MS5-P16 Structural insight into magnetochrome-mediated magnetite biomineralization

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Biomineralization is the process by which organisms produce minerals from environmental elements. The minerals produced often result in materials, which have superior properties than similar man-made materials, making them of significant interest in understanding the mechanisms of biomineralization. Magnetotactic bacteria (MTB) are a group of microorganisms which biomineralise nano-sized crystal of magnetite. These crystals present in a prokaryotic organelle, the magnetosome, allow them to swim along Earth's magnetic field lines. Magnetosomes are proteolipidic vesicles filled by a 35-120 nm magnetite crystal. Since magnetite is a mix of iron(III) and iron(II), iron redox state management within the magnetosome is a key issue. In this respect, we have recently started pointing out the importance of a MTB-specific *c*-type cytochrome domain (magnetochrome; MCR), found in several magnetosome-associated proteins (MamE, P, T and X). In order to understand the mechanistic importance of this domain in the biomineralization process, we have elucidated the structure of the MCR-containing MamP protein. Our results demonstrate that MamP is an iron oxidase that contributes to the formation of iron(III) ferrihydrite eventually required for magnetite crystal growth in vivo, demonstrating the molecular mechanisms of iron management taking place inside the magnetosome, emphasizing the role of the MCR in iron biomineralization.

Reference:

Siponen MI, et al (2013) Structural insight into magnetochrome-mediated magnetite biomineralization. *Nature* **502(7473):** 681-4

Siponen MI, Adryanczyk G, Ginet N, Arnoux P, Pignol D (2012) Magnetochrome: a c-type cytochrome domain specific to magnetotatic bacteria. *Biochem Soc Trans*. 40(6):1319-23

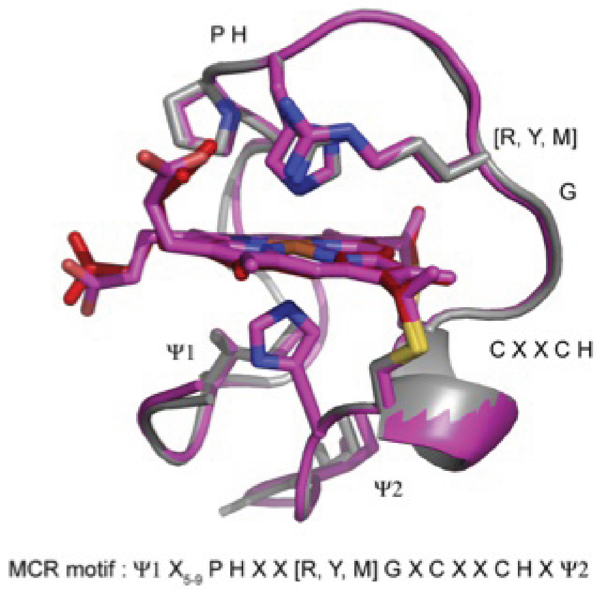

Figure 1. The magnetochrome domain is one of the smallest C-type cytochrome domains identidied thus far. This domain has shown to be specific to magnetotactic bacteria and requiered for electron tranfer in the ferrous oxidase activity of the MamP protein.

Keywords: Biomineralization, magnetotactic bacteria, magnetochrome protein domain