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Radio-labeled nano-platforms for imaging, image-guided drug deliveryand theranostics

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The molecular imaging and nanotechnology laboratory at the University of Wisconsin - Madison is mainly focused on three areas: 1) development of multimodality molecular imaging agents; 2) nanotechnology and its biomedical applications; and 3) molecular therapy of cancer. In this talk, I will present our recent work on molecular imaging and image-guided drug delivery in cancer with a variety of nanomaterials. The primary imaging techniques used in this study are positron emission tomography (PET), photo-acoustic tomography (PAT), optical imaging and magnetic resonance imaging (MRI). Three of the major molecular targets that we are investigating are CD105 (i.e. endoglin), VEGFR and integrin αvβ3. The nanomaterials that will be discussed in this presentation include nano-graphene oxide, zinc oxide nanomaterials, micelles, silica-based nanoparticles, magnetic nanoparticles, hybrid nanomaterials, among many others. A few representative side projects will also be presented, such as the facile synthesis of PET/MRI and PET/PAT dual-modality imaging agents.

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OncoCiDia: A Novel Depersonalized Combination of Targeted Chemo- and Radio-Theragnostics for the Management of Solid Malignancies

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Imaging and contrast media research has enabled discovery of small molecular necrosis-avid compounds (NACs) for the diagnosis of myocardial infarction and therapeutic assessment of tumor ablation with MRI, nuclear scintigraphy and optical imaging1,2. The *in vivo* affinity of NACs to necrosis appears orders of magnitude higher than antigen-antibody, ligand-receptor and biotin-avidin interactions in vivo. Based on a soil-to-seeds hypothesis3, this stroma targetability is extended from diagnostic to theragnostic utilities by combined use of vascular disrupting agents (VDAs) such as CA4P to formulate a novel pan-anticancer approach, namely a small-molecular sequential dual targeting theragnostic strategy3. The dual targeting properties and conjugated iodine-131 that emits both beta and gamma radiations provide solid cancers (Onco) with both tumoricidal (Ci) and imaging diagnostic (Dia) effects, hence an acronym OncoCiDia3. Instead of directly attacking multimutant and refractory cancer cells (seeds) as in other cancer therapies, OncoCiDia selectively destroys and radioactively sterilizes the tumor microenvironment (soil)4. Multicenter preclinical investigations on the efficacy, safety, formulations and dosimetry suggest that this novel and unconventional anticancer strategy may present a relatively simple, workable, affordable and generic solution for diverse cancer problems, and deserve further exploitation.

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