# Scientists uncover details of viral infections that drive environmental, human health

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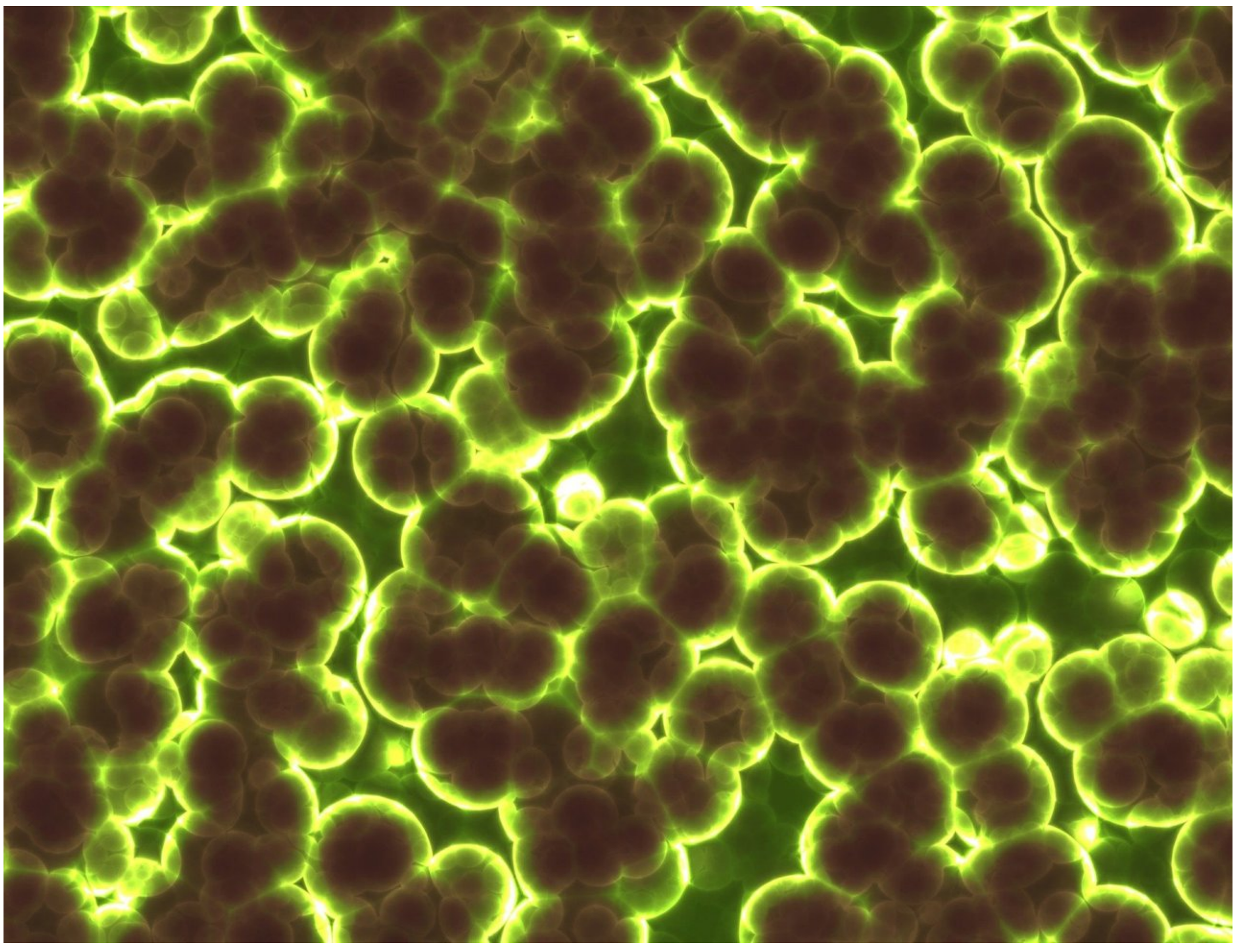

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Below the surface of systems as large and ancient as an ocean and as small and new as a human baby are communities of viruses and bacteria that interact to influence everything from worldwide oxygen levels to the likelihood a newborn will fall ill.

Understanding the interplay between those microbes could one day help scientists devise ways to preserve the environment and tackle hard-to-fight diseases.

New research from The Ohio State University offers a glimpse into the complexity of interactions between bacteria and the viruses - or phages—that infect them. The study appears online in *The ISME Journal*.

These interactions are routine and can be good or bad for the infected bacteria, but until now little was known about how different one of these interactions might be from another, said lead researcher Cristina Howard-Varona, a postdoctoral microbiology researcher at Ohio State.

"We're trying to understand how effective a virus—or phage—is when it infects one bacteria versus another and we've learned that there are important differences," Howard-Varona said.

"In any environment, not all phages are going to infect in the same way, at the same speed and with the same success."

In the study, the research team used advanced equipment in collaboration with the U.S. Department of Energy to piece together in real time the details of the infection inside two genetically similar bacterial "hosts" when they were infected by either the same or different viruses. The Orbitrap mass spectrometer and next-generation gene sequencers allowed them to watch for all the steps in the interaction between the viruses and the bacterial cells, which were quite different in speed and success.

The bacterial strains used in the study are commonly found in the environment and affect nutrient turnover, health and disease.

"The infection efficiency was very, very different when looking at two different phages that infected the same bacterial host. In one case, the phage propagates and kills cells incredibly fast—in about an hour—and in the other case it's much slower, more than 10 times as long," Howard-Varona said.

While it's too early to say where this science might lead, the aim is to eventually understand these interactions in a way that could open the door to improving the environment and human health, she said.

"In some cases, phage infection is good and you could envision intervening to boost infection efficiency to fight all sorts of human pathogens that are no longer sensitive to antibiotics, such as MRSA," Howard-Varona said. "But to do that, we need to understand the basic mechanisms, including those outlined in this study."

The research highlights the importance of moving beyond studies of "ideal" interactions between bacteria and viruses in the lab setting and seeking more knowledge about the true varying interplay between microorganisms in nature, said Matthew Sullivan, an associate professor of microbiology at Ohio State.

"When you look at natural phage and bacteria interactions—such as those in this study - you see that many steps in the phage-host interaction are needed to infect efficiently, and that the infection differs depending on the phage and the bacteria."

Added Howard-Varona, "Historically, in the lab, scientists have used these model systems with the fastest, greatest infection efficiency but that's not always true in nature—in water, or soil or in our bodies—and it's important to understand the differences."

Provided by The Ohio State University