

## **Penn State University Radiology Research**

### *Historical perspective*

The Penn State Department of Radiology has a long history of commitment to imaging research. Historically the primary focus has been NMR/MRI research with installation of one of the first *in vivo* multi-nuclear NMR spectroscopy systems in 1983, and development of the Penn State Center for NMR Research in 1991 with installation of one of the first human 3.0 T human scanners (Bruker S-300 Scanner). Since 1991, the Center has become one of the premier sites for ultra-high field MRI research receiving a \$6.9 million NIH Bioengineering Partnership Grant to evaluate ultra-high MRI in 2002 and subsequently renewed in 2007.

Major research interests of the Center for NMR Research include modeling and simulation of ultra-high field radio-frequency and static field behavior in MRI, pulse sequence development for fMRI and ultra-high field MRI applications, olfactory functional MRI (fMRI), and quantitative imaging for evaluation of *in vivo* cartilage biomechanics and early structural degeneration. Radiology researchers have a long history of collaboration with investigators at Penn State as well as numerous outside institutions. Currently, the Center serves as the primary research facility for 3.5 faculty members of the Department of Radiology.

The Penn State MRI Core facility was developed in 2007 to provide imaging resources and service for investigators on the Penn State Hershey campus. The MRI Core has three MRI systems dedicated for research: 1) a 3.0T Siemens Tim Trio installed in 2008 equipped with 18-receiver / 8-transmit channels, latest hardware and software packages with full clinical capability, a similar system was installed at the University Park Campus in 2009 and allows for cross campus collaboration on MRI protocols 2) a Bruker S-300, 90 cm bore, 3.0 Tesla whole body MR spectrometer/imager and 3) a 7.0 T Biospec 70/20 as small animal imaging system. In addition, a Philips Achieva 3.0 T MRI with eight receiver channels located in the main hospital complex within 150 yards of the MRI Core facility is also available for research activities. The institution is presently awaiting a funding decision on a NIH shared instrument grant for a whole body 7 T whole body MRI scanner, which received a score of 20 on the initial submission.

Additional equipment includes an Eloquence™ System for functional MR imaging (fMRI) (Invivo Corp, FL, USA), which includes an LCD visual display, audio system, button response unit and software (E-Prim) for paradigm creation, patient management, protocol planning, precise delivery of brain stimulation and behavioral data analysis (BrainVoyager package).

### **Internal Review of Department of Radiology Research Program**

The Department of Radiology undertook an internal assessment of the Radiology research program in January 2010 with the following objectives:

## Objectives

- Identify internal and external factors that are likely to impact future biomedical imaging research at Penn State
- Evaluate potential opportunities and barriers to biomedical imaging research
- Develop objective outcome measures to evaluate, promote, and reward research activities in the Department
- Develop 5 year plan to achieve research targets

## Methods

Faculty surveys were completed in January 2010 addressing the 2 general questions:

- Identify what you feel are important factors external (*International/National*) and internal (*Institution/Department*) to the Department that may impact the future of research in our Department.
- Identify what you feel are current research opportunities and barriers. For research opportunities assess the priority of this research to the Institution, Department, and to you as an individual faculty member

Results from the faculty surveys were used for discussion topics at a Faculty Research Summit held January 25, 2010. The summit used both large groups and small group discussion format to identify opportunities, barriers, and needs for research in the Department.

Based on survey response and group discussions the following were identified as critical elements impacting research in the Department:

### *Perceived barriers to research*

- Continued demand for greater clinical productivity reduces availability for research and scholarly activities
- Future changes in residency requirements will decrease availability of residents for clinical coverage and will likely result in a greater demand for clinical productivity from faculty.
- Lack of cross-over between clinical work and research
- Limited clinical research activity in the Institution results in few opportunities for collaboration
- Young faculty with little training in research methods, grant writing
- High competition for grant funding
- Lack of CTSA limits opportunities for clinical and translational research at Penn State

### *Opportunities for research*

- External research networks (ACRIN, ACRIN-PA) provide opportunities in multi-center clinical trials and training in clinical research

- Penn State Center for NMR Research has unique expertise in MRI techniques with opportunities to apply novel technology to translational research
- Penn State Neuroscience Center, Spine Center
- Growing interest in educational outcomes research
- Collaboration with basic science departments at University Park (Engineering, Image guided modeling of physiological processes, quantitative image analysis, fMRI)

#### *Research Needs*

- Improved technology for data mining from clinical case materials
- Protected research time
- Administrative research support (grant writing, technical writing)

#### *Future Plans and Goals*

1. Integrate research into clinical sections
  - Provide incentives for research productivity at section level rather than investigator level to foster collaboration and team approach to build and reward research activities
  - Develop mentoring network within section for junior faculty and fellows
  - Identify inter-disciplinary research opportunities with clinical investigators in disease focused areas
  - Identify common areas of research interest in section and identify common infrastructure to support research activity (Data bases, analysis tools, imaging protocols etc)
2. Increase level of participation of Department in ACRIN trials
  - Identify ACRIN protocols in development and target HMC investigators that could potentially serve as site PIs
  - Develop mechanism with PSU Cancer Institute for joint cooperative group ACRIN trials
  - Support travel to ACRIN meeting in October
  - Develop focus groups to develop research proposals for ACRIN-PA RFA
3. Implement new technologies to provide methods for data mining of clinical case material
  - Install Primordial Radiology Report Search and Teaching File software to facilitate free word text search of reports
4. Leverage interest of faculty in educational outcomes research
  - Identify potential outside consultants with educational outcome expertise to provide training on educational research methods and techniques
  - Implement technology to develop novel educational resources that could yield objective data to evaluate research effectiveness
  - Develop educational research application for the Woodward Education Awards