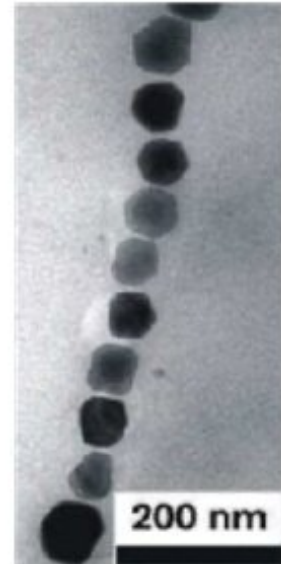
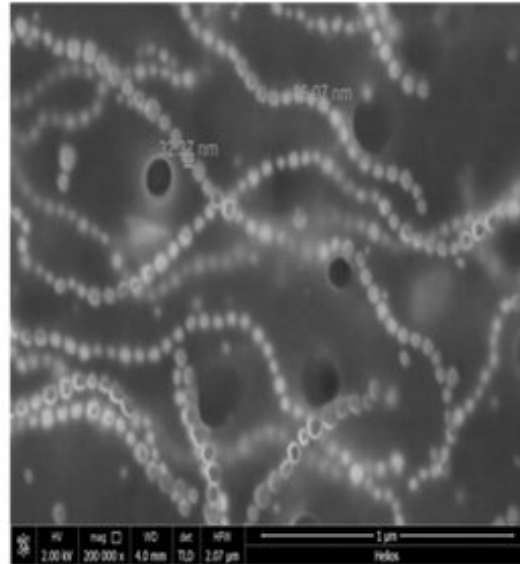
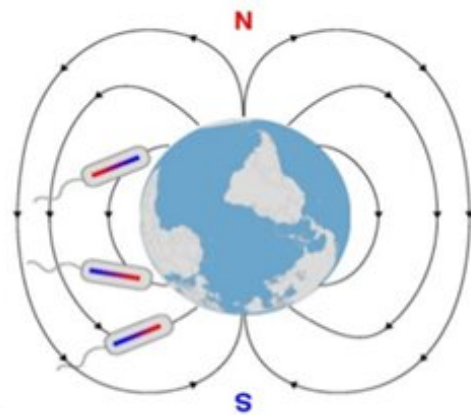


