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Aerobic respiration by two Sulfate reducing magnetotactic bacteria, strains RS-1 and FH-1

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Magnetotactic bacteria is the categorical name for a group of prokaryotes that biomineralize magnetosomes which are intracellular, membrane-bounded magnetic iron mineral crystals. The focus of this study is on two magnetite-producing, magnetotactic sulfate-reducing bacteria (SRB), *Desulfovibrio magneticus* strain RS-1 and strain FH-1 which also belongs in the genus *Desulfovibrio* in the δ-Proteobacteria. SRB utilize sulfate as a terminal electron acceptor under anaerobic conditions reducing sulfate to sulfide. A large number of organic compounds as well as some inorganic compounds have been shown to provide electrons for sulfate reduction. Traditionally, because no SRB have been shown to convincingly grow with O2 as a terminal electron acceptor, they have been classified as obligate anaerobes.

In characterizing several magnetotactic SRB, we found that cells of *D. magneticus* and strain FH-1 utilized O2 as an electron acceptor for growth. To prove this we grew cells of both strains in several different semi-solid growth media under air or N2 gas. Cells of both strains grew as a microaerophilic band of cells at the oxic-anoxic interface (OAI) in media under air lacking sulfate (medium contained cysteine or cysteine with either Casamino Acids or Yeast Extract as a sulfur source). Sulfide (as FeS; high [Fe] was used as a trap for sulfide) was not produced in these tubes. Cells did not grow under anaerobic conditions (under N2) in this medium unless sulfate was present. When sulfate was present in the growth medium, under air, initial growth of the strains was also as a microaerophilic band of cells at the OAI. However as time went on, the band of *D. magneticus* split into two. The band of FH-1 cells did not split into two bands and moved up the tube almost to the meniscus. The medium also turned dark indicating sulfide production. The results show that these magnetotactic SRB strains are capable of aerobic growth with O2 as a terminal electron acceptor.
Aerobic Respiration by Two Sulfate Reducing Magnetotactic Bacteria, Strains RS-1 and FH-1

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Abstract
Magnetotactic bacteria are the categorial name for a group of prokaryotes that biomineralize magnetosomes which are intracellular, membrane-bounded magnetic iron mineral crystals. The focus of this study is on two magnetotactic sulfate reducing bacteria, Desulfobulbus magnetostrigatus strain RS-1 and strain FH-1. These magnetotactic bacteria have a unique ability to use the Earth's geomagnetic field as a guide to move through the environment. This is because the cells contain a chain of magnetosomes which are highly magnetized and align along the Earth's magnetic field lines. This movement is known as magnetotaxis and allows the bacteria to move towards or away from specific environments based on the strength and direction of the Earth's magnetic field. The study aimed to investigate the role of magnetotaxis in bacterial movement and its potential applications in environmental monitoring and biotechnology.

Methods
Growth Medium
Ingredients per liter (final concentrations in growth medium are in parentheses)
5 ml of Modified Iron Solution (all sulfate salts were replaced with chloride salts; the concentration of the metals were the same as in original Iron Solution)

Introduction
Magnetotactic bacteria (MTB) biomineralize intracellular, membrane-bounded, magnetite iron mineral crystals called magnetosomes which cause the cells to align along the Earth's geomagnetic field. Magnetosomes contain either magnetite (Fe₃O₄) or greigite (Fe₃S₄). MTB are phylogenetically and metabolically diverse although most are affiliated with the Proteobacteria. The presence of magnetosomes is a distinguishing feature of MTB and is often used as a diagnostic tool to identify these bacteria. The study aimed to investigate the role of magnetotaxis in bacterial movement and its potential applications in environmental monitoring and biotechnology.

Results
The cells of strain FH-1 move up the tube stirring at the O₂-air interface (OA). Thus, cells of FH-1 appear to prefer to use O₂ as an electron acceptor even in the presence of sulfide. The bacteria of strain RS-1 grow in a tube with stirring at the OA. Left: H₂-sulfuric acid (left); right: sulfuric acid (right).

Conclusion
The cells of strain FH-1 and DS. magnetostrigatus are grown as a tube terminal electron acceptor, proving that some SRB are not strict obligate anaerobes.

Future Outlook
To further investigate the role of magnetotaxis in bacterial movement and its potential applications in environmental monitoring and biotechnology.

Acknowledgement
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References