

## ***Fundidesulfovibrio magnetotacticus* sp. nov., a novel sulfate-reducing magnetotactic bacterium isolated from a pond in Saitama, Japan**

Hirokazu Shimoshige<sup>1,2</sup>, Hideki Kobayashi<sup>1</sup>, Shigeru Shimamura<sup>2</sup>, Toru Maekawa<sup>1,3</sup>

<sup>1</sup>Bio-Nano Electronics Research Centre (BNERC), Toyo University, 2100 Kujirai, Kawagoe, Saitama 350-8585, Japan

<sup>2</sup>Institute for Extra-cutting-edge Science and Technology Avant-garde Research (X-star), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), 2-15 Natsushima-cho, Yokosuka, Kanagawa 237-0061, Japan

<sup>3</sup>Graduate School of Interdisciplinary New Science (IdNS), Toyo University, 2100 Kujirai, Kawagoe, Saitama 350-8585, Japan

Magnetotactic bacteria are a diverse group of aquatic prokaryotes that synthesize intracellular membrane-bounded magnetic nanoparticles (NPs) named magnetosomes, which are composed of magnetite ( $\text{Fe}_3\text{O}_4$ ) and/or greigite ( $\text{Fe}_3\text{S}_4$ ). It is known that the magnetotactic bacteria belonging to the phylum *Desulfobacterota* (formerly *Deltaproteobacteria*) are ubiquitous in the sediments of freshwater, brackish, marine and hypersaline environments. Mostly known magnetotactic *Desulfobacterota* are sulfate-reducing bacteria that synthesize bullet-shaped  $\text{Fe}_3\text{O}_4$  NPs and/or pleomorphic  $\text{Fe}_3\text{S}_4$  NPs, but only a few axenic cultures have been obtained so far. Here, we report the isolation and characterization of a novel sulfate-reducing magnetotactic bacterium, designated strain FSS-1, isolated from Suwa Pond located in Hidaka, Saitama, Japan. Phylogenomic analysis based on 30 single-copy marker genes showed that strain FSS-1 was a member of the genus *Fundidesulfovibrio* (formerly *Desulfovibrio*) within the family *Desulfovibrionaceae* and most closely related to *Fundidesulfovibrio putealis* B7-43<sup>T</sup>. The average nucleotide identity (ANI) value between strain FSS-1 and *F. putealis* B7-43<sup>T</sup> was 80.7%. The phylogenomic analysis also showed that strain FSS-1 was closely related to a sulfate-reducing magnetotactic bacterium, *Solidesulfovibrio* (formerly *Desulfovibrio*) *magneticus* RS-1<sup>T</sup>, belonging to the family *Desulfovibrionaceae*. Strain FSS-1 synthesized approximately 10 bullet-shaped  $\text{Fe}_3\text{O}_4$  NPs in the cell when grown in the presence of fumarate as a carbon source. The magnetosome gene cluster of strain FSS-1 was different from that of *S. magneticus* RS-1<sup>T</sup>. The phenotypic characteristics of strain FSS-1 also differed from those of *F. putealis* B7-43<sup>T</sup> and *S. magneticus* RS-1<sup>T</sup>. Thus, strain FSS-1 is considered to represent a novel sulfate-reducing magnetotactic bacterium belonging to the genus *Fundidesulfovibrio*, for which the name *Fundidesulfovibrio magnetotacticus* sp. nov. is proposed. Our isolate also provides a promising tool for elucidating the process of magnetosome formation and the origin of magnetotaxis.