As the Director of the National Institutes of Health (NIH), I am pleased to present the Congressional Justification of the NIH fiscal year (FY) 2017 budget request. This budget request for a $33.136 billion total program level reflects the President's and the Secretary's dedication to improving the health and wellness of all Americans, as well as the Administration's commitment to ensuring the country's place as the global leader in biomedical science. The request articulates NIH's focus on basic research to identify underlying causes of disease, as well as bold new efforts to translate basic science discoveries into effective interventions. The Agency is capitalizing on advances in big data and technology to improve diagnostics, treatments, and preventive approaches. NIH also remains committed to further developing and supporting a diverse and talented biomedical research workforce. The investments outlined herein will enable NIH to remain on the cutting edge of scientific breakthroughs that deliver on our mission – to enhance health, lengthen life, and reduce illness and disability.

The recently released NIH-Wide Strategic Plan (Fiscal Years 2016-2020) describes the Agency's dedication to planning and priority setting in order to serve as a responsible steward of the public funds with which it is entrusted. The emphasis on stewardship is intertwined throughout this budget request, articulating how NIH strives to manage our resources and cultivate our role as a leader in biomedical research and policy across the country and around the world. Prudent resource management also is reflected in the Agency's priority setting process. Through a deliberative balance of supporting highly meritorious research while addressing public health needs, NIH remains poised to take advantage of emerging scientific opportunities, including the unique opportunities presented by rare diseases. These processes afford the flexibility to respond urgently to public health crises, and to fund exceptionally innovative, investigator-initiated ideas.

The budget request also discusses some of the most exciting scientific research areas that NIH plans to support in FY 2017. Advances and further investment in basic science promise to revolutionize how we view microscopic particles and image various parts of the body; explain how brain circuits interact in time and space (the BRAIN initiative); and provide new understanding of how cells and organ systems work. Bridging both basic and translational research, the President's Precision Medicine Initiative offers the opportunity to usher in a new era of medicine in which researchers, providers, and participants work together to develop individualized treatment and prevention strategies. Instead of recommending a treatment based on how the average person might respond, precision medicine takes into account individual variability in genes, environment, and lifestyle, which can be used to select a targeted therapy for each person that may be more effective than the "average" option. Robust investment in emerging technologies will facilitate the success of precision medicine and other areas of bioscience.

Capping off the new initiatives, and with passionate and principled leadership from the Vice President, the National Cancer Moonshot will work to accelerate cancer research efforts and break down barriers to progress by enhancing data access and facilitating collaborations. The initiative focuses particularly on cancer immunotherapy, and aims to make more therapies available to more patients while also improving our ability to prevent cancer and detect it at an early stage.

The FY 2017 budget request represents an extraordinary opportunity for NIH to advance biomedical research in ways not previously possible. By capitalizing on groundbreaking advances in science and technology, and judiciously leveraging new research investments, biomedical science is poised to make substantial gains in diagnosing, treating, and preventing disease. I look forward to discussing the FY 2017 budget request and NIH's plans for the future.

Francis S. Collins, M.D., Ph.D.

