

SYLLABUS IT22700
Spring 2017
BIOTECHNOLOGY LAB II

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Class Time: Lab (Section I) 9:30-11:20 W/F (LillyG-401)
Lab (Section II) 3:30-5:20 W/F (LillyG-401)

Office Hours: Available by appointment

Course Description

The course is a Course Undergraduate Research Experience (CURE), more specifically, a part of the Howard Hughes Medical Institute's (HHMI) (<http://www.hhmi.org/grants/sea/>) Science Education Alliance and is an authentic research experience. Students engage in hands-on discovery as scientists with the ultimate objective of contributing new mycobacteriophage genomes to the scientific literature and public databases (<http://www.hhmi.org/news/pdf/hatfulljacobs.pdf> and www.phagesdb.org).

Welcome BACK to the SEA

In a prior course (IT22600, Biotechnology Lab I) students isolated bacteriophage from soil samples, purified them, performed electron microscopy, and isolated the viruses' DNA. Phage genomes were sequenced at the Purdue sequencing center. In this course, students will translate the As, Ts, Gs, and Cs of the phage genome into biological information. Like the *In Situ* phase last semester, the *In Silico* portion, is divided into three sections: **Analyze**, **Discover**, and **Share**. In **Analyze**, the student will be introduced to genomes and genes. Additionally, the student will be given information to help them examine the DNA sequence and identify potential genes. Students will download their sequence information from the Internet, annotate their selected phage genome (that is, identify the genes and other structures present), and compare their genome to other phage genomes. The student will use a variety of bioinformatics tools to *discover* genomic organization by mapping gene locations, identifying potential gene products, and placing genes into families with the use of several different types of databases. Finally, the student will have the opportunity to share their discoveries with others within the Alliance and with the scientific and general population communities. While the object of *In Situ* was to obtain a novel phage, the object of *In Silico* is to analyze the **genome** and discover its novelties. These unique features will be found in the form of DNA **sequence** information, i.e., the ordering of its building blocks (nucleotides). The sequence information encodes the organism's **genes**, the characteristics that make an **organism** what it is. (*From the HHMI--SEA Lab manual*).

All participants will share their discoveries, ideas, and challenges via the HHMI Science Education Alliance wiki (<http://www.hhmi.org/seawiki/dashboard.action>). It is expected that all students who contribute data and intellectual information to the genome will become authors on the published genome announcement.

Course Goals

- A. The student will analyze the genetic code of a unique phage in order to determine potential genes

- B. The student will discover the genomic organization of their unique phage
- C. The student will use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome.
- D. The student will read and discuss scientific literature related to their research project
- E. The student will share the information gathered with others in the scientific community

Learning Objectives

CURE learning outcome 1: Students will be involved in the use of scientific practices.

- The student will gain literacy in the basic methods and applications of bioinformatics, including quantitative literacy.
 - The student will be able to explain the experimental basis of techniques used, indicating the significance of the work, presenting, calculating, and discussing the data, and drawing conclusions.
 - The student will describe the theory and application of computational approaches that are used to analyze biological data.
 - The student will use algorithms to define potential genes, assign putative functions to them, and determine the order in which they appear in the genome.
 - The student will identify genomic features that can define genes: elements important for transcription, elements important for translation, elements that indicate a non-protein-coding gene

CURE learning outcome 2: Students will be involved in the process of discovery.

- The student will gain experience in dissecting and extracting pertinent information from scientific journal articles.
- The student will be able to navigate uncertainty

CURE learning outcome 3: Students will be involved in broadly relevant or important work.

- The student will compare the structure and organization of the genome to other genomes
- The student will share the information gathered with others in the scientific community

CURE learning outcome 4: Students will be involved in collaboration.

- The student will work on a team and communicate their results

CURE learning outcome 5: Students will be involved in iteration.

- The student will design and conduct a research project to contribute new knowledge about the unique phage.

Course Requirements & Grading

Computer requirements: Students will need to own or have ready access to a computer and broadband Internet. The computer can use Mac, Windows or Linux operating systems. Each student group will need a computer with Windows. You must also have administrative privileges for the computer as you will be installing provided analytical software for genomic research. Though a laptop computer is preferred it is not required.

