

## Microbe that breaks down metals, *S. oneidensis*, is sequenced

Scientists have determined the genome sequence of a microbe that has the potential to help remove pollutants from the environment. Found in soil and sediment worldwide, the bacterium transforms, or reduces, metals like iron and uranium, causing them to drop out of groundwater.



*Shewanella oneidensis* growing on the surface of the iron oxide mineral hematite.  
Courtesy Pacific Northwest National Laboratory

The bacterium, *Shewanella oneidensis*, could potentially be used to clean up run-off from copper mines. The research is part of an ongoing effort supported by the US Department of Energy to investigate microbes that may help solve environmental problems.

Just as humans inhale oxygen and exhale carbon dioxide, the bacterium metabolizes metals and changes their chemical structures by giving them electrons. In their new form, the toxins precipitate out of groundwater and can be isolated.

The bacterium "dumps electrons" on metals, says John F. Heidelberg, who led the sequencing at The Institute for Genomic Research in Rockville, Maryland. A paper

describing the genome, which includes about 5,000 genes, has been published online in *Nature Biotechnology*

The bacterium lives in the presence and absence of oxygen and therefore could reduce metals in a variety of environments. It also means scientists can study the bacterium in the laboratory without special devices.

One of the study's findings was that the bacterium has 39 genes for enzymes called cytochromes. These enzymes are used to transport electrons and may be what make the microbe so potentially useful for cleaning up toxins—a process known as bioremediation. Before the organism is tested as an environmental agent, more needs to be known about how the bacterium lives. One potential issue for bioremediation is that the bacterium may release organic contaminants into the environment as certain metals are metabolized. Indeed, many questions remain about the biology of the organism. A group of scientists called The Shewanella Federation, among others, are using the genome sequence to try to understand how the bacterium functions in the environment.

The chemical reaction that reduces metals is relatively straightforward, but the details of how the organism makes this happen are a mystery, according to Jim K. Fredrickson of the Pacific Northwest National Laboratory in Richland, Washington, and a leader of The Shewanella Federation.

A big question, for instance, is how the bacterium switches from consuming oxygen to consuming metals once the oxygen in its environment is depleted. The federation researchers, which include academic and government scientists, will use tools such as 'gene chips' to investigate how *S. oneidensis* utilizes different energy sources in different environments.

The organism also breaks down chromium, which the World Health Organization lists as a cancer-causing agent. Chromium was the subject of an environmental lawsuit in California in the 1990s that was later depicted in the movie "Erin Brockovitch."

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[Metal-eating microbe \*Geobacter metallireducens\* swims](#)

For more information, visit The Shewanella Federation [here](#).