

## **Applications: Translational Challenges and Opportunities for Molecular MR Imaging**

**Session:** Molecular & Cellular Imaging: From the Bench to the Bed

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### **Highlights**

- Compare and contrast the translational timeline, hurdles, and potential of molecular MR with other imaging modalities
- Review bench to bedside nuclear medicine based molecular imaging studies and discuss recent applications of nuclear medicine based molecular imaging
- Discuss novel applications of molecular MR and identify opportunities where MR may have an advantage over other modalities
- Discuss the potential opportunities for multi-modal molecular imaging utilizing simultaneous MR and PET data acquisition

**Target audience:** Basic science and clinical investigators interested in applications of molecular imaging

**Overview:** An important step in the development of a new molecular imaging agent involves the selection of the appropriate imaging modality for the biology of interest. It is well acknowledged that current MR methods offer high spatial resolution, the use of non-ionizing radiation but suffers from lower sensitivity than that found in nuclear medicine techniques<sup>1, 2</sup>. In contrast, nuclear medicine based molecular imaging has high sensitivity and quantitative capabilities but poor spatial resolution. The markedly different sensitivities of these methods generate greater regulatory and financial hurdles for moving a molecular MR agent into human studies. We will discuss the implications of these hurdles as it pertains to the identification of appropriate applications of molecular MR methods. In order to better appreciate the translational timeline for molecular imaging agents, we will review recent “success stories” in the nuclear medicine field where novel agents have been systematically evaluated in cells, animals and are currently in clinical trials. Given the quality and quantity of biological information available from MRI (e.g. metabolite determination, perfusion, angiography, cellular sensitivity), its combination with PET systems for quantitative molecular imaging will also be considered.

**Objectives:** At the completion of this seminar the attendee should 1) have an improved understanding of how molecular MR imaging compares to other modalities in terms of sensitivity, dosing and translatability, 2) be able to better identify which applications are best suited for molecular MR imaging, 3) have a better awareness of novel molecular imaging applications, both clinical and pre-clinical, across multiple modalities and 4) have insights into the potential opportunities for molecular imaging using simultaneous MRI and PET systems.

### **References:**

1. Gore JC, Yankeelov TE, Peterson TE, Avison MJ. Molecular imaging without radiopharmaceuticals? *J Nucl Med.* Jun 2009;50(6):999-1007.
2. James ML, Gambhir SS. A molecular imaging primer: modalities, imaging agents, and applications. *Physiol Rev.* Apr 2012;92(2):897-965.