Newly discovered giant viruses have 'the most complete translational apparatus of known virosphere'

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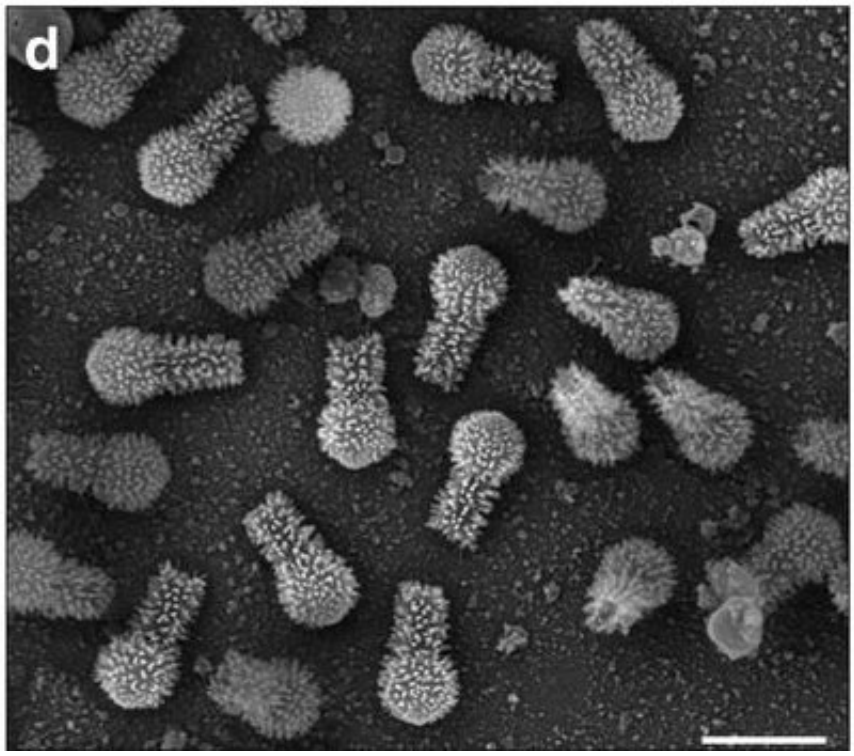

Credit: *Nature Communications* (2018). DOI: 10.1038/s41467-018-03168-1

A team of researchers with members from several institutions in France, Brazil and Sweden has discovered two new strains of giant viruses, which they note have "the most complete translational apparatus of the known virosphere." In their paper published in the journal *Nature*

Communications, the group describe characteristics of the viruses including details about their genomes.

It has been only a little more than a decade since a team of researchers identified Mimivirus, a giant virus that caused biologists to rethink the nature of viruses. That effort will likely heat up as two new strains of a giant virus have been discovered, both in Brazil—one in Soda Lake, the other off the coast of Rio de Janeiro. Together, the two new strains have been named Tupanvirus, after the Brazilian god Tupã.

More remarkable than their size is the complexity of their genome—they were found to have approximately 1.5 million DNA base pairs and enough genes to create 1,425 types of proteins—a translational apparatus larger than all other viruses. It is their ability to produce their own peptides using RNA instructions that sets them and Mimivirus apart from other viruses—all others must rely on their hosts for protein synthesis. It is this ability that has biologists scratching their heads—before the discovery of Mimivirus, they were not even willing to call viruses forms of life—for example, they do not have metabolism because they do not eat or digest anything. These new findings suggest that viruses might have to be reclassified. The giant viruses, which are so large they are actually bigger than some bacteria, are also able to perform DNA replication and repair as well as transcription and translation—something only living organisms are supposedly able to do. Intriguingly, approximately 30 percent of their genome is still undocumented, so there is more to learn.

The researchers note that like Mimivirus, Tupanvirus infect amoebae, which they use as a form of viral factory to produce copies of themselves. Unlike Mimivirus, however, the two new strains are able to infect multiple types of amoebae.

More information: Jônatas Abrahão et al. Tailed giant Tupanvirus

possesses the most complete translational apparatus of the known virosphere, *Nature Communications* (2018). DOI: 10.1038/s41467-018-03168-1

Abstract

Here we report the discovery of two Tupanvirus strains, the longest tailed Mimiviridae members isolated in amoebae. Their genomes are 1.44–1.51 Mb linear double-strand DNA coding for 1276–1425 predicted proteins. Tupanviruses share the same ancestors with mimivirus lineages and these giant viruses present the largest translational apparatus within the known virosphere, with up to 70 tRNA, 20 aaRS, 11 factors for all translation steps, and factors related to tRNA/mRNA maturation and ribosome protein modification. Moreover, two sequences with significant similarity to intronic regions of 18 S rRNA genes are encoded by the tupanviruses and highly expressed. In this translation-associated gene set, only the ribosome is lacking. At high multiplicity of infections, tupanvirus is also cytotoxic and causes a severe shutdown of ribosomal RNA and a progressive degradation of the nucleus in host and non-host cells. The analysis of tupanviruses constitutes a new step toward understanding the evolution of giant viruses.