DEPARTMENT OF HEALTH AND HUMAN SERVICES

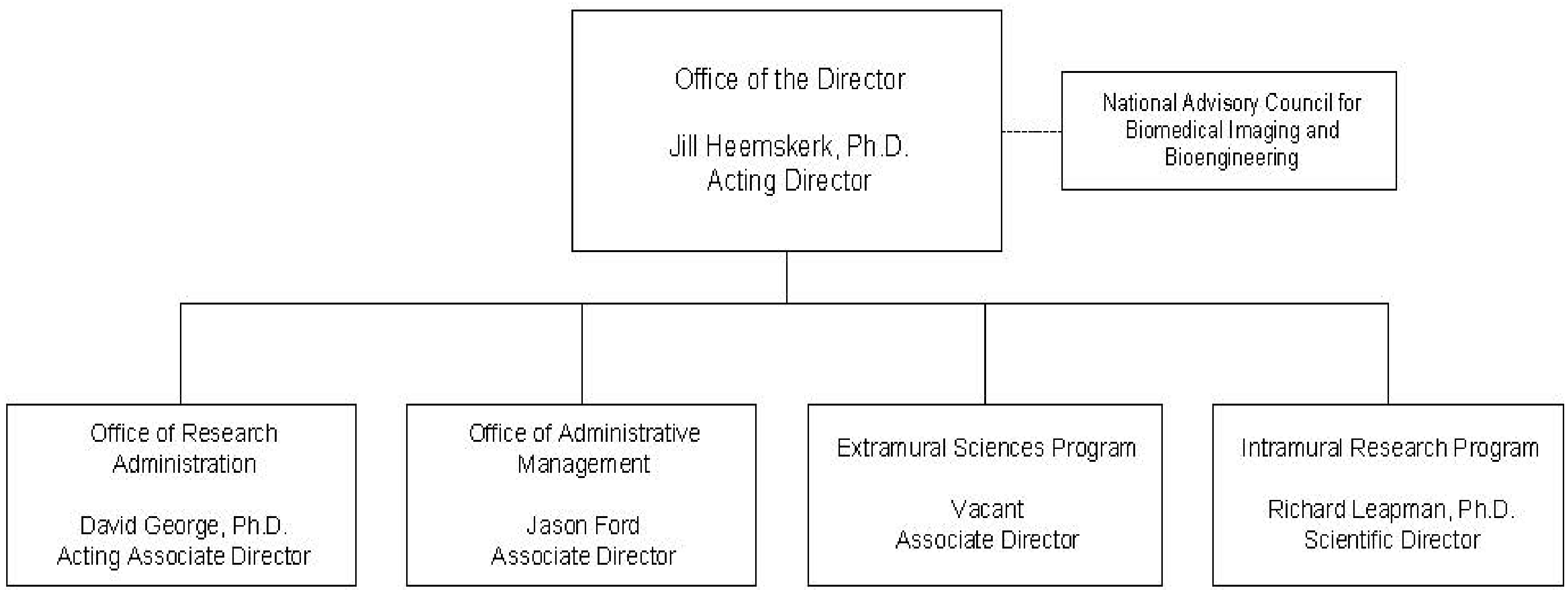
NATIONAL INSTITUTES OF HEALTH

National Institute of Biomedical Imaging and Bioengineering (NIBIB)

FY 2019 Budget | Page No.

National Institute of Biomedical Imaging and Bioengineering

NIBIB ORGANIZATIONAL CHART



NATIONAL INSTITUTES OF HEALTH

National Institute of Biomedical Imaging and Bioengineering

For carrying out section 301 and title IV of the PHS Act with respect to biomedical imaging and bioengineering research, $346,550,000.

NATIONAL INSTITUTES OF HEALTH
National Institute of Biomedical Imaging and Bioengineering