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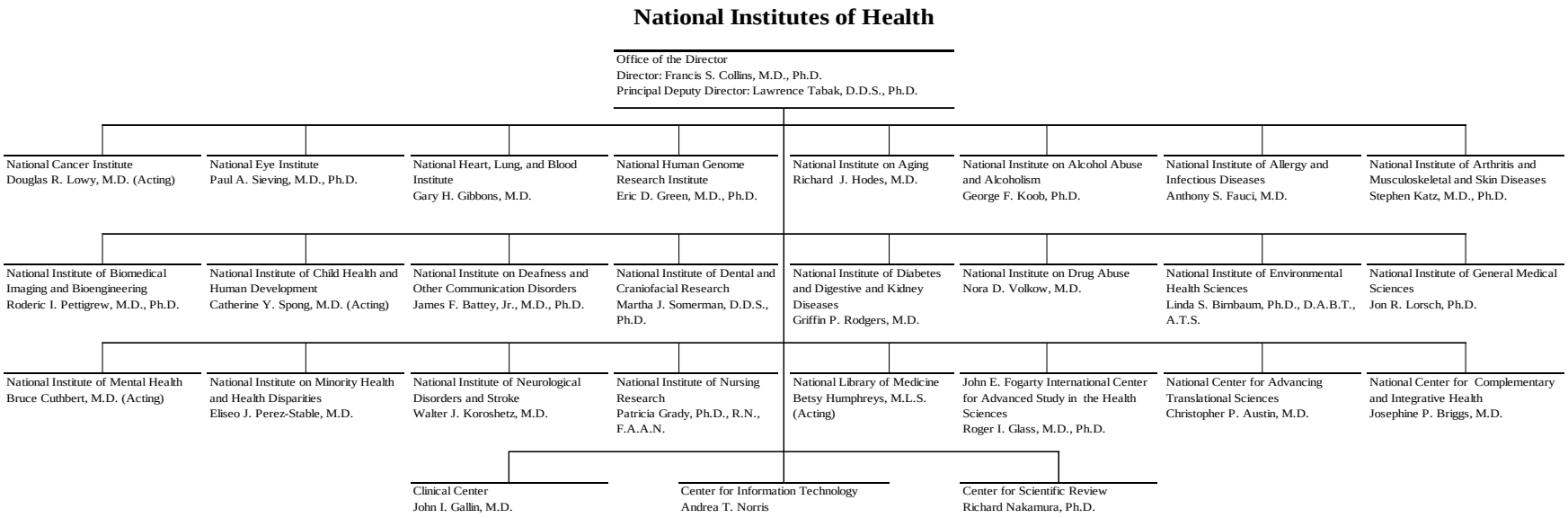

INTRODUCTION AND MISSION

The mission of the National Institutes of Health (NIH) is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability. In pursuit of this mission, NIH conducts or supports research designed to understand the basic biology of human health and disease; apply this understanding towards designing new approaches for preventing, diagnosing, and treating disease and disability; and ensure that these new approaches are available to all.

As the Nation's medical research agency and the largest source of funding for biomedical and behavioral research in the world, NIH plays a unique role in turning basic scientific discovery into improved health. A significant and enduring investment by NIH in basic research today assures the breakthroughs in the health care of tomorrow, and NIH's translational research aims to enhance the health of each individual. This robust research enterprise depends upon NIH's ability to recruit and retain the brightest minds into successful scientific careers. With continued support, NIH contributes significantly to the economic engine that drives American competitiveness in science and technology in pursuit of advances that will lead to a Nation in which all Americans enjoy long healthy lives.

ALL PURPOSE TABLE

(Dollars in Thousands)[1]	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget[2]	Request +/- FY 2016 Enacted
Total, NIH Program Level	**$30,311,349**	**$32,311,349**	**$33,136,349**	**$825,000**
Less mandatry and funds allocated from different sources:				
Mandatory Type 1 Diabetes Research	-150,000	-150,000	-150,000	0
PHS Program Evaluation	-715,000	-780,000	-847,489	-67,489
Cancer Initiative Mandatory Financing			-680,000	
Other Mandatory Financing			-1,145,000	
Total, NIH Discretionary Budget Authority	**$29,446,349**	**$31,381,349**	**$30,313,860**	**-$1,067,489**
Interior Budget Authority	-77,349	-77,349	-77,349	0
Total, NIH Labor/HHS Budget Authority	**$29,369,000**	**$31,304,000**	**$30,236,511**	**-$1,067,489**
Number of Competing RPGs	*9,540*	*10,753*	*9,946*	*(807)*
Total Number of RPGs	*34,379*	*35,840*	*36,440*	*600*
FTEs	*17,824*	*18,000*	*18,000*	*0*

[1] Excludes Ebola-related funding.

[2] Includes mandatory financing.

OVERVIEW OF BUDGET REQUEST

For FY 2017, NIH requests a total program level of $33.1 billion, which is $825 million more than the FY 2016 Enacted level. This funding request will enable NIH to continue seeking fundamental knowledge about living systems and to translate that knowledge into ways to enhance health, lengthen life, and reduce illness and disability. Since its humble beginnings as a one-room laboratory 130 years ago, the impact of NIH-funded research on the health of all Americans has been truly remarkable. Due in large measure to NIH-funded research, a baby born in the United States today can expect to live to be almost 79 years old – about three decades longer than one born in 1900.[1] The Centers for Disease Control and Prevention (CDC) asserts that much of the recent improvement in life expectancy in the United States can be attributed to reductions in death rates from major causes of death, such as heart disease, cancer, stroke, and chronic lower respiratory diseases.[2] While heart disease remains the leading cause of death in the United States, the death rate from heart disease fell approximately 36 percent from 1999 to 2013.[3] Similarly, cancer death rates have been dropping more than one percent annually for the past 15 years (annual decline of 1.8 percent for men and 1.4 percent for women).[4] Likewise, HIV/AIDS treatments have extended lives greatly, and emerging strategies are enabling us to envision the first AIDS-free generation in 30 years.

A healthier Nation also results in a healthier economy, and every dollar invested by NIH multiplies the Nation's investment. For cancer alone, improvements in treatment and survival rates yield substantial economic value, estimated at nearly $500 billion in savings to current and future generations for every one percent decline in cancer deaths.[5]

NIH's exemplary record of scientific discovery is rooted in its steadfast support of basic research, its flexibility to take advantage of scientific opportunities and respond to emerging public health needs, and its careful stewardship of the resources provided by the American public. To continue in the pursuit of cutting-edge advances at the frontier of biomedical research, in FY 2017, NIH will focus on the following priority themes:

1. Foundation for Discoveries: Basic Research
2. The Promise of Precision Medicine
3. Applying Big Data and Technology to Improve Health
4. Stewardship to Inspire Public Trust

By using these themes to guide strategic investments, NIH will continue to drive biomedical discovery and innovation in the United States, maintain the country's competitive edge as a global leader in research, bolster the U.S. economy, and ultimately make significant inroads in improving the health of the Nation.

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[1] http://www.cdc.gov/nchs/fastats/deaths.htm.
[2] Ibid.
[3] CDC WONDER Compressed Mortality Data, 1999-2013. http://wonder.cdc.gov/mortSQL.html
[4] Jemal A, Simard EP, Dorell C, et al. Annual Report to the Nation on the Status of Cancer, 1975–2009, Featuring the Burden and Trends in HPV-Associated Cancers and HPV Vaccination Coverage Levels. *J Natl Cancer Inst.* 2013 Feb 6;105(3):175-201.
[5] Murphy KM and Topel RH. The Value of Health and Longevity. *Journal of Political Economy*, 2006, 114(5).

Cutting across these themes, NIH requests $680 million in FY 2017 for the National Cancer Moonshot. With passionate and principled leadership from the Vice President, and in partnership with the Food and Drug Administration and other Federal agencies, the National Cancer Institute (NCI) will launch a bold and promising cancer research initiative to make broad advances across a range of exciting opportunities to prevent, diagnose, and treat cancer. In addition to the FY 2017 investment, NCI will also begin the initial work on components of this effort during FY 2016. The initiative has many important facets, including broad engagement across the cancer research and oncology community, and engagement with many other partners and stakeholders to make progress against all forms of cancer.

The elements of the FY 2017 Cancer Research Initiative include:

- developing new techniques to detect cancer earlier
- developing new vaccines to prevent cancer-causing infections and vaccines to target genetic changes that can cause cancer
- expanding recent successes in cancer immunotherapy to a much wider range of tumor types
- expanding research on mutations that drive cancer and determine how cells respond to cancer
- accelerating progress on detecting and treating childhood cancers
- fostering enhanced data sharing to speed discovery and verify treatment response
- funding other promising opportunities in cancer discovery, prevention, and treatment

Theme 1: Foundation for Discovery: Basic Research

NIH invests more than half of its resources in basic biomedical research. Basic research provides the foundational knowledge of the mechanisms of biology and behavior necessary to understand the causes of disease onset and progression, to identify risk factors and biological markers that allow for better diagnostics, and to develop new cures and preventive treatments. Often, this foundational knowledge is built in increments that eventually lead to major breakthroughs, but it also provides essential groundwork for tackling newly emerging infectious diseases or complex chronic diseases that are increasing rapidly in burden. Investments in basic research will continue to yield inestimable rewards and benefits to public health. Because the private sector spends the vast majority of its research dollars on translational and clinical research, NIH spending on basic research is a critical balancing factor for the health of the overall national research enterprise. Therefore, fostering a broad basic research portfolio is critical for the NIH mission. This section highlights a few examples of NIH-supported basic research activities and initiatives providing the foundation for future medical and technological advances in FY 2017 and beyond.

Advances in Microscopy

Advances in imaging techniques are giving scientists a window to observe molecular interactions with extraordinary detail. For example, NIH-funded researchers recently used cryo-electron microscopy (cryo-EM) to view, in near-atomic detail, the configuration of an enzyme while it is bound to a drug that blocks the enzyme's activity. Enzymes are typically proteins that catalyze biochemical reactions in the cell, and understanding the detailed structure of an enzyme can help enable scientists to design new drugs that change the enzyme's function to treat a disease, much like understanding the detailed structure of a lock might allow the design of a key. Other

techniques used to determine molecular structure, such as x-ray crystallography, require conditions which could alter the structure, and therefore might give inaccurate information. But cryo-EM permits researchers to see the protein in a nearly natural state by flash-freezing the sample so the water around the protein remains liquid-like, preventing the formation of damaging ice crystals. Determining accurate protein structures allows for more reliable drug design and development methods.

Another application of this type of NIH-supported basic research is shedding light on how to develop therapies to target rapidly mutating viruses. Single particle electron microscopy, related to the technique described above, is an imaging approach now being used in Ebola vaccine development. Researchers have determined how the antibodies in a powerful Ebola drug, called ZMapp, attach to the surface of the Ebola virus. The images revealed that some of them can prevent Ebola from invading a host cell, while others act as a beacon, alerting the host immune system that the virus is present and must be destroyed. This basic structural biology experiment provided the scientific rationale for ZMapp as an effective Ebola treatment, currently being tested in clinical trials. These methods can be used for many other diseases, and FY 2017 investments will explore using these techniques for future drug development.

BRAIN Initiative

The Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative continues to address basic neuroscience questions. A collaboration with the National Science Foundation, the Defense Advanced Research Projects Agency (DARPA), the Intelligence Advanced Research Projects Activity, the Food and Drug Administration (FDA), and industry partners, this program is developing and using technologies to produce a clearer, more dynamic picture of how individual cells and neural circuits interact in time and space. Measuring activity at the scale of neural networks in living organisms has the potential to decode sensory experience, memory, emotion, and thought. Furthermore, these developing technologies may help reveal the underlying pathology in various brain disorders and provide new therapeutic avenues to treat, cure, and prevent neurological and psychiatric conditions.

To guide the BRAIN Initiative, a working group of the NIH Advisory Committee to the Director (ACD) developed a plan, released in June 2014, which outlines scientific goals, a timetable, milestones, and a cost estimate for FYs 2016-2025. According to the working group recommendations, accomplishing the ambitious goals of this Initiative will require significant increases in investment. BRAIN will be supported by an NIH total budget of $195 million, an increase of $45 million for FY 2017. The increased funds will continue to support basic neuroscience research, human neuroscience, neuroimaging, and training initiatives, as well as potential projects to collaborate with industry to test novel devices in the human brain, new ways to address big data from the brain, and developing devices for mapping and tuning brain circuitry.

Human Placenta Project

The placenta is arguably one of the most important but most neglected organs in the human body. It influences the health of a woman and developing fetuses during pregnancy and affects

the lifelong health of both. Despite this, understanding of the biology of the placenta is very limited. Although some foundational knowledge has resulted from ultrasound exams, blood tests, and examining placental tissue after delivery, countless questions about placental development and function remain. Focusing attention on these basic research questions will enhance