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2022 SEA Symposium Abstract

Purdue University

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Discovery, Annotation, and -Omics Analysis of Phage at Purdue University

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The Department of Agricultural and Biological Engineering (ABE) has been a part of the SEA-PHAGES program since 2010. In the 2021/2022 academic year, over 70 students enrolled in the phage discovery and bioinformatics courses, accounting for a 30% increase since 2020. The course leadership team was expanded to adequately cater to the increased enrollment. The course leadership team comprises a professor, four graduate teaching assistants, and twenty undergraduate peer leaders subdivided into five functional groups: media prep, grading, lab leadership, annotation, and research meeting leadership.

In the summer and fall of 2021, 28 phages were isolated from soil samples, mainly around West Lafayette, IN, using direct and enriched isolation methods. The phages were purified, amplified, imaged, DNA extracted, restriction enzyme digested, and archived. During the spring semester, the research team is annotating six phages. Three of the phages are Maby2021, PhiRho, and YemiJoy2021, which are mycobacteriophages discovered by students at Purdue University. The other three phages are non-mycobacterium phages adopted from HHMI’s genome exchange. The adopted phages include Phabuloso, Gordonia phage from cluster DN, JimJam Streptomyces phage from cluster BE2, and Yuma, Microbacterium phage from cluster ED2. DNA Master and PECAAN programs are currently being used in the annotation process. To further investigate membrane proteins, SOUSI and TMHMM programs are utilized. During the academic year, the temporal proteomic and lipidomic profiles of three mycobacteriophages are being analyzed. One of the phages being further investigated is C1 phage Zalkecks. Krili, a lytic cluster O phage, and PotatoSplit, a lysogenic cluster A3 phage, are also being explored.

From the phages discovered, nine were of myoviridae morphotype which is primarily seen with C1 phages. Three of the myoviridae phages were sequenced and are currently being annotated by students. The -omics analysis is still ongoing, but preliminary results show lipid and protein profiles changing between lytic and lysogenic cycles and over time.

Students taking these courses are exposed to different laboratory techniques and bioinformatic skills essential for future research and career paths in biotechnology. As the world’s requirement for innovative solutions to health and environmental challenges continues to grow, the need for phage discovery, annotation, and further experimentation is imperative.