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Magnetospirillum gryphiswaldense

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Summary

Magnetospirillum gryphiswaldense is amongst the best studied representatives of magnetotactic bacteria. These microbes use the Earth's magnetic field for navigation thanks to unique organelles, the magnetosomes, which are membrane-enveloped, iron-rich magnetic particles. Because it can be grown in the lab relatively easily and is genetically tractable, *M. gryphiswaldense* has been subject of many studies on magnetotaxis, organelle biosynthesis and biomineralization in prokaryotes and used for environmental and medical applications. Magnetosome biosynthesis starts with the formation of empty membrane vesicles, in which large amounts of iron is transported and mineralized as magnetite (Fe₃O₄). Chains of nascent magnetosome particles are concatenated, positioned and segregated by a multi-partite cytoskeletal network ("magnetoskeleton"). The >30 most relevant proteins controlling magnetosome biosynthesis are encoded by large gene clusters within a 100 kb genomic "magnetosome island".

Key Facts

Isolated from sediment of the river Ryck near the town of Greifswald (Latin: "*Gryphiswaldia*") in Germany in 1990 by D. Schüler, it was one of the first magnetotactic bacteria recovered in culture.

The founding species of the genus *Magnetospirillum* that comprises several other well-studied magnetotactic species but also non-magnetotactic members.

Spiral-shaped Gram-negative bacterium, producing 20-50 intracellular magnetite crystals arranged in a chain.

Microaerophilic, facultative anaerobe using oxygen or nitrate as respiratory electron acceptors. Tolerates atmospheric oxygen for growth, but forms magnetosomes only in suboxic conditions.

Highly motile by two polar flagella. Magneto-aerotactic swimming polarity is controlled by oxygen sensing through one of the most complex chemosensory networks known in bacteria.

Entire magnetosome biosynthesis pathway has been genetically transplanted from *M. gryphiswaldense* to non-magnetotactic bacteria.

Amenable to mass cultivation and production of magnetic nanoparticles. Living bacteria and engineered and functionalized magnetosomes are being studied for use in applications including magnetic nanorobots, biocatalysts, probes for drug delivery, magnetic resonance imaging and cancer therapies.

Taxonomic and Classification information

KINGDOM: Bacteria

PHYLUM: Proteobacteria

CLASS: Alphaproteobacteria

ORDER: Rhodospirillales

FAMILY: Rhodospirillaceae

GENUS: *Magnetospirillum*

SPECIES: *gryphiswaldense*

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