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## Nanozyme mediated sensors for biomolecules detection

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Nanozyme is a well-established term which used to demonstrate nanomaterials with enzyme-like activity. Up to date several metal, metal oxide, metal sulphide, metal halide and carbon-based derivates were reported for their intrinsic peroxidase, oxidase, catalase and superoxide dismutase equivalent activities. The discovery of this nanozyme activity enables to craft an alternative colorimetric approach for biomolecules detection. The color change which originated as a result of nanozyme activity is independent from aggregation of nanomaterials and changed as a function of existing biomolecule concentration. However, most of these nanozyme utilized colorimetric sensors are centered on non-specific glucose and hydrogen peroxide ($H_2O_2$) due to lack of efficient Molecular Recognition Element (MRE). Thus our research group focused on elaborating the practical applicability of this nanozyme mediated colorimetric approach for specific biomolecules detection by using single standard DNA (known as aptamers) and proteins. The combination nanozymes with the abovementioned MRE able to deliver an ultra-fast, highly specific and sensitive colorimetric approach which enable detection of small molecules existing as food contaminants (kanamycin) and environmental pesticide (acetamiprid) as well as whole cells which include bacteria (Staphylococcus aureus), virus (norovirus) and mammalian cells (brain cancer cells). The promising results obtained during these research efforts further highlighted the successful transformation of this concept as a viable technique for development of point of care devices.

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## Gold nanoparticles for non-invasive in vivo cell tracking with CT imaging

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Cell-based therapy is the transplantation of living cells for the treatment of diseases and injuries. Such therapy offers a promising solution for the treatment of various pathologies that conventional medicine cannot cure effectively, thus encouraging future medical breakthroughs. For instance, cancer-fighting T-cells may be injected in the course of cancer immunotherapy and stem cells may treat neurodegenerative diseases, heart disease, muscular dystrophy and diabetes. A major obstacle in the advancement and implementation of cell therapy is the challenge of non-invasively tracking transplanted cells in the body. In vivo cell tracking could elucidate essential knowledge regarding mechanisms underlying the success or failure of therapy. An optimal solution for the challenge of cell tracking does not yet exist hence the need for an accurate imaging technique. We developed a novel methodology for longitudinal and quantitative in vivo cell tracking, based on the combination of CT as an imaging modality and gold nanoparticles as labeling agents. We were able to show that uniting the superior visualization abilities of classical CT with state-of-the-art nanotechnology is the key for high-resolution cell tracking. In the future, this technology has the potential to be applied clinically and to serve as an early warning system for patients after cell transplantation.

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