Study identifies relatives of microbe that became part of us

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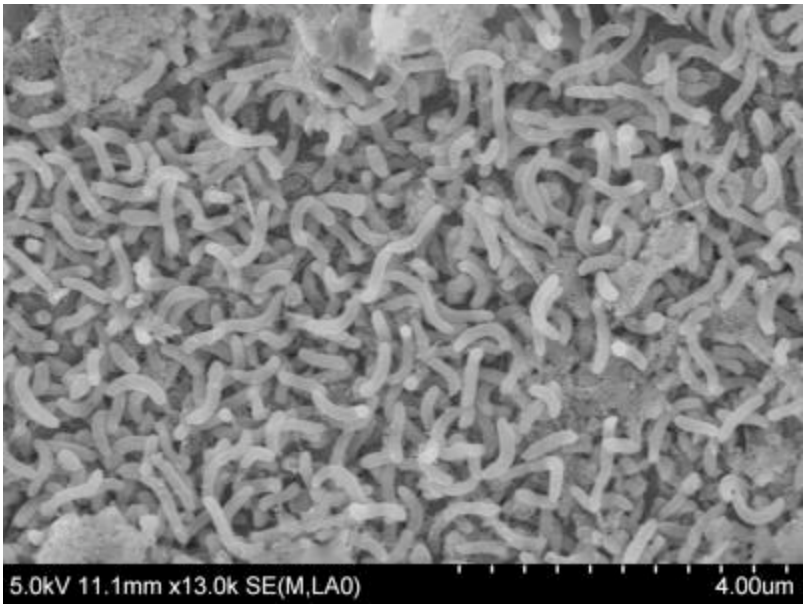
Courtesy of University of Hawaii - SOEST
and World Science staff

Billions of years ago, a strange and fateful step in evolution took place, biologists say. Some bacteria started living inside other cells, and over generations lost the ability to live anywhere else. Their hosts also lost the ability to do without them.

Now, they're simply part of us. Those bacteria's descendants are "mitochondria": essential, energy-generating subcompartments of normal animal and plant cells.



A strain of SAR11 bacteria under an electron microscope. (Credit: Michael Rappe, SOEST/UHM)

While most biologists have accepted this story for decades—based on similarities between bacteria and mitochondria (which have their own DNA and even look like bacteria)—it has been a mystery just who these interlopers were, or where they came from.

Now, it may be less of a mystery.

A new study proposes mitochondria are relatives of a lineage of marine bacteria known as SAR11,

perhaps Earth's most abundant group of microorganisms. It accounts for as many as one third of the cells found in the upper oceans, and has produced simple, efficient organisms well-adapted to low-nutrient conditions, according to Oregon State University scientists.

"This is a very exciting discovery," said Michael Rappé of the University of Hawaii-Manoa, one of the researchers in the new study, published online June 14 in the journal *Nature Scientific Reports*.

The proposal makes sense "in a lot of ways," he added. "the physiology of SAR11 makes them more apt to be dependent on other organisms, and based on the contemporary abundance of SAR11 in the global ocean, the ancestral lineage may have also been abundant in the ancient ocean." This abundance, he speculated, could have led to frequent encounters between SAR11 microbes and "the host of the original symbiosis event." Symbiosis is a relationship of mutual dependence between two species.

SAR11 bacteria are part of plankton, floating masses of microscopic organisms often eaten by bigger sea creatures.

Colleagues of Rappé at Oregon State University used several interconnected computer programs to compare the genomes of mitochondria from widely ranging species, with those of various SAR11 strains. In this way they concluded that the bacteria and the mitochondria must have had a common ancestor. The findings also led the researchers to propose the existence of a new family of bacteria, *Pelagibacteraceae*.

The SAR11 lineage "contains a significant amount of genetic diversity, which potentially indicates significant diversity in metabolism," said Rappé.

Mitochondria are a part of all "eukaryotic" cells, a complex, compartmentalized type of cell that characterizes animals, plants and fungi and their close single-celled ancestors.