Much of the controversy over nuclear power is concerned with what to do with the waste—material that is still somewhat radioactive and must be held for long periods before it can be considered safe. Unfortunately, sometimes radioactive material, from nuclear plant waste or nuclear fuel mining or even found naturally in the environment, can leech into streams and other water sources and contaminate them.

It is not as easy to clean such contamination as one might think; the radioactive compounds are soluble so they can't just be filtered out. One strategy proposed for cleaning up contaminated water is using bacteria that change the soluble waste into an insoluble form so that it will fall to the bottom and can be filtered out. However, we've had trouble figuring out how bacteria do this, without much progress even after two decades.

But now, scientists from Michigan State publishing in the Proceedings of the National Academy of Sciences this past September have made a breakthrough in determining the mechanism by which *Geobacter sulfurreducens* makes uranium compounds insoluble.

These bacteria change the form of uranium by taking electrons off other molecules and putting them onto the uranium, a process called reduction.

The scientists wanted to find out how *Geobacter* reduces uranium without allowing it to damage its cellular components. They thought maybe the bacteria do this using little hair-like structures on their surface called pili. So they grew some cells with uranium at 25 degrees Celsius and others at 30 degrees, because the extra heat prevents pilus formation. As a control, they also used mutant cells with a pilus gene knocked out. The bacteria at the lower temperature, the ones that made pili, reduced more uranium than the others.

Then the researchers used a powerful electron microscope to look at where the uranium deposited on the bacterial cells, to see where the reaction was taking place. In cells with pili, the uranium was most dense around clusters of pili, as would be expected, while most of it in the cells without pili was right against the cell surface.

Finally, the scientists wondered if the reduction of uranium by pili was protecting the bacteria from uranium toxicity, so they used a dye to test the cells' respiratory activity, or their "vitality," how well their energy-generating system worked. The cells that formed pili had more activity and recovered from exposure to uranium faster than cells without.

So it seems that *Geobacter* extends little hairs out from its surface with which it changes the form of uranium in order to protect itself!

The more we know about how these bacteria affect uranium, the better we will be able to use them for that purpose, and this study definitely increases our knowledge. It would be nice if cleaning up uranium in rivers were easy. Though that is not the only kind of nuclear contaminant, the scientists believe they may be able to modify the cells to clean up other kinds. With bacteria, is anything impossible?