

Newly identified viruses found in dolphins

Research reveals new genus, adds to understanding of marine ecosystems

By Richard Harth, ASU News

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In a new study, researchers from Arizona State University together with national and international collaborators have identified anelloviruses in dolphins for the first time. Anelloviruses are a widespread family of viruses found in many mammals, including humans, where they are considered part of the natural virome because they have not been clearly linked to disease.

The researchers found that dolphins often carried multiple anellovirus strains simultaneously. This suggests these viruses are a natural part of the dolphin ecosystem, much like bacteria in the human microbiome.

The research underscores the importance of studying virus-host interactions beyond the context of disease, as these relationships may be essential for maintaining biodiversity and ecosystem stability.

The team revealed the presence of these viruses in four dolphin species — short-finned pilot whales, killer whales, false killer whales and pantropical spotted dolphins — expanding our understanding of marine organism-associated viral diversity. The newly identified dolphin anelloviruses belong to a previously unrecognized genus, tentatively named Qoptorquevirus.

Powerful tool yields new knowledge

To uncover these viruses, the researchers used viral metagenomics, a powerful approach that allows scientists to study all viral-like genetic material in a sample at once. The method is especially useful for identifying known and unknown viruses because it provides a relatively comprehensive viral signature within the sample. In this study, viral metagenomics enabled researchers to identify an entirely new lineage of anelloviruses in dolphin species, helping to build a more complete picture of marine viral ecosystems.

Researchers identified 69 complete anellovirus genomes, classified into 22 distinct species, broadening the known host range of anelloviruses and providing valuable insights into their evolution and potential role in marine ecosystems.

This discovery highlights how viruses evolve in different environments, showing that dolphins, like humans, have unique viral communities, underscoring the need to better understand their role in marine ecosystems.

“We know very little about virus diversity overall. Most of what we understand at a genomic level is heavily skewed toward viruses that cause disease in organisms we care most about — humans, agricultural crops and domestic animals,” says [Arvind Varsani](#). “Additionally, viruses have largely been studied through the lens of disease, creating a bias in our understanding. However, many viruses have symbiotic or even mutualistic relationships with their hosts, while others, like marine viruses, play a crucial role in carbon cycling. As a result, our knowledge of viruses at an ecosystem level remains extremely limited.”

Varsani, co-corresponding author, is a researcher with [the Biodesign Center for Fundamental and Applied Microbiomics](#), the [Center for Evolution and Medicine](#), and a professor in the [School of Life Sciences](#) at ASU.

His team at ASU is joined by researchers from Institut Pasteur (France); Barrouallie Whalers Project (Saint Vincent and the Grenadines); University of the West Indies at Cave Hill (Barbados); University of Cape Town (South Africa); Coastal Carolina University (USA); University of the South (USA); National Institutes of Health (USA).

[The research](#) appears in the current issue of the Journal of Virology.

Hidden world

Viruses exist everywhere in nature, but not all cause disease. Some live in animals without harming them, forming a balance with their hosts. One mystery associated with anelloviruses is their widespread presence in vertebrates without any clear disease association.

Studies have detected anellovirus DNA in human bodily fluids and tissues, including blood, saliva and feces — indicating that these viruses are present throughout the body. The reported infection rates, ranging from 5% to 90%, suggest that some populations or study groups have a much higher prevalence than others, possibly due to differences in age, geography, immune system status or detection methods.

Most people acquire these viruses early in life without showing symptoms, leading scientists to believe that anelloviruses, while coexisting harmlessly with their hosts, may play a role in

regulating microbial communities.

Despite their presence in many land mammals, little research has explored anelloviruses in marine mammals. Researchers analyzed archived tissue samples from four abundant Caribbean dolphin species, which historical whaling data suggests are among the region's most numerous cetaceans.

Critical protein

One important finding from the study is that a key structural protein in dolphin anelloviruses, known as ORF1, is much larger than in other mammals. ORF1 is responsible for forming the virus' outer shell, called the capsid, which protects the virus' genetic material when it is outside a host cell. Researchers found that specific structural changes led to this expansion.

Intriguingly, similar expansions in ORF1 have also been observed in anelloviruses that infect primates, even though these viruses evolved separately in different hosts. This means that, rather than inheriting this feature from a common ancestor, the viruses independently developed larger ORF1 proteins as they adapted to their respective hosts — dolphins and primates.

This pattern, known as convergent evolution, suggests that anelloviruses may increase the size of their ORF1 protein in response to certain host-related factors, such as immune system pressures or the way the virus replicates inside cells. Understanding why these expansions occur could provide clues about how viruses evolve to maintain long-term, nonharmful relationships with their hosts.

The study marks a significant step in understanding viruses in marine organisms and more broadly in ocean ecosystems. By identifying a novel lineage of anelloviruses in dolphins, researchers have expanded the known host range of these viruses and highlighted the intricate relationship between viruses and the animals they infect. As virologists explore the vast and largely uncharted world of marine viruses, discoveries like these shed light on the intricate ways viruses evolve and adapt.

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Main image



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Text image(s)



Arvind Varsani