Comparative Mycobacteriophage Genomics: Purdue Branch of the HHMI National Genomics Research Initiative

INITIATIVE

Kari Clase aimed to develop an interdisciplinary biotechnology program that would contribute both to scientific research and provide an understanding of best practices for undergraduate science education. She and Jenna Rickus developed a scientific research course on understanding and identifying bacteriophages. Bacteriophages are possibly the most numerous organisms on earth, but few are classified and categorized. The genomic analysis of novel bacteriophages can provide information that will be the basis for new disease-fighting treatments. A compendium of novel bacteriophages provides rich data for comparisons.

The course is a part of the Howard Hughes Medical Institute Science Education Alliance. Clase and Rickus have been teaching the course, guiding the students’ research and introducing innovative technologies for assessment in both the teaching laboratory area in The Hall for Discovery and Learning Research and the research laboratory area in Bindley Bioscience Center, both part of the Discovery Park complex.

IMPACT

- The course has created an opportunity to study how students best learn science.
  - Their data supports that students learn practical laboratory skills in addition to complex research skills such as experimental design, critical thinking, how to collaborate and share data, using virtual resources in the context of an authentic genomics research project.
  - These professors have developed novel assessments to evaluate students’ achievements in the next implementation of the course.
- To date, 120 undergraduate students at Purdue have isolated and characterized 46 novel Mycobacteriophages of a strain particularly related to Mycobacterium tuberculosis. Research on this strain and, hence, in developing new drugs for tuberculosis is slow and challenging. The contributions of these 46 new phages are significant additions for researchers in this field. So far, the students have fully sequenced 13 genomes and published 3 genomes in Genbank.

- The impact on individual students is equally impressive. Students are allowed to name the novel bacteriophage that they identify and analyze. Emilia Czysczon named her bacteriophage, Czysczon1, which she discovered in a soil sample from the wall of a cave in Bedford, Ind. Said Emilia, “They (bacteriophages) show potential for fighting bacterial-caused diseases at a time when bacteria are becoming resistant to antibiotics. ... It would be cool to see if my bacteriophage could be a stepping stone to finding a treatment for tuberculosis.”