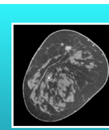
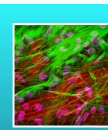
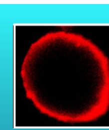
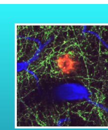
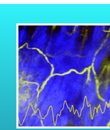
DIVISION OF APPLIED SCIENCE & TECHNOLOGY

National Institute of Biomedical Imaging and Bioengineering

National Institutes of Health

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National Institute of Biomedical Imaging and Bioengineering

Introduction

The mission of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) is to improve human health by leading the development and accelerating the application of biomedical technologies. The Institute is committed to integrating the physical and engineering sciences with the life sciences to advance basic research and medical care.

The Division of Applied Science and Technology is one of three divisions within the NIBIB's Office of Extramural Science Programs. Through grant, cooperative agreement, and contract mechanisms, the division promotes, fosters, and manages biomedical imaging research programs in the funding areas listed below.

Research Programs

- ***Molecular Imaging –*** The focus of this program is the development, evaluation, and application of molecular imaging/ therapy agents and novel molecular imaging methods for studying normal biological and pathophysiological processes at the cellular and molecular levels, as well as the clinical or preclinical applications of molecular imaging research. Examples of supported research include the development and application of surface functionalized nanoparticles, bioactivated imaging agents, theranostic agents, and high sensitivity/specificity molecular imaging approaches.
(Karen Peterson, kpeterso@mail.nih.gov)

- ***Image-Guided Interventions –*** This program addresses the development of technologies that use images particularly during minimally invasive surgery or biopsy. Technologies may include interventional device development, as well as algorithms and imaging devices used for guidance, navigation, and orientation during minimally invasive procedures.
(Steve Krosnick, krosnics@mail.nih.gov)

- ***Magnetic, Biomagnetic and Bioelectric Devices –*** The technological development of magnetic, biomagnetic, and bioelectric devices (e.g. electroencephalography, magnetoencephalography, and electrical impedance spectroscopy) is the focus of this program. Examples include novel detectors, increased sensitivity and spatial resolution, improved reconstruction algorithms, and multiplexing with other imaging techniques.
(Antonio Sastre, sastrea@mail.nih.gov)

- ***Magnetic Resonance Imaging (MRI) and Spectroscopy –*** This program involves the technological development of magnetic resonance imaging (MRI) and MR spectroscopic imaging for research and clinical applications. Examples include fast imaging, highfield imaging, MRI hardware including novel radio frequency (RF) and gradient coils, new pulse sequences, and new imaging contrast mechanisms. The program emphasizes technological development rather than detailed applications for specific diseases or organs. (Guoying Liu, liug@mail.nih.gov)

- ***Nuclear Medicine –*** Research in this area involves functional and molecular imaging using single photon or positron emissions from radioactive agents that are injected, inhaled, or ingested into the body and then concentrated in specific biological compartments. Two particularly active areas are PET and single photon emission computed tomography (SPECT). Other areas of interest include the design of higher resolution or sensitivity devices, hybrid imaging systems (PET/MRI), the development of better radiopharmaceuticals and nuclear medicine probes, crystal scintillators and semiconductor detectors, high performance collimators, novel approaches to dosimetry, radiation dose reduction via hardware or software, novel reconstruction techniques, and dualisotope imaging.
(Antonio Sastre, sastrea@mail.nih.gov)

- ***Optical Imaging and Spectroscopy –*** This program supports the exploration, development, and translation of imaging technologies at terahertz, infrared, visible, and ultraviolet wavelengths. The central aim of this program is to enhance, integrate, and quantify spatial, spectral, and temporal techniques including fluorescencebased approaches, multiphoton imaging, coherent processes, topographic methods and spectroscopic analysis by supporting the development of innovative light sources, microscopy designs and image reconstruction methods with the potential to be translated for clinical use. The program also includes technological development in optical coherence technology (OCT), photoacoustic imaging, diffuse optical tomography (DOT), Raman spectroscopy, and photodynamic therapy (PDT) (Behrouz Shabestari, behrouz.shabestari@nih.gov)

