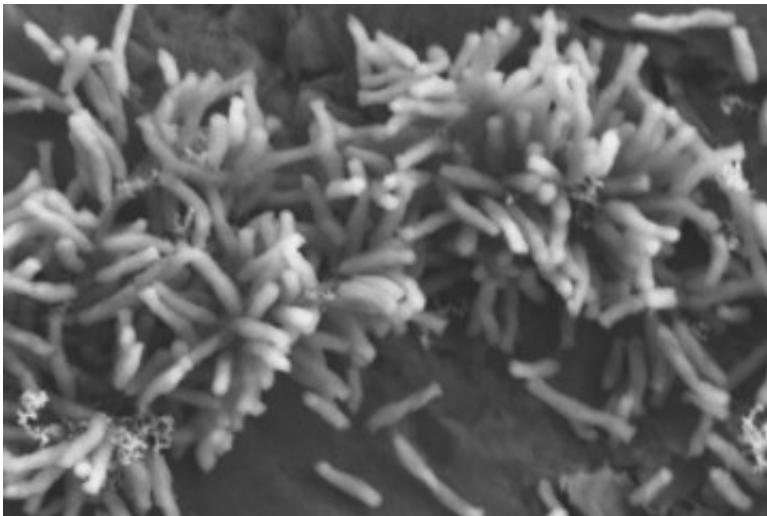


# Researchers discover novel process microbes use to harvest electrons

November 5 2019, by Talia Ogliore

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Photoferrotrophy is a form of anoxygenic photosynthesis whereby bacteria utilize soluble or insoluble forms of ferrous iron as an electron donor to fix carbon dioxide using light energy. New research from the laboratory of Arpita Bose, assistant professor of biology in Arts & Sciences at Washington University in St. Louis, shows how one of these kinds of bacteria builds a special electron conduit to harvest electricity directly from the source. Credit: Bose laboratory, Washington University in St. Louis

Ever since scientists discovered that certain microbes can get their energy from electrical charges, researchers have wondered how they do it.

Bacteria don't have mouths, so they need another way to bring their fuel

into their bodies. New research from Washington University in St. Louis reveals how one such [bacteria](#) pulls in electrons straight from an electrode source. The work from the laboratory of Arpita Bose, assistant professor of biology in Arts & Sciences, was published Nov. 5 in the scientific journal *mBio*.

"The molecular underpinning of this process has been difficult to unravel until our work," Bose said. "This is mostly due to the complex nature of the proteins involved in this process. But now, for the first time, we understand how phototrophic microbes can accept electrons from solid and soluble substances."

Dinesh Gupta, a Ph.D. candidate in the Bose laboratory, is the first author on this new study. "I was excited when we found that these phototrophic bacteria use a novel processing step to regulate the production of key electron transfer protein involved in this process," Gupta said. "This study will aid in designing a bacterial platform where bacteria can feed on electricity and [carbon dioxide](#) to produce value-added compounds such as biofuels."

Getting the electricity across the outer layer of the bacteria is the key challenge. This barrier is both nonconductive and impermeable to insoluble iron minerals and/or electrodes.

Bose and her collaborators, including Robert Kranz, professor of biology, showed that the naturally occurring strain of *Rhodospseudomonas palustris* TIE-1 builds a conduit to accept electrons across its outer membrane. The bacteria relies on an iron-containing helper molecule called a deca-heme cytochrome c. By processing this protein, TIE-1 can form an essential bridge to its electron source.

Extracellular electron uptake, or EEU, can help microbes to survive under nutrient-scarce conditions.

Now that Bose has documented these mechanisms behind EEU, she hopes to use it as a biological marker to identify other electricity-eating bacteria in the wild. The findings will help researchers to understand the importance of this functionality in metabolic evolution and microbial ecology.

**More information:** Dinesh Gupta et al, Photoferrotrophs Produce a PioAB Electron Conduit for Extracellular Electron Uptake, *mBio* (2019). [DOI: 10.1128/mBio.02668-19](https://doi.org/10.1128/mBio.02668-19)

Provided by Washington University in St. Louis

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