Special Lecture:

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Ultrasound assisted magnetic microbubble delivery system for multimodal theranostics

Thursday, 23 June 2016,

Seminar room, HBZ, 18:00 - 19:00 h

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Recently, in order to establish more specific and individualized therapies for various pathologies, the promising theranostics paradigm involving a combination of diagnostic and therapeutic applications into a single agent has been shown to offer significant advantages over conventional drug delivery systems. The development of innovative all-in-one drug delivery systems, which can be triggered to deliver drugs, imaging components in spatial-, temporal- and dosage-controlled fashions has attracted considerable attention. Due to its low-costs, non-invasive nature and relative high sensitivity, ultrasound technology in combination with microbubbles has received increasing attention not only as a non-invasive conventional diagnostic modality but also as spatially targeted drug delivery methodology.

When biomedical superparamagentic iron oxide nanoparticles are elaborately assembled with microbubbles, the magnetic microbubbles (MBs) can be co-constructed as a novel controllable multi-scale platform for multimodal diagnostic imaging, therapeutic and theranostic ultrasound assisted drug delivery. The magnetic shelled bubbles can possess sufficient magnetization such that they can be controlled with external magnets, and their shell elasticity still allows for volume oscillations in moderate acoustic fields. Since maintaining the magnetic and acoustic characteristics, the magnetic MBs can be visualized using ultrasound imaging, magnetic resonance imaging, and also can be localized by using an externally applied magnetic and ultrasonic field. Further, the MMBs can be exploited to the combined effects of magnetofection and sonoporation for therapeutic delivery. Therefore, ultrasound assisted magnetic microbubble delivery system can be established as a versatile molecularly targeted multimodal theranostic means at the preclinical level and in the future also in patients.