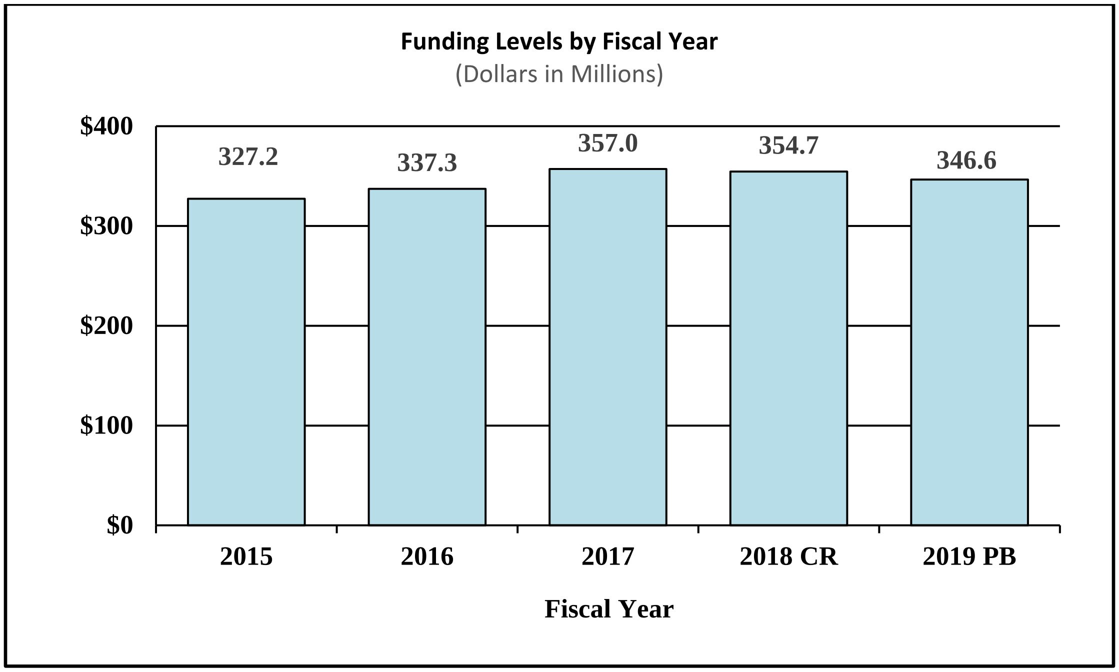
Amounts Available for Obligation[1]
(Dollars in Thousands)

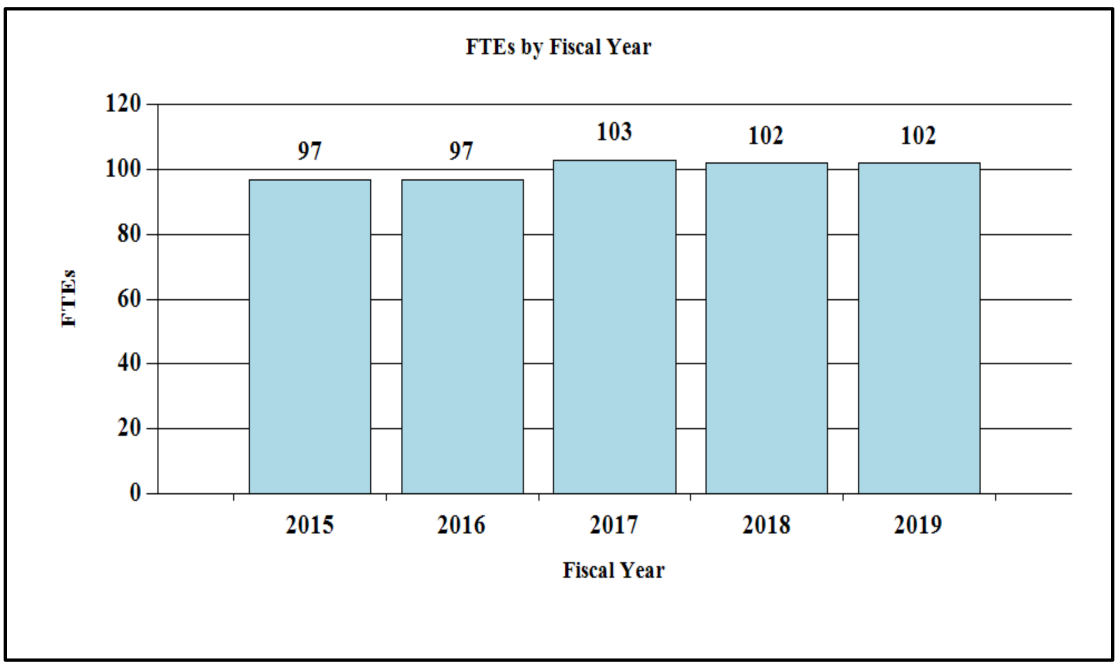
Source of Funding	FY 2017 Final	FY 2018 Annualized CR	FY 2019 President's Budget
Appropriation	$357,080	$357,080	$346,550
Mandatory Appropriation: (non-add)	-	-	-
Type 1 Diabetes	*(0)*	*(0)*	*(0)*
Other Mandatory financing	*(0)*	*(0)*	*(0)*
Rescission	0	-2,425	0
Sequestration	0	0	0
Secretary's Transfer	-796		
Subtotal, adjusted appropriation	$356,284	$354,655	$346,550
OAR HIV/AIDS Transfers	697	0	0
Subtotal, adjusted budget authority	$356,981	$354,655	$346,550
Unobligated balance, start of year	0	0	0
Unobligated balance, end of year	0	0	0
Subtotal, adjusted budget authority	$356,981	$354,655	$346,550
Unobligated balance lapsing	-10	0	0
Total obligations	$356,971	$354,655	$346,550

