

Scientists say NASA's 'new arsenic form of life' was untrue

9 July 2012, by Kerry Sheridan



File photo of the Mono Lake in Lee Vining, California. Two scientific papers appear to have disproved a controversial claim made by NASA-funded scientists in 2010 that a new form of bacterial life in the lake had been discovered that could thrive on arsenic.

Two new scientific papers have disproved a controversial claim made by NASA-funded scientists in 2010 that a new form of bacterial life had been discovered that could thrive on arsenic.

"Contrary to an original report, the new research clearly shows that the bacterium, GFAJ-1, cannot substitute arsenic for phosphorus to survive," said a statement by the US journal *Science*, a prestigious, peer-reviewed magazine.

Science published Sunday the much-hyped initial study in December 2010, with lead researcher Felisa Wolfe-Simon, then a fellow in NASA's astrobiology program, announcing that a new form of life had been scooped from a California lake.

The bacterium in arsenic-rich Mono Lake was said to redefine the building blocks of life, surviving and growing by swapping phosphorus for arsenic in its DNA and cell membranes.

Biologists consider these six elements as necessary for life: carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.

Arsenic is similar to phosphorus but is typically poisonous to living organisms.

The original study needed to be confirmed in order to be considered a true discovery, and two separate teams found that indeed, the bacterium needed some phosphate to survive, and could not fully substitute arsenic to live.

NASA has conducted numerous probes at eastern California's Mono Lake, an unusually salty body of water with high arsenic and mineral levels, as it is likely to reflect conditions under which early life evolved on Earth, or perhaps Mars.

While Wolfe-Simon and colleagues acknowledged that there were very low levels of phosphate within their study samples, they concluded that this was a level of contamination that was insufficient to permit GFAJ to grow.

Two separate *Science* articles "now reveal that, in fact, her medium did contain enough phosphate contamination to support GFAJ-1's growth," said a statement by the magazine issued late Sunday.

One paper was written by Marshall Louis Reaves and colleagues at Princeton University, Rosemary Redfield at the University of British Columbia, and Leonid Kruglyak of the Howard Hughes Medical Institute.

Life's building blocks

- ▶ NASA-funded scientists claimed in peer-reviewed journal Science in 2010 that they discovered bacteria that thrives on arsenic
- ▶ They claimed that the finding would rewrite the rules for the basic elements necessary for life
- ▶ Now two scientific papers have said that the original claim was untrue

The building blocks for life

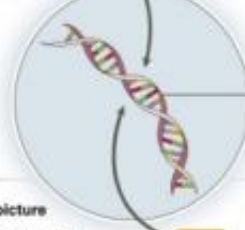
Carbon Hydrogen Oxygen Nitrogen

C H O N

Scientists generally agree that **without these six elements life as we know it cannot exist**

Phosphorus **P** Sulfur **S**

The role of phosphorus



Phosphorus is a vital element in the structure of DNA
It helps to form the "backbone" spiral ladder
Without it DNA cannot form

Arsenic in the picture

- Arsenic is chemically similar to phosphorus
- This actually makes it toxic to most forms of life, by replacing phosphorus and destroying cells

As

Arsenic

- **GFAJ-1** bacteria collected from Mono Lake in California had apparently thrived in arsenic flooded conditions
- Researchers said the bacteria swapped arsenic for phosphorus in its DNA

■ The latest research says that the samples had been contaminated with phosphorus, and that's why they continued to thrive

AFP Source: NASA/Science/4/astrobiology.nasa.gov

Graphic on the basic elements of life. Researchers have refuted claims of a NASA-funded study that said a new form of bacterial life had been discovered that could thrive on arsenic. Text slug: Science-US-space-astrobiology-biology130 x 144 mm

It found that the bacterium was not really replacing phosphorus with arsenic throughout its DNA but "may sometimes assimilate arsenate into some small molecules in place of phosphate."

Co-author Redfield, a Canadian microbiologist, was among the first outspoken critics of the initial study.

"I don't know whether the authors are just bad scientists or whether they're unscrupulously pushing NASA's 'There's life in outer space!' agenda," wrote Redfield in a blog that ignited the web furor shortly after the paper was first published.

The other paper to refute the findings was written by Tobias Erb and colleagues at the Institute of Microbiology, ETH Zurich, and found that the bacterium, while able to live in a high-arsenic environment, still needed phosphorus to survive and grow.

Rather than being a new form of life that thrives on arsenic, Science's statement summed up the latest studies by describing the bacterium as "a well-adapted extremophile that lives in a high-arsenic environment."

It "is likely adept at scavenging phosphate under harsh conditions, which would help to explain why it can grow even when arsenic is present within the cells," said the journal's statement.

"The scientific process is a naturally self-correcting one, as scientists attempt to replicate published results," it added.

The journal did not retract the original study but said it was "pleased to publish additional information on GFAJ-1."

Wolfe-Simon said in a statement sent to AFP that the data in the new papers "are consistent with our original paper" and that she and colleagues expect to publish new information in the next few months.

"A great thing about science is that the ability to do rigorous tests with controls provides an increasingly accurate knowledge of life and the universe that is extremely useful," she said.

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APA citation: Scientists say NASA's 'new arsenic form of life' was untrue (2012, July 9) retrieved 7 October 2022 from <https://phys.org/news/2012-07-scientists-nasa-arsenic-life-untrue.html>

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