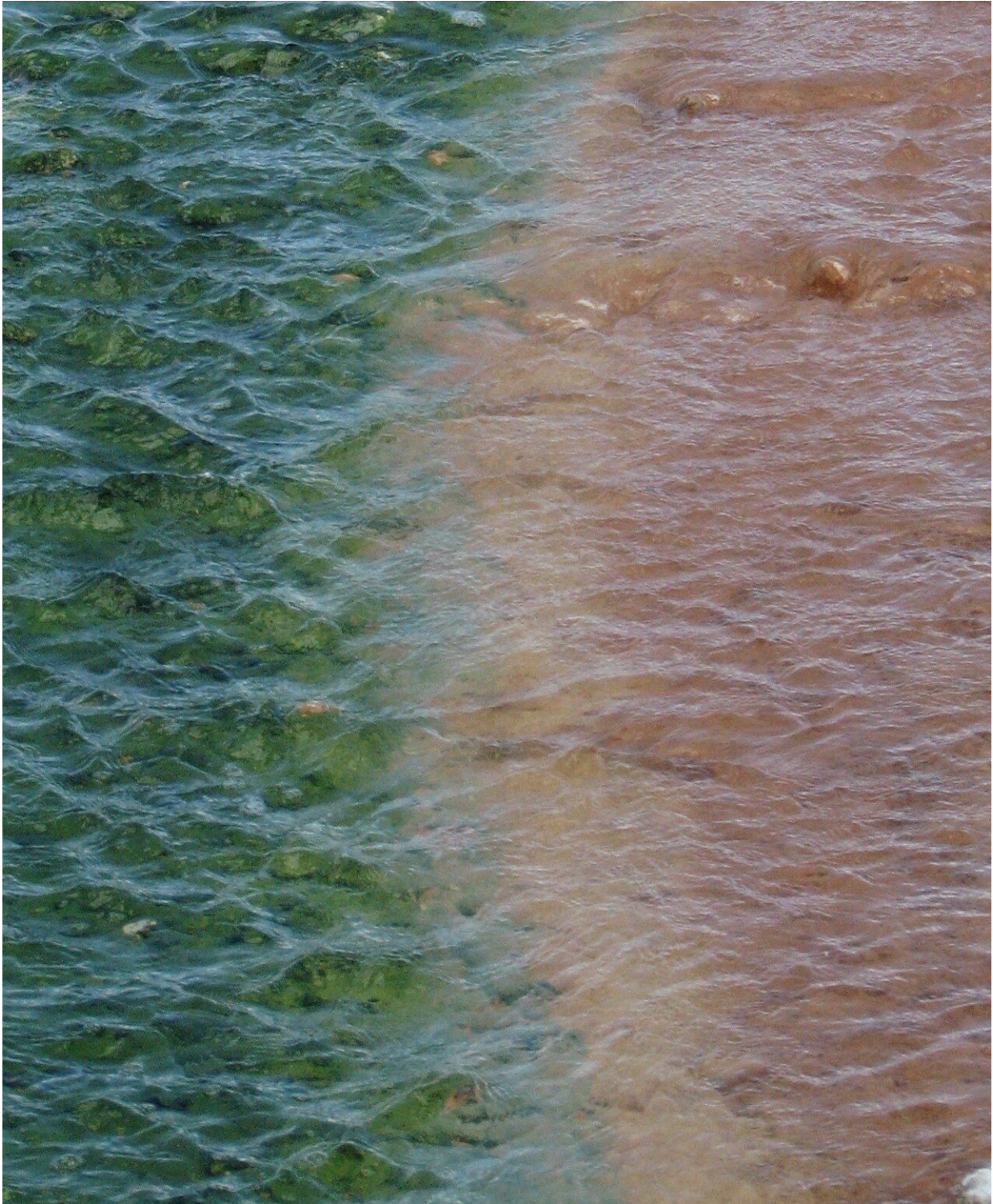


Red algae steal genes from bacteria to cope with environmental stresses

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Cyanidiales species of red algae, which appear green in this photo because chlorophyll masks their red pigment, growing in a hot spring at Yellowstone National Park. Credit: Debashish Bhattacharya/Rutgers University-New

It's a case of grand larceny that could lead to new fuels and cleanup chemicals. Ten species of red algae stole about 1 percent of their genes from bacteria to cope with toxic metals and salt stress in hot springs, according to a study in the journal *eLife*.

These red algal species, known as *Cyanidiales*, also stole many genes that allow them to absorb and process different sources of carbon in the environment to provide additional sources of energy and supplement their photosynthetic lifestyle.

"The role of stolen genes in eukaryotes, which include most living things such as [algae](#), has been hotly debated and many think it is unimportant and plays little to no role in their biology," said co-author Debashish Bhattacharya, a Distinguished Professor in the Department of Biochemistry and Microbiology at Rutgers University-New Brunswick. "Our robust genome data provide the first major evidence that this is a false narrative and that adaptation to a challenging environment can be directly facilitated by stolen genes."

Finding such phenomena in nature inspires scientists to figure out how gene theft happens, and they can use these rules of nature to develop novel genetic engineering methods in the lab to benefit humans. This can be done by designing algae that produce fuels or chemicals that can clean up polluted sites because *Cyanidiales* can process toxic compounds and metals such as arsenic and mercury, according to Bhattacharya, who works in the School of Environmental and Biological Sciences.

In the new study, the scientists generated 10 novel *Cyanidiales* genomes in the genus *Galdieria* that thrive in [hot springs](#) such as at Yellowstone

National Park, despite high temperatures and highly acidic conditions. The goal was to determine whether these algae adapted to their extreme environment by stealing genes from resident, pre-adapted bacteria that made them resistant to the stresses. Genome analyses showed that about 1 percent of the red algal genes came from bacteria.

The next steps are to build genetic tools to study the red algal species and conduct more lab tests to determine if they turn on bacterial [genes](#), as expected, under stress. Julia Van Etten, a [doctoral student](#) in the Bhattacharya lab, recently received a three-year NASA award to conduct these studies with *Cyanidiales*.

More information: Alessandro W Rossoni et al, The genomes of polyextremophilic cyanidiales contain 1% horizontally transferred genes with diverse adaptive functions, *eLife* (2019). [DOI: 10.7554/eLife.45017](#)

Provided by Rutgers University

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