

RSNA R&E Foundation Education Scholar Grant SAMPLE APPLICATION

NOTE: Personal information for the applicant and other investigators has been removed from this sample application.

Title:

Toward Clinical Translation of Interventional Molecular Imaging: An Educational Program for New Generations of Interventional Radiologists

Abstract:

Molecular imaging is an emerging technology for in vivo detection of biological events at molecular/cellular levels. It has demonstrated great promise in early diagnosis of diseases and precise guidance of advanced treatments, such as gene and cell therapies. Recent common interest in molecular imaging among diagnostic and interventional radiologists has led to a new concept, called "Interventional Molecular Imaging." This concept, by combining interventional radiology (IR) with molecular imaging, aims to fully apply the advantages of both imaging fields. Specifically, interventional radiology can extend the capabilities of currently-available molecular imaging techniques in (i) reaching deep-seated targets; (ii) getting a close look at small targets; (iii) precisely guiding delivery of non-targeted imaging tracers/therapeutics; and (iv) super-selectively enhancing the effectiveness of targeted imaging and treatment.

To prompt successful translation of interventional molecular imaging from benches/animal labs to clinical practice, one of crucial steps is to get the new generations of interventional radiologists prepared for application of this new technology. To this end, we have designed an educational program that will provide IR trainees hands-on experience in interventional molecular imaging. Through practicing a relatively complex IR procedure, transjugular intrahepatic portosystemic shunt (TIPS), with subsequent molecular MRI-guided intraTIPS agent delivery on near-human-sized pigs, the trainees will not only gain understanding of the concept of interventional molecular imaging but also become familiar with the necessary techniques. We propose a 3-phase program, including (i) a 2-hour theory course on TIPS and interventional molecular imaging; (ii) a pre-clinical hands-on training on the TIPS procedure and subsequent MRI-guided intraTIPS agent delivery; and (iii) a hands-on experience in confirming successful agent delivery using various laboratory methods.

Our long-term goal is to attract the interest and attention of new IR generations to molecular imaging-integrated interventional technologies, and thereby facilitate the translation of interventional molecular imaging to clinical practice on humans.

Percent of Time Dedicated to this Project:

10% PI, 10% co-investigator

Priority Statement:

Molecular imaging, a frontier in modern medicine, is becoming a new member of medical imaging family. In the past years, RSNA has asserted tremendous effort in promoting the translation of molecular imaging to clinical practice. The progress of such translation has been slow, with the majority of the molecular imaging modalities remaining at the technical developmental phases. A primary reason for this is that many sophisticated molecular imaging techniques are developed by PhDs through multidisciplinary collaborations, including biomedical engineering, molecular biology, chemistry, and computer science. However, these PhDs do not have direct access to clinical patient care. On the other hand, most of practicing physicians are focused on busy routine clinical services. They do not really have opportunities to personally experience the advances in the basic scientific field of molecular imaging. In recent years, National Institute of Health (NIH) has emphasized "translational medicine," which primarily aims to fill the gap, to establish the links between basic science and clinical practice. As an MD and PhD, I have been involved in both basic research and clinical practice in diagnostic imaging and interventional radiology (IR) for more than 20 years. I am confident that my MD/PhD background enables me to function as a "bridge" to bring the sophisticated molecular imaging techniques from benches/animal labs to clinical application on humans. In a recent issue of Radiology, I have initiated a new concept, named "Interventional Molecular Imaging."¹ This concept, by combining interventional radiology with molecular imaging, is aiming to fully apply the advantages of both imaging fields. In fact, interventional radiology can overcome many disadvantages of the current molecular imaging techniques. Interventional molecular imaging is becoming one of the frameworks to bring molecular imaging from benches/small animal labs to large animal suites, and to certain clinical applications in humans. It is time to

educate the new generations of interventional radiologists the new concept of interventional molecular imaging. To this end, we have proposed the present educational program via RSNA. In this program, by providing the IR trainees an opportunity to have initial hands-on practice of one of the most complicated IR procedures, transjugular intrahepatic portosystemic shunt (TIPS), we will introduce the trainees the concept of using molecular MRI to monitor intraTIPS delivery of diagnostic agents and, ultimately, therapeutic agents to inhibit one of the most common complications associated with this procedure, post-TIPS stenosis and occlusion. We strongly believe that the hands-on training on the complex TIPS procedure with molecular MRI-guided intraTIPS agent delivery should function as a vehicle to attract the interest and attention of new IR generations to molecular imaging-integrated interventional technologies, and thereby facilitate the translation of interventional molecular imaging to clinical practice on humans.

Budget:

*(Budget details have been **removed** from this sample)*

A. Personnel

- Xiaoming Yang, MD, PhD, Principal Investigator (10% in years 1 and 2)
- Feng Zhang, MD, PhD, Program Assistant (10% in years 1 and 2)

B. Supplies:

- Imaging Contrast Agents will be used for both DSA and MRI
- Glassware & Disposables (saline, culture, pipettes, etc) will be used to carry out in vivo experiments.
- Catheters & guidewires is needed to perform endovascular interventional procedures

C. Other Expenses:

- MR Scans: The subjects will be scanned on the Philips Achieva 3T Scanner
- X-ray imaging: The animals will undergo X-ray imaging-guided TIPS at UW South Lake Union Campus
- Domestic pigs will be purchased to prove the principle of the new concept
- Shipping and Processing fees
- Comparative Medicine Services: \$1,200/pig
- Animal Housing:

Other Investigators:

Feng Zhang, MD, PhD

Research Scientist (1.2 Calendar Months in years 1-2), is a radiologist with comprehensive experiences on both medical imaging and interventional radiology. Dr. Zhang has worked on animal studies for several years. He is a primary scientist in our several projects on intraluminal MRI-guided delivery of tracers and therapeutics, such as genes and drugs. As an assistant of the educational program, Dr. Zhang will be responsible for coordinating the surgical and MR schedules, functioning DSA-surgical labs, operating MRI-guided intraTIPS agent delivery, carrying out pre- and post-procedure care of animals, processing data analysis of MRI-histologic correlation, and preparing a potential manuscript resulted from the educational program for Radiology.

Detailed Education Plan: (See Next Page)