

# Giant viruses discovered on Greenland ice sheet could reduce ice melt

June 4 2024, by Jeppe Kyhne Knudsen

---



The algae blackens the ice. When that happens the ice reflects less sunlight and melts faster. Several areas in Greenland are covered with black algae. Credit: Laura Perini

Every spring when the sun rises in the Arctic after months of darkness, life returns. The polar bears pop up from their winter lairs, the Arctic

tern soar back from their long journey south, and the musk oxen wade north.

But the animals are not the only life being reawakened by the spring sun. Algae lying dormant on the ice start blooming in spring, blackening large areas of the ice.

When the ice blackens, its ability to reflect the sun diminishes and this accelerates the melting of the ice. Increased melting exacerbates global warming.

But researchers might have found a way to control the snow algae growth—and maybe in the long run reduce some of the ice from melting. Living on the ice alongside the algae, postdoc Laura Perini from the Department of Environmental Science at Aarhus University and her colleagues have found [giant viruses](#). Their findings are [published](#) in the journal *Microbiome*.

She suspects that the viruses feed on the snow algae and could work as a natural control mechanism on the [algae blooms](#).

"We don't know a lot about the viruses, but I think they could be useful as a way of alleviating ice melting caused by algal blooms. How specific they are and how efficient it would be, we do not know yet. But by exploring them further, we hope to answer some of those questions," she says.

## **Bigger than bacteria**

Viruses are normally much smaller than bacteria. Regular viruses measure 20-200 nanometers in size, whereas a typical bacterium is 2-3 micrometers. In other words, a normal virus is around 1,000 times smaller than a bacterium.

That is not the case with giant viruses, though. Giant viruses grow to the size of 2.5 micrometers. That is bigger than most bacteria.

But the giant viruses are not only bigger in size. Their genome is much bigger than regular viruses. Bacteriophages—bacteria-infecting viruses—have between 100,000 and 200,000 letters in their genome. Giant viruses have around 2,500,000.



Part of the Greenland Ice sheet with blackened ice caused by algae. Credit: Shunan Feng

### **Never found on the ice before**

Giant viruses were [first discovered in 1981](#), when researchers found them in the ocean. These viruses specialized in infecting green algae in



the sea. Later, giant viruses were found in soil on land and even in humans.

But it's the first time that giant viruses have been found living on the surface ice and snow dominated by microalgae, Perini explains.

"We analyzed samples from dark ice, red snow and melting holes (cryoconite). In both the dark ice and red snow we found signatures of active giant viruses. And that is the first time they've been found on surface ice and snow containing a high abundance of pigmented microalgae," she says.

A few years ago everyone thought this part of the world to be barren and devoid of life. But today we know that several microorganisms live there—including the giant viruses.

"There's a whole ecosystem surrounding the algae. Besides bacteria, [filamentous fungi](#) and yeasts, there are protists eating the algae, different species of fungi parasitizing them and the giant viruses that we found, infecting them. In order to understand the biological controls acting on the algal blooms, we need to study these last three groups," Perini continues.

Even though the viruses are giant, they can't be seen with the naked eye. Perini hasn't even seen them with a light microscope yet. But she hopes to do so in the future.

"The way we discovered the viruses was by analyzing all the DNA in the samples we took. By sifting through this huge dataset looking for specific marker genes, we found sequences that have high similarity to known giant viruses," she explains.

To make sure that the viral DNA didn't come from long dead

microorganisms, but from living and active viruses, the team also extracted all the mRNA from the sample.

When the sequences of the DNA that form genes are activated, they are transcribed into single stranded pieces called mRNA. These pieces work as recipes for building the proteins the virus needs. If they are present, the virus is alive.

"In the total mRNA sequenced from the samples, we found the same markers as in the total DNA, so we know they have been transcribed. It means that the viruses are living and active on the ice," Perini says.



One of the samples in which Laura Perini found giant viruses. At first glance it looks like dirty water, but the bag is teeming with microorganisms, one of those being the ice algae that darkens the ice. Credit: Laura Perini

## **DNA and RNA in viruses**

At the center of the giant viruses is a cluster of DNA. That DNA contains all the [genetic information](#) or recipes needed to create proteins—the [chemical compounds](#) that are doing most of the work in the virus.

But in order to use those recipes, the virus must transcribe them from double-stranded DNA to single stranded mRNA.

Normal viruses can't do that. Instead, they have strands of RNA floating around in the cell waiting to be activated when the virus infects an organism and hijacks its cellular production facilities.

Giant viruses can do that themselves, which makes them very different from normal viruses.

Whereas DNA from dead viruses can be found in samples, mRNA is broken down much faster. mRNA is therefore an important marker of viral activity. In other words, mRNA-recipes of certain proteins show that the viruses are alive and kicking.

## **Not sure exactly how they work**

Because giant viruses are a relatively new discovery, not a lot is known about them. In contrast to most other viruses, they have a lot of active genes that enable them to repair, replicate, transcribe and translate DNA.

But why that is and exactly what they use it for is not known.

"Which hosts the giant viruses infect, we can't link exactly. Some of them may be infecting protists while others attack the snow algae. We simply can't be sure yet," Perini says.

She's working hard on discovering more about the giant viruses and has more research coming out soon.

"We keep studying the giant viruses to learn more about their interactions and what exactly their role is in the ecosystem. Later this year we'll release another scientific study with some more info on giant viruses infecting a cultivated microalgae thriving on the surface ice of the Greenland Ice Sheet," she concludes.

*Correction note (6/7/2024): In the article, it was incorrectly stated that bacteriophages are "virus-infecting bacteria." Bacteriophages are actually bacteria-infecting viruses.*

**More information:** Laura Perini et al, Giant viral signatures on the Greenland ice sheet, *Microbiome* (2024). [DOI: 10.1186/s40168-024-01796-y](https://doi.org/10.1186/s40168-024-01796-y)

Provided by Aarhus University

Citation: Giant viruses discovered on Greenland ice sheet could reduce ice melt (2024, June 4) retrieved 20 June 2024 from <https://phys.org/news/2024-06-giant-viruses-greenland-ice-sheet.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.