San José State University
Computer Science Department
Computer Science / Biology 123B: Bioinformatics II, Spring 2022

Course and Contact Information

Instructor:	Philip Heller
Office Location:	MacQuarrie Hall 211
Email:	philip.heller@sjsu.edu
Office Hours:	Tu 1:30 – 2:30 on Zoom https://sjsu.zoom.us/j/89032039621 until we're back in person Wed 9-10 on Zoom: https://sjsu.zoom.us/j/87384318325
Class Days/Time:	Tu/Th 9-10:15 (Section I), Tu/Th 10:30-11:45 (Sec II).
Classroom:	MacQuarrie Hall 223
Prerequisites:	CS/BIOL 123A

Course Description

Advanced Bioinformatics algorithms, tools, databases. Biological background; protein structure/function; sequencing technology; sequence identification; transcriptomics; metagenomics; CRISPR. Possible additional topics: functional genomics; protein networks; drug discovery; pathway analysis; immunoinformatics; analysis pipelines; machine learning applications. Project applying advanced approaches to real-world problems.

Course Format

Sessions will be either lecture format, hands-on exercises, or a combination.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

- List the 4 levels of protein structure.
- Identify common sequencing technologies, and select bioinformatic analysis strategies for data generated by those technologies.
- Use appropriate gene function identification approaches to predict the function of nucleotide and protein sequences.
- Interpret transcriptomic, metagenomic, and metatranscriptomic data.
- Summarize the stages of CRISPR-Cas immunity, use public software tools to find novel CRISPR systems, and clarify CRISPR gene editing.

Required Texts/Readings

Textbook

"Understanding Bioinformatics" by Marketa Zvelebil and Jeremy Baum, 1st edition, Garland Science,

2008, ISBN 0-815-34024-9.

Other technology requirements / equipment / material

Students must bring a charged wifi-enabled laptop computer to all in-person sessions.

Course Requirements and Assignments

Homework Assignments: Homework assignments must be uploaded to Canvas by the due date/time. No late homework will be accepted except by prior arrangement with the instructor or in cases of documented emergency.

Term Project: Students will do a term project individually or in teams of 2. Students in CS 123B must do a project that includes programming, in the language of their choice. Students in Biology 123B may do the same, or may do a project involving acquiring published data and then analyzing the data using 3rd-party bioinformatics tools. Projects include a written report and an oral presentation.

Quizzes: There will be a short in-person quiz at the start of most in-person lectures, covering material from the previous lecture. There will be no quizzes during Zoom lectures. The 2 lowest quiz grades will be dropped.

Midterm Exams: There will be 2 midterm exams. Note that the exam dates given in the schedule below are approximate and are subject to change.

Final Exam: Monday May 23, 7:15 AM (early section). Friday May 20, 9:45 AM (late section). Makeup final exams will be only be given in cases of verifiable emergencies or, if the instructor is notified at least 3 weeks before the last class meeting, to students with at least 2 other finals in a 24-hour period.

Grading:

Homework: 15%
Quizzes: 15%
Midterm 1: 15%
Midterm 2: 15%
Project: 20%
Final Exam: 20%

At least	Letter Grade
97%	A plus
93%	A
90%	A minus
87%	B plus
83%	B
80%	B minus
77%	C plus
72%	C

70%	C minus
67%	D plus
62%	D
60%	D minus
<60%	F

Classroom Protocol

Students are expected to attend all class sessions for their assigned section unless they have a personal emergency. During lectures, students' devices may only be used for course-related purposes such as taking notes. Disruptive behavior is not allowed. The consequence for the first incident of disruption is a reduction of 1/3 grade point from the final letter grade (e.g. B minus becomes C plus). The consequence for the second incident is a reduction of 2/3 grade point from the final letter grade (e.g. B minus becomes C). The consequence for the third incident is an F in the course. All incidents will be reported to the university, which may impose further sanctions.

