Living sensor can warn of arsenic pollution

8 September 2008

Scientists studying arsenic pollution have discovered a living sensor that can spot contamination. They have also discovered new bacteria that can clean up arsenic spills even in previously untreatable cold areas, microbiologists heard today (Monday 8 September 2008) at the Society for General Microbiology's Autumn meeting being held this week at Trinity College, Dublin.

The Giant Mine in Canada is in the sub-arctic. It contains over 230,000 tonnes of arsenic-containing dust, making it one of the most polluted places on Earth as well as one of the most inhospitable.

"Water seeps through the mine cracks carrying the arsenic with it as it drips down the walls," said Thomas Osborne from University College London, UK. "We discovered new types of bacteria living in biofilms on the walls of Giant Mine that consume arsenic compounds contained in the polluted water seeping through."

Arsenic is toxic to all living cells, and in people causes fatal cancers of the lung, liver, kidney and bladder. It also causes cirrhosis and gangrene, and on a wider scale seriously damages wildlife in fragile environments. Arsenic contamination is a global problem, with some countries including Vietnam, West Bengal, Mexico, Canada, Argentina, Bangladesh and USA all severely affected.

"Until now, no bacteria have ever been isolated that can thrive in cold temperatures and deal with arsenic contamination. The new bacteria we discovered function at temperatures from 20oC down as low as 4oC," said Thomas Osborne. "These bacteria also live in a community called a biofilm, which means that we can build them into a new system to clean up contaminated areas by removing the arsenic from soil or drinking water, even in the cold far north and south, or in winter".

"The other exciting possibility that this opens up is that we can isolate the enzyme from these new strains of bacteria and develop an arsenic biosensor to use in cold environments. This will warn when traces of arsenic are escaping from areas like mine workings, industrial chemical facilities, or even laboratories, alerting us before pollution manages to get into watercourses or drinking water supplies. We could also use it to test newly drilled wells in countries like Bangladesh where water supplies are known to be contaminated," said Thomas Osborne.

Many organisms, including all plants and animals, ultimately get their energy from the sun via photosynthesis. But over the last few decades scientists have discovered more and more microbes that can get their energy directly from breaking down chemical bonds. This enables them to survive in extraordinary and dark environments such as deep inside the Earth or at the bottom of the coldest, deepest oceans, where previously no life was expected to exist at all.

Source: Society for General Microbiology