- ***Diagnostic Ultrasound –*** The diagnostic ultrasound program includes the design and development of innovative transducers and transducer arrays. Also included are the development of innovative image acquisition and display methods, innovative signal processing methods, and functional imaging methods, including elastography, Doppler and color Doppler, and radiation force imaging. It also includes development of innovative imaging agents for contrast enhancement and molecular imaging. (Richard Conroy, richard.conroy@nih.gov)

- ***Interventional Ultrasound –*** The interventional ultrasound program includes the use of ultrasound as an active agent for therapeutic intervention and noninvasive surgery. Areas of interest include uses of high-intensity focused ultrasound (HIFU) for ablation of tumors and facilitating drug delivery and thrombolysis. Research on non-HIFU ultrasound is also promoted for thrombolysis and for use as an acoustic radiation force agent. The program emphasizes the identification of physical and biological mechanisms that will allow investigators to gain full understanding and control of this technology for eventual safe use in clinical applications.
(Steve Krosnick, krosnics@mail.nih.gov)

- ***X-ray, Electron, and Ion Beam –*** Computed tomography (CT), computed radiography (CR), digital radiography (DR), digital fluoroscopy (DF), phase-contrast and diffraction-enhanced imaging, and other related X-ray modalities are included in this program. Research areas of support include development of flat panel detector arrays and other detector systems and materials, as well as improved contrast materials and methods. High priority is given to innovative approaches for radiation dose reduction, including improved CT reconstruction algorithms, as well as photon counting detectors for use with CT to improve image quality and utilization of optimal energy bands for specific applications and improved contrast. Research areas dealing with development of clinical application methods of diffraction-enhanced imaging and phase contrast imaging are of great program interest.
(Antonio Sastre, sastrea@mail.nih.gov)

- ***Biomedical Imaging Informatics –*** This program encompasses the development of software technologies for interpreting and analyzing information content in biomedical images. Some of the objectives include algorithm development, automated and/or real-time segmentation tools, denoising methods, shape analysis techniques such as morphometry, and development of techniques for improving signal-to-noise in acquired data. The program also includes development and optimization of computer-aided diagnosis techniques, approaches to quantify and evaluate medical image perception research, and techniques for simulating CT doses using virtual phantoms with a view to reducing radiation doses in clinical scenarios. (Vinay Pai, paiv@mail.nih.gov)

Collaborations

The division is currently involved in several important collaborative efforts, most notably:

- ***Single Cell Analysis –*** As part of a trans-NIH Common Fund Program, this area involves the development of innovative tools and techniques for high throughput, high content imaging of cells in situ to identify and measure cellular heterogeneity, emergent properties in subpopulations, rare cell types, and response of complex environments to therapies. It also includes development of new methods for integrating genomic, metabolomic, proteomic and imaging data to identify imaging biomarkers, multi-scale imaging, which links cellular characteristics to organ function, and novel approaches for distinguishing relevant signal from biological and technical "noise".
(Richard Conroy, richard.conroy@nih.gov)

- ***The Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative –*** The goal of this initiative is to map circuits of the brain, measure fluctuating patterns of electrical and chemical activity flowing within those circuits, and understand how their interplay creates our unique cognitive and behavioral capabilities. By accelerating the development and application of innovative technologies, researchers will be able to produce a dynamic picture of the brain that, for the first time, shows how individual cells and complex neural circuits interact in both time and space. It is expected that the application of these new tools and technologies will lead to new ways to treat, cure, and even prevent brain disorders. For more information: http://www.nih.gov/science/brain/index.htm.
(Guoying Liu, liug@mail.nih.gov)

- ***4D Nucleome –*** Genetic material, located within the nucleus of a cell, is not randomly organized. Although the spatial configuration of DNA and DNA-associated proteins is known to influence gene expression and cellular function, how this occurs is unknown. The Common Fund's 4D Nucleome program aims to understand the principles behind the 3D organization of the nucleus in space and time, the role nuclear organization plays in gene epxression and cellular function, and how changes in nucelar organization affect normal development as well as disease.
(Richard Conroy, richard.conroy@mail.nih.gov)

NIBIB Contacts

Contact NIBIB program staff with your questions about funding opportunities or the application process. We welcome the opportunity to speak with potential applicants about the Institute's programs. Areas of scientific coverage for each member of the program staff are listed in the Research Programs section of this fact sheet and on the NIBIB website at http://www.nibib.nih.gov/Research/ProgramAreas.