Zeta proteobacteria

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Zetaproteobacteria

- The **Zetaproteobacteria** is the sixth and most recently described class.
- The Zetaproteobacteria were first discovered in 1991 by Craig Moyer, Fred Dobbs and David Karl .
- The Zetaproteobacteria were originally represented by a single described species, *Mariprofundus ferrooxydans*, which is an iron-oxidizing neutrophilic chemolithoautotroph.
- Molecular cloning techniques focusing on the small subunit ribosomal RNA gene have also been used to identify a more diverse majority of the Zetaproteobacteria that have as yet been unculturable.

- The Zetaproteobacteria are distributed worldwide in deep sea and near shore environments at oxic/anoxic interfaces.
- With this wide distribution, the Zetaproteobacteria have the potential to play a substantial role in biogeochemical cycling, both past and present.
- Ecologically, the Zetaproteobacteria play a major role in the engineering of their own environment through the use of the controlled deposition of mineralized iron oxides, also directly affecting the environment of other members of the microbial community.

Mariprofundus ferrooxydans

- ***Mariprofundus ferrooxydans*** is neutrophilic, chemolithotrophic, Gram-negative bacterium which can grow by oxidising ferrous to ferric iron.
- It is one of the few members of the class Zetaproteobacteria in the phylum Pseudomonadota.
- is typically found in iron-rich deep sea environments, particularly at hydrothermal vents.
- *M. ferrooxydans* characteristically produces stalks of solid iron oxyhydroxides that form into iron mats.
- *M. ferrooxydans* lives in microoxic conditions and uses Fe(II) as an electron donor and oxidizes it to Fe(III) as its main energy acquiring pathway, using oxygen as the electron acceptor and CO_2 as its carbon source.

- *M. ferrooxydans* cells are Gram-negative curved rods that cycle through two life stages: they have a free-living stage where they are motile, and a second stage where they are oxidizing iron and forming solid iron oxides.
- The fibrous twisted stalks of iron oxyhydroxides extruded by *M. ferrooxydans* are found in iron mats and are predicted to consist of an organic matrix which allows the iron oxide structure to form in a manner characteristic of *M. ferrooxydans*.
- This organism is also motile and chemotactic, which enables it to move towards appropriate concentrations of oxygen even in the heterogeneous and rapidly changing environment of hydrothermal vents; the organism can rapidly detect and respond to changing oxygen concentrations to allow aerotaxis towards appropriate levels of oxygen.
- Motility allows *M. ferrooxydans* to remain in microoxic conditions despite the amount of mixing occurring in its environment, and remain where it can out-compete abiotic iron oxidation to acquire enough energy to survive.