

**RSNA R&E Foundation Education Scholar Grant  
Education Scholar Grant Application**

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

**Title: Curriculum Development for Hybrid Molecular Imaging and Evidence Based Clinical Practice**

**Abstract:**

Molecular imaging with FDG PET/CT is the fastest growing imaging modality in the last decade in the United States. There is increased integration of functional aspect of PET with structural imaging of contrast enhanced CT and MRI in clinical practice. This is further fueled by recent approval of new radiopharmaceuticals by FDA, such as for amyloid PET imaging in dementia, Dopamine SPECT imaging for Parkinson's disease and prostate PET imaging with 11C choline. Recent installments of clinical PET/MRI units at many institutions in the United States further evidence for this evolving clinical practice. Despite this growing trend in clinical practice over the last decade, there is a serious gap in our educational programs for radiology residents and training for practicing radiologists in PET/SPECT/CT/MRI, radiopharmaceuticals, instrumentation and its use for evidence based clinical practice in oncology, neurology and cardiology. The objective of this educational curriculum is to fill this knowledge void and bridge the gap between our educational programs and evolving clinical practice. Health care administrators, regulatory agencies and professional societies are looking for evidence how imaging adds value to patient management and outcome. The broad scholarship on molecular imaging with PET/SPECT/CT/MRI, radiopharmaceuticals, instrumentation and evidence based clinical practice and policy will be distilled through a series of video recorded lectures, supportive reading materials for evidence based practice and assessment modules. These will be placed on a website available for residency programs and practicing radiologists in the United States and the world. The emphasis will be on evidence based clinical practice and value for patient management and outcome. It is anticipated that the curriculum will inspire young minds of trainees and educate the experienced mind of practicing radiologists in this evolving new paradigm of integration of functional and structural imaging in the context of evidence based clinical practice.

**Percent of Time Dedicated to this Project:**

Time for this project: 20%

Other projects: 10% Clinical: 70%

**Priority Statement:**

I am a full time staff radiologist / nuclear medicine physician and a visiting associate professor in the Russell H Morgan Department of Radiology at the Johns Hopkins University. My academic appointment at the school of medicine and school of public health are pending as I moved to Hopkins this year. I am fellowship trained in MRI, Nuclear Radiology, Neuroradiology and board certified in diagnostic radiology and neuroradiology subspecialty by the American Board of Radiology and the Royal Australian and New Zealand College of Radiologists. I was an ACRIN Fellow in clinical trials of imaging from 2004 to 2006 and a GERRAF fellow from 2009 to 2011 at the Boston University. I completed a PhD in radiology at the University of Auckland, New Zealand in 2008 and an MPH at Harvard School of Public Health in 2011, focusing on clinical effectiveness and health policy. My academic focus and passion is hybrid molecular imaging with PET/SPECT/CT/MRI in oncology and neurology. I am a passionate educator and mentor in hybrid molecular imaging. I did a Masters in Clinical Education, inspired by my teaching to medical students when I was a resident and continued to teach students, residents, fellows in New Zealand, Australia, and at the Mayo Clinic, Boston University and now at Hopkins. I have given more than 70 CME lectures on molecular hybrid imaging in the United States, New Zealand, Kuwait, Singapore and Columbia. I recently published a book titled 'PET/CT and PET/MRI in oncology – A practical guide'. In the master's program at Harvard, I was among a few radiologists in a class that had more than 200 students from the United States and around the world. I was amazed during the group discussions how effective, important and otherwise deficient the perspective of a radiologist can be. Equally, I was filled with trepidation at the thought of how unaware our profession might be of the lexicon that it used to advance the case for its vitality. As the spotlight on imaging shines with greater ferocity, I feel that there is still a case to be made that appropriate imaging is under-valued, even if imaging in the aggregate may be over-priced. There is an urgency to develop evidence based imaging practices that demonstrate added value to patient management and outcome. My motivation for creating a curriculum and a learning base for hybrid molecular imaging and evidence based clinical practice is only partly explained by the zest that has arisen from what I have learnt. More importantly, I feel a sense of urgency that this subject matter be conveyed with clarity and

