What have magnetotactic bacteria ever done for us?

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The fortuitous discovery of magnetotactic bacteria in 1975 by Richard Blakemore [1] identified a new sensing mechanism (magnetotaxis), 'organelles' in a prokaryote (magnetosomes), and a new model of biomineralization. Thus, the discovery opened a novel and interdisciplinary field of research that promised to deliver fundamental new insights into biomineralization, environmental and biological magnetism, and iron biogeochemistry. After more than four decades of intense research, it is time to ask what advances we have made in these fields, and how science and technology benefited from knowledge accumulated through the study of magnetotactic bacteria.

At some points along the distinct branches of research it may have appeared that we have all the answers: magnetic sensing is used for navigating in vertical concentration gradients; each step of the biomineralization process is controlled by specific proteins; and, it is only a matter of time that magnetosomes will find their applications in biomedicine. However, each new result generated new questions and revealed more complexity: magnetic sensing might have several functions; the interplay of magnetosome proteins in biomineralization is still not completely understood; and the technological use of magnetosomes has remained a promise. Nevertheless, research on magnetotactic bacteria sparked many new ideas that cross-fertilized various science disciplines. Magnetotactic bacteria have served as platforms for the development of novel research tools (e.g., for imaging magnetic fields), and they remain the simplest and best understood models of biomineralization. Knowledge gained from studying biomineralization by magnetotactic bacteria has been used for the biomimetic synthesis of magnetic nanostructures, examples of which will be presented [2,3].

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