Imaging Sciences Pathway
Seeking Applications for Graduate Student Fellowships

***Due Date April 9, 2018***

The Imaging Sciences Pathway is open to graduate students in the Division of Biology and Biomedical Sciences (DBBS), Chemistry, Physics and the School of Engineering and Applied Sciences. Graduate students who have completed training in the Imaging Sciences Pathway will be poised to follow a unique career trajectory, which may involve imaging technology development, the chemistry and use of novel contrast agents, the visualization and manipulation of macromolecular complexes and organelles in cells and in animals, and the application of these technologies to the visualization of human disease states.

Students who participate in the Imaging Pathway will obtain their degrees in one of the current science and engineering degree-granting programs; however, their education will be enhanced by an emphasis in interdisciplinary coursework and research experiences in imaging sciences.

Selection will be made from students currently in their 2nd year of graduate training. Students will be selected from laboratories of faculty members doing research in the imaging sciences, and chosen by a panel selected by the steering committee of the Imaging Sciences Pathway. Three new students will be selected for this 2018 competition. The selected new students will be given two year fellowships. The requirements are below:

CURRICULUM

The curriculum for the Graduate Imaging Sciences Pathway includes taking 4 courses to allow trainees to specialize in one or more areas of Imaging Sciences. Additionally, there are relevant courses being taught in other WU departments that may be incorporated into the curriculum.

Required core courses for all fellows.

- **Seminar in Imaging Sciences & Engineering (ESE 596/BME 506/Bio 5139).** This seminar course consists of a series of tutorial lectures on imaging science and engineering with emphasis on applications of imaging technology. Students are exposed to a variety of imaging applications that vary depending on the semester, but may include multispectral remote sensing, astronomical imaging, microscopic imaging, ultrasound imaging, and tomographic imaging. Guest lecturers will be from both Danforth and medical school campuses. The only requirement is attendance at the lectures; the course is pass/fail. (1 credit)

- **Principles and Applications of Biological Imaging (Bio 5146).** The purpose of this course is to provide students with an overview of the imaging sciences and to demonstrate the interdisciplinary nature of the field. The course is designed to briefly cover many interrelated topics that define biological imaging. Individual topics will be addressed in greater depth in classes later on in students’ training.

- **One of the following two courses in cell biology:**
  1. **Fundamentals of Molecular Cell Biology (Bio 5068).** The goal of the course is for incoming graduate students to learn about research on molecular mechanisms that underlie cell structure and function. As such, the course emphasizes research and experimental strategies. Topics covered in the course include protein structure analysis, protein purification, membrane structure and function, protein and vesicular trafficking, enzyme kinetics, receptor-ligand binding, membrane channel electrophysiology, signal transduction, the cell cycle, apoptosis, cell motility, and extracellular matrix. The format is two lectures and one small-group discussion section per week. Each discussion section focuses on one or more original research articles that the students read, critique in writing, and discuss in the group, which is facilitated by a faculty member.
  2. **Molecular Cell Biology for Engineers (BME 530).** This course is designed for students with a background in engineering. The course covers the biology of cells of higher organisms:
protein structure and function; cellular membranes and organelles; cell growth and oncogenic transformation; cellular transport, receptors and cell signaling; the cytoskeleton, the extracellular matrix, and cell movement. Emphasis will be placed on examples relevant to biomedical engineering. In the discussion section, the emphasis will be on experimental techniques used in cell biology and the critical analysis of primary literature.

- **Required for students with 2 year fellowships - One of the following two courses in biological imaging:**
  1. **Contrast Agents for Biological Imaging** (Bio/Chem 5147). This course is designed to build the chemistry foundations for how contrast agents are designed and utilized in diagnostic imaging. The chemistry of PET/SPECT, MRI, optical and ultrasound contrast agents will be covered. The chemistry of contrast agent design is diverse, and includes some working knowledge of organic, inorganic, physical and analytical chemistry methods.
  2. **Biological Imaging Technology** (ESE 483/583; BME 494) This class will develop a fundamental understanding of the physics and mathematical methods that underlie biological imaging and critically examine case studies of seminal biological imaging technology literature. The physics section will examine how electromagnetic and acoustic waves interact with tissues and cells, how waves can be used to image the biological structure and function, image formation methods and diffraction limited imaging. The math section will examine image decomposition using basis functions (e.g. Fourier transforms), synthesis of measurement data, image analysis for feature extraction, reduction of multi-dimensional imaging datasets, multivariate regression, and statistical image analysis. Original literature on electron, confocal and two-photon microscopy, ultrasound, computed tomography, functional and structural magnetic resonance imaging and other emerging imaging technology will be critiqued.

**APPLICATION REQUIREMENTS**

- The Application Cover Page, which includes:
  1. Name, birthdate, address, academic program and year in program
  2. Contact information (e-mail and telephone)
  3. Mentor with whom the student is or will be working (must be doing imaging research)
  4. Name of research collaborator/secondary mentor (A secondary mentor is required.)
  5. GRE or equivalent test scores and undergrad GPA
- Clear photocopy of student's Washington University identification badge
- CV or resume
- One-paragraph description of why the student is interested in the program
- One-page description of the student's Ph.D. dissertation goals
- Recommendation letter from the faculty sponsor
- Recommendation letters from two other faculty members

**NOTE:** Two of the fellowship slots this year will be funded directly by an NIH T32 training grant which requires U.S. citizenship. We are happy to announce an additional fellowship slot (1) that will not require US citizenship or Permanent Residency and will be funded by Institutional Support.

**Applications should be submitted by April 9, 2018 to:**
Terry Sharp, Division of Radiological Sciences, Box 8225 or by e-mail to tlsharp@wustl.edu

For questions about the program, e-mail Terry Sharp at tlsharp@wustl.edu

For more information, including a list of mentors, please see the Imaging Sciences Website and the Graduate Imaging Sciences Pathway brochure.
http://dbbs.wustl.edu/imaging