Stuttgarter Physikalisches Kolloquium

Fachbereich Physik, Universität Stuttgart
Max-Planck-Institut für Festkörperforschung
Max-Planck-Institut für Intelligente Systeme

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Login data will be announced by e-mail and on the colloquia webpage

Dienstag, 15. Juni 2021 | **16:15 Uhr** | **Online-Vortrag**

Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart-Vaihingen

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Wireless Medical Microrobots

Metin Sitti
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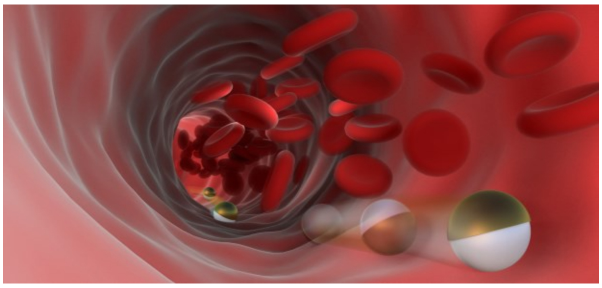

Abstract

Wireless medical microrobots have the potential to improve healthcare significantly, since they have the unique capability of accessing, operating and possibly staying inside hard and currently not possible to reach small spaces inside the human body non-invasively. In this direction, two alternative approaches are investigated to create micron-scale medical robots. As the first approach, external light, magnetic fields and ultrasonic waves are used to propel microrobots remotely. Carbon nitride-based light-driven microswimmers with intrinsic photocharging ability and biocompatible propulsion in biological and ionic media are reported. They can also have responsive on-demand drug delivery function towards medical use. Next, using rotating external magnetic fields, magnetic Janus microparticles-based microrollers are used to move against the blood flow on the vessel walls. They can adhere to the specific cancer cells using their antibody coating and release drugs triggered by light. Also, alternating magnetic fields can stimulate magnetopiezoelectric nanoparticles for wireless deep brain neural stimulation to treat the Parkinson's disease, which is validated in in vivo mouse tests. Moreover, using ultrasonic waves, microswimmers with integrated microbubbles are propelled on a surface by fluidic flows induced by the bubble oscillation. As the second approach, cell-driven biohybrid microswimmers are proposed towards targeted active drug delivery applications. Bacteria- and alga-driven microswimmers are steered using remote magnetic fields and local chemical, oxygen or pH gradients in a given physiological microenvironment. In vitro active cargo delivery demonstrations of such microswimmers are reported.