Functional Nanoclusters for Multimodal Imaging of Atherosclerosis

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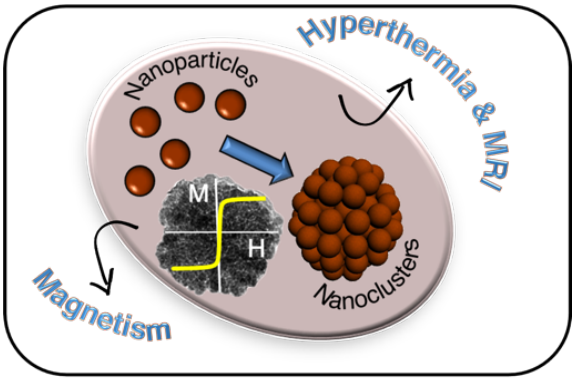
ABSTRACT

Colloidal nanocrystals with size-, shape-, assembly- enhanced functionality are among the most prominent targets in the field of magnetic resonance imaging (MRI), medical diagnostics and therapy. The various chemical processes that guide the synthesis of materials in the nanometer scale can be defined as nanochemistry, which plays a crucial role in tailoring the physical and chemical properties of nanoparticles. An interesting development in this approach is the synthesis of multi-subunit colloidal nanocrystals with attentively regulated topological arrangements or self-assembled cluster-like structures and magnetic properties (*e.g.* γ-Fe_2O_3)[1]. In addition, coupling nanoparticles to bioaffinity ligands such as small organic compounds (*e.g.* EDC/NHS crosslinkers[2]), antibodies and proteins enables their use in high sensitivity biomolecule assays or in vivo molecular imaging. Gold nanoparticle (AuNP) bioconjugation has emerged as a pivotal technique for the advanced detection of pathogens.

The present study aims at cardiovascular diseases (CVD), which remain the leading cause of morbidity and mortality worldwide. The high mortality is mainly caused by coronary atherosclerosis and associated stroke. This emphasizes the need to improve early detection. Since this lipid-driven disease, results in atherosclerotic plaques on the artery walls, a major challenge for medical imaging is the development of appropriate contrast agents (CAs), which can resolve vulnerable plaques. As molecular imaging can detect better via coupled magneto-plasmonic properties, nanoclusters with efficient bioconjugation are developed to target molecular markers resting at early atherosclerotic lesions and thus assist in therapeutic pathways.



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