

BIOL 4840: Genetic Biotechnology

Instructor:	Dr. James J. Youngblom	Term:	Fall 2019
Office:	Naraghi Hall 260	Lecture Times:	Mon. 5:30-7:30
Office Phone:	664-6924	Lab Times:	Wed. 5:30-7:30
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Office Hours:	2:00-3:30 Tues & Thurs. or by appt.		

University Course Catalog Description

BIOL 4840 3.0 units. Principles and applications of recombinant DNA technology. Emphasis on the tools of gene manipulation, genomic scale analysis, and bioinformatics. Weekly activity involving DNA analysis software. **Prerequisite: BIOL 3350, C- or higher.** (Lecture, 2 hours; activity, 2 hours)

Course Requirements

Students need knowledge of DNA structure, eukaryotic gene organization, transcription and translation, Mendelian genetic terminology, molecular properties, and chemical bonds. Basic level computer skills are required (web browsing, word, excel).

What is this course about?

The lectures on Mondays are designed to prepare you to fill any position that requires knowledge of how scientists in the early 21st century manipulate DNA. The lectures describe the tools that are now available to learn about DNA, RNA, and proteins in any type of cell. This information will be valuable, most obviously, for students applying for graduate school in molecular biology. Since these tools and activities are so universal, the information is also valuable for students interested in health care, food science, microbiology, plant science, wildlife biology, etc. It is difficult to think of an area of biology that is not being transformed by the ability to decipher and edit DNA.

The Wednesday labs are different. All of the labs involve the use of DNA sequence analysis software. Students will become familiar with some of the most common methods for analyzing DNA sequences. In addition, students will be reinforcing what they have learned about how biology research progresses. After a few weeks of practice exercises, students will spend a couple of months working on an independent research project that will create publishable information. The Wednesday activities will also reinforce some important genetic concepts for the students- what is the structure of a eukaryotic gene, how do genes evolve, and how can a single gene create variable protein products. See more about the lab activities below.

By the end of this course students will understand how to clone a gene and the value of genomic and cDNA libraries. Students will be able to explain PCR, gene cloning, DNA sequencing methods, gel electrophoresis, Southern and Northern blotting, and CRISPR. Students will know how to select the appropriate molecular tools given a particular biological question. Students will

appreciate the various approaches to gene mapping. Students will understand why various methods are used for expression of gene products. Student will be able to select and utilize the appropriate DNA sequence analysis software. Students will know how to efficiently read an article from primary literature. Students will know how to assemble and appropriately prepare and present a PowerPoint presentation.

Required Text-

- 1) The Genome War by James Shreeve- Ballantine Books, 2005

Required Text-

- 2) None for the lab activities

Required-

- 3) An iClicker (any version except the iClicker app)

Dates to Remember-

Mon. Sept. 2- Campus closed, Labor Day
Thur. Sept. 19- Last day to drop a course
Tues. Oct. 8- No classes, Columbus Day
Mon. Nov 11- Campus closed, Veteran's Day

Th./Fri. Nov. 28/29- Thanksgiving
Tues. Dec. 10- Last day of classes
Wed. Dec. 11- Reading Day
Final Exam- Mon. Dec. 16, 5:30

Exams:

Mon. Sept. 30- **Exam #1 (55 pts)**

Mon. Nov. 4- **Exam #2 (55 pts)**

Monday, Dec. 16, 5:30 pm - **Final Exam (130 pts)**

Exams/Quizzes/Reports-

Lab Reports (weeks 1-2) 16 pts. possible

EXAM 1-Monday Sept. 30- 55 pts.

Annotation Test- Wed. Sept. 18, 14 pts.

Quiz #1- Wednesday Oct. 9, 9 pts (Genome Wars: Chapters 1 → 8)

Quiz #2- Wednesday, Oct. 16, 9 pts (Genome Wars: Chapters 9 → 19)

Quiz #3- Wednesday, Oct. 23, 9 pts (Genome Wars: Chapters 20 → end)

Writing Assignment #1- due Oct. 14- 10 pts.

Quiz on Science article- 20 pts.

EXAM 2- Monday Nov. 4 - 55 pts.

Final Annotation reports- Wednesday, Nov. 6, 8 p.m., 7 x 10 = 70 pts.