excitement to an audience in whom lies the reigns of the future of imaging, namely our trainees. I hope to grow as an educational leader. My growth will be inspired, nurtured and challenged during the programs and the people with whom I will interact at the Harvard Macy Institute which is proposed as part of this RSNA educational scholar grant. This will augment my growth as a leader in radiology as I have taken responsibilities such as chair of the RSNA nuclear medicine education exhibits committee, secretary of Maryland Radiological Society, Treasurer of the American College of Nuclear Medicine, President of the Radiology Research Alliance and the Vice Chair of the ACR commission on Nuclear Medicine and molecular imaging. In summary, I feel that a curriculum in hybrid molecular imaging and evidence based clinical practice in imaging represent areas of need in the education of radiology residents. Whilst there are undoubtedly many great texts in this subject, a distillation boasting intellectual breadth, simplicity, clarity is distinctly conspicuous at present time. I feel that I am well placed to undertake this venture as well as grow as an educational leader in radiology.

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

Project Timeframe: 7/1/2013 through 6/30/2015 (2 year)

Total Project Budget: \$150,000

Year 1:

A. Personnel		
Salary		\$56,113
B. Supplies		
Project: (video recording, website, supplies:		\$ 8,137
C. Other		
Harvard Macy courses:		\$ 7,500
Travel and accommodation for Harvard Macy courses:		\$ 3,250

Total Year 1: \$75,000

Year 2:

A. Personnel		
Salary:		\$57,235
B. Supplies		
Project: video recording, website, supplies:		\$ 7,015
C. Other		
Harvard Macy courses:		\$ 7,500
Travel and accommodation for Harvard Macy courses:		\$ 3,250

Total Year 2: \$75,000

**Other Investigators:**

N/A

**Detailed Education Plan:** (See Next Page)

## **Introduction**

### **Rationale and Purpose**

The United States health care reform has brought in challenges to radiology clinical practice. The main focus will be on quality of our services and our value contribution to patient management and outcome. There will be intense focus on cost containment and evidence based medical imaging for clinical practice.

The functional and structural imaging has grown in silos and thus our educational programs and clinical practice. The economic reality, intense scrutiny from government agencies and payers, and efficiency of information flow to clinicians is shaping our practice patterns. More and more functional and structural imaging is performed in an integrated manner forced by the evolution in imaging technology. These paradigm shifts demand our next generation imaging specialists have an understanding and knowledge of hybrid molecular imaging and its evidence based clinical practice based on patient management and outcome.

The academic leadership has long recognized the importance of outcomes research and hybrid molecular imaging in radiology. The Association of University Radiologists (AUR) has partnered with General Electric to promote outcomes-based research through an academic fellowship. The RSNA and other professional societies hold special sessions in molecular imaging. Nonetheless, there is no resident curriculum, lecture series or online resource that is at once readily accessible and directed towards clinical practice, comprehensive, multidisciplinary and integrated.

The primary goal of this proposal is to create an educational backbone for radiology residents and practicing radiologists to understand the basic principles of hybrid molecular imaging, evidence based clinical practice and policy, through a series of lectures supported by an online vehicle. The secondary goal is my growth as an educational leader and mentor for serving residents, fellows and junior faculty in radiology.

### **Objectives**

1. Creation of a lecture series bringing together the fundamentals of radiopharmaceuticals, instrumentation, clinical application and evidence based imaging practice of molecular imaging, focused on integration of functional and structural imaging.
2. Establishment of an online resource for clinical molecular hybrid imaging with PET/SPECT/CT/MRI, pertinent research, clinical problems and discussions.
3. Creation of high level of literacy among radiology residents and practicing radiologists about the added value of clinical hybrid molecular imaging with PET/SPECT/CT/MRI for patient management and outcome.
4. Develop educational leadership and mentor residents, fellows and junior faculty.

### **Student population**

The target audience comprises principally residents in radiology, nuclear medicine but the curriculum will also be useful to medical students who are interested in clinical molecular imaging or who may be pursuing further study in clinical research, epidemiology or evidence based practice. Practicing radiologists will find the material useful in their clinical practice.

### **Previous Experience**

I have given lectures on PET/CT/MRI to medical students, radiology residents, nuclear medicine residents, practicing radiologists and clinicians at the Mayo Clinic, the Boston University and at the Johns Hopkins University over the last 6 years. In addition, I have taught numerous CME and refresher courses in RSNA, AUR, ARRS, ACR, SNM and ASTRO in the United States and internationally in Kuwait, Singapore, Columbia and New Zealand in their national meeting of professional imaging societies. I have given live lectures on molecular imaging as part of the Hopkins e radiology learning lecture program, which is broadcasted for radiology residents worldwide.