A magnetosome-like structure with high tumor tissue penetration efficiency

November 8 2022, by Zhang Nannan



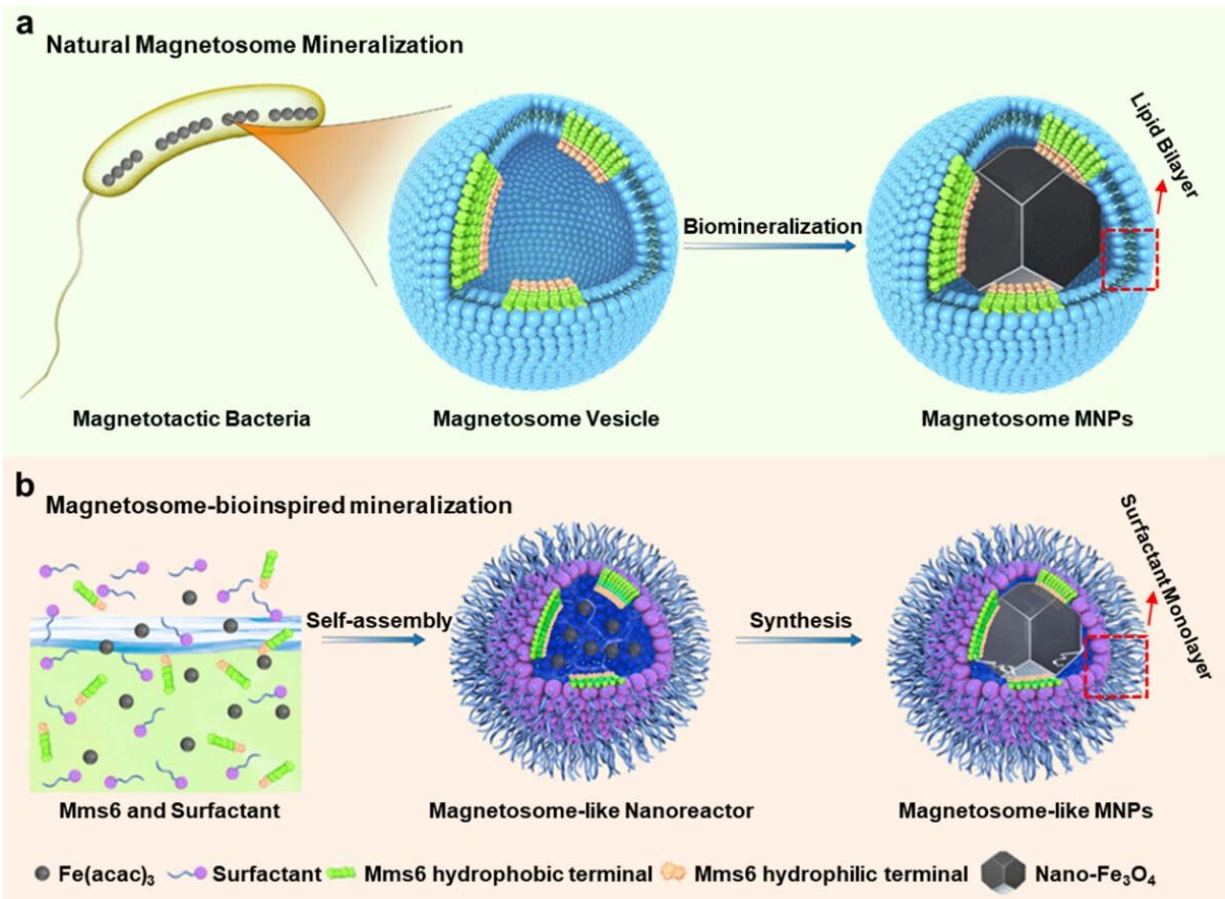
Magnetic navigation of magnetotactic bacterial and the magnetosome Chains.
Credit: MA Kun

In a study published in *PNAS*, a research team led by Prof. Wang Junfeng from the Hefei Institutes of Physical Science (HFIPS) of the Chinese Academy of Sciences biomimetically synthesized soft ferromagnetic nanoparticles with high magnetic targeting and tumor tissue penetration based on the biomineralization mechanism of a natural "biocompass"—magnetotactic bacteria.

Targeted delivery of anti-[tumor](#) drugs can effectively improve the efficacy and minimize the toxicity of drugs. Due to the limitations of the complexity of the tumor microenvironment, the average tumor targeting efficiency of nanodrugs is less than 1%, which constitutes one of the bottlenecks of tumor therapy.

Animals like pigeons, turtles and lizards can use the geomagnetic field to navigate. The bacteria, after obtaining iron from the surrounding environment, can move directionally along the [magnetic field](#) in the geomagnetic or artificial magnetic field. The magnetosomes offer a wide range of application prospects thanks to their obvious advantages in [magnetic properties](#), biocompatibility and stability. However, natural magnetosome particles are easy to accumulate and precipitate in the [external environment](#), which hinders their ability to penetrate the lesion area and the potential danger of deposition in blood vessels.

