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Nano-theranostics: harnessing nanoscale functionality for next-generation theranostic technologies

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Abstract

Nanoscale geometric confinement changes the properties of materials. The most immediate effect is an enhancement in the surface area to volume ratio, which results in faster surface chemistry reaction rates, a property exploited in various nanomedicine approaches. Arguably more interesting, however, are changes in physical properties, including optical, electrical and magnetic properties. In this talk, I will focus on how the superparamagnetic properties of iron oxide nanoparticles can be harnessed to enhance imaging with PET-MRI and to enable novel image-guided, tumour-targeting nano-theranostic strategies. Super-Paramagnetic Iron Oxide Nanoparticles (SPIONs), which enhance MRI image contrast, were labelled with a PET isotope (Zr-89) to demonstrate their use in PET-MRI [1]. Moreover, it was found that the SPIONs localise the emitted positrons sufficiently to improve PET image resolution in PET-MRI [2]. Such SPIONs were also labelled with a range of clinical therapeutic (Y-90) and theranostic (Lu-177, Cu-64/67) radioisotopes, thus demonstrating their potential for cancer nano-theranostics leveraging clinical imaging technologies.

References

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[2] Y. Gholami et al. Positron annihilation localization by nanoscale magnetization. Sci. Rep. 10, 20262 (2020) doi.org/10.1038/s41598-020-76980-9

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