[1] Excludes the following amounts (in thousand) for reimbursable activities carried out by this account:
FY 2017 - $2,656 FY 2018 - $2,656 FY 2019 - $1,862

Fiscal Year 2019 Budget Graphs

History of Budget Authority and FTEs:





NATIONAL INSTITUTES OF HEALTH
National Institute of Biomedical Imaging and Bioengineering

Authorizing Legislation

	PHS Act/ Other Citation	U.S. Code Citation	2018 Amount Authorized	FY 2018 Annualized CR	2019 Amount Authorized	FY 2019 President's Budget
Research and Investigation		42§241	Indefinite		Indefinite	
				$354,655,070		$346,550,000
National Institute of Biomedical Imaging and Bioengineering	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				$354,655,070		$346,550,000

NATIONAL INSTITUTES OF HEALTH
National Institute of Biomedical Imaging and Bioengineering

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2009	$300,254,000	$310,513,000	$307,254,000	$308,208,000
Rescission				$0
2010	$312,687,000	$319,217,000	$313,496,000	$316,852,000
Rescission				$0
2011	$325,925,000		$325,415,000	$316,852,000
Rescission				$2,779,778
2012	$322,106,000	$322,106,000	$333,671,000	$338,998,000
Rescission				$640,706
2013	$336,896,000		$337,917,000	$338,357,294
Rescission				$676,715
Sequestration				($16,983,210)
2014	$338,892,000		$337,728,000	$329,172,000
Rescission				$0
2015	$328,532,000			$330,192,000
Rescission				$0
2016	$337,314,000	$338,360,000	$344,299,000	$346,795,000
Rescission				$0
2017[1]	$343,506,000	$356,978,000	$361,062,000	$357,080,000
Rescission				$0
2018	$282,614,000	$362,506,000	$371,151,000	$357,080,000
Rescission				$2,424,931
2019	$346,550,000			

[1] Budget Estimate to Congress includes mandatory financing.

Justification of Budget Request

National Institute of Biomedical Imaging and Bioengineering

Authorizing Legislation: Section 301 and title IV of the Public Health Service Act, as amended.

Budget Authority (BA):

	FY 2017 Final	FY 2018 Annualized CR	FY 2019 President's Budget	FY 2019 +/- FY 2018
BA	$356,981,000	$354,655,070	$346,550,000	-$8,105,070
FTE	103	102	102	0

Program funds are allocated as follows: Competitive Grants/Cooperative Agreements; Contracts; Direct Federal/Intramural and Other.

Director's Overview

The National Institute of Biomedical Imaging and Bioengineering (NIBIB)[1] conducts and supports biomedical research that integrates the life sciences with engineering and the physical sciences to develop new technologies and speed their application to improve health. Technology is rapidly changing all over the world, but especially in the fields of health and medicine. Just a few short decades ago x-rays were the only real method of noninvasively seeing inside the body. Now patients have access to magnetic resonance imaging (MRI), computed tomography (CT), and ultrasound, among others. A visit to a doctor's office may now include rapid tests for common illnesses such as strep throat, and assistive devices are enabling greater independence for people with disabilities. NIBIB-supported research brings together multi-disciplinary teams to develop the tools and technology for tomorrow's medicine and partners with industry, academia, and other federal agencies to coordinate and promote interdisciplinary research.

Partnerships to support entrepreneurs. A major challenge in the development of new biomedical technologies is making the leap from discovery to commercialization. Many researchers are experts in solving medical problems, but have little experience in commercializing technology. NIBIB established a distinctive program to provide innovators with the specialized business backgrounds and essential tools for successful translation of biomedical technologies from lab to market. NIBIB and NIH are extending this program to grantees who receive other types of grant awards (in addition to SBIR/STTR), thus expanding opportunities and the impact of this public-private partnership. In the past four years, 55 teams were supported through this program. The program's curriculum and customized mentoring are designed to position companies for commercialization success. The Food and Drug Administration (FDA) is a key partner in the commercialization process and NIBIB chairs the Trans NIH-FDA Medical Devices Research Interest Group, facilitating interactions between small businesses and the FDA.