Writing Assignment #2- due Nov. 25- 10 pts.

Annotation Report Oral presentation, Wed. Dec. 4, 20 pts.

RNA Seq Project- Friday Dec. 6, 20 pts.

iClicker questions – throughout the term- 33 pts.

FINAL EXAM- Monday Dec. 16, 5:30- 130 pts.

Lab Assessments Total = 135 pts.

Lab Reports (weeks 1-2) 16 pts. possible
Annotation Test- Wed. Sept. 18, 14 pts.
Final Annotation reports- Wednesday, Nov. 6, 8 p.m., 65 points
Oral Presentation (Lab work) - Wednesday Dec. 4, 20 points
RNA Seq Project- 20 pts.

(In addition, the final exam will have a gene annotation question – 15 pts!)

Lecture Assessments Total = 340 pts.

Exam 1- 55 pts.

Exam 2- 55 pts.

3 book quizzes- 27 pts.

iClicker- 33 pts.

Writing Assignments- 20 pts.

Quiz on Science magazine article- 20 pts.

Final Exam- 130 pts.

Make-up:

If you know you cannot be in class, please see me beforehand so we can discuss the situation. I may allow you to turn in materials at a later date. If something comes up unexpectedly on the day of class, please contact me, especially if an assignment is due. If you leave a message, leave a phone number, so we can be in touch. Do not 'let it ride' and plan on discussing it with me later. If I don't hear from you promptly, you get penalized for late assignments.

Assessments

iClicker Points

Every lecture (we will not use clickers in the lab) there will be clicker questions. At least one question will garner 1 pt. for everyone in attendance as long as you are present and enter a response. Other questions will be worth 2 pts. and will be based on information from the previous Monday. Some impromptu questions will be for no points. The pts. from the clicker questions will total 33 pts.

Writing Assignment:

Two times, you will be given an article from Scientific American to read. After reading the article, you will be given a related question. Your **assignment** is to answer the question by writing a 200-250 word response. Make sure you have 200-250 words in your response (don't count the words in your title, references, your name, etc.). Don't copy text from any sources. Don't copy this article! Read the article, highlight important points, and then write your answer in your own words. Run a spelling and grammar check. Proof read your writing to make sure your sentences are coherent. Write a thoughtful, nuanced reply. Use complete sentences. Print your document. It should all be on one page. Make sure it is double-spaced. It will be graded and

returned to you quickly. After the assignment is graded, you need to spend 5-10 minutes with your instructor reviewing your writing. You have ~2 weeks to do this. Failure to review your assignments, forfeits your points. This part of the assignment is worth 10 pts. Later everyone is giving a second article and second question. Your 2nd writing **assignment** is to answer the 2nd question with a 150-200 word response. This part of the assignment is worth 10 pts.

Lab Reports 1 & 2- 8 pts. each. These are submitted via email and are due on the following Monday at 11:59 pm. Late reports are penalized 1.5 pts. per day. Each person submits a report.

Annotation test (Sept. 18) - The annotation test is to confirm that students have learned the basics of gene annotation. Students failing the annotation test on Sept. 18 will take another annotation test on Sept. 25. Students failing the annotation test twice lose 14 pts.

Annotation reports (written [65 pts.] and oral [20 pts]). - The annotations reports are the final products from your gene annotation projects. The type of reports for each gene is well documented and will be explained as you learn how to annotate genes. Your grade will be determined by the neatness, accuracy, thoroughness, coherency, and timeliness of your reports. Each time a section of your report needs to be rewritten, there is a penalty. You are responsible for 5 reports. The first 2 are due on Wed. Oct. 16 at 8 pm (10 pts. each). The last 3 (15 pts. each) are done jointly with another student and are due at 8:00 p.m. on Nov. 6. Tardiness on the annotation reports will result in a penalty: 10% if it is 1 workday late, or 20% for 2-5 workdays late, 30% if 6-10 workdays late. These assignments will not be accepted if overdue by more than 10 workdays. If the report is returned to you for corrections or additions, the edited version is due back to your instructor in 5 days. Late returns will incur penalties.

