

Science for Environment Policy

Mercury-resistant bacteria useful for studying toxic metal cycling

Mercury-resistant bacteria could help scientists to understand more about mercury cycling in the environment. In a new study, researchers identified one particular strain of soil bacterium that could serve as a model for the conversion of the toxic metal into less toxic forms. They also discovered a new gene involved in the conversion process.

Bacteria play an important role in the cycling of mercury. Certain bacteria have *mer* genes, which allow them to convert mercury from one chemical form to another less toxic form. This ability can make the bacteria themselves resistant to the metal and can also be important for influencing the toxicity of mercury entering food chains. Humans and other animals are susceptible to the methylmercury (MeHg) that accumulates in contaminated fish, whilst elemental mercury – mercury (Hg) atoms that are not bound up in compounds – is less toxic and evaporates from water and soil. Mercury ions (Hg(II)) – charged atoms – are more toxic than elemental mercury but less toxic than MeHg.

So far, scientists know more about how *mer* genes contribute to mercury cycling in lakes than in soils or deeper below the surface, including in groundwater. In this study, researchers wanted to understand more about mercury metabolism in soil bacteria. They selected one particular strain as an example of bacteria from the class Alphaproteobacteria – recent studies show this class is active in sediments contaminated with mercury. The strain they selected, *Xanthobacter autotrophicus* Py2 (Py2 for short), has stretches of DNA containing *mer* genes.

The researchers showed that the model species, Py2, is capable of converting both the most toxic form of mercury, MeHg, as well as less toxic Hg(II) ions, into the least toxic form, elemental mercury. They did this by growing Py2 cells in bottles in the lab and exposing them to known quantities of MeHg or Hg(II) and then measuring the amounts present after the cells were left to grow. After two hours, only around 17% of the MeHg added initially remained, compared to 100% in control experiments using Py2 cells that had been heat-treated to kill them. Most of the MeHg seemed to have been converted to elemental Hg, which the researchers were able to recover from the solution flushed from the bottles.

In addition to observing mercury metabolism in the bacteria, the researchers analysed bacterial DNA from the segments of the genome containing the *mer* genes. Their analyses revealed two sections of DNA in Py2 bacteria that control mercury conversions and resistance. Some of the genes in these sections were similar to *mer* genes seen in other bacteria, but the researchers also discovered and named a new gene, *merK*, which was present in both of the sections.

The researchers suggest that the sections of DNA identified in Py2 are representative of those in other soil- and ocean-dwelling bacteria that are resistant to mercury, and that future experiments with this species may help scientists to understand more about cycling of the toxic metal within different environments.



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