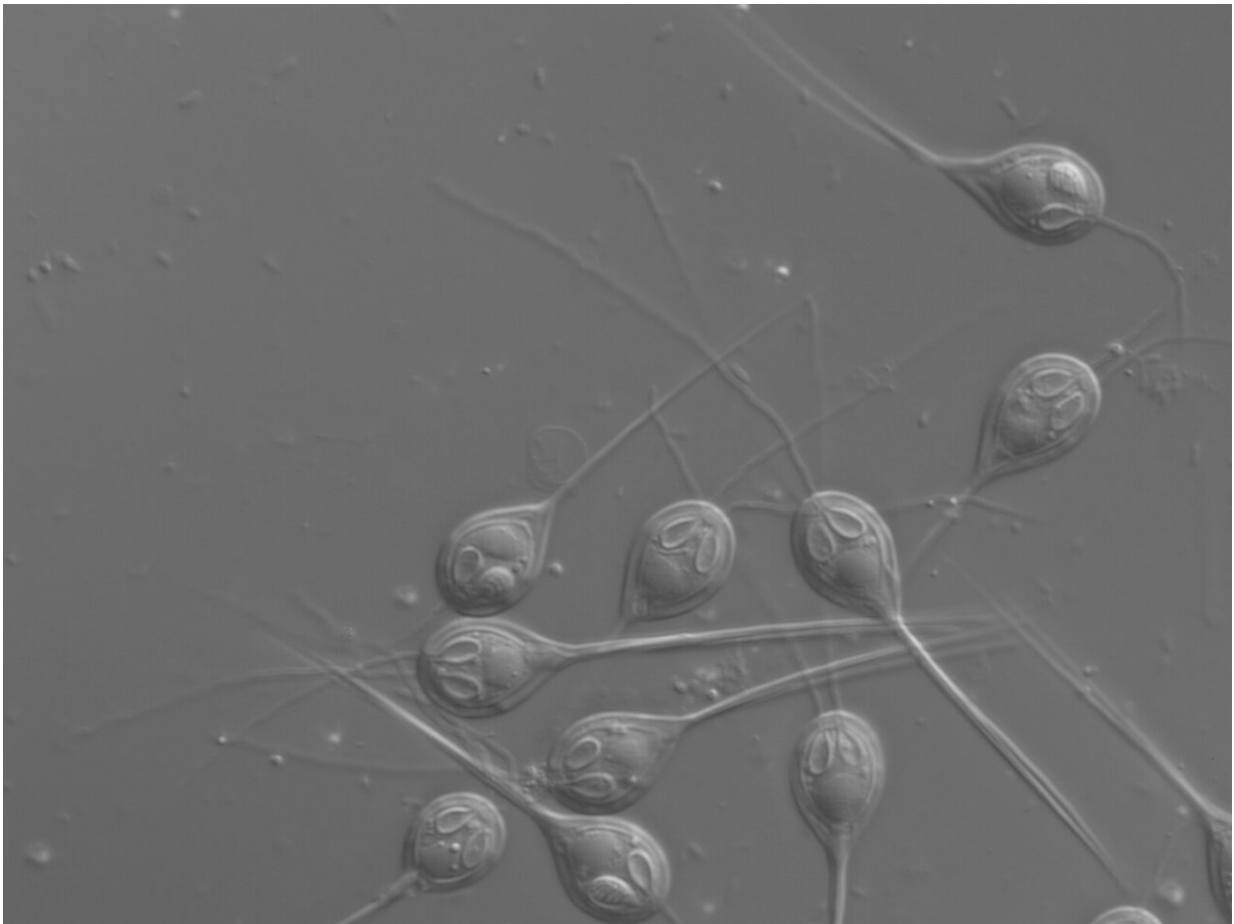


Henneguya salminicola: Microscopic parasite has no mitochondrial DNA

February 25 2020, by Bob Yirka



Light microscope image of spores of the parasitic cnidarian *Henneguya salminicola*, from Chinook salmon. Credit: Stephen Douglas Atkinson.

