Better contrast agents based on nanoparticles

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Scientists at the University of Basel have developed nanoparticles which can serve as efficient contrast agents for magnetic resonance imaging. This new type of nanoparticles produce around ten times more contrast than the actual contrast agents and are responsive to specific environments. The journal *Chemical Communications* has published these results.

Contrast agents enhance the imaging of tissues obtained by magnetic resonance imaging (MRI). Whilst the detection of structural details in the body can be significantly improved by using contrast agents, current substances produce insufficient contrast for the detection of the early stages of diseases. Another limitation is that current contrast agents do not sense their biochemical environments. Researchers from the Department of Chemistry at the University of Basel have developed nanoparticles, which can serve as "smart" contrast agents for MRI.

Contrast agents are usually based on the metal Gadolinium, which is injected and serves for an improved imaging of various organs in an MRI. Gadolinium ions should be bound with a carrier compound to avoid the toxicity to the human body of the free ions. Therefore, highly efficient contrast agents requiring lower Gadolinium concentrations represent an important step for advancing diagnosis and improving patient health prognosis.

Smart nanoparticles as contrast agents

The research groups of Prof. Cornelia Palivan and Prof. Wolfgang

Meier from the Department of Chemistry at the University of Basel have introduced a new type of nanoparticles, which combine multiple properties required for contrast agents: an increased MRI contrast for lower concentration, a potential for long blood circulation and responsiveness to different biochemical environments. These nanoparticles were obtained by co-assembly of heparin-functionalized polymers with trapped gadolinium ions and stimuli-responsive peptides.

The study shows, that the nanoparticles have the capacity of enhancing the MRI signal tenfold higher than the current agents. In addition, they have an enhanced efficacy in reductive milieu, characteristic for specific regions, such as cancerous tissues. These nanoparticles fulfill numerous key criteria for further development, such as absence of cellular toxicity, no apparent anticoagulation property, and high shelf stability. The concept developed by the researchers at the University of Basel to produce better contrast agents based on nanoparticles highlights a new direction in the design of MRI contrast agents, and supports their implementation for future applications.

More information: Severin J. Sigg et al, Nanoparticle-based highly sensitive MRI contrast agents with enhanced relaxivity in reductive milieu, *Chem. Commun.* (2016). DOI: 10.1039/C6CC03396B

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