I am also the administrative editor for Oakstone reviews for nuclear medicine. I review 20 abstracts selected, monthly, by an editorial team for impact on the field and clinical practice. I enjoy this task, immensely and fortunate and humbled to receive the invitation from the Johns Hopkins CME office and Oakstone, following the death of Henry Wagner Jr who held this position. I am also an assistant editor for molecular imaging and nuclear medicine for American Journal of Roentgenology (AJR). These two responsibilities give me a breadth of ongoing perspectives in the field.

During my MPH at Harvard and GERRAF award, I focused on clinical effectiveness and health policy with advanced courses in statistics, meta analysis and evidence based guidance. Currently I am involved with Johns Hopkins University Evidence based Practice Center (EPC), as the clinical lead advisor for a topic refinement project for AHRQ, on prevention of contrast induced nephropathy, for evidence based guideline development. Working with a Government agency on evidence based development with wide stakeholder perspectives including professional societies, payers and patients is an invaluable experience in clinical practice leadership.

I am an avid educationist with a Masters in Clinical Education. My course work and thesis were focused on medical student and radiology resident education, especially on objectives, student and clinician perspectives and resident feedback and learning environment. I continue my educational efforts teaching medical students, residents and as a member of the admissions committee of the Johns Hopkins School of Medicine and the LCME self study assessment of Johns Hopkins School of Medicine preparing for LCME accreditation.

### **Project Plans**

RSNA education scholar grant will support (a) development, dissemination, ongoing improvement of the curriculum and (b) provides me a formal program to develop digital technology expertise and educational leadership by attending courses and interacting with many national and international educational leaders at the Harvard Macy Institute.

#### **(a) Development and Dissemination of Curriculum**

The three pillars underpinning the curriculum of molecular hybrid imaging and its delivery include lectures, online resource with problems and discussions, and assessment modules. The emphasis will be on fundamental knowledge, comprehensive coverage and constant relevance to clinical practice.

**1. Lectures:** The subject matter will be taught through a series of video taped lectures. Each lecture will be preceded by a manageable reading list and followed by a test available online. The lectures (appendix 1) will cover the basics of molecular imaging, radiopharmaceuticals, hybrid instrumentation, clinical applications and evidence based clinical practice. This can be taken leisurely over the course of the residency.

**2. Online resource:** An online website will be developed (or in discussion with RSNA or AUR, their website may be used). Initially, the website will serve as a repository of lectures and reading material. Later, and crucially, it will function as an online source and first port of call for evidence based clinical practice for hybrid molecular imaging and policy as relevant to molecular imaging with PET/CT/MRI.

**3. Assessment modules:** To aid learning, both qualitative and quantitative problems, will be presented, with multiple options, and an explanation for both the correct and incorrect answer. I hope to model the successful ACR case-in-point (CIP) format.

#### **Reaching out to residents:**

1. E mailing the program directors individually to alert them of this learning opportunity for their residents and through APDR.
2. Presentation to the ACR resident and fellow section at the annual meeting.
3. Presentation to the American Alliance of the Academic Chief Residents in Radiology and the Association of Program Directors in Radiology, at the annual AUR meeting.
4. Advertise through the residents meeting lounge at the annual RSNA meeting.
5. Presentation to residents at AIRP

#### **Time schedule**

**July 2013 – December 2013:** Completion of the first 6 lectures and the website. The lectures will be available online on 01/01/2014 for trial viewing and feedback, restricted initially to residents from Maryland.

**January 2014 – June 2014:** Completion of lectures 7-12 and accompanying test questions for lectures 1-12. By July 1st 2014 the lectures will be online and available to all residents.

**July 2014 – December 2014:** Completion of lectures 13-20, their accompanying test questions and starting material for interactive problems in evidence based imaging. By January 1, 2015, the online forum will start the interactive teaching problems.

**January 2015 – June 2015:** Creation of a bank of teaching problems to set in motion the interactive and ongoing educational program. By July 1st 2015, recruitment of other imaging professional to make the online program organic and self-perpetuating is desired.

