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Identification of Desulfuromonas carbonis sp. nov. Metabolites that are Secreted in Response to Different Electron Acceptors

Zohar Tik, Hanni Vigderovich, Orit Sivan, and Michael M. Meijler
Department of Earth and Environmental Sciences, Ben-Gurion University of the Negev, Be'er Sheva, Israel

Anaerobic respiration is being observed in many aquatic environments as an outcome of oxygen depletion. Chemical profiles in porewater of organic-rich sediments indicate that various microbes use several electron acceptors in the anaerobic dissimilatory respiration. These electron acceptors are used in the order of decreasing chemical potential, beginning with nitrate, then manganese and iron oxides, then sulfate and finally carbon dioxide .1 During respiration, organisms consume and produce metabolites and thus are changing their environment.
Some bacteria are capable of using various compounds as final electron acceptors (EA). One of those bacteria is Desulfuromonas carbonisis sp. nov., a Gram-negative, obligatory anaerobic, rod-shaped bacterium. This bacterium is closely related to bacteria from the Geobacter genus, which is well known as a major iron reducer through dissimilatory anaerobic respiration. Species from this genus are found in natural anaerobic systems and are capable of reducing Fe(III)-oxides, S0, and Mn(IV)-oxides. Here we investigated the change in Desulforomonas metabolites as a result of available EA.
Bacterial cultures were extracted, and liquid chromatography-tandem mass spectrometry (LC-MS/MS) data were analyzed using the global natural products social molecular networking (GNPS) online platform.2 Our results indicate that unique metabolites are produced by the bacteria depending on the presence of different EA in the culture, while some of the metabolites were shared by two groups or more. Indole-3-carboxaldehyde (I3C) was found almost exclusively in the iron-oxide containing cultures. This compound is known as part of tryptophan metabolism and is known to affect chemical communication of bacteria. To the best of our knowledge, I3C was not identified in the Desulfuromonas genus until now.
We were able to detect this compound not only in pure cultures but also in cultures containing the bacterium, natural anoxic lake sediment and iron oxides. That establishes the potential of I3C to be involved in natural processes specific to dissimilatory iron reduction. We will continue to investigate these processes and the connection between I3C signaling and iron.

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