[1] www.nibib.nih.gov

Basic research in technology for better understanding of brain injury. Technologies that allow physicians to observe, track, and analyze brain activity can lead to a better understanding of disease or injury of the brain and nervous system. As an active partner in the Brain Research through Accelerating Innovative Neurotechnologies (BRAIN) initiative, NIBIB is supporting development of new technologies that image the brain, one of the focus areas of the BRAIN initiative. One example is a project to design, build, and test a portable, head-only MRI scanner. Researchers are developing a unique magnet system that is the most compact and lightweight design ever built and will allow the body to be completely outside the machine from the top of the shoulders down. The reduced size, weight, and power requirements will enable the scanner to be transported and used in far more locations.

Creating rapid and accurate diagnostic tests for improving health. Point-of-care (POC) medical tests have the potential to provide rapid diagnosis, which can allow for on-site treatments, and better outcomes for patients. NIBIB's POC technology program supports a range of research to bring about discoveries that can be implemented in clinics, at doctors' offices, or at home. In one example, researchers have developed a microfluidic chip to detect sepsis which could enable earlier intervention for this life-threatening complication that yields one of the highest medical expenses in hospitals worldwide. A portable device that can rapidly diagnose sepsis with a single drop of blood would be a significant improvement over the current method, which is to monitor a patient's vital signs and try to identify the source of the infection. The device is designed to detect the direct cause of sepsis instead of looking for the infection, allowing for rapid treatment at the first sign of disease. In a test using a small number of patient blood samples, the results from this simple device correlated well with results from the standard, more time-consuming tests.

NIBIB also co-chairs the NIH-Bill and Melinda Gates Foundation Working Group on POC Diagnostics. This group of government and private partners is working to identify and collaborate on projects to develop diagnostic tests for low resource areas. One area of focus is to leverage resources for development of a rapid POC diagnostic test for viral infections such as HIV or influenza.

Engaging the research workforce of the future. Developing and supporting the next generation of biomedical researchers is a priority for NIBIB, and the Institute supports programs across the career continuum. A diverse and multidisciplinary workforce is needed to solve the health care problems of today and meet the demands of the future. To this end, NIBIB is leading the Enhancing Science, Technology, Engineering, and Math Educational Diversity (ESTEEMED) Research Education Experiences program. This effort supports educational activities that enhance the diversity of the biomedical research workforce through early preparation for undergraduate students in STEM fields. Participants are from diverse backgrounds interested in ultimately pursuing Ph.D. or M.D./Ph.D. degrees and a biomedical research career in academia or industry. The ESTEEMED program builds on findings from a previous effort, namely that two of the key factors for successful engagement and retention of students are strong mentoring at multiple levels and early hands-on research experiences.

Program Descriptions and Accomplishments

Discovery Science and Technology (DST)
In FY 2019, this program will support bioengineering-based discovery and technological innovation to address a broad array of medical problems and improve treatment access and health for all populations.

A new way to preserve tissue scaffolds. To address a key need in organ transplantation, a group of NIBIB-supported researchers has taken a totally new approach to bioengineer a lung. To date, a process known as decellularization has been used on tissue taken from the body to remove damaged or diseased lung cells, leaving the original scaffold that holds cells together intact. This technique, also required the development of a multi-staged process to spare the vascular network. The vascularized scaffold can then be repopulated with healthy cells, and prodded to develop into viable tissue. This novel approach was recently tested in a small rodent model, and could improve the ability of researchers to grow human tissues for drug testing, and one day to treat specific diseases.[2]

Making medication adherence easier. Malaria affects hundreds of millions of people every year, killing more than 500 thousand people worldwide. Part of the difficulty of eliminating malaria stems from the fact that a large portion of the at-risk population lives in rural areas where access to health care can be a challenge. Many patients often do not comply with the strict daily schedule that malaria prevention medicines require. Researchers have developed a capsule that, when dissolved in the stomach, releases a star-shaped material that keeps the device in the stomach for two weeks, during which it slowly disintegrates while continuing to release proper dosages of the drug. The technology was tested in a swine model and was shown to be effective for two weeks.[3] This new drug delivery system may someday eliminate the need to take medication daily.

Nanoparticles to prevent inflammation. For some diseases, the immune system is too active and needs to be dialed back to prevent, for example, problems caused by scar tissue that forms following a spinal cord injury. Researchers are working on ways to modify the immune system to prevent this type of damage using nanoparticles. A biodegradable nanoparticle injected after a spinal cord trauma showed promise in preventing these problems that can impede the repair process. The nanoparticles work by binding to the cells that cause the inflammation, and diverting them to the spleen. In a study in mice, those that received the nanoparticle injection could walk better after spinal injury than those that didn't receive it.[4] The treatment could potentially limit secondary damage to the spinal cord in humans if administered within a few hours after an accident. While this approach is not a cure, by preventing secondary damage, it could lead to better outcomes for patients.

