



BIOLOGY 446

MICROBIAL GENOMICS

SPRING 2016

4 UNITS

Instructor: Prof. José R. de la Torre, Ph.D.
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Lectures: Monday/Wednesday, 10:10AM – 12:00PM • SCI 249

Prerequisites:

- This class is open to all Biology, Biochemistry, and Computer Science students.
- BIOL 401/402 (General Microbiology Lecture/Lab) and BIOL 355 (Genetics) are required. BIOL 442 (Microbial Physiology) highly recommended.
- Regular access to a computer and internet connection outside of class are required.

Course Description:

The increasing ease and decreasing costs of large scale sequencing are revolutionizing the field of Microbiology. Over the past twenty years, the cost of sequencing the average microbial genome has dropped from over \$50,000 to less than \$100. Consequently, new microbial genome sequences are appearing at an exponential rate: fifteen years after the publication of the first microbial genomes, the number of genome sequencing projects stands at over 5000. Microbiologists now operate in a world where genome sequences are the norm rather than the exception, and coping with that vast amount of information is now more of a challenge than generating it. In this class, we will delve into the world of microbial genomics, drawing examples from both the medical and environmental branches of Microbiology. Students will be introduced to basic methodologies involved in genome sequencing, assembly and annotation, as well as the tools required evaluate the quality of genomic data. Students will then apply this newly gained knowledge to analyze a real, unannotated microbial genome sequence. The results of these analyses may be incorporated into peer-reviewed publications with course participants listed as contributing authors.

Learning Objectives:

- Understand the general methods utilized in the field of microbial genomics (including metagenomics).
- Analyze and annotate a microbial genome fragment.
- Describe and use the methods for comparing microbial genomes.
- Use genomic databases and bioinformatic resources to explore microbial processes in the environment.
- Read, understand and critically evaluate relevant papers published in the scientific literature.
- Conduct an original comparative microbial genomic study based on independent reading. This includes the identification of interesting questions that can be addressed using methodology discussed in class, designing and executing an experimental approach to answer the research goals and communicating the findings to scientific peers.

Alignment between student and program learning outcomes:

One of the objectives of the degree program in Microbiology is to develop students with the knowledge and skills necessary for entering laboratory positions as experienced scientists. This course combines traditional lectures with project-based learning in a rapidly advancing field. In addition, this course will serve as an upper-division elective for Biology Majors with Concentration in Microbiology or Cell and Molecular Biology.

Textbook:

Select readings will be chosen from *Computing for Comparative Microbial Genomics* by Ussery, Wassenaar & Borini (Springer) and *Genomes 2* By T.A. Brown (Oxford) and other texts available online:

<http://www.springerlink.com/content/978-1-84800-254-8>

<http://www.ncbi.nlm.nih.gov/books/NBK21128/>

Additional readings will be assigned in class and made available through iLearn.

Data Usage Policy:

A large amount of the data to be used in the class are confidential at the property of Dr. de la Torre. Students are not to share these data with people outside of the class under any circumstance. Any questions regarding the use of the class data should be addressed to Dr. de la Torre.

Evaluation and Grading:

Gene Annotation Project (50 points). Over the course of the semester, students will be responsible for annotation a number of genes using tools and strategies defined in class.

Assignments (50 points). Several take-home assignments will be given over the course of the semester. Assignments will include reading and analyzing primary research articles, presenting project progress reports to the class or conducting more in-depth analysis (computational or otherwise) of material or data examined in class.

All late assignments will be marked down 10% for each day they are overdue. There will be NO make-up assignments.

Project Proposal & Peer Evaluation (50 points). Students will prepare a short (2 page) proposal of the final project they intend to complete. *This proposal should be hypothesis-driven.* We will discuss these proposals and how to write them in class. To generate feedback, proposals will be evaluated by students as well as by the instructor.

Class Participation (50 points). Individual participation is critical for productive class discussions and for the completion of a large group project. Participation will be evaluated based on attendance, involvement in class discussions, completion of peer-evaluations and completion of the individual project objectives.

Final Project (200 points). All students will be required to complete an independent research project over the course of the semester. This project should be centered on the genome we are analyzing in class and should develop an original thesis of the student's

choosing. *Students will prepare a poster presentation of their research project to be presented at the annual College of Science & Engineering Student Project Showcase on Friday May 6th, 2016 (3-6pm in the Student Life Event Center – ANNEX I).*

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| Annotation Project | 50 pts | 12.5% |
| Take-Home Assignments | 50 pts | 12.5% |
| Project Proposal & Peer Evaluations | 50 pts | 12.5% |
| Class Participation | 50 pts | 12.5% |
| Final Presentation (poster @ COSE Showcase) | 100 pts | 50.0% |
| ----- | | |
| Total | 400 pts | 100% |

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|-------------|-------------|-------------|-------------|----------------|
| A = 96-100% | B+ = 86-89% | C+ = 76-79% | D+ = 66-69% | F = 59 or less |
| A- = 90-96% | B = 83-86% | C = 73-76% | D = 63-66% | |
| | B- = 80-83% | C- = 70-73% | D- = 60-63% | |

Attendance:

Students enrolled in BIOL 446 are expected to attend all class sessions. Students missing class are responsible for obtaining the information covered in class from a classmate.

Note: Too many absences or late arrivals will negatively impact the Class Participation grade.

Class Website & E-mail Policy

Course material, including handouts and assignments, will be made available online through the iLearn system (<http://iLearn.sfsu.edu/>). If you encounter any problems downloading or printing these files, please contact the instructor immediately. Students are encouraged to e-mail questions to the instructor. Whenever e-mailing questions, please include "**BIOL 446**" in the subject line and identify yourself by signing the message with your **full name** and **SFSU ID number**. If appropriate, responses will be posted on iLearn or discussed in class—without identifying the student. *Be advised that, in general, e-mails will receive responses within a day or two.*

Changes to the Syllabus or Lecture Schedule

The syllabus and lab schedule are subject to change. Changes to the syllabus or lab schedule will be announced in class and/or posted on iLearn.

Statement on plagiarism and cheating

Students are expected to maintain a high level of academic integrity in all work pursued at SFSU. **Cheating or plagiarism will not be tolerated under any circumstances in this class.** Plagiarism, defined as either direct copying or loose paraphrasing of text from any published work (including online) without appropriate referencing, or use of another person's work or ideas without appropriate attribution, will result in an automatic zero points for that entire assignment. **Plagiarism includes computational results and mis-appropriation of software code without giving proper credit to the author(s).** There will be no second chances. Any incidence of cheating or plagiarism will be reported to the Chair of the Biology Department, the Dean of the College of Science and Engineering, and the Office of Student Affairs for

possible disciplinary action. Consequences can include penalties up to expulsion from the University.

Cell phones & pagers

Please silence cell phones and pagers before arriving in class.

American with Disabilities (ADA) Accommodation

SFSU is committed to providing reasonable academic accommodation to students with disabilities. Students with disabilities who need reasonable accommodations should contact the instructor. The Disability Programs and Resource Center (DPRC) will facilitate the accommodation process for individuals with verified disabilities. If a student is a DPRC client, he/she must present an RAV (Reasonable Accommodation Verification) AND an EAR (Exam Accommodation Request) to the instructor at the beginning of the semester. Students are responsible for submitting the completed EAR form to the DPRC. Any changes to the accommodation require prior approval by a DPRC specialist. Changes cannot be requested during an exam. The DPRC is located in the Student Service Building (SSB-110) and can be reached by telephone (voice/TTY 415-338-2472) or by email (dprc@sfsu.edu).

Student disclosures of sexual violence.

SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the [Dean of Students]. To disclose any such violence confidentially, contact: [The SAFE Place - (415) 338-2208; http://www.sfsu.edu/~safe_plc/] [Counseling and Psychological Services Center - (415) 338-2208; <http://psyservs.sfsu.edu/>] For more information on your rights and available resources: [<http://titleix.sfsu.edu>]

Important Deadlines for Add/Drop/Withdrawal:

February 8, 2016 (midnight)

Deadline for FACULTY to drop students from courses without a W.

February 9, 2016 (midnight)

Deadline for STUDENTS to drop courses without a W.

February 28, 2016

Deadline to add courses with instructor-issued permit number.

February 10 – April 26, 2016

Withdrawal period -- no documentation required.

Withdrawals will result in a “W” grade on transcript records.

April 27 – May 17, 2016

Withdrawal is permissible only for **serious and compelling reasons**. Students must file a petition to be reviewed by the Instructor and the Department Chair. Approved withdrawals will result in a “W” grade on transcript records. ***“Withdrawals are not normally permitted during the final three weeks except in verified cases of accident or serious illness where the cause of withdrawal is due to circumstances clearly beyond the student's control and where the assignment of an incomplete is not practical. Ordinarily, withdrawals in this category will involve total withdrawal from the University.”*** (SFSU Bulletin)