#### **Outcomes**

- 1) A lecture series comprising the integration of clinical hybrid molecular imaging and fundamentals of evidence based imaging practice and policy.
- 2) An online repository of lectures, reading material, problems and solutions.
- 3) An online center, which can serve as a first port of call for education in clinical molecular hybrid imaging, evidence based imaging practice, with an attempt to emulate the ACR CIP in design, number of contributors and popularity.
- 4) Creation of a vibrant community of trainees and experienced radiologists exchanging ideas and knowledge pertaining to evidence based imaging practice, clinical hybrid molecular imaging and policy.

#### **Evaluation**

**1. Feedback:** All visitors to the site will be asked to provide feedback on the lecture quality, website design and exposition of quantitative and qualitative problems.

**2. Level of participation:** The success of this curriculum can be judged, by the number of online visitors and participants in the discussion forums and assessments. In the longer term, number of contributors will be a metric of success. Since there is no normative frame for the optimal number at any point in time, the curriculum would be best judged longitudinally and its relevance to clinical practice.

**3. Test:** Residents and radiologists will have the option of taking an assessment at the beginning and end of each lecture to determine their knowledge base and understanding. The score in the test would be a metric of their degree of understanding. However, the mere taking of the test is a substrate for interest in the subject matter and would be another useful metric to adjudicate success of the curriculum.

**(b) Harvard Macy Institute Programs:**

As an RSNA education scholar, I will attend three resident courses (a total of 4 weeks) over the two years, at the Harvard Macy Institute, to grow my digital technology skills in educational delivery and educational leadership. I will bring these educational and leadership skills back into radiology to serve our medical students, residents, fellows and junior faculty.

The three programs I will undertake are:

**Become a digital citizen: Technology in health care education**

This course provides health care educators with the skills needed to make use of current technology and social medial tools to support teaching and learning. Participants learn how to use technology to create learning environments and materials, filters to manage information overload and customize online searchable repositories. In short, the course teaches how to leverage Web 2.0 and social medial tools to create professional learning networks.

**Program for Educators in Health Professions**

The goal of this Program is to provide a select group of 60 participants with the knowledge base and skills to enhance their expertise in both conducting an educational project of their own design and taking a leadership role in the educational activities at their institutions.

The program consists of two sessions in residence at Harvard: an 11-day winter session and a 6-day spring session. Learning formats include whole-group presentations, interactive exercises, problem-based learning, observations, reflective use of journals, and discussion in large and small groups. When scholars leave the winter session, they are linked to program faculty who will follow the progress of projects between sessions. During the spring residence at Harvard, the scholars will report on the development of their projects, analyze their experiences, and formulate new strategies for their institutions. Formal coursework in May will build on discussions begun in January and will emphasize the participants role in leading innovations at the level of a course, a department, and an institution.

**Leading innovations in Health Care and Education**

The program curriculum is designed to assist me in developing my own strategies for leading change within a rapidly evolving health care delivery system. Using classic management studies and case studies of education reform, we will analyze the interlocking elements of change strategies and develop guiding principles drawn from organizational research.

The informal exchange of insights and experiences among international participants and faculty drawn from multiple professional disciplines is a vital part of this experience. This unique leadership course is offered with Harvard Business School Professor Clayton Christensen.

## **Appendix: List of lectures**

### **(a) Foundation Lectures**

1. Evidence development for clinical practice
2. Health Policy: Economics of imaging
3. Health Policy: Metrics of Value and Quality
4. Integration of functional and structural imaging: Why?
5. Molecular radiopharmaceuticals in imaging
6. Hybrid Instrumentation: PET/SPECT/CT/MRI

### **(b) Evidence based clinical practice & hybrid imaging**

7. Central nervous system
8. Head and Neck
9. Lung
10. Pleura and mediastinum
11. Cardiovascular: Heart & vessels
12. Esophagus and stomach
13. Colon, liver and pancreas
14. Genitourinary organs
15. Musculoskeletal and skin
16. Endocrine Organs

### **(c) System integration & clinical practice**

17. Therapy assessment: Imaging methods and challenges
18. Imaging biomarkers in clinical practice
19. Quantitative Imaging in clinical practice
20. Integration of imaging and radiation delivery