

Biology 312L (Fall 2018)

Molecular Biology Lab – HHMI Phage Research

Lab: Th 12:15 – 3:15pm, RITA 145

Instructor: Dr. Christine Byrum

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Office Hours: By appointment

Prerequisites/Co-requisites: Co-enrollment or completion of Genetics (BIOL 305) and co-enrollment or completion of Molecular Biology (BIOL 312).

Course Overview:

In collaboration with the Howard Hughes Medical Institute (HHMI) students in this upper level undergraduate course will participate in bacteriophage genomics research! This is part of a national effort to discover, isolate, and sequence genomes of previously unidentified viruses. Students participate in authentic hands-on research combining molecular genetics and computational approaches for large-scale analysis of bacteriophage genomes. In this course students will:

- Collect environmental samples.
- Isolate bacteriophages from those samples.
- Use PCR and restriction digests to identify different viruses.
- Use transmission electron microscopy to examine structure of the isolated viruses.
- Prepare viral DNA for sequencing.
- Send purified viruses for whole genome sequencing using next generation Illumina technologies.
- Collaborate with other schools in the HHMI network on an online forum.
- Upload viral sequences to a publicly accessible database.
- Present findings at the national HHMI conference.
- Contribute to scientific discovery!

Course Objectives/Student Learning Outcomes:

- 1) Demonstrate the ability to use and explain modern molecular biology techniques.
- 2) Demonstrate understanding of developing hypotheses and designing experiments.
- 3) Communicate, analyze, and discuss experimental results.
- 4) Demonstrate ability to evaluate/ apply information presented in scientific journals.
- 5) Demonstrate the ability to utilize key tools needed in molecular biology (e.g. performing gel electrophoresis, setting up and running a PCR reaction, extracting DNA, and searching for sequences using Genbank or BLAST)

Required Supplies:

- Phage Discovery Guide - PDF will be provided on OAKS free of charge. An online version of this is also available at the following website:
<https://seaphagesphagediscoveryguide.helpdocsonline.com/home>
- Lab notebook (To be kept in lab during and after completion of course)

Course Policies

Attendance: Regular classroom participation is critical. If you are absent, your research cannot proceed. If you cannot attend a class, be sure to get the information from a classmate or from the instructor so that you don't fall behind and to make up the missed time in an open lab if needed. If an absence is anticipated, inform the instructor ahead of time. Make-up assignments will only be approved with an official excuse from the Dean of Students (Undergraduate Affairs Office) at the instructor's discretion. Students with multiple unexcused absences will likely fail the course.

Assignments and Grading: Course grades will be calculated based on the following:

Participation/Research Productivity	30%
Lab Notebook	20%
Quizzes/Homework	40%
Virus Presentation	10%

Participation/Research Productivity: A critical portion of your grade will be based on participation and research productivity. This grade is determined based on the following criteria: regular attendance; B) research focus (evidence that lab work is performed correctly and that the student makes progress in the project or in troubleshooting if obstacles are encountered); and C) ability of the student scholar to interact productively with others, actively contribute during class discussions, and maintain a positive attitude. Aspects that will be considered include the following:

- Is the student curious and interested in communicating discoveries?
- Has the student become familiar with what is already known about the subject?
- Does the student doggedly pursue the question (continuing to work hard even after failing multiple times)?
- Is the student able to work independently?
- Does the student help fellow students?
- Does the student ask good questions during discussions?
- Does the student skillfully execute experiments?
- Can the student develop and clearly state hypotheses?
- Can the student clearly describe results and ideas to others?
- Can the student logically troubleshoot when things go wrong?
- Can the student correctly interpret outcomes of experiments?

Lab Notebook: Throughout the semester, students will record their activities in a lab notebook. These lab notebooks should stay in the lab during the semester and will be kept by the instructor afterwards so that we can refer to your data as manuscripts are prepared for publication. Your pages will ultimately be archived in a National Phage Repository, so it is important that you clearly document your experiments. Lab notebooks will be evaluated twice during the semester. When grading, the instructor will consider the following:

- Did the student record all aspects of the project (are the contents complete)?
- Did the student state their aims clearly for each portion of the project?
- Are the methods stated?
- What were the results?
- Are future plans stated?
- Are drawings included and understandable?
- Is the material presented easy to interpret and understand?
- Did the student include photos of data?

Quizzes/Homework: Each week students will complete assigned exercises to be turned in at the beginning of the next class. Lab assignments will be announced in class and/or placed on OAKS prior to the week they are due. These assignments may involve reading papers before class, preparing for discussions, completing worksheets, quiz prep, writing a short report, etc. A research poster summarizing your work will be required at the end of the semester. Scores received on these exercises will comprise 40% of the final grade.

Presentation: At the beginning of the semester each student will select a date to do a short presentation about viruses (~5 minutes). Students can describe recent findings in the news, present historical information about, describe mechanisms of viral activities, discuss an industrial use of viruses, etc. The information presented should be, in some way, relevant to the molecular biology of viruses. Feel free to discuss this with me ahead of time if you're unsure whether your topic is suitable. Students will sign up for a presentation date at the beginning of the course (these will be posted on OAKS) and students should plan to arrive 5-10 minutes before class on the day of their presentation. Be sure that your topic differs from previously covered information.

Grading Scale

93 and above: A	73-76.9: C
90-92.9: A-	70-72.9: C-
87-89.9: B+	67-69.9: D+
83-86.9: B	63-66.9: D
80-82.9: B-	60-62.9: D-
77-79.9: C+	below 60: F

Websites: In this course, the instructor will regularly post information on OAKS and the students will also utilize HHMI's website, PHAGESDB.ORG.

Lab Safety and Attire: Before attending the next lab, each student should review the official SSM safety manual posted on OAKS. Students should be sure to dress appropriately, wearing closed-toed shoes and pants rather than shorts. Also, do not bring any food or drinks into the lab.

Additional Lab Hours: Due to the nature of this research course, you will need to come to the lab between classes or during open lab periods on the weekend (times that the instructor will be available to meet students during open lab will be posted/announced in class ahead of time). Be sure to record anything that you do during these times in your notebook as well.

Classroom Courtesy: Students are expected to switch off cell phones and any other disruptive devices during lab, lectures, and discussions. Do not text, watch movies on a tablet, shop online, or engage in any other disruptive behaviors. Focus on class activities. Exceptions to the cell phone policy will be made in extreme situations such as spouses anticipating the birth of a child or a serious emergency. Permission to leave an electronic device on should be obtained before class.

Academic Integrity: Students are expected to behave in an honest and responsible manner. Violations of the honor code are offensive and will generally be dealt with severely. We will adhere to the following policy as quoted from the Honor Council's recommended guidelines:

"Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines that the student's actions are related more to a misunderstanding will be handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed both by the instructor and the student, will be forwarded to the Dean of Students and placed in the student's file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This status indicator will appear on the student's transcript for two years after which the student may petition for the XX to be expunged. The F is permanent. The student may also be

placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration--working together without permission--is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone, tablet, or computer), copying from others' exams, fabricating data, and giving unauthorized assistance.

Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor.

Students can find the complete Honor Code and all related processes in the *Student Handbook* at:

<http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>."

Office Hours: Office hours will be by appointment. To schedule an appointment, contact the instructor by email, telephone, or during/after class. Students with questions are highly encouraged to come by and discuss them with the instructor.

Center for Student Learning: Students are encouraged "to utilize the Center for Student Learning's (CSL) academic support services for assistance in study strategies, speaking & writing strategies, and course content. This office offers tutoring, supplemental instruction, study strategy appointments, and workshops. Students of all abilities have become more successful using these programs throughout their academic career and the services are available to you at no additional cost. For more information regarding these services please visit the CSL website at <http://csl.cofc.edu> or call (843) 953-5635."

Accommodations for Students with Disabilities: Any student who needs accommodations because of a disability should talk to the professor about this during the first week of classes or as soon as they have been approved for these services so that this can be addressed. For more information on Disability Services, please refer to the following website: <http://disabilityservices.cofc.edu>

Lab Schedule

Date/Day	Topic
Aug. 23 Th	Lecture: Introduction to HHMI and Phage Lab Lab: Collect Samples/Aseptic Technique/Pipetting
Aug. 30 Th	Lecture: Intro to Viruses and Bacteria/Quiz Lab: Direct and Enriched Isolation
Sept. 6 Th	Lecture: Notebooks/Paper Discussion (Genome Announcement) Lab: Plaque Isolation/Spot Test
Sept. 13 Th	Lecture: Phage Genome Features Lab: Plaque Purification (Serial Dilution and Spot Titer)
Sept. 20 Th	Lecture: Genbank and BLAST/Virus, Bacteria, Genome Features/Quiz Lab: Plaque Purification (Full Titer plates)
Sept. 27 Th	Lecture: Titer Plates Lab: Plaque Purification (Pick Plaque and Do Second Serial Dilution/Spot Titer)
Oct. 4 Th	Lecture: Primer Design Lab: Full Titer Plates or Multispot Plates to Collect Lysate
Oct. 11 Th	Lecture: PCR/Quiz Lab: Serial Dilutions to Check Lysate Concentration Set Up PCR to Detect Viral Genes
Oct. 18 Th	Lab: Plaque Purification
Oct. 25 Th	Lecture: DNA Extraction Lab: DNA Extraction
Nov. 1 Th	Lecture: Restriction Enzymes/Quiz Lab: Restriction Digests
Nov. 8 Th	Lecture: Gel Electrophoresis Lab: Gel Electrophoresis
Nov. 15 Th	Lecture: TEM Lab: TEM
Nov. 22 Th	Thanksgiving Break
Nov. 29 Th	Archiving/Final Notebooks Due

** Schedule may vary subject to scheduling changes and other modifications as needed.*