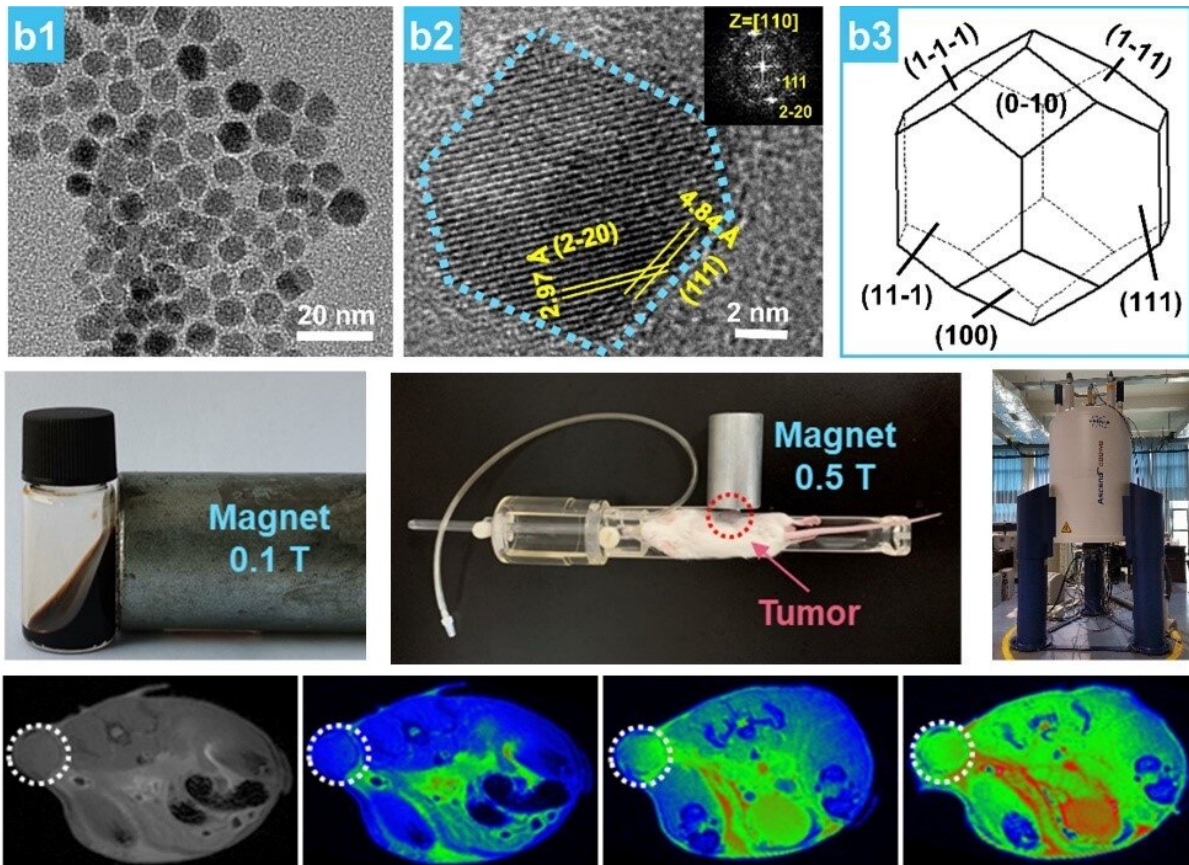
In this work, the researchers proposed a new strategy for biomimetic synthesis of magnetosomes. They constructed a magnetosome-like nanoreactor, and reconstructed the microenvironment of magnetosomes biomineralization of [magnetotactic bacteria](#) in vitro.



A reverse micelle nanoreactor regulated by the Mms6 protein to simulate the biomineralization process in magnetotactic bacterial. Credit: MA Kun

"The magnetosome-like nanoparticles synthesized with this method performed excellently," said Ma Kun, first author of the study, "The DSPE-mPEG-coated magnetosome-like magnetic nanoparticles penetrated the lesion area of a tumor mouse model."

Experimental findings demonstrate the improvement by an order of magnitude in the targeting and penetrability of biomimetic magnetosomes in tumor tissues compared with other magnetic nanodrugs.



Magnetosomes have the same crystal morphology and magnetic properties as natural magnetosomes, can effectively respond to external magnetic field and achieve targeted enrichment and efficient penetration of tumor tissues. Credit: MA Kun

This work not only provides an efficient carrier for magnetic targeting delivery of nanodrugs, and but also expands a new model system for studying the biomineralization mechanism of magnetotactic bacteria in vitro.

More information: Kun Ma et al, Magnetosome-inspired synthesis of soft ferrimagnetic nanoparticles for magnetic tumor targeting,

Proceedings of the National Academy of Sciences (2022). [DOI: 10.1073/pnas.2211228119](https://doi.org/10.1073/pnas.2211228119)

Provided by Chinese Academy of Sciences

Citation: A magnetosome-like structure with high tumor tissue penetration efficiency (2022, November 8) retrieved 23 April 2024 from <https://phys.org/news/2022-11-magnetosome-like-high-tumor-tissue-penetration.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.