[2] *Science Advances* 3:e1700521 (2017)
[3] *Science Translational Medicine* 8:365ra157 (2016)
[4] *Neurobiology of Disease* 108:73-82 (2017)

Program Portrait: Sensor technology in healthcare

Sensors are becoming a ubiquitous part of life. They are in our cars to alert us when we stray into another lane, they are in our refrigerators and let us know when we need more milk, and we wear them to count our steps and measure our heart rate. Sensors can also help to revolutionize the diagnosis, monitoring, and treatment of disease.

Researchers are developing a revolutionary 3D printer that could pave the way for the direct printing of biomedical devices onto human skin. Working layer by layer the printer builds flexible electronic sensors that can measure pressure. These sensors could potentially improve sensation in prosthetic hands as well as the type of robotic arms doctors use to perform surgery. With this technology, the sensors can be printed at room temperature directly onto human skin, a prosthetic hand, or any curved surface. In one test the sensors were worn for three consecutive days and showed no signs of degradation of function.[5] This new technology could give people with artificial limbs better control, such as the ability to hold an egg without crushing it, or provide tactile feedback to a physician controlling a surgical robotic arm.

Another research group is using sensors to reduce the more than 10,000 drunk-driving fatalities that occur each year[6] by developing a wearable sensor that can measure a person's skin alcohol level. The sensor is applied to the skin like a tattoo and transmits alcohol levels to a cell phone or other device.[7] A collaborative product of nano, computing, and electrical engineers, the sensor induces perspiration and then measures the alcohol content contained in the sweat. Because it is noninvasive and alcohol levels can be measured discreetly, researchers believe the device has great potential for people to self-monitor their alcohol intake and avoid driving if they have had too much to drink. Researchers are exploring other potential uses of this type of sensor, such as a noninvasive way to measure blood glucose levels.

Applied Science and Technology

Imaging research is continuing to improve technology and discover ways to quickly and noninvasively detect and monitor diseases and treatments. In FY 2019, this program will continue to support a broad spectrum of research in diagnostic and interventional imaging technology.

Detecting pancreatic cancer noninvasively. In an example of using imaging to biopsy tissue, one group of researchers is developing an optical "biopsy" tool for identifying early cancerous cells within pancreatic cysts using a method called light-scattering spectroscopy (LSS). Using current methods, imaging can locate a mass, but a biopsy is still needed to confirm if tissue is benign or cancerous, and the diagnosis is often delayed. Also, the uncertainty of existing methods can cause patients to undergo unnecessary surveillance, have unneeded surgery for benign cysts, or dangerously delay surgery to remove precancerous lesions. The tool under development is an endoscopic procedure that bounces light off targeted tissue to detect structural changes in the tissue. In pilot clinical trials using LSS, researchers could, with a very high degree of accuracy, distinguish benign cysts from cancerous cysts, as well as identify those with malignancy potential.[8] The LSS tool shows promise for enabling fast, inexpensive and more accurate detection of pancreatic cancer.

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[5] *Advanced Materials* 29: 1701218 (2017)

[6] National Center for Statistics and Analysis, http://www-nrd.nhtsa.dot.gov/Pubs/812219.pdf

[7] *ACS Sensors* 1:1011–1019 (2016)

[8] *Nature Biomedical Engineering* 1: 0040 (2017)

Biopsy without the knife. Skin cancer is the most common type of cancer in the U.S. and many types of skin cancer are highly treatable if detected early. NIBIB-supported researchers have developed a non-invasive imaging technique that accurately detects skin cancer without surgical biopsy, making diagnosis potentially faster and identifiable at earlier stages of the disease. This new system involves simply looking through a special laser microscope directly at the patient's skin and determining whether it appears to be cancerous or not. In normal cells, the mitochondria (parts of a cell that produce energy) are spread throughout the cell in a web-like pattern, while cancerous skin cells show a very different pattern with the mitochondria found in clumps or clusters typically at the center of the cell along the border of the nucleus. In this study, the technique was tested in 10 patients with skin cancer (melanoma or basal carcinoma) and four who did not have skin cancer. The imaging technique results were compared to the traditional biopsy results obtained from each patient.[9] The results demonstrated that the imaging technique correctly identified skin cancer in all 10 cancer patients, and made no false diagnoses in the four individuals without skin cancer. This new approach could allow a doctor to make a quick diagnosis during a patient visit and begin treatment immediately, which could lower risk and health care costs associated with these common types of cancers.