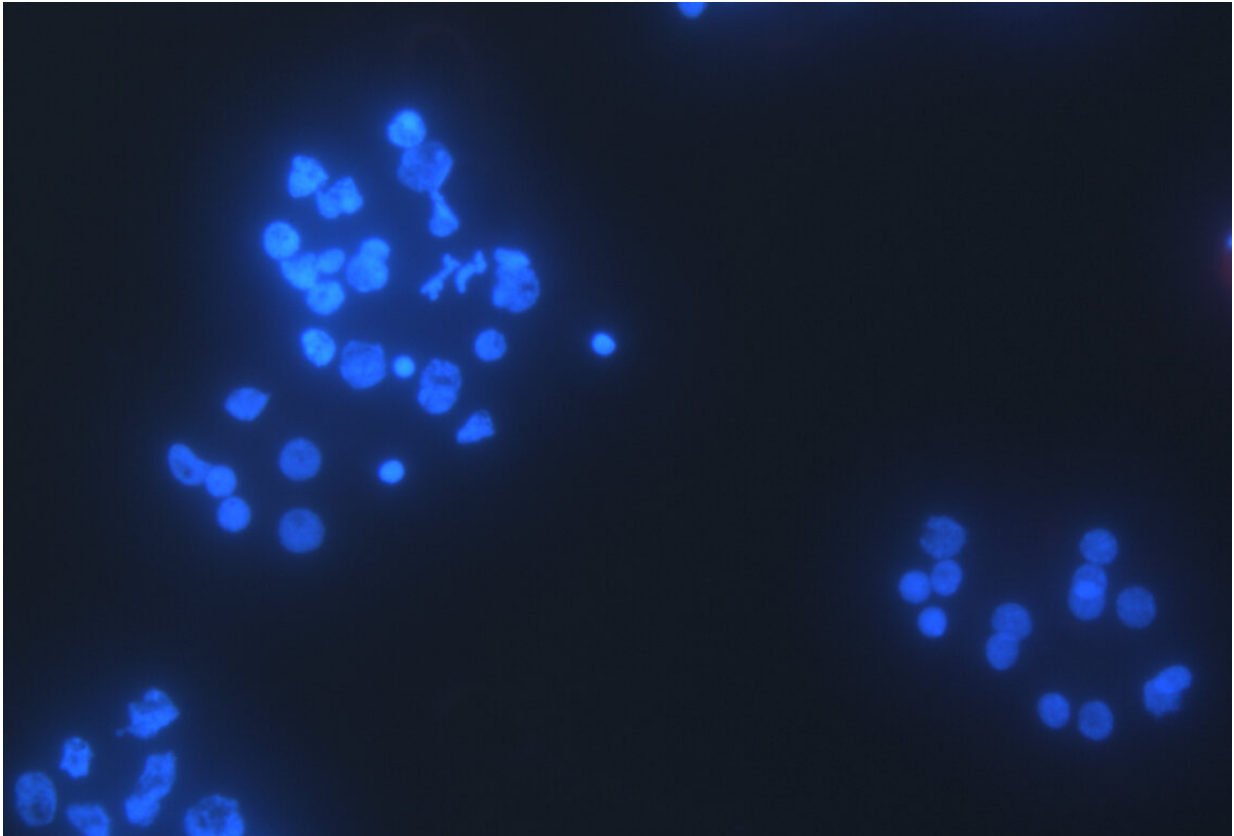
An international team of researchers has found a multicellular animal with no mitochondrial DNA, making it the only known animal to exist without the need to breathe oxygen. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their study of *Henneguya salminicola*, a microscopic, parasitic member of the group Myxozoa and its unique physiology.

One of the common characteristics of all multicellular animals on Earth is [mitochondrial respiration](#)—the process by which oxygen is used to generate [adenosine triphosphate](#)—the fuel used to power [cellular processes](#). The process takes place in mitochondria, which has both its own genome and the main genome found in the rest of the body's cells. But now, there is a known exception: *Henneguya salminicola*.