The final grades for the course will be determined by a total accumulation of points from all activities and assignments. Individual progress toward course objectives and final grades will be computed based on the following weights:

Assignments	Percentage of Final Grade
Annotation Quality	15
Lab Notebooks	20
Reflections	15
Laboratory Participation and Performance	10

This syllabus is subject to change. If edits are made a new syllabus will be distributed in class and/or posted in Blackboard.

Final Presentation	20
Final Research Report	20
Total	100

We will use an electronic tool to objectively evaluate your individual contribution and group participation. Your grade for the highlighted rows above (Annotation Quality, Lab Notebooks, Lab Participation and Performance, and Final Presentation) will be weighted from the peer group score in CATME (www.catme.org).

Annotation Quality

As a class, we will be annotating genomes. It is important that your data is submitted on time and in the format requested and that all annotation activity be completed by the end of the semester.

The quality of your data, including quality and clarity of the annotation is critical and will account for 10% of the 15% total. Timeliness will account for the remaining 5%. A format for annotation will be provided and must be strictly adhered. Deadlines for submission will be determined from the date that the data becomes available from the sequencing facility (currently expected by the 2nd week of the semester). Once a timetable is established it is expected that you will follow it closely.

You should review the class schedule and lab activities for each week in Blackboard. Progress will be assessed weekly, with preliminary evaluation and a time to address questions and problems that have arisen during class presentations and discussion.

Lab Notebooks.

Because your work in this course is real research, the output of your assignments and your work will be used by the broader scientific community for years to come. For this reason, documentation of your work and the data you collect is critical. You will maintain an electronic laboratory notebook using Google Docs. You will create a shared (i.e. viewable by your instructors and peers) notebook. You will be graded on the completeness, organization, accuracy, ease of use by outside readers, and adherence to our research documentation protocols (to be distributed and discussed in class). Your electronic lab notebooks will be graded at periodic checkpoints during the semester and again at the end of the semester.

Reflections.

Reflections will be completed bi-weekly and submitted electronically to provide updates of laboratory progress, troubles encountered, and apply foundational scientific content knowledge related to the research project. Discussion questions from the assigned readings may also be included.

Laboratory performance.

A portion of your grade (10%) will also depend on laboratory performance including, but not limited to, any of the following:

- Arriving late to class
- Being unprepared for the exercise and lab meetings
- Leaving the laboratory before completing the exercise
- Conducting yourself unprofessionally
- Any activity that is considered to violate academic integrity and research ethics standards

Your laboratory performance will also be impacted by your CATME group peer review feedback and lab participation:

- The class meets twice a week for 2 hours. You are expected to attend each class, prepared to learn the computational repertoire needed for the course, to update the class on the status of your analysis, discuss both the implication of your own and your peer's work, and discuss strategies for the next steps.
- Grading of participation will be assessed based on in-class participation (includes active participation in discussion, preparation for class, active role in data assessment and analysis).

This syllabus is subject to change. If edits are made a new syllabus will be distributed in class and/or posted in Blackboard.

- During class time you should be on task. Do not browse the Internet, check your social sites, email, or chat. Internet should be used for class purposes.

Assigned Readings.

Readings will be assigned to provide more information and background on the concepts applied in the research laboratory. There will be oral discussions over the readings and occasional writing activities. Oral participation will count toward your Laboratory Performance grade. Discussion questions may be included in your reflections.

Final Presentation and Final Paper.

A final presentation and report will be completed to both summarize research findings from the semester and outline potential future areas of research. Each group will prepare and present a poster at the symposium on Tuesday, April 11, based upon the phage research project from the course in lieu of a presentation at the end of the semester. The final paper will follow a rubric given in class and will take the form of an academic paper. Readings from the scientific literature will be assigned throughout the semester to help provide a foundation for the literature review. The data that you collect throughout the semester will be summarized in the paper and presented as data that provides a rationale for the paper discussion and proposed next steps for future research.

