MAR11-2010-002813

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Biomagnetism and Magnetotaxis in Bacteria: What Bacteria Know About Magnetic Materials and Permanent Magnet Design

RICHARD FRANKEL, California Polytechnic State University, San Luis Obispo, CA

Magnetotactic bacteria (mtb) migrate along geomagnetic field lines, i.e., they behave like self-propelled magnetic compass needles. Mtb make single-magnetic-domain crystals of magnetite (Fe_3O_4) and greigite (Fe_3S_4) in intracellular structures called magnetosomes. The magnetosomes are arranged in linear chains that comprise permanent magnetic dipoles with remanent moments approaching the saturation moment, causing the mtb to be oriented in the geomagnetic field as they swim. This allows them to keep their heading and efficiently migrate to, and remain in, a preferred, microaerobic, aquatic habitat. The mtb have solved the difficult problem of designing a permanent magnet that is sufficiently robust to cause the cell to be oriented in the geomagnetic field at ambient temperature, yet fit inside a micron-sized object, and be assembled *in situ* from potentially toxic materials scavenged from the environment. I will describe some recent advances in mtb genetics that illuminate the process by which they make and arrange their magnetosomes.