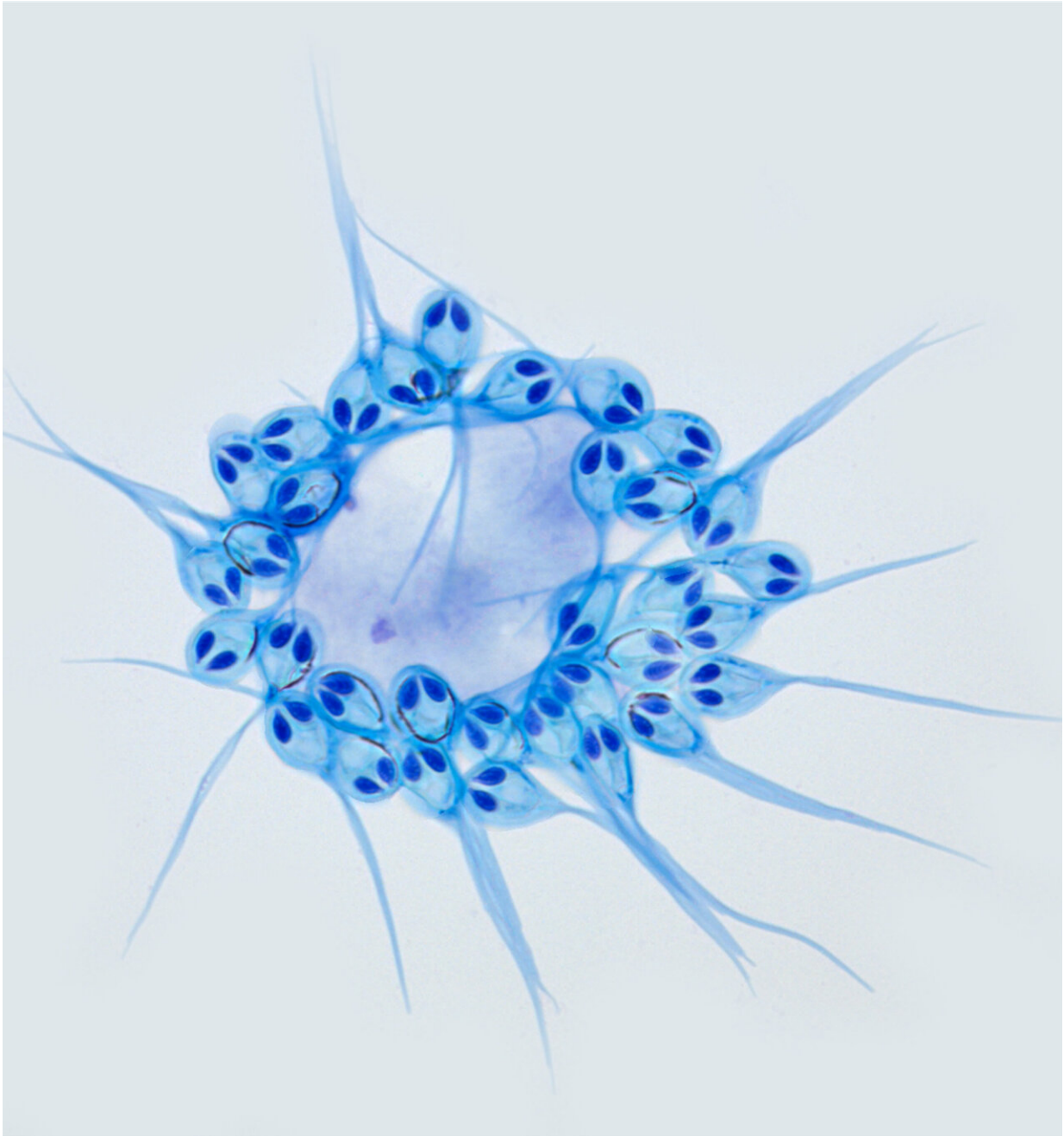
H. salminicola is a microscopic parasite that infects salmon. When the host dies, spores are released that are consumed by worms, which can also serve as hosts for the parasite. When salmon eat the worms, they become infected as the parasite moves into their muscles. They can be seen by fishermen as white, oozing bubbles, which is why salmon with *H. salminicola* infections are sometimes said to have tapioca disease.

In their work, the researchers sequenced the DNA of *H. salminicola* tissue and found no mitochondrial DNA at all. Believing they had made an error, the team repeated their work and once again found no sign of mitochondrial DNA. Confused, they sequenced the DNA of close relatives of *H. salminicola* and found evidence of the expected mitochondrial genomes. *H. salminicola* did have structures that resembled mitochondria but they were not capable of producing the enzymes needed for respiration, a finding that suggested the creature was capable of surviving without oxygen—a first. The presence of structures that resemble mitochondrial DNA suggests that the tiny [parasites](#) have undergone a process of de-evolution. In addition to losing the apparatus to create ATP, they also have lost tissue, nerve cells and muscles.