Laser pulses drum up sharp images of organs. While photoacoustic imaging has been available for years, a new technique uses lasers (source of photons) to create detailed images of working organs in live animals by measuring acoustic signals that are generated from the laser light. It works by using light (photo) from a laser to penetrate up to a few inches deep in tissue. The heat from the laser creates sound (acoustic) waves through a process known as thermal expansion. Then, an ultrasonic detector absorbs the sound waves and creates images from those signals using computer software. Different types of tissue in the body create sound waves with different frequencies which results in detailed images. Sound waves do not scatter as much as light waves, so they produce sharp high-quality images of tissue. The method allows for complete internal body scans with high enough resolution to see active organs, circulating cancer cells, and brain function in real-time.[10] This technique is practical for extended scans and could be used to study biological processes that occur over longer time scales. An example of this use might be monitoring the effects of an experimental drug or gaining a better understanding of metastasis by tracking cancer cells circulating in the blood. Initially this technique could prove useful for visualizing biological processes for basic research, and eventually for clinical applications.

[9] *Science Translational Medicine* 8:367ra169 (2016)
[10] *Nature Biomedical Engineering* 1:0071 (2017)

Program Portrait: Contrast agents helping to see and evaluate tumors

It is well established that medical imaging such as MRI has revolutionized health care. This procedure to noninvasively see tumors, tissue, and other structures inside the body has made exploratory surgery almost unnecessary. To improve images, dyes that contain metallic ions, or contrast agents, are sometimes used in imaging scans to show different anatomy, pathology, or injuries more distinctively. The dyes are designed to circulate within blood or attach to proteins on specific types of cells, such as a solid tumor. These agents have been instrumental in helping to detect abnormalities or diseases at early stages that otherwise would be invisible when imaging without the contrast agent. For some specific groups of patients, the metallic dyes have been known to remain in the body longer than needed and can't be used for those with a complicating disorder such as kidney disease or a severe allergy to currently available agents. Researchers are developing a new organic metal-free contrast agent that is safer for more patients and produces an enhanced MRI image of tumors. In an animal study, an agent was developed with a safer organic compound that will accumulate in tumors but not in other parts of the body and could be used in a broader population of patients.[11]

Another challenge in cancer diagnosis using imaging, especially in prostate cancer, is the ability to differentiate high-risk tumors that need treatments from those low-risk tumors that do not require treatment. To overcome this challenge, a research team engineered a small peptide that binds to a protein found in high-risk prostate cancers. By linking the peptide to a clinically used MRI contrast agent, the group used MRI to identify aggressive, metastatic tumors in mouse models of prostate cancer. This approach is a promising step for reliable early detection and treatment of a high-risk, life-threatening cancer. The tests in the mouse models revealed that a significant amount of the agent rapidly bound to aggressive prostate tumors that produced a high MRI signal within 10 minutes following injection; while little to no MRI signal was detected in the low-grade prostate tumor cells.[12] In addition, the system could also be used to routinely and non-invasively monitor patients with slow-growing tumors for any changes in the aggressiveness of their tumors over time. Research is also underway to test the ability of the agent to not only locate early stage breast cancer but to distinguish aggressive cancer cells from slower growing cells.

Technological Competitiveness-Bridging the Sciences

To ensure a technologically competitive workforce that can accomplish its mission, NIBIB supports training across the career continuum. Programs focus on interdisciplinary training that will cultivate investigators who are able to bridge the quantitative sciences with biology and medicine. Programs are designed to increase the number of clinician-scientists and enhance the participation of underrepresented populations in biomedical imaging and bioengineering research. NIBIB also supports efforts to bridge the gap between research and commercialization, and highly focused interdisciplinary approaches to solve major medical problems or to resolve technology-based medical challenges.

One strategy to encourage young investigators is NIBIB's Trailblazer program. This mechanism is designed to support new and early stage investigators as they embark on their independent research careers. This opportunity provides the resources needed to pursue a new or emerging research program. NIBIB has received tremendous interest in this program since its inception in September 2016.

