



The National Institute of Biomedical Imaging and Bioengineering (NIBIB) is one of the 27 institutes and centers of the National Institutes of Health (NIH), the nation's premier medical research agency. The mission of the 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.

NIBIB supports emerging technology research and development through grants, collaborations, and training. Currently, NIBIB funds more than 700 grants and the work of approximately 5,000 researchers around the country and internationally. NIBIB also works with industry, academia, and other federal agencies to coordinate and promote interdisciplinary research and training. Finally, NIBIB informs health care providers, researchers, and the general public about research findings.

## Extramural Research Programs

NIBIB supports innovative research through the following divisions:

- **Division of Applied Science and Technology (Biomedical Imaging)**  
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More information at <http://www.nibib.nih.gov/research/scientific-program-areas>

## Intramural Research Program

NIBIB's Intramural Research Program (IRP) is located on the NIH campus in Bethesda, Maryland. The IRP plays a key role in fulfilling the Institute's mission, particularly to advance knowledge in imaging and bioengineering research using a combination of basic, translational, and clinical science and to develop effective training programs in related fields. For information about ongoing research in an NIBIB lab or training opportunities, visit <http://www.nibib.nih.gov/research/labs-at-nibib>

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## Training

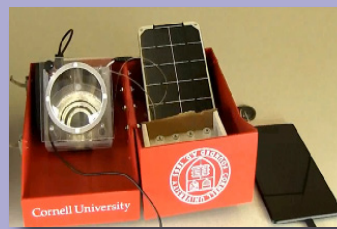
A broad range of institutional and individual training and career development programs are provided to assist engineers and biological, computational, and physical scientists working at the intersection of the life and physical sciences. These programs are intended to fill critical gaps in the career continuum, increase the number of clinician-scientists, and enhance the participation

of underrepresented populations in biomedical research. More information can be found at: <http://www.nibib.nih.gov/training-careers>

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## Examples of NIBIB-Supported Research

**Point-of-Care Technologies (POC)** — POC technologies bring modern medicine to remote areas and allow for more timely health-related



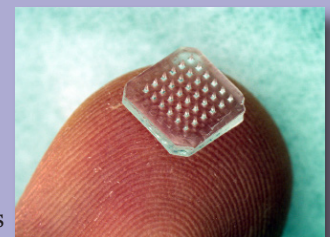
Portable diagnostic device, KS-Detect, developed by David Erickson and Ethel Cesarman, Cornell University

decisions and more patient-centered health care delivery. These technologies improve diagnosis and treatment and help patients manage chronic disease and compensate for impaired functionality to maintain healthy independent living. For example, researchers are developing a device that can diagnose a type

of cancer called Kaposi's sarcoma in less than thirty minutes. The device uses solar energy to heat a reaction that amplifies small samples of DNA taken from a tumor, and a smartphone application to analyze and display the results. It runs on so little power that a smartphone can run it for up to seventy hours.

**Ultrasound** — Ultrasound can be used as a tool for imaging and for therapeutic intervention. Current innovations include intraoperative image guidance for surgery or biopsy, as well as functional imaging capabilities that can show the difference between normal and abnormal tissue. Therapeutic innovations include the use of ultrasound for noninvasive destruction of clots in blood vessels, as well as the use of high-intensity ultrasound to non-invasively destroy tumors, or to facilitate delivery of drugs to targeted organs.

**Drug Delivery** — Drug delivery systems are engineered technologies to optimize the delivery of therapeutic agents. Microneedle arrays are one example of a new method to deliver medications through the skin. In these arrays, dozens of microscopic needles, each far thinner than a strand of hair, can be coated or filled with a medicine. The needles are so small that, although they penetrate the skin, they don't reach nerves in the skin, thus delivering medications painlessly. NIBIB-funded scientists are developing a microneedle patch for vaccine delivery that is easy to use and doesn't require refrigeration or special disposal.



Micropatch for vaccine delivery developed by Mark Prausnitz, Georgia Institute of Technology

**Rehabilitation Engineering** — Ongoing research in rehabilitation involves the design and development of new, innovative assistive devices. An important research area focuses on the development of new technologies and techniques for improved therapies that help people regain physical or cognitive functions lost because of disease or injury. Recently, four individuals paralyzed below the chest were able to voluntarily move their hips, legs, ankles, and toes thanks to a novel rehabilitation strategy that involved electrical stimulation of their spinal cord.

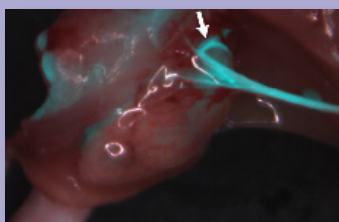


A young man paralyzed below the chest moves his leg while undergoing spinal stimulation.

Source: University of Louisville

**Magnetic Resonance Imaging** — The rapid evolution of MRI has improved the diagnosis and treatment of numerous diseases and injuries. For example, magnetic resonance (MR) elastography offers a more reliable alternative to liver biopsy. For the 100,000 people seen in the hospital each year for chronic liver disease, MR elastography means less risk, less pain, and less expense than traditional biopsy. Early results suggest that this noninvasive technique may also be useful for detection of breast cancer and to help distinguish cancer from a benign mass. Another example is diagnostic magnetic resonance (DMR), a miniature MR point-of-care diagnostic device for sensing and rapid profiling of cancer cells.

**Image-Guided Interventions** — Researchers are developing novel tools and techniques to help doctors view inside the body while performing surgery or carrying out procedures. Such advances enable minimally invasive surgeries and help surgeons distinguish between diseased and healthy tissue, such as at the boundary of a tumor.



Fluorescently labeled probes for imaging nerves allow surgeons to more adroitly separate tumor from critical nerve connections. Source: Adapted with permission of Macmillan Publishers Ltd. Nat. Biotech Whitney et al. Feb 2011.

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