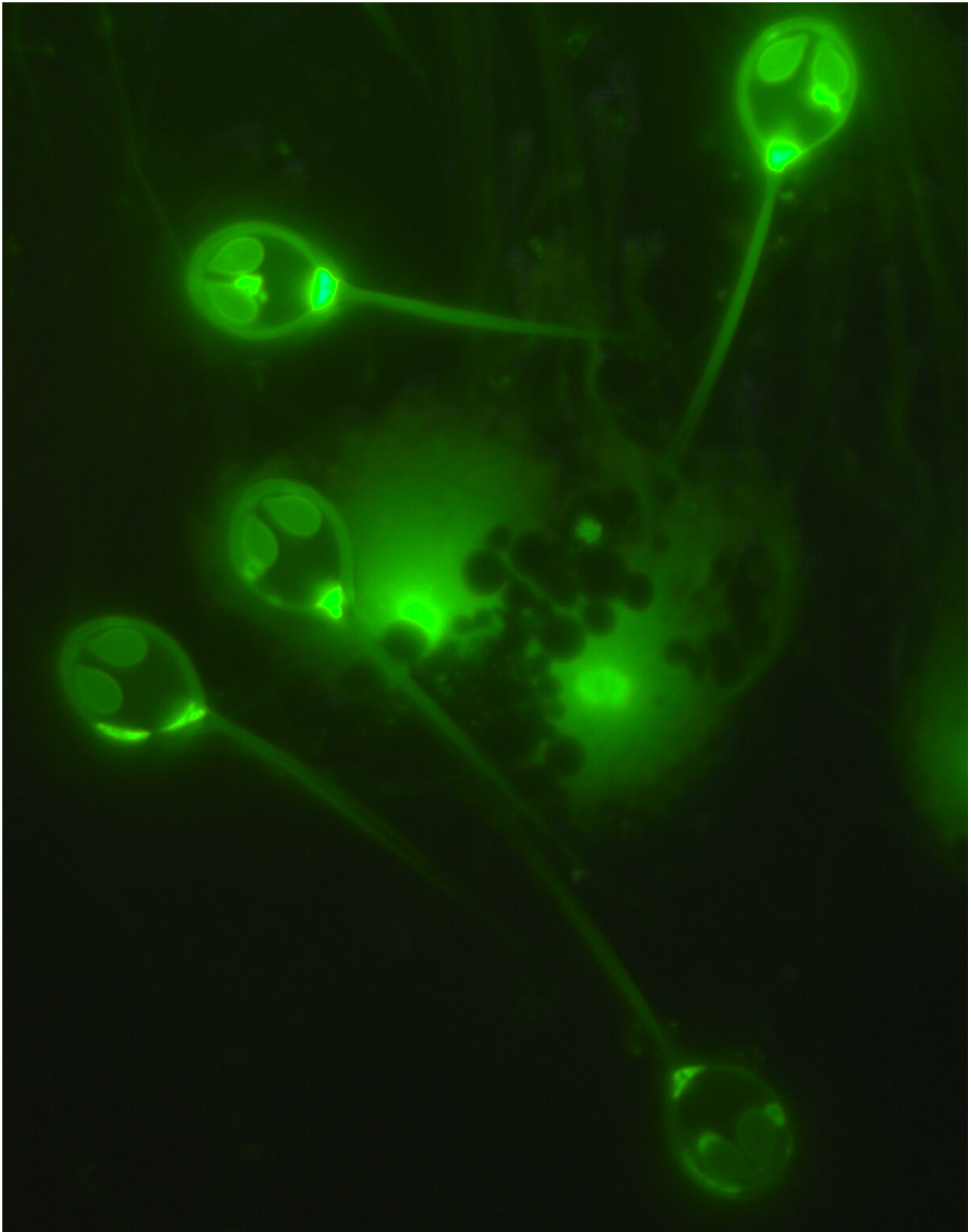
The researchers did not find any other mechanism for producing the fuel cells in *H. salminicola* would need to survive, but suggest they likely steal energy from their host using some type of proteins.



Fluorescence micrograph showing normal nuclear DNA (glowing blue circles) of the parasitic cnidarian *Henneguya salminicola*. The images show that there are no mitochondria present (which would be visible as many smaller blue dots near the larger circles). Credit: Stephen Douglas Atkinson.



Spores of *H. salmonicola*, which lacks a mitochondrial genome and capacity for aerobic respiration. Credit: Stephen Douglas Atkinson



Fluorescence micrograph of spores of the parasitic cnidarian *Henneguya*

salminicola. The fluorescent dye has penetrated the spore nuclei and membranes.
Credit: Stephen Douglas Atkinson.

More information: Dayana Yahalomi et al. A cnidarian parasite of salmon (Myxozoa: *Henneguya*) lacks a mitochondrial genome, *Proceedings of the National Academy of Sciences* (2020). [DOI: 10.1073/pnas.1909907117](https://doi.org/10.1073/pnas.1909907117)

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