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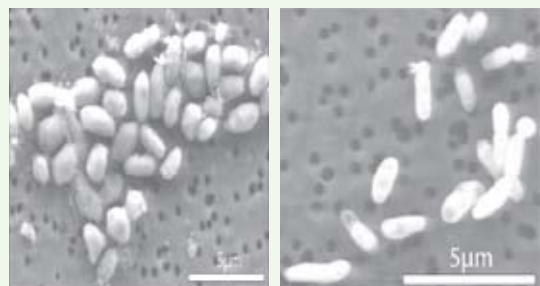
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## Does the Poisonous Arsenic Support Life?

Atbin Doroodchi

A group led by Felisa Wolfe-Simon through a NASA funded project discovered a strain of bacteria called GFAJ-1 that uses arsenic as a metabolite. This strain of bacteria lives in the harsh conditions of Mono Lake in California. Conventionally, it was thought that the basic building blocks of life are carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur. However, the addition of arsenic to this category is revolutionary. “The definition of life has just expanded,” said Ed Weiler, NASA’s associate administrator for the Science Mission Directorate. Weiler also mentioned that in order to find life in outer space, we have to “broaden our definition of life.” GFAJ-1 bacteria are bacillus bacteria, which belong to a common group of bacteria called Gammaproteobacteria. In this strain, phosphorus, which is commonly found in many other organisms, has been replaced with arsenic. Phosphorus is an essential element present not only in the DNA and RNA backbone but also in the metabolic pathways in the form of ATP. Arsenic—belonging to the same periodic group as phosphorus—is toxic because of its ability to replace phosphorus in the metabolic pathways in other organisms which will result in death.

Interestingly, GFAJ-1 showed a significantly higher growth rate in the presence of arsenic than they did in the presence of phosphorus. Wolfe-Simon and her group insist that GFAJ-1 has replaced phosphorus in their DNA and RNA backbone with arsenic. However, biochemist Steven Brenner expressed doubt on whether this strain uses arsenic in its DNA and RNA backbone. He thinks that a trace contamination can be a source of phosphorus for the bacteria. Brenner suspects that arsenic is used somewhere else in the cell. Nonetheless, this discovery is an important breakthrough in the fields of biochemistry, cellular and molecular biology, and astrobiology. This discovery changes our understanding about the definition of life and the chemical structure of DNA and RNA.



*GFAJ-1 in the presence of arsenic (right) and phosphorus (left)*

Image Credit: Jodi Switzer Blum, obtained from nasa.gov