

San José State University
Computer Science & Biological Sciences Department
Biology 145 / Computer Science 185C / Computer Science 286

Marine Bioinformatics Spring 2024

Course and Contact Information

Instructors:	Maya deVries (BIOL) / Philip Heller (CS)
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Office Hours:	Dr. deVries: Mon/Tues: 11:00-12:00, 340 Duncan Hall Dr. Heller: Weds 1:00-2:00 (Zoom: <link>); Thurs 1:00-2:00 (In person) (Zoom link: https://sjsu.zoom.us/j/81228820144?pwd=ZHRpeFVLazJVMW1uTHFZOU96blJnQT09)
Class Days/Time:	T/Th 3:00 – 4:15
Classroom:	352 Duncan Hall
Prerequisites:	Biology: BIOL 155 or 156, BIOL 115 or 118; Computer Science: CS 123A for undergraduates

Course Description

A team-taught course taught by Marine Biology and Bioinformatics faculty. Application of Bioinformatic analysis to issues affecting ocean life. Organisms will include microbes, invertebrates, and large mammals. Topics chosen from: biogeochemical cycles, coral reef and kelp forest ecology, and megafauna.

Course Format

In order to promote independent inquiry and critical thought in applying bioinformatics tools to life in the ocean, sessions will be lecture format, discussion, hands-on exercises, or a combination. Be prepared to an active contributor to this course, as we will have many engaging learning components.

Faculty Web Page and MYSJSU Messaging

Course materials, including the syllabus and assignments, can be found by logging onto the **Canvas webpage for CS 286**. There, you should see the course listing with the link. You are responsible for regularly checking the messaging system through Canvas, as we will periodically post updates there. Please make sure that your email in the MySJSU system is the one you regularly check. This is the only email list we will use for correspondence. Instructors do not read or respond to Canvas mail. Please use our SJSU email addresses to get in touch with us directly.

Writing assignments must be uploaded to the Canvas Learning Management course website where they will be analyzed for plagiarism by Turnitin.com. Submissions must be in .docx format.

Program Learning Objectives (Department of Biological Sciences)

PLO1: Students will demonstrate the ability to formulate hypotheses and design experiments to address a scientific question.

PLO2: Students will demonstrate an understanding of the relevant content in their discipline.

PLO3: Students will demonstrate laboratory or field skills in their discipline.

PLO4: Students will demonstrate proficiency in scientific writing skills.

PLO5: Students will demonstrate proficiency in oral presentation skills.

Program Learning Objectives (Department of Computer Science)

PLO 1: Apply computing and math knowledge an ability to apply knowledge of computing and mathematics to solve problems.

PLO 3: Design, implement, evaluate system, process, component, or program – An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.

PLO 6: Communicate effectively – An ability to communicate effectively with a range of audiences.

PLO 9: Current techniques, skills, tools for computing – An ability to use current techniques, skills, and tools necessary for computing practice.

PLO 10: Tradeoffs in design choices – An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

Course Learning Outcomes (CLO)

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

CLO1: Identify aspects of marine communities that can be described bioinformatically.
Dept. Biol PLO's 1-5; CS PLO 1

CLO2: Apply appropriate bioinformatic analysis, such as barcoding, metagenomics, and population genetics, to organismal data, from the microbial to megafaunal scale.
Dept. Biol PLO's 1-5; CS PLO 6,9,10

CLO3: Interpret data from experiments, observations, and bioinformatics to support hypotheses about broad-scale genetic patterns to inform marine organismal distributions and abundances.
Dept. Biol PLO's 1-5; CS PLO 6,9

CLO4: Identify and describe a critical question in marine systems and understand how bioinformatics helps to explain those questions
Dept. Biol PLO's 1,2,4,5; PLO 1,3,6

CLO5: Describe how bioinformatics data can be used to understand current and future changes in marine ecosystems.
Dept. Biol PLO's 1,2; PLO 1,6

Texts/Readings

Recommended Textbook

“Understanding Bioinformatics” by Marketa Zvelebil and Jeremy Baum, 1st edition, Garland Science, 2008, ISBN 0-815-34024-9.

Other reading: Additional reading will be available on Canvas in the corresponding module.

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 will be posted with their due dates on Canvas and announced in class and on Canvas. All assignments must be uploaded to Canvas by the due date/time, except by prior arrangement with the instructor or in cases of documented emergency. If you turn in an assignment late, a total of 5% per day will be deducted up to a total of 50% of the assignment grade. If you miss an assignment entirely, you will receive 50% of the assignment grade.

Midterm Exams: There will be 2 midterm exams. The second one will be comprehensive.

Term Project: Students will do a term project. Students in CS 185C/286 must do a project that includes programming in the language of their choice. Students in Biology 145 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 in-class presentation.

Final Exam: There will be no formal final exam. Instead, we will be meeting for the final set of project presentations. Attendance is mandatory.

Grading Information

Homework: 35%

Midterm 1: 15%

Midterm 2: 20%

Project: 30%

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

Writing Skills Test: Passage of the Writing Skills Test (WST) or ENGL/LLD 100A with a C or better (C- not accepted), and completion of Core General Education are prerequisites to all SJSU Studies courses. Completion of, or co-registration in, 100W is strongly recommended. A minimum aggregate GPA of 2.0 in GE Areas R, S, & V shall be required of all students.

Classroom Protocol

Participation and attendance: You are expected to attend and participate in every lecture. Missing class will make it more difficult for you to succeed in the course. If you have to miss a class for unforeseen circumstances or prior critical commitments, you must inform us before class, if possible, via email, and provide university approved documentation for your absence (i.e. doctor's note, graduation workshop attendance confirmation, etc.).

Exams and due dates: Due dates are not expected to change.

Cell phone and laptop use: The lectures are for you to gain the foundational information you'll need for this course. I highly recommend putting down your cell phone and laptop and focusing on the lecture. If you choose to use your laptop for note taking, I cannot emphasize enough the importance of handwritten notes for student success.

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 not composed by the student will not be accepted.

The penalty 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. A minus becomes C minus). The penalty for the second incident is an F in the course.

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.

Biology 145 / Computer Science 185C/286 Spring 2023 Course Schedule

Note: Except for holidays and the final exam, dates/topics are approximate and are subject to change. Midterm exam changes will be announced in class and on Canvas at least 2 weeks in advance.

Week	Date	Topics, Readings, Assignments, Deadlines
1	1/25	Review syllabus and answer discussion questions posted on Canvas.
2	1/30	Course mechanics. The microbial, invertebrate, and macrofaunal scales. Big History of life on Earth – deVries/Heller
2	2/1	Bioinformatics background: molecular biology – Heller
3	2/6	Bioinformatics background: evolution – deVries
3	2/8	Bioinformatics background: alignment, identification, and BLAST – Heller
4	2/13	Bioinformatics background: alignment, identification, and BLAST – Heller Lab 1: alignment
4	2/15	(Microbial scale) Basic ocean processes and food webs with a focus on plankton ecology and diversity – deVries
5	2/20	(Microbial scale) Biogeochemical cycles. The carbon pump. Nitrogen fixation. Nitrogenase evolution/diversity. – deVries/Heller
5	2/22	(Microbial scale) Metagenomics. – Heller
6	2/27	(Microbial scale) UCYN-A. – Heller Lab 2: phylogenetic tree building
6	2/29	Review for Midterm 1.
7	3/5	Midterm 1
7	3/7	(Invertebrate scale) Coral reef ecology/biology – deVries
8	3/12	(Invertebrate scale) Barcoding and CO-ARBitrator - Heller
8	3/14	(Invertebrates) The role of calcified coralline algae on coral reefs. – Guest Lecture: Anna Rothstein, former SJSU MS student
9	3/19	(Invertebrates) Coral monitoring: Autonomous Reef Monitoring Structures (ARMS), Coral Vision – deVries/Heller
9	3/21	(Invertebrates) Lab 3: coral reefs – Heller
10	3/26	(Invertebrate scale) Sponges: important for reef building and destroying. – deVries
10	3/28	(Invertebrate scale) Sponges: important for reef building and destroying. – deVries/Heller
11	4/2	NO CLASS: Spring Break!
11	4/4	NO CLASS: Spring Break!
12	4/9	(Invertebrate scale) Sponges: deep learning and sponge community structure – Guest Lecture: Amanda Khan (Moss Landing Marine Labs)
12	4/11	(Invertebrate scale) Mantis shrimp: transcriptomics (differential expression) – deVries/Heller

13	4/16	(Invertebrate scale) Mantis shrimp: predation on current and future coral reefs. – deVries
13	4/18	(Macro scale) Sea otters and kelp forests. – deVries
14	4/23	(Macro scale) Whales. – deVries/Heller
14	4/25	(Macro scale) Conservation genetics in the ocean. – deVries
15	4/30	Review for Midterm 2
15	5/2	Midterm 2
16	5/7	Project Presentations.
16	5/9	Project Presentations.
ExamWeek	5/21	Project Presentations. (Final exam time 2:45 – 5:00 PM)