is something that can be researched with bioinformatics tools. (25 pts) – **Due 11/8** |
| 11/8-11/12 | | | **Challenge Problem #5:** Proteomic Profiling, Clustering, & PCA (40 pts) – **Due 11/3** | **Project 2B:** Upload your refined hypothesis and annotated bibliography. (75 pts) – **Due 11/15** |
| 11/15-11/19 | Streamlined Data Ingestion with Pandas (20 pts)– **Due 11/19** | Introduction to Importing Data in R (20 pts) – **Due 11/19** | **Challenge Problem #6:** RNAseq analysis and protein expression data (30 pts) – **Due 11/17** | **Project 2C:** Draft 1 of your Jupyter or R notebook – Get feedback from a peer in the course. (50 pts) – **Due 11/22** |
| 11/29-12/3 | | | **README and GitHub (5 points)** – **Due 12/3** **End of Course Survey (10 points)** | **Project 2D:** Final Draft of your jupyter or R notebook (presented to the professor & your pod). Upload to github and create your github page (200 pts) – **Due 12/7** |

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.

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

## 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- | 500 – 724 |
| B | 825 – 864 | D | < 500 |

  *Entrance survey is due September 26th, 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. These are not long videos, or difficult to understand, and if you complete them you earn 20 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 or slowing down your PODmates.*
  *Project 1D & 1E is due at 12 PM. Every week it is late, a total of 25 pts will be taken off of the final score (out of 350 pts).*
  *Project 2D is due at 12 PM. Every day it is late, a total of 25 pts will be taken off of the final score (out of 350 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.*

## 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 ligand-binding. She has expertise in python, machine learning, virtual screening, and molecular dynamics.

Virtual Office Hours: Every Friday at 4:30-5:30 PM
Lecture: Every Wednesday at 6:00-7:30 PM
Email: jmschiffer@ucsd.edu

*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*



**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. Coding and bioinformatics have continued to be useful tools for all facets of my research, and I enjoy seeing others learn how to use these techniques for their own interests.

Operating System: PC
Coding Language of Choice: R
Discussion Section: Wed 4:30 – 5:30 PM
Code Together/Animal Facts Session: Mon 4:30 – 5:30 PM

**Hanqing Zhao**

Hanqing is a second-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 her 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
Virtual Office Hours: Mon 5:30-6:30 PM

## 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**<br>*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<br><br>**Counseling and Psychological Services**<br>*Confidential counseling and consultations for psychiatric service and mental health programming*<br><br>**Triton Concern Line**<br>*Report students of concern:* (858) 246-1111<br><br>**Office for Students with Disabilities (OSD)**<br>*Supports students with disabilities and accessibility across campus* | **Community and Resource Centers**<br>**Office of Equity, Diversity, and Inclusion**<br>*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*<br>(858).822-.3542 \| diversity@ucsd.edu<br><br>**Get Involved**<br>*Student organizations, clubs, service opportunities, and many other ways to connect with others on campus*<br><br>**Undocumented Student Services**<br>*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**