

San José State University
Computer Science Department
Computer Science / Biology 123B: Bioinformatics II, Spring 2021

Course and Contact Information

Instructor:	Philip Heller
Office Location:	MacQuarrie Hall 211
Email:	Philip.Heller@sjsu.edu
Office Hours:	Tu 10:30 – 11:30
Class Days/Time:	M/W 9:00 – 10:15 AM (early section), 10:30-11:45 (late section)
Classroom:	
Prerequisite:	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.

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: Wednesday May 19, 7:15 AM (early section). Tuesday May 25, 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: 20%

Midterm 1: 15%

Midterm 2: 15%

Project: 25%

Final Exam: 25%

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

Academic Integrity

Students 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*.

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.

Computer Science / Biology 123B Spring 2021 Course Schedule

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	1/27	Course mechanics. Bioinformatics: historical development, current challenges.
2	2/1	Sequencing technology.
2	2/3	Sequencing technology.
3	2/8	Sequence identification: Hidden Markov Models.
3	2/10	Sequence identification: Hidden Markov Models.
4	2/15	Sequence identification: Hidden Markov Models.
4	2/17	Sequence identification: Profile Hidden Markov Models.
5	2/22	Sequence identification: Profile Hidden Markov Models.
5	2/24	Review for Midterm 1.
6	3/1	Midterm 1.
6	3/3	CRISPR.
7	3/8	CRISPR.
7	3/10	The NASA Genelab Transcriptome pipeline.
8	3/15	The NASA Genelab Transcriptome pipeline.
8	3/17	Conserved domains and ARBitrator.
9	3/22	Conserved domains and ARBitrator.
9	3/24	Guest speaker.
10	3/29	Spring Break.
10	3/31	Spring Break.
11	4/5	Metagenomics.
11	4/6	Deep Learning meets Bioinformatics: Poriferal Vision and Coral Vision
12	4/12	Review for Midterm 2.
12	4/14	Midterm 2.
13	4/19	Project presentations.
13	4/21	Project presentations.
14	4/26	Project presentations.

Week	Date	Topics, Readings, Assignments, Deadlines
14	4/28	Project presentations.
15	5/3	Project presentations.
15	5/5	Project presentations.
16	5/10	Review for Final Exam.
Final Exam (9:00 AM section)	5/19 (Wed)	Final exam. 7:15 AM.
Final Exam (10:15 AM section)	5/25 (Tues)	Final exam. 9:45 AM.