IMPRS on Multiscale Biosystems

Project description

Title: Growing Elongated: How Magnetotactic Bacteria Synthesize Anisotropic Magnetite Crystals
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In collaboration with: Kerstin Blank

Project description: Magnetotactic bacteria are microorganisms that form intracellular magnetite crystals, so-called magnetosomes. These particles are embedded in a membrane and show strain-specific morphology and size. In particular, some strains are able to form elongated crystals. It is largely unclear how these elongated structures are formed inside the bacteria. In this project you will investigate the factors that determine the bacterial synthesis of these crystals. Subsequently, you will employ these principles for the controlled *in vitro* synthesis of elongated magnetic particles for which no green synthetic routes are currently available.
Due to the advancement of genomic techniques, it has recently been proposed that a series of so-called *mad* genes is responsible for the control of the particle morphology in strains forming elongated crystals. Based on our initial biomimetic synthesis, we have already identified a subset of these genes that are potentially involved in this morphological control. You will experimentally test the binding of these identified biological additives to magnetite using single-molecule force spectroscopy. These experiments will provide the affinity of possible binders to specific magnetite thin-film surfaces. Interesting candidates of binders will then be used for the *in vitro* synthesis of magnetite to test their influence on the formation of elongated crystals.
In this project, special emphasis will be laid on interdisciplinary research so that close collaboration with scientists working on (bio)chemical, biological and physical aspects of biomineralization and biomimetics of magnetite synthesis will be expected.

Required background: We seek for a student with background in (bio)chemistry, biophysics or biotechnology. Skills in synthetic approaches, characterization of nanomaterials as well as single molecule force spectroscopy will be highly appreciated. Good knowledge in English is required.

Papers to read before the interview:

1. Baumgartner J., Carillo M. A., Eckes K., Werner P., Faivre D. (2014) Biomimetic Magnetite Formation: From biocombinatorial approaches to mineralization effects, Langmuir 30, 2129-2136.
2. Morfill J., Blank K., Zahnd C., Luginbühl B., Kühner F., Gottschalk K.-E., Plückthun A., Gaub H. E. (2008) Affinity-matured recombinant antibody fragments analyzed by single-molecule force spectroscopy, Biophysical Journal 93, 3583-3590.

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