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seminar

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Host: Dr. Jesús Ruiz-Cabello

Nanoparticle-based imaging agents for molecular imaging and particle tracking applications

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Non-invasive imaging techniques support disease diagnosis and pathological characterisation with ease in a comparatively safe manner. These techniques include modalities such as positron emission tomography (PET) and magnetic resonance imaging (MRI). MRI is routinely utilised because of its associated intrinsic high spatial resolution, deep tissue penetration, and three-dimensional anatomical information. PET has no tissue depth penetration limits, as the high-energy gamma-ray photons emitted by radionuclides can easily pass-through tissue and can be performed on a whole-body scale. Additionally, PET is greatly more sensitive although with poorer resolution than MRI. Combination of both, PET/MRI, can therefore provide non-invasive imaging with great sensitivity and resolution by using adequate contrast agents that potentiate the skills of the imaging technique. In this regard, nanomaterials offer unique physical, chemical, and biological properties of interest for medical imaging. In this context, radiolabelling magnetic nanomaterials allows whole-body and non-invasive in vivo tracking by PET whilst provide optimal contrast in MRI. Moreover, their high surface-to-volume ratio, supporting a high ligand (protein, antibody, and peptide) payload allow the vectorisation of the particles towards specific regions of interest based on molecular recognition providing an optimal scenario for their application in molecular imaging. Another potential application of radiolabelled materials is the tracking of single particles. Unlike PET, Positron emission particle tracking (PEPT) consists of the fast and accurate localisation of a single radiolabelled particle while moving within a piece of equipment. PEPT has been only exploited in industrial fields mainly due to the lack of suitable radiolabelled particles falling in the appropriate properties. Implementing PEPT for biomedical applications will bring a powerful and new diagnostic tool for the early diagnosis of multiple diseases and certainly constitute an important breakthrough in the molecular imaging field.

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