

# 'Genetic arms race' between bacteria, viruses subject of stimulus grant

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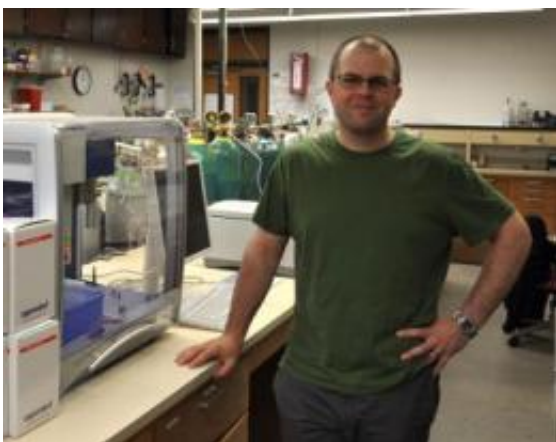


These viruses attach a cyanobacteria culture. Credit: Jay Lennon, MSU Kellogg Biological Station

The oceans teem with microscopic bacteria that produce much of Earth's oxygen as they absorb carbon dioxide greenhouse gas. But fast-mutating viruses also populate the seas, attacking marine bacteria in an ages-old evolutionary arms race.

A Michigan State University researcher will probe that ancient dynamic against the backdrop of environmental and climate change, and the pivotal role played by aquatic bacteria in maintaining the Earth's biological balance.

"Even though (viruses) are important for regulating these (bacteria) populations, we find there's a lot of rapid evolution that occurs," said Jay Lennon, an MSU assistant professor of microbiology and molecular genetics. In laboratory settings the organisms known as cyanobacteria can take just weeks to evolve resistance to viruses, Lennon said, while viruses similarly mutate to find new ways to infect them.



Michigan State University researcher Jay Lennon will work with researchers in Tennessee to probe the interplay between cyanobacteria and viruses. Credit: Steven Harley/MSU Kellogg Biological Station

Cyanobacteria play a vital role in sequestering ocean nitrogen and phosphorus nutrients, during which they remove carbon dioxide from the air and produce oxygen. Understanding how they evolve to resist viruses could unlock information critical to environmental and climate studies, Lennon said.

Lennon will pursue his research using a \$199,000 National Science Foundation grant, including American Recovery and Reinvestment Act funds. He will work with microbiologist Steven Wilhelm of the University of Tennessee and biochemist Nathan VerBerkmoes of Oak

Ridge National Laboratory, both funded by other grant amounts.

One of the most common mechanisms for virus resistance is evolutionary change or loss of cell surface [receptor molecules](#) - the structures through which viruses enter their hosts. The researchers will study such changes in natural cyanobacteria populations. Lennon will focus on generation of virus-resistant bacterial cell lines and species competition experiments, once key receptors are identified, at his lab at the W.K. Kellogg Biological Station in Hickory Corners, north of Kalamazoo.

Marine viruses have been the subjects of interest only since the late 1980s, Lennon said, and little about how that parasite-host relationship operates is understood. Just a milliliter of seawater can contain up to 10 million viruses, he said, some of which are deadly to some cyanobacterial hosts but not to others. The viruses also could wield substantial influence on global environmental cycles by killing vulnerable cyanobacteria and changing the nature of marine bacterial populations through natural selection, the researchers said.

Earlier research by MSU evolutionary biologist Richard Lenski and others has shown that virus-based natural selection can negatively affect cellular organisms' ability to take in nutrients - that there's a fitness trade-off in bacterial evolution.

Cyanobacteria are sometimes referred to as blue-green algae, but are in fact bacteria more closely related to organisms such as *E. coli* than to green algae. Ancient forms of life found on fossils billions of years old, cyanobacteria might be responsible for formation of many of today's oil and iron ore deposits, and they remain one of the most prevalent forms of bacteria on earth.

Cyanobacteria population explosions in some freshwater lakes in recent

hot seasons have released toxins killing waterfowl and forcing closure to recreation. Such "blooms" are not typical in oceans, but because of their importance in global nutrient cycling, carbon sequestration and oxygen production, cyanobacteria are still considered pivotal to the global environment.

Source: Michigan State University ([news](#) : [web](#))

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