

Park algae detoxifies arsenic

Studies may lead to biological way of neutralizing poisons

By BRETT FRENCH
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Although its name may be more well-known as a tasteless poison, arsenic has been employed in gold mining, as a wood preservative and in medical applications.

But there's a good reason it has been used as a poison. "At very low concentrations the stuff is nasty," said Tim McDermott, professor in the Department of Land Resources and Environmental Sciences at Montana State University in Bozeman.

It is the most common toxic substance found in the environment, ranking it first on the Environmental Protection Agency's Superfund list of hazardous substances. Safe arsenic levels in drinking water are set at less than 10 parts per billion for human consumption.

But a red alga that inhabits the hot springs of Yellowstone National Park actually thrives in water laden with arsenic, McDermott and his fellow researchers found. The one-celled alga, called Cyanidioschyzon, chemically modifies the arsenic that occurs naturally in the springs, reducing it to less dangerous forms.

"These algae represent something new and different for my lab," McDermott said.

In a decade of research in the park, he has studied the photosynthetic alga for only the past two years. It lives in the outflow channels from acidic hot springs where temperatures can climb to 135 degrees.

Research on the alga could someday lead to a way to remove arsenic from mine tailings, as well as provide insight to life forms on other planets in the solar system with harsh climates.

"Certainly, it would be real positive if we could use a photosynthetic organism to, with very little cost inputs, deal with an environmental contaminant," McDermott said.

But, he added, "we were less concerned with that question than what the algae were doing with arsenic in Yellowstone."

McDermott was one of the lead authors of a paper posted this week on the alga and its detoxification of arsenic in the Proceedings of the National Academy of Sciences. Barry Rosen, of Florida International University, was the other lead author of the paper. One of the four co-authors was Corinne Lehr, who formerly worked with McDermott as a postdoctoral scientist at MSU and is now a faculty member at California Polytechnic State University.

Surviving in acidic water isn't the alga's only unusual quality. It also is subjected to harsh levels of ultraviolet radiation at the high elevations of Yellowstone's Norris Geyser Basin, where McDermott conducts his research.

"The levels of UV light we measure in Yellowstone increases about tenfold between December and June," he said. "In some of these springs, the algae bake for 15 hours a day in UV. Imagine lying out in the sun for 15 hours a day. Your skin would take a beating."

The researchers cloned the alga's genes and mass-produced them to study how it detoxified arsenic. They also found that two different populations of algae inhabit the hot springs, one prospering in the winter and the other thriving in the summer.

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