[11] *ACS Central Science* 3:800-811 (2017)

[12] *Bioconjugate Chemistry* 28:1031-1040 (2017)

Program Portrait: Engaging the next generation of researchers

Supporting and nurturing undergraduate students is one way to engage the next generation of researchers. The Design by Biomedical Undergraduate Teams (DEBUT) Challenge is another example of a partnership that encourages students to learn and work in a team environment to solve real world healthcare problems. DEBUT challenges teams of at least three undergraduate students to develop prototypes of devices that advance technology with the goal of improving human health. The creative approaches in this year's challenge seek to improve the diagnosis and treatment of a broad range of problems including: a low-cost portable device for early diagnosis of Alzheimer's disease before clinical symptoms are apparent; a device to digitize a brain mapping process used during awake brain surgery to mark areas that control critical functions; a device that improves the insertion of healthy cornea grafts to replace damaged tissue; a rapid paper-based test that uses a simple urine sample to diagnose latent tuberculosis; and a comfortable and discreet nasal dilator that can be inserted into obstructed nostrils to open the airways and facilitate breathing. This past year, 41 teams representing 22 universities from 16 different states participated in the DEBUT Challenge. This ongoing Challenge is leading to tangible results. A previous winner obtained FDA-approval and recently commercialized a device used to measure lung function to diagnose and monitor respiratory diseases.

Health Informatics Technology (HIT)

NIBIB supports research in health information technology, biomedical informatics, image processing, and visual perception research programs. This division also supports trans-NIH and Government-wide activities in health informatics, a field that integrates computer and information science with clinical science to improve health care.

Analyzing large datasets to improve patient care. Death rates from brain cancer have not been reduced significantly for over 25 years[13] despite advances in our knowledge about the biology, diagnosis, and treatment of this type of cancer. This is due, in part, to the lack of accurate pre-treatment information about the precise size of tumors, especially those that are difficult to detect. To address this problem, NIBIB-supported scientists are developing new software tools to improve the detection and analysis of brain tumors in MRI imaging scans. The tools are being designed so that they will be widely available to other researchers. The tools will provide an accurate, objective, and consistent means for distinguishing brain tumors from surrounding abnormal tissue such as dead brain cells. This will help doctors provide more precise radiotherapy, surgery, and follow-up treatment.

Improving ultrasound with augmented reality technology. Researchers are optimizing the use of ultrasound systems in emergency situations at the point-of-care. A group of engineers have developed systems that contain embedded computer algorithms that simplify acquiring and interpreting ultrasound images. The technology turns simple imaging devices into intelligent diagnostic systems to meet the demands of urgent care by emergency medical technicians (EMTs). The group has recently developed a system that employs augmented reality. The sophisticated system uses tracking and artificial intelligence to project a video image onto the patient. The image on the patient guides the user's movement of the ultrasound probe to more rapidly find areas of internal bleeding, help accurately insert a needle, or find a foreign object in a patient. This type of on-the-spot ultrasound could be a powerful tool to help EMTs save lives.

[13] Cancer Stat Facts, https://seer.cancer.gov/statfacts/html/brain.html

Intramural Research Program (IRP)

The Intramural Research Program supports NIBIB's mission to integrate bioengineering with the life and physical sciences, conducting research across basic, translational, and clinical science and conducting effective training programs in related fields. Researchers are working to create optical imaging technologies that provide unprecedented combinations of high resolution and speed to study living cells in real time. Others create "theranostic" imaging probes—based on nanomaterials—that combine therapeutic and diagnostic capabilities to improve early diagnosis, monitor therapeutic responses, and guide drug discovery and development. Still others are collaborating to create the world's first complete 3D video atlas of neurodevelopment—from egg to adult—in the model organism *C. elegans* to accelerate basic research for understanding neurological disorders.

Improving diagnostic capability. Researchers at NIBIB developed a new radiotracer to diagnose prostate cancer and completed a successful Phase I clinical trial with a small group of patients to establish safety and identify possible side effects. While prostate cancer is relatively easy to treat in its initial stages, it is difficult to diagnose, is prone to metastasis, and can quickly become deadly. The research team developed a radiotracer that could identify prostate cancer at all stages and help determine the best course of treatment. This new tracer is one of the first dual-receptor target tracers, or tracers that target more than one biomarker, to be studied in humans.[14] This new method greatly improves on the current practice that can lead to many false positive results and cause the patient to undergo unnecessary treatments or painful biopsies.

