Magnetovesicles: A Mechanochemical Toolkit for the Remote Control of Iron Homeostasis

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Remote control of cellular functions is a key challenge in biomedical research and important for the development of new therapies. Here we address this challenge by developing a novel magnetic manipulation approach with the eventual goal to control iron homeostasis - i.e. the regulation of vital iron levels in cells. Iron is an essential atom for numerous physiological processes and likewise a potential toxin. Failure in iron regulation was recently shown to have implications for diabetes, cancer and Parkinson's disease, but hitherto iron regulation is little understood and treatment strategies are scarce. To realize the control of iron uptake and release, functionalized magnetic nanoparticles (MNP) in conjunction with magnetic fields are used, since magnetic fields can penetrate deep into tissue and allow for the local stimulation of MNP associated molecules. Next to applying this approach to cells, the technological development will be based on artificial biomembranes which exhibit the molecules of interest coupled to MNPs. These so called Magnetovesicles have the advantage to enable quantification of molecular activity states and to establish the magnetic control using chemical, spatial or mechanical cues. Thus, a rich toolkit for the magnetic control of iron homeostasis is generated which may be transferred to a variety of regulatory problems in biology and medicine.

Projektbeteiligte

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