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Biomimetic Nanozyme Sensors: From Molecules to Bacteria to Cancer Cell Detection

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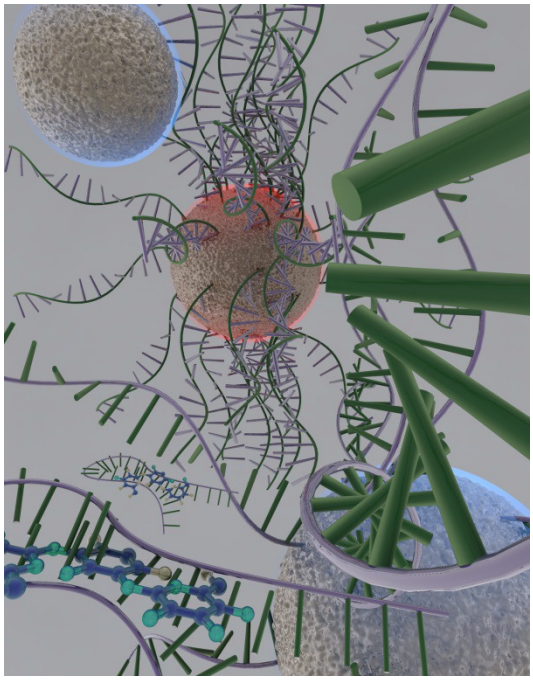

Nanomaterials are well-known for their impressive catalytic activity. However, more recently, a number of nanomaterials are being discovered to behave similar to the traditional biomolecular enzymes such as peroxidase, oxidase, catalase and superoxide dismutase. This biomimetic activity of nanomaterials is establishing 'nanozymes' as artificial inorganic enzymes and the research field have just begun to explore this unique property for a range of applications.

Our group has established that by combining nanozyme activity of different nanomaterials (e.g. metals, metal oxides, 2-D dichalcogenides) with certain molecular recognition elements (MREs) such as aptamers and antibodies, the nanozyme activity can be actively modulated.

This control over nanozyme activity of inorganic materials has allowed us to develop new ultrafast, highly sensitive and selective colorimetric nanobiosensors for the detection of a range of analyte molecules. We have shown that this generic biosensing approach can be applied for the detection of a range of analyte molecules relevant to environmental monitoring[1] as well as biomedical and food industries.[2] Our more recent investigations show that the same approach can be adapted for highly specific detection of pathogenic bacteria (with sup-species level specificity), as well as highly sensitive detection of cancer cells. We will discuss some of the recent developments made by our group in this area.[3]

Acknowledgements
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References
[1]T. K. Sharma et al. Aptamer-mediated 'turn-off/turn-on' nanozyme activity of gold nanoparticles for kanamycin detection. *Chemical Communications* 2014, *50*, 15856-15859.
[2]P. Weerathunge et al. Aptamer-controlled reversible inhibition of gold nanozyme activity for pesticide sensing. *Analytical Chemistry* 2014, *86*, 11937-11941.
[3]T. K. Sharma et al. Moving forward in food safety and security through NanoBioSensors: adopt or adapt biosensor technologies? Proteomics 2015, 15, 1680-1692.