High speed, high resolution microscopy. By devising a simple, elegant solution, NIBIB researchers are improving the speed, resolution, and light efficiency of an optical microscope that produces high resolution images at unprecedented speed. Why does this matter? These types of improvements in microscopy are vital for studying living organisms. For example, being able to see how a virus enters a cell, or how a neuron develops, will increase our understanding of how diseases develop and help find more effective ways for treatment and prevention. In traditional microscopes most of the light is scattered, and therefore requires more light and a much longer time to acquire a clear picture. The longer light exposure damages the tissue sample and it is no longer useful for observing biological processes. This latest microscope uses mirrored coverslips, which allows the sample to be seen not only by the lenses themselves, but, like looking in a mirror with a camera, they record the reflected images of the sample provided by the mirror. Computer processing software developed with a collaborator on the project is used to identify and remove the unwanted background in the conventional and mirrored images and rapidly produce a much clearer image. Using the mirrored coverslips in conjunction with the computer software, the team improved the speed two-fold and almost doubled the resolution compared to a previous version of microscope.[15] The researchers hope that in the future this technique may be adapted to improve other forms of microscopy.

[14] *Journal of Nuclear Medicine* 58:228–234 (2017)

[15] *Nature Methods* 14:869–872 (2017)

Research Management and Support (RMS)

RMS activities provide administrative, budgetary, logistical, and scientific support in the review, award, and monitoring of research grants, training awards, and research and development contracts. RMS functions also encompass strategic planning, coordination, communication, and evaluation of the Institute's programs, regulatory compliance, international coordination, and liaison with other Federal agencies, Congress, and the public.

As part of NIBIB's communication efforts in the past year, the Institute launched two apps for mobile devices. The first, Understanding Medical Scans, explains what to expect during a medical imaging scan and how scans can help with both diagnosis and treatment. The question-based navigation, images, and videos in the app makes medical imaging information easily accessible. The second app, called Surgery of the Future, is an interactive experience that highlights how NIBIB-funded research could make surgery safer, more effective, and less invasive. These tools are one of many approaches to help educate and inform the public about the research supported by NIBIB.

NATIONAL INSTITUTES OF HEALTH
National Institute of Biomedical Imaging and Bioengineering

Detail of Full-Time Equivalent Employment (FTE)

OFFICE/DIVISION	FY 2017 Final			FY 2018 Annualized CR			FY 2019 President's Budget		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
Extramural Science Program									
Direct:	23	-	23	23	-	23	23	-	23
Reimbursable:	2	-	2	2	-	2	2	-	2
Total:	25	-	25	25	-	25	25	-	25
Intramural Science Program									
Direct:	23	-	23	23	-	23	23	-	23
Reimbursable:	5	-	5	5	-	5	5	-	5
Total:	28	-	28	28	-	28	28	-	28
Office of Administrative Management									
Direct:	27	-	27	27	-	27	27	-	27
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	27	-	27	27	-	27	27	-	27
Office of Research Administration									
Direct:	19	-	19	19	-	19	19	-	19
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	19	-	19	19	-	19	19	-	19
Office of the Director									
Direct:	4	-	4	3	-	3	3	-	3
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	4	-	4	3	-	3	3	-	3
Total	103	-	103	102	-	102	102	-	102
Includes FTEs whose payroll obligations are supported by the NIH Common Fund.									
FTEs supported by funds from Cooperative Research and Development Agreements.	0	0	0	0	0	0	0	0	0

FISCAL YEAR	Average GS Grade
2015	12.6
2016	12.5
2017	12.9
2018	12.9
2019	12.9

NATIONAL INSTITUTES OF HEALTH
National Institute of Biomedical Imaging and Bioengineering

Detail of Positions[1]

GRADE	FY 2017 Final	FY 2018 Annualized CR	FY 2019 President's Budget
Total, ES Positions	0	0	0
Total, ES Salary	0	0	0
GM/GS-15	17	17	17
GM/GS-14	23	23	23
GM/GS-13	17	17	17
GS-12	8	8	8
GS-11	3	3	3
GS-10	2	2	2
GS-9	3	3	3
GS-8	0	0	0
GS-7	6	6	6
GS-6	0	0	0
GS-5	0	0	0
GS-4	0	0	0
GS-3	0	0	0
GS-2	0	0	0
GS-1	0	0	0
Subtotal	79	79	79
Grades established by Act of July 1, 1944 (42 U.S.C. 207)	0	0	0
Assistant Surgeon General	0	0	0
Director Grade	0	0	0
Senior Grade	0	0	0
Full Grade	0	0	0
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Subtotal	0	0	0
Ungraded	36	35	35
Total permanent positions	79	79	79
Total positions, end of year	115	114	114
Total full-time equivalent (FTE) employment, end of year	103	102	102
Average ES salary	0	0	0
Average GM/GS grade	12.9	12.9	12.9
Average GM/GS salary	116,675	118,950	119,973

[1] Includes FTEs whose payroll obligations are supported by the NIH Common Fund.