Academic Integrity

Student are expected to be familiar with the University's Student Conduct Code (https://www.sjsu.edu/studentconduct/docs/SJSU-Student-Conduct-Code-2016.pdf). Cheating, plagiarism, and other forms of misconduct will not be tolerated and will have severe consequences. All prose submitted must be in the student's own words. Text composed by anyone other than the student will not be accepted, *even if it is quoted and cited*.

The consequence for the first incident of cheating or plagiarizing is zero points on the assignment or exam, and a reduction of a full grade point from the final letter grade (e.g. B minus becomes C minus). The penalty for the second incident is an F in the course. All incidents will be reported to the university, which may impose further sanctions.

All course materials, including slides, homework assignments, lab assignments, exams, and instructor's solutions, are the instructor's intellectual property and may not be distributed without permission. Distribution includes posting to social media sites. Distribution is grounds for failing the course, and all incidents will be reported to the university, which may impose further sanctions.

University Policies

Per University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (http://www.sjsu.edu/gup/syllabusinfo), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources.

College of Science COVID-19 Safety

All students registered for a College of Science (CoS) class with an in-person component must view the CoS COVID-19 Training slides and the SJSU Phased Adapt Plan website and acknowledge reading them according to their instructor's directions. By working together to follow these county and SJSU safety practices, we can keep our college safer. Students who do not follow COVID-19 Safety practice(s) outlined in the training, the SJSU Phased Adapt Plan, or instructions from their instructors, TAs or CoS Safety Staff may be dismissed from CoS buildings, facilities or field sites. Please review this training as needed throughout the semester, as updates will be implemented as changes occur (and posted to the same links).

Zoom Links

The University has declared that classes will be via Zoom until mid-February. This is subject to change, but for now expect to attend in person starting Feb 15. Until then, the zoom links are:

- Section 1 (Tu/Th 9-10:15): https://sjsu.zoom.us/j/81942917381
- Section 2 (Tu/Th 9-10:15): https://sjsu.zoom.us/j/83405082495
- Office hours (Tu 1:30, starting Feb 1): https://sjsu.zoom.us/j/89032039621 until we're back in person.

Wednesday office hours (10 – 11 AM) will be via Zoom throughout the semester from Feb 2 through May 11, except March 30 (Spring Break): https://sjsu.zoom.us/j/87384318325

Computer Science / Biology 123B Spring 2021 Course Schedule

Course Schedule

All dates are approximate and subject to change, except for holidays and final exams. If a midterm exam date changes, at least 1 week's notice will be given via a Canvas Announcement.

Week	Date	Topics, Readings, Assignments, Deadlines
1	1/27	Course mechanics. Sequencing technology.
2	2/1	Sequencing technology.
2	2/3	Statistics overview.
3	2/8	Sequence identification: Hidden Markov Models.
3	2/10	Sequence identification: Hidden Markov Models.
4	2/15	Sequence identification: Profile Hidden Markov Models.
4	2/17	Sequence identification: Profile Hidden Markov Models.
5	2/22	Sequence identification: Profile Hidden Markov Models.
5	2/24	CRISPR.
6	3/1	CRISPR.
6	3/3	Midterm 1 review.
7	3/8	Midterm 1.
7	3/10	The NASA Genelab Transcriptome pipeline.
8	3/15	COI barcoding.
8	3/17	ARBitrator.
9	3/22	ARBitrator and CO-ARBitrator.
9	3/24	Codon bias.
10	3/29	Spring Break.
10	3/31	Spring Break.
11	4/5	Metagenomics. Case study: UCYN-A.
11	4/7	Case study: UCYN-A.
12	4/12	The future of Bioinformatics.
12	4/14	Guest speaker.
13	4/19	Review for Midterm 2.

Week	Date	Topics, Readings, Assignments, Deadlines
13	4/21	Midterm 2.
14	4/26	Project presentations.
14	4/28	Project presentations.
15	5/3	Project presentations.
15	5/5	Project presentations.
16	5/10	Project presentations.
16	5/12	Review for Final Exam.
Finals	5/20 (Fri)	Final exam, late (10:30) section. 9:45 AM.
Finals	5/23 (Mon)	Final exam, early (9:00) section. 7:15 AM.