Synthesis of magnetic filaments using flagellin-based fusion proteins as templates

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The filament part of the bacterial flagellum is built up from thousands of flagellin subunits by a self-assembly process. Previous studies have shown that foreign proteins can be furnished with self-assembling ability by creating fusion constructs with the polymerizable flagellin protein. The central D3 domain of the flagellin is exposed on the filament surface and since it has no significant role in the construction and stabilization of the filament, it can be removed or replaced with suitable proteins without disturbing self-assembling ability. Our goal is to create iron- and magnetite-binding proteins and peptides which can form nanorods applicable as templates for the synthesis of highly regulated magnetic nanostuctures under ambient conditions. The concept of this project is to replace the D3 domain of flagellin with (1) magnetosome-associated proteins that are involved in crystal nucleation in magnetotactic bacteria and (2) oligopeptides with known magnetite-binding properties.

Several types of flagellin-based fusion proteins were created, and then they were produced by flagellin-deficient *Salmonella* bacteria. The polymerization ability of the fusion constructs was checked *in vivo* and *in vitro* by electrophoresis and transmission electron microscopy. The swimming ability of the bacteria was observed by dark-field microscopy. Experiments are under progress to use the mutant filaments as templates for the formation of iron oxide nanostructures, both by nucleating magnetite on the periodically repeated recognition sites of the filament that have strong affinity to bind iron, and by capturing magnetite nanoparticles from solution. Magnetic nanostructures with elongated shapes can have special properties that can be used in many nanotechnological applications.