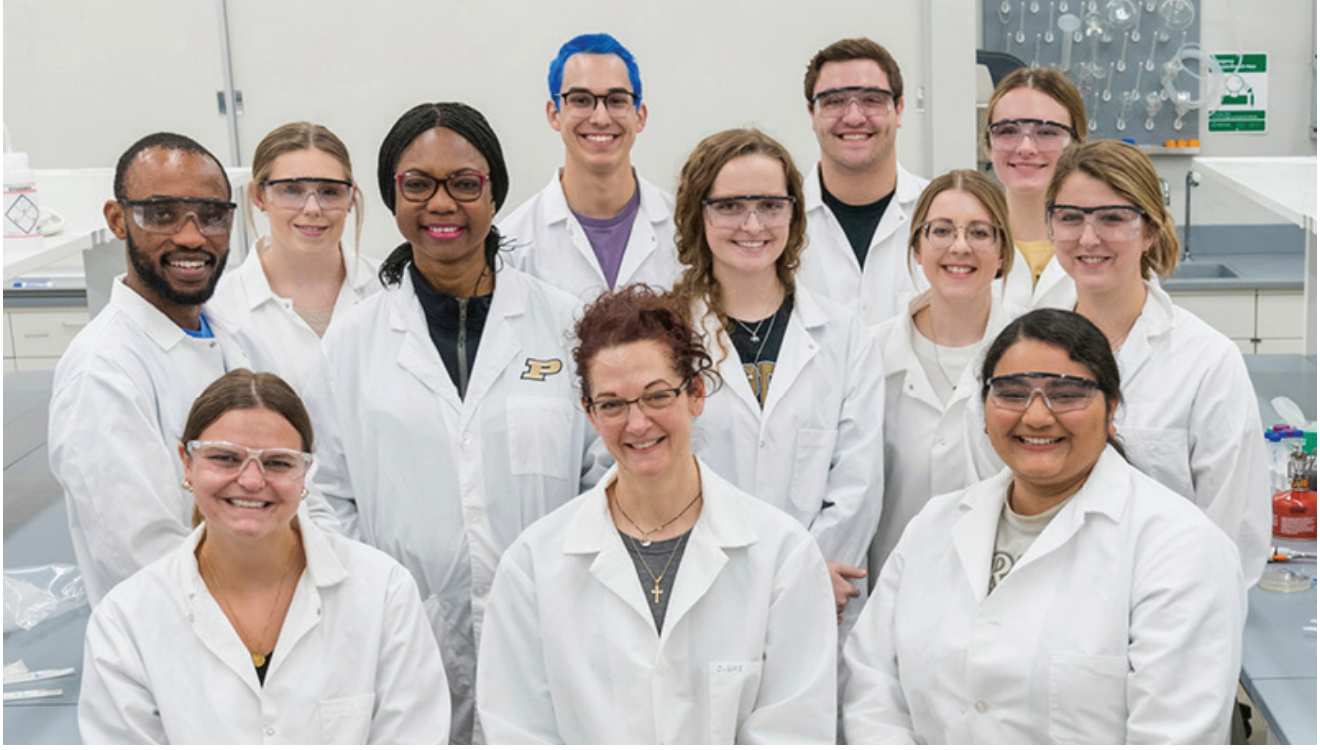

Undergraduate students from a range of majors take part in a biotechnology course to isolate and study bacteriophages, viruses that destroy bacteria cells by infecting them and reproducing inside them. Some bacteriophages may be able to help treat antibiotic-resistant bacteria. Students in the class recently named one of their bacteriophages for President Mitch Daniels. (Purdue University/John Underwood)

COVER IMAGE RESEARCH SUMMARY

ABE 22600 (Biotechnology Laboratory I) and ABE 22700 (Biotechnology Laboratory II) are two-semester course-based undergraduate research experiences (CUREs). These courses are a part of the Biotechnology Innovation and Regulatory Science Center, located at Purdue University, and the Howard Hughes Medical Institute's Science Education Alliance Phage Hunters Advancing Genomic and Evolutionary Science (SEA-PHAGES) project (http://www.hhmi.org/grants/sea). The courses provide undergraduates with a structured syllabus that includes the hands-on scientific discovery experience.

The objective of the courses is to introduce students to the step-by-step process of scientific discovery while developing techniques commonly used in biotechnology research in both academic and industrial settings. Students maintain a scientific notebook, learn to apply experimental design, develop critical-thinking skills in the critique of journal articles, and use computer databases. More specifically, these courses focus on current laboratory techniques used to isolate, manipulate, and identify biological molecules, such as nucleic acids and proteins. Basic laboratory techniques (pipetting, solution making, buffer preparation, good safety techniques), aseptic techniques, and compliance procedures are also discussed.

Each fall semester begins with students digging for soil samples in different areas, with the ultimate objective of contributing new actinobacteriophage (virus that infect actinobacteria) genomes to the public databases. Students isolate bacteriophage from soil samples, purify and amplify them, extract their DNA, and finally characterize them via electron microscopy and gel electrophoresis, progressing through a series of microbiological techniques and eventually to complex genome annotations processes and bioinformatic analyses in the spring semester.

The discovery of novel phages by students creates a sense of ownership and purpose, fully confident that their research will someday affect the world in general in areas like health care, agriculture, and so forth. The more we provide students with opportunities to use their acquired skills, the more they are prepared for the world ahead. Providing more hands-on learning is also vital for the development of professional and communication skills of students, leading to the production of well-rounded lifelong learners to serve the future world.

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http://dx.doi.org/10.7771/2158-4052.1600