Oral presentation- You and your partner should create a PowerPoint lecture to summarize the most interesting findings of your gene annotation project. You do not need to explain basic genetic terms that have already been explained in class. Rehearse your PowerPoint presentation. The presentation should be 5'-8' minutes in length. **Your score will be deducted if your presentation is too long or too short.** You are not allowed to read anything during your presentation. No reading of notes and no reading of your PowerPoint slides. Use your PowerPoint slides as a rough outline for you to follow and then know the material well enough to explain each slide without reading it or using notes. Show important screen captures from the analysis of your gene and explain them to the class.

The labs:

BIOL 4840 provides CSU Stanislaus undergraduates the opportunity to contribute to original research involving a large-scale comparative genomics projects from the University of Alabama. By participating you are a member of The Genomics Education Partnership (GEP). The GEP is a national, collaborative, scientific investigation that uses comparative genomics to engage students in genomics research within regular academic-year laboratory courses (<http://gеп.wustl.edu>). Each student will analyze the DNA of one gene from 5 species of fruit flies that could include *D. simulans*, *D. yakuba*, *D. erecta*, *D. ananassae*, *D. pseudoobscura*, *D. willistoni*, *D. mojavensis*, *D. virilis*, *D. grimshawi*, or *D. elegans*. You will compare the data of your assigned gene to the heavily researched genes found in the model organism *D. melanogaster*. This semester you will be contributing to a new research initiative from the GEP to use a comparative genomics

approach using *Drosophila melanogaster* as the reference genome to study the evolution of the core components of the Insulin Signaling pathway in *Drosophila* species. You will determine gene organization for your assigned gene in your assigned species. The lab tools will be various types of DNA sequence analysis software. If you successfully complete the annotation of your *Drosophila* genes and give your instructor contact information that is reliable in the future, you will be contacted to see if you want to be a co-author when The Genomics Education Partnership is ready to publish a paper on the comparative genomics of various species of *Drosophila*.

- During the 1st and 2nd Wednesdays of the semester, the class will work together to explore several DNA analysis software tools. During this time, students will learn how to analyze genomic data. Homework from these labs is due the following Monday.
- At the Sept. 11 lab meeting, each student will be assigned genes and species to analyze.
- All students will complete a brief annotation test on Sept. 18.
- Independent work will happen in class and outside of class.
- On Dec. 4 all students will give a 5-8' minute PowerPoint presentation, summarizing their most interesting annotation problem.**

Class information:

The website <http://www.csustan.edu/Blackboard/> will have a link for this class. On Blackboard, I will post materials pertaining to this class. For example, lab handouts are available on Blackboard.

Notes:

Each Wednesday (and Monday) you work on a computer. Laptops are provided if needed. All of the DNA tools we will use are web-based. If you want to work on your own laptop, you can as long as you can connect to the internet in Naraghi Hall. The first two weeks are structured and will include a lab handout that is due the following week. The first portion of class will be your instructor introducing some important concepts. Both the lab exercises and demonstration materials will be available electronically on the class Blackboard site.

Email

I will use email to send you course announcements. The emails are sent to your csustan email account. Email is the good way for you to communicate with me outside of class time. I check my email many times per day on weekdays and periodically on weekends.

Student Conduct- The Wednesday activities will run the full two hours. Attendance is required. Do not enroll in this class if you have conflicts or other commitments on Wednesday evenings. Be on time for class. During the first minutes of many Wednesday lab periods we will discuss the day's activities. Do not leave the classroom in the middle of a discussion. Do not use cell phones, ipods, or other electronic devices during class. Computers are only allowed in class as a tool for class exercises.

Cheating/Academic Dishonesty- Students caught cheating are prosecuted as described in the university catalog. A report is filed with the Dean of Student Affairs. Class homework assignments are not group projects. Copying from someone's paper and presenting it as your own is a form of academic dishonesty. All electronic devices (including phones) & headphones must be kept in purses or backpacks during the exams and quizzes. No exceptions. You can use a real calculator and not the calculator function on a cell phone or PDA.

Taping Policy- Audiotaping of classes is permitted only with prior permission of the instructor; videotaping is not permitted under any circumstances. Authorized tapes are for the personal use of the student, and may not be distributed to others without the permission of the instructor.

Guest Policy- Guests are generally not permitted in this class. For an exception to this policy you must request prior permission.