Decoding The King of Poisons in the Wild

Professor Corinne Lehr Unveils Mysteries of One-Celled Algae

By Scott Roark
Photos courtesy of Corinne Lehr

Fill a tub with battery acid laced with arsenic. Heat it to 140 degrees Fahrenheit. Now imagine soaking in it – thriving in it.

Unappealing as that sounds, it's comparable to a bubble bath and champagne for Cyanidioschyzon, a particular one-celled alga that grows where almost everything else dies. The red algae can be found on the bottom of shallow hot springs, where it neutralizes many of arsenic's most toxic elements by adding carbon to it.

This process could have future commercial applications, such as cleaning water supplies contaminated with arsenic, though such applications are further down the road according to Cal Poly Chemistry Professor Corinne Lehr.

The Calgary native has studied extreme-friendly organisms for some time, completing her post-doctoral work at Montana State University by studying arsenic biogeochemistry with a team of colleagues in the hot springs of Yellowstone National Park.

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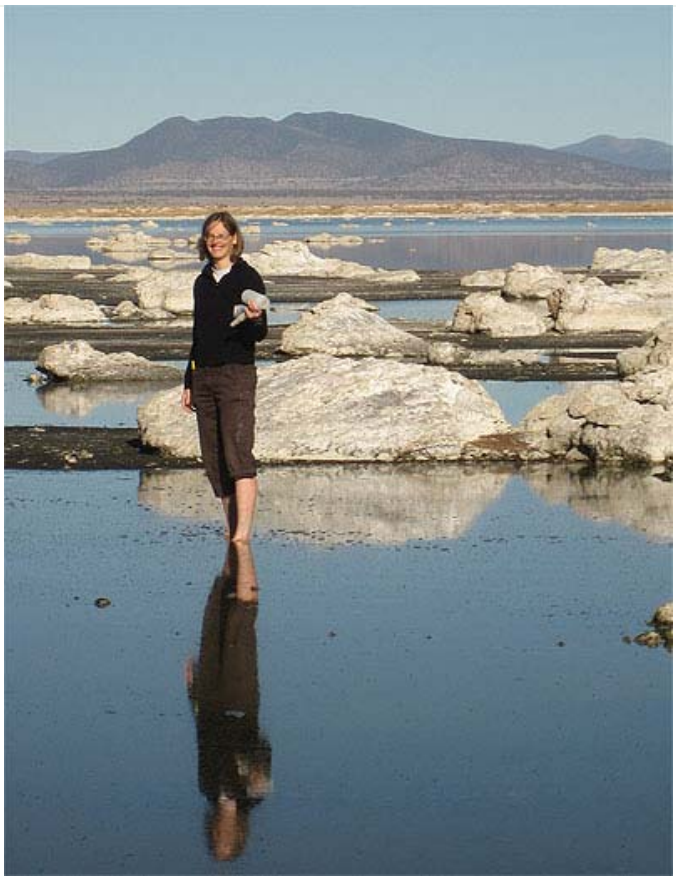
For now, Lehr said, the team is focused on how this red alga affects arsenic in different environments. It lives in both high and very low temperatures, in water at pH1 (which is acidic), and in liquids with very high pH levels.

"It's truly amazing what this organism can live in," Lehr said.

Lehr is conducting research at Mono Lake in California, looking at algae that thrives in non-acidic environments but still has the same detoxifying affect on arsenic. She wants to know how the arsenic is treated in different environments.

"We are still trying to fully grasp the process," Lehr said. "Why exactly does the alga do it? Is it one factor or a combination of factors?"



Getting her feet wet - Cal Poly Chemistry Professor Corinne Lehr at Mono Lake, near Yosemite National Park. Lehr is studying algae at Yosemite and Mono Lake that can detoxify the poison arsenic.

Lehr makes the journey to Mono Lake about every six weeks. The lake's surreal tufa sculptures framed by the harsh, open landscape are a fitting backdrop for another potential application of this research – providing an understanding of how life forms could survive in harsh environments on other planets.

Another remarkable trait of the algae is that it can withstand high levels of ultraviolet radiation, Lehr said. Coupled with an ability to interact with one of the most universal poisons on the planet and survive where no other living organism can, the algae is an ideal candidate for research.

Arsenic comes mostly from rocks, with large amounts found in volcanic areas and in the ocean. The tasteless substance at one time was used frequently for homicidal poisoning, giving it the name "king of poisons" or "poison of poisons." In Imperial Rome, official tasters were employed because of arsenic's popularity for dispatching political opponents.

Modern forensic science has nearly ended arsenic's use in homicide. Now one of the main issues is drinking water. Arsenic pollution in water can be natural or can result from such things as mining or farming. In Bangladesh, for example, it's estimated that millions of people are suffering from arsenic poisoning because of poor water quality control standards and government negligence.

"Water treatment methods are one goal of this type of research," Lehr said. "This type of algae can be found in hot springs throughout the world. The potential is there."

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