Required Texts & Reading

1. A User Guide to DNA Master; Jacobs-Sera D, Pope WH, Russell DA, Cresawn SG, and Hatfull GF; University of Pittsburgh, Pittsburgh, PA; 2012. (available at [seaphages.org http://seaphages.org/media/docs/Annotation_Guide_12.02.2015.pdf](http://seaphages.org/media/docs/Annotation_Guide_12.02.2015.pdf))

2. Selected journal articles including:

- “Mycobacteriophages: Genes & Genomes” G. Hatfull. 2010 Annual Reviews of Microbiology. Vol 64. Pg 331 – 356. Available at the Phage Database (www.phagesdb.org), on the HHMI SEA wiki, and via Purdue University Libraries
- Hatfull et al. 2010. “Comparative genomic analysis of 60 Mycobacteriophage genomes: genome clustering, gene acquisition, and gene size.” Journal of Molecular Biology. Vol 397, Issue 1, Pages 119-43, 2010. Available at the Phage Database (www.phagesdb.org), on the HHMI SEA wiki, and via Purdue University Libraries
- Pearson, Helen. “What is a Gene?”. Nature. 2006. Vol. 441. Pg. 399 Available on Nature’s Website Via Purdue Subscription. <http://www.nature.com/nature/journal/v441/n7092/full/441398a.html>

Other readings as assigned

Optional References

1. Current Protocols in Bioinformatics. Copyright (©) 2009 John Wiley & Sons, Ltd.. Online ISBN: 9780471250951. Available On-line via the Purdue University Libraries. <http://cda.currentprotocols.com/WileyCDA/CPTitle/isbn-0471250937.html>
2. Baxevanis A.D. and Ouellette, B.F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. (2005) Third Edition. Wiley-Liss. (optional)
3. Writing Reference: The Elements of Style. Fourth Edition. By Strunk & White. Allyn & Bacon Publishing. 2000.

General Course Policies

Contacting Dr. Clase: Email. Sometimes email will be fast (within the hour), sometimes email will be slow (many days). I am happy to correspond by email, but don't count on instantaneous communication. **Phone.** Leave a voicemail for urgent matters. Any issues regarding attendance should be communicated through direct (phone or voicemail) communication. **Office hours.** Feel free to utilize office hours. This may be the most efficient communication.

Late Assignments: Assignments must be submitted the beginning of class. Late assignments will not be accepted unless special arrangements have been made with the instructor, preferably in advance. See attendance policy. Assignments can be accepted early.

Grade Complaints: Grade complaints must be submitted in writing to the instructor within 1 week after the graded material is returned to the student. Grade complaints will be subject to an entire regrade. All grades will be posted in Blackboard.

Grading Scale

Grade	GPA Value	% Range
A	4.0	90-100
B	3.0	80.0-89.9
C	2.0	70.0-79.9
D	1.0	60.0-59.9
F	0.0	<60.0

Academic Dishonesty

University policies regarding academic honesty will be upheld in the course. Any form of academic dishonesty *including plagiarism* may be grounds for a failing grade and referral to the Dean of Students office. The university policy can be found at: www.purdue.edu/odos/aboutodos/academicintegrity.php

Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

Attendance

You should attend all classes. Class discussions enhance and clarify your understanding of course material.

I understand that on *rare* occasions you may have legitimate business that conflicts with class. If you need to miss class, please inform me in advance (in person, by phone, or voicemail) so you can arrange to submit your work early. Students who are absent are still responsible for knowing course material and getting assignments and announcements regardless of attendance. Past experience shows that successful students were those who attended class, completed all assignments and quizzes.

This syllabus is subject to change. If edits are made a new syllabus will be distributed in class and/or posted in Blackboard.

You are expected to be punctual and to stay for the entire class period. It is simply a matter of courtesy to your fellow students and instructors.

University Policy states that students are expected to be present for every meeting of the classes in which they are enrolled. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible...For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, or by contacting the main office that offers the course. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students.

The university policy can be found at: www.purdue.edu/odos/services/classabsence.php

Grief Absence Policy for Students

Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for misses assignments or assessments in the event of the death of a member of the student's family.

Missed or Late Work

Assignments are due in class. Late work will not be accepted. For excused absences please arrange with the professors to turn in your assignments early.

Use of Copyrighted Materials

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Violent Behavior Policy

Below is Purdue's policy prohibiting violent behavior. See the following website for additional information:

http://www.purdue.edu/policies/pages/facilities_lands/i_2_3.shtml

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

Students with Disabilities

If you have a disability that requires special academic accommodation, I am more than happy to work with you. Please make an appointment to speak with me within the first three (3) weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. It is the student's responsibility to notify the Disability Resource Center (<http://www.purdue.edu/drc>) of an impairment/condition that may require accommodations and/or classroom modifications.

Purdue University is required to respond to the needs of the students with disabilities as outlined in both the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 through the provision of auxiliary aids and services that allow a student with a disability to fully access and participate in the programs, services, and activities at Purdue University.

Emergencies

In case of campus emergencies, we will notify the class via email and/or an announcement in blackboard as to how we will proceed.

University Policy: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Nondiscrimination

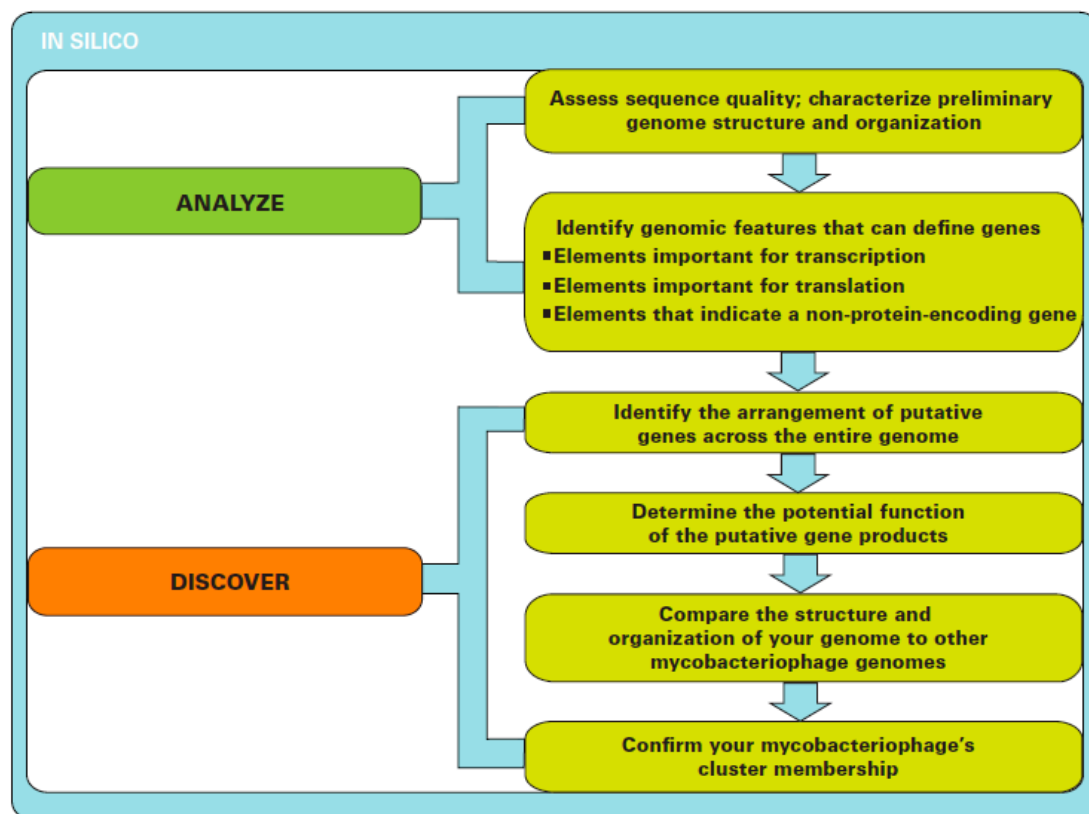
Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in [Executive Memorandum No. D-1](#), which provides specific contractual rights and remedies. Any student who believes they have been discriminated

against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

Class Schedule –see attached document

Our timeline will follow the Research Workflow presented in the SEA In Silico Laboratory Manual:



Note that GenBank submissions and the submission of the genome announcement publication may take place AFTER the 14th week and will be handled by course faculty and TAs.

The selection of Purdue's representative to the SEA-PHAGES Symposium in June will be done in collaboration with input from the class. One presenter and an alternate will be selected. Preparation for the symposium will require some additional time after the end of classes to prepare slides and practice the oral or poster presentation at the Annual SEA-PHAGES Symposium in June 2017.

