

Bacteriophage Investigations – *in Silico*
A Bacteriophage Annotation Project
Spring, 2020

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Course Objectives: Congratulations! You have been selected to participate in a unique and challenging project that will provide you an opportunity to make a real and important contribution to the scientific community. The Howard Hughes Medical Institute Science Education Alliance is a national, collaborative project consisting of twelve institutions of higher education. The purpose of this project, and this course, is to introduce undergraduate biology students to real, discovery-based science. The aim of this program is to discover and characterize a new Actinobacter phage (viruses that infect bacteria of the various Actinobacter species). The data generated will be incorporated with the data of other participating institutions. The discoveries made in this lab will increase our knowledge of bacteriophage diversity, genetics, and evolution. It is data that will be published and disseminated to other scientists world-wide. Therefore, you will not just be a student; you will also be a scientist. The University of Louisiana at Monroe is a member of Cohort 1 of the HHMI-SEA PHAGES Program and during the past 10 years has worked with over 250 ULM undergraduates to successfully isolate over 150 novel phages. To date, 25 ULM-annotated phages have appeared in GenBank and several of these novel isolates have been featured in peer-reviewed publications.

Course Description: This project is traditionally delivered as a two-semester course sequence. In the first semester wet-lab portion, the focus is on the isolation of new Actinobacter bacteriophage from the environment. Students generate a pure, high-titer culture of these phages and characterize their structure using electron microscopy. In addition, they isolate and purify the genomic DNA of these bacteriophages and submit this DNA for sequencing to the University of Pittsburgh. The second portion of this project involves the characterization and annotation of the genomic DNA.

Course Reading Materials: You will be provided with an electronically-accessible laboratory manual and additional reading materials.

Student Expectations: As mentioned above, you will be both a student and a scientist in this course. Therefore, you will be expected to quickly master techniques and the relevant quantitative skills. Since you are generating scientific data that will ultimately be published, you will be required to properly maintain a laboratory notebook and you will be held to the same ethical and professional standards required of all practicing scientists. The instructors reserve the right to remove any students, at any time, that fail to meet these standards.

Instructional Methods and Activities: Labs will incorporate both Zoom lectures and computer lab exercises. Students will complete annotation exercises either in groups or individually.

Evaluation and Assessment: Assessment will be based on the following criteria:

Conduct (safety, attitude, participation, professionalism, collegiality, and ethics) - 20%

Lab notebook (gene product annotation notes) and postings to DNA Master - 30%

Mastery of annotation scheme and associated topics (survey responses; reflection essay submission) – 30%

Assignments/Quizzes/Moodle Postings - 20%

Minimum Requirements for Enrollment in this Project:

- Personal computer and high-speed internet access
- Basic computer skills – can download/upload files, ability to perform web-based searches
- Basic knowledge of molecular biology and genetics
- Sophomore, junior, or senior undergraduate status
- Past participation in an independent research project or the SEA PHAGES program is a plus but not required

Proposed schedule:

Week of June 15: General overview; *in silico* resource guide; DNA sequencing video

Week of June 22: Introduction to genome organization and annotation; DNA Master

Week of June 29: DNA Master – Gordonia phage - Lamberg

Week of July 6: DNA Master – Gordonia phage - Lamberg

Week of July 13: DNA Master – Gordonia phage – Lamberg; annotation review/submission
DNA Master – Gordonia phage - Dexdert

Week of July 20: DNA Master – Gordonia phage – Dexdert;
Gattaca – view movie; *Gattaca* survey

Week of July 27: DNA Master – Gordonia phage – Dexdert; annotation review/submission