Novel In Vivo Imaging and Analysis of Microscale Events: Stem Cell Migration and Viral Envelope Biodistribution

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Abstract: Molecular imaging techniques enable the macroscopic observation of cellular and molecular events through imaging modalities such as magnetic resonance imaging (MRI) and positron emission tomography (PET). Two molecular imaging studies will be presented in this talk. The first study was to develop a reproducible, in vivo imaging assay to evaluate stem cell migration in a quantitative manner using MRI. Such an assay would be applicable to the evaluation of different cell types, cell pre-conditioning and/or co-administered therapeutics for cell therapy. A method to efficiently label neural stem cells with a MRI contrast agent enabled cells to be distinguished from surrounding tissue on MRI after transplantation. Quantitative image analysis tools were used to evaluate therapeutic outcomes. This study demonstrated the migratory capacity of transplanted neural stem cells in the normal, adult rat brain and showed that the migrating cells could be distinguished from the clearance of cell debris and loose contrast agent. The second study used PET imaging to quantify the initial biodistribution dynamically of the hemagglutinating virus of Japan, a viral vehicle commonly used for gene delivery to the central nervous system. The efficiency of delivery to various organs was quantified on high resolution PET images using pixel-based image analysis with and without magnetic targeting to the head. The viral vehicle was primarily distributed in the liver and spleen, and external, permanent magnets were able to alter the biodistribution in the head region. The molecular imaging techniques developed and characterized in this dissertation have applications in understanding fundamental biological mechanisms and translating novel therapies to clinical use.

Biography: Jennifer Flexman recently defended her PhD in the Department of Bioengineering at University of Washington in the area of molecular imaging, co-advised by Dr. Satoshi Minoshima (Radiology) and Dr. Yongmin Kim (Bioengineering). In her graduate research, Jennifer developed imaging techniques for the rodent using PET and MRI to observe molecular and cellular events through the use of contrast agents and statistical analysis. Jennifer obtained her Bachelor's of Engineering in electrical engineering from McGill University in Montreal and worked for two years as a Microwave Test Engineer at Teradyne, Inc., in Boston. During her graduate research, she was supported by a Post Graduate Scholarship from the Natural Sciences and Engineering Research Council (NSERC) of Canada. Jennifer is completing a fellowship at the National Academies of Science in Washington, DC, on policy issues related to university-industry partnerships, after which she will join the British Columbia Cancer Research Center and the University of British Columbia in Vancouver, BC, as a Senior Fellow investigating angiogenesis in pancreatic cancer using molecular and imaging techniques.