BIOL/BIOMI 568 Bioinformatics

Fall 2022

# Course Information

Class Days / Times: MW Lecture: 1300-1350, Lab: M **or** W 1400-1640

Class Location: On-line only (see Zoom info below)

Mode: lecture, discussion, lab, synchronous.

Platform: Canvas

**Zoom Info:**

LECTURE, LAB and OFFICE HOURS

<https://SDSU.zoom.us/j/85681424766>

Meeting ID: 856 8142 4766

Instructor: Dr. Scott Kelley; TA Fernanda Terrazas

Preferred pronouns: He/him

Email: skelley@sdsu.edu

TA email: tfernanda@sdsu.edu

Office location: Online (see Zoom Info)

Office hours: By Appointment

# Communication

Please call me Dr. Kelley or Dr. K and I can be reached by email which I check regularly.

# LAND ACKNOWLEDGMENT

For millennia, the Kumeyaay people have been a part of this land. This land has nourished, healed, protected and embraced them for many generations in a relationship of balance and harmony. As members of the San Diego State University community, we acknowledge this legacy. We promote this balance and harmony. We find inspiration from this land, the land of the Kumeyaay.

# ESSENTIAL STUDENT INFORMATION

For essential information about student academic success, please see the [SDSU Student Academic Success Handbook](https://docs.google.com/document/d/1rXNpNGs1K7nIxcS73o6R-fxZqPIWQwS9gHD7XpIqjhM/edit).

* SDSU provides disability-related accommodations via the Student Ability Success Center (sascinfo@sdsu.edu | [sdsu.edu/sasc](http://sdsu.edu/sasc)). Please allow 10-14 business days for this process.
* Class rosters are provided to the instructor with the student's legal name. Please let me know if you would prefer an alternate name and/or gender pronoun.

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# COURSE MATERIALS

**Table 1 Example of Course Materials**

|  |  |  |
| --- | --- | --- |
| Materials (including texts, readings, course fees, equipment, and any technology requirements) | Required or optional | Where and how it can be obtained |
| **Interactive Algorithm Learning Website**:Kelley Bioinformatics | Required | Free Online: [www.kelleybioinfo.org](http://www.kelleybioinfo.org) |
| **Computational Biology: A Hypertextbook,** by Kelley and Didulo | Required | SDSU Campus Bookstore[https://www.wiley.com/en-us/Computational+Biology%3A+A+Hypertextbook-p-9781683673033](https://www.wiley.com/en-us/Computational%2BBiology%3A%2BA%2BHypertextbook-p-9781683673033)<https://www.barnesandnoble.com/w/computational-biology-scott-t-kelley/1133679834><https://www.amazon.com/Computational-Biology-Hypertextbook-Scott-Kelley/dp/1683670027> |
| **Python for Biologists** | Optional | <https://gum.co/sMbCt> |

# COURSE DESIGN: MAJOR ASSIGNMENTS AND ASSESSMENTS

The format of the course will be 2 weekly lectures and a lab course. The lectures will present material that is important for understanding bioinformatics algorithms and fundamentals behind the biology. The lectures include a strong active learning component including in-class anticipatory learning exercises, group sharing, and interactive quiz practice. There will also be regular low stress reading quizzes and exercises to keep students on track as well as homework exercises.

This course also includes hands-on computer learning in lab. The first part of each lab will include a short problem that introduces the students to Bioinformatics concepts or programming language basics. The rest of the lab will then be spent practicing on the computer. The professor will be available during the lab time to provide additional instruction and help students debug their code during the completion of in-class exercises or class projects. Students will also be encouraged to help one another with concepts and exercises but are expected to turn in their own work on all assignments.

All information for the course will be posted on Canvas. Please be sure to consult Canvas for scores, PDF files, notes, etc. A separate document lists specific lecture topics and dates, including due dates for assignments and exams.

**Major Assignments and Assessments:** Midterm Exam; Lab Practical; Final Project. Other lower stake assessments include Lab Exercises (weekly), Online Homework assignments, and reading quizzes.

# COURSE SCHEDULE

Refer to the schedules posted in Canvas.

# Grading Policies

|   | Biology degree learning outcomes | Level of emphasis |
| --- | --- | --- |
| **Concepts** | Provide examples of the relation between form and function in biology, as expressed in molecular, cellular, and whole-organism physiology | **Reinforced** |
| Compare and contrast the major cellular processes in eukaryotes and prokaryotes | **Reinforced** |
| Explain how genetic information is transmitted, and the relationship between genetics and evolution | **Reinforced** |
| Compare and contrast the primary mechanisms of evolutionary diversification | **Not Addressed** |
| Categorize the diversity of life in terms of the phylogenetic relationships among major organismal groups | **Reinforced** |
| Describe how interactions among organisms and their environment influence populations, communities, and ecosystem function | **Not Addressed** |
| **Skills** | Quantitatively answer biological questions using mathematical or statistical tools | **Major component** |
| Design, conduct, and interpret experiments using common biological lab and field techniques | **Reinforced** |
| Effectively and concisely present scientific ideas and the results of scientific research in written and oral form | **Major component** |
| Critique scientific papers, as demonstrated by written or oral summaries of hypotheses, methodology, and conclusions | **Not Addressed** |

# GRADING POLICIES

Exams and Assignments

**ASSIGNMENTS:** All assignments including take home exams, activities, lab exercises, the lab practical and final projects will be turned in on Canvas. The pre-reading quizzes will be performed on Canvas. See the schedule (and supplemental schedule) for details on due dates and times.

**NOTE:** YOU HAVE UP TO ONE WEEK AFTER A GRADE IS ASSIGNED TO ASK QUESTIONS ABOUT THE GRADING OF YOUR ASSIGNMENT.

**LATE WORK:** 10% or your grade will be deducted per day late. After 3 days, the assignment will not be accepted.

**How to complete non-programming lab assignments**:

1. Download the assignment. Immediately save as under a new name: YourLastNameLab1.doc. For instance, I would name my first lab KelleyLab1.doc
2. Answers should be in boldface and text only (unless an image is requested) just after the question.
3. You can often use screen capture and paste images into the document if necessary. Please resize them.
4. Email it to yourself as a means of backing up your work. YOU ARE RESPONSIBLE FOR MAKING SURE YOUR WORK IS SAVED, INCLUDING THE LAB PRACTICAL.

The following table details the combined total assignments for lecture and lab. The labs are all started in class and are due by the beginning of lab the next week. These labs include both the web-based bioinformatics labs and the programming labs. The Lab Practical will cover the lab material for the first part of the course and assignments will be completed in lab at the computer. It will be open book and open note. The Midterm will cover the algorithms and other materials covered in lecture or as homework activities.

Approximate Grade Distribution:

|  |  |
| --- | --- |
| **Assignment** |  **Percentage** |
| Reading Quizzes |  8\* |
| Labs | 25 |
| Lab Practical | 20 |
| Midterm | 25 |
| Python Quiz 1 | 3 |
| Python Quiz 2 | 7 |
| Final Project | 12 |

**\*** The lowest reading quiz will be dropped (one for the bioinformatics section, and one for the programming section). As a result, there will be no re-takes of these quizzes.

**Grading Range**

A: 93-100%

A-: 90-92%

B+: 88-89%

B: 83-87%

B-: 80-82%

C+: 78-79%

C: 73-77%

C-: 70-72%

D+: 68-69%

D: 60-67%

F: >=59%

Grades are rounded to the nearest whole percent.

There will be no make-up exams unless the student provides **a valid written excuse**, such as from a doctor, etc. Excuses for work-related activities are not valid.

# STUDENT LEARNING OUTCOMES

* Provide 5 - 8 SLOs consistent with purpose / scope of course that specify measurable, assessable knowledge, skills, and abilities.
* Understand the purpose and algorithms underlying computational biology approaches to basic and still very widely used methods for discovery including sequence alignment, RNA structure prediction, phylogenetics and many pattern matching approaches.
* Master and apply computational algorithms for biological research.
* Use modern biological software applications for analyzing molecular sequence data and be able to apply it to real existing data sets.
* Learn fundamental programming concepts and how they are used by Bioinformaticians. The students will learn the widely used Python programming language and gain familiarity with Unix and the R statistical package.
* Advanced students (Masters students) will also learn object-oriented programming concepts and how to use the Biopython package.
* Real Life Relevance: This class has extensive real-world applicability, especially for molecular biology students and for bioinformatics students. First, students will master programs such as BLAST (and many others) that are used in every biology lab and in most Biotechnology companies. This will be a major advantage when applying for such positions. Second, students will learn a powerful programming language used by bioinfomaticians around the world as well as in companies such as Google. Third, understanding what sequence data can do for medicine and research will be generally useful in daily life as our society becomes even more infused with big data.
* **From the COS Diversity and Inclusion Plan:** Require the inclusion of DEI issues and contributions among the student learning outcomes in the syllabus in all CoS courses by the beginning of the Fall 2022 semester: Either by reviewing the historical context of the science being taught, highlighting the contributions of people of color to science, or directly addressing the issues of equity, inclusion, and diversity, this intervention seeks to increase the feelings of belonging among our student population from underrepresented groups in science.

# Academic Honesty

The University adheres to a strict [policy prohibiting cheating and plagiarism](http://go.sdsu.edu/student_affairs/srr/cheating-plagiarism.aspx). Please see this link for a full description of the University rules:

<https://sacd.sdsu.edu/student-rights/academic-dishonesty/cheating-and-plagiarism>

Examples of academic dishonesty include but are not limited to:

* Copying, in part or in whole, from another's test or other examination;
* Obtaining copies of a test, an examination, or other course material
without the permission of the instructor;
* Collaborating with another or others in coursework without the permission of the instructor;
* Falsifying records, laboratory work, or other course data;
* Submitting work previously presented in another course, if contrary to the policies of the course;
* Altering or interfering with grading procedures;
* Assisting another student in any of the above;
* Using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
* Copying and pasting work from an online or offline source directly and calling it one's own;
* Using information found from an online or offline source without giving the author credit;
* Replacing words or phrases from another source and inserting one's own words or phrases.

Plagiarism is defined as the act of incorporating ideas, words, or specific substance of another, whether purchased, borrowed, or otherwise obtained, and submitting same to the university as one's own work to fulfill academic requirements without giving credit to the appropriate source. Plagiarism shall include but not be limited to:

1. submitting work, either in part or in whole, completed by another;
2. omitting footnotes for ideas, statements, facts, or conclusions that
belong to another;
3. omitting quotation marks when quoting directly from another,
whether it be a paragraph, sentence, or part thereof;
4. close and lengthy paraphrasing of the writings of another;
5. submitting another person's artistic works, such as musical com-
positions, photographs, paintings, drawings, or sculptures; and (f) submitting as one's own work papers purchased from research companies.

Unauthorized recording or dissemination of virtual course instruction or materials by students, especially with the intent to disrupt normal university operations or facilitate academic dishonesty, is a violation of the Student Conduct Code. This includes posting of exam problems or questions to on-line platforms. Violators may be subject to discipline.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

# Classroom Conduct Standards

SDSU students are expected to abide by the terms of the [Student Conduct Code](https://newscenter.sdsu.edu/student_affairs/srr/conduct.aspx) in classrooms and other instructional settings. Violation of these standards will result in referral to appropriate campus authorities.