Specialty Area: Preclinical Imaging
Speaker: Kevin M. Bennett, PhD

Title: Anatomy and Microstructure: Introduction

Summary:

This overview will provide a broad summary of basic scientific and clinical problems to motivate the development of new MRI techniques to image tissue anatomy and microstructure. The presentation will identify several key areas of investigation, guided by the following topics:

- Preclinical anatomical and microstructural studies for biomarker discovery
- Novel structural properties of tissue that are elucidated by MRI techniques.
- Large-scale preclinical phenotyping with MRI.
- Combining morphology with quantitative MRI
- Preclinical drug testing and drug discovery
- Anatomy and microstructure in contrast agent development with preclinical imaging

This presentation will provide background for the following discussions of quantitative susceptibility mapping, diffusion-weighted imaging, and will provide a motivation for development of fully quantitative, 3D imaging analysis of tissue.

Finally, this overview presentation will provide specific examples of the impact of preclinical anatomical and microstructural imaging on human health. Specific diseases, including neurological disease, cancer, liver disease, metabolic and renal disease, and cardiovascular disease will be discussed. Technological breakthroughs will be highlighted that are enabling high-resolution MRI for preclinical studies of these diseases.

References:

1. Badea A, Johnson GA. Magnetic resonance microscopy. *Stud Health Technol Inform.* 2013; 185:153-84.
2. Norris FC et al. A coming of age: advanced imaging technologies for characterizing the developing mouse. *Trends Genet.* 2013; 29(12): 700-11.
3. Xie L. et al. Four dimensional MRI of renal function in the developing mouse. *NMR Biomed.* 2014; 27(9): 1094-102.
4. Kim S et al. Association between sociability and diffusion tensor imaging in BALB/cJ mice. *NMR Biomed.* 2012; 25(1): 104-12.
5. Gimi B. Magnetic resonance microscopy: concepts, challenges, and state-of-the-art. *Methods Mol. Med.* 2006; 124: 59-84.
6. Hoyer C et al. Advantages and challenges of small animal magnetic resonance imaging as a translational tool. 2014; 69(4): 187-201.
7. Nathoo N et al. Using magnetic resonance imaging in animal models to guide drug development in multiple sclerosis. *Mult. Scler.* 2014; 20(1): 3-11.

8. Evans MC et al. Magnetic resonance imaging of pathological processes in rodent models of amytotrophic lateral sclerosis. *Amytotroph Lateral Scler*. 2012; 13(3):288-301.
9. Cyran CC et al. Visualization, imaging, and new preclinical diagnostics in radiation oncology. *Radiat Oncol.* 2014; 3:9:3.
10. Albanese C et al. Preclinical magnetic resonance imaging and systems biology in cancer research: current applications and challenges. *Am J Pathol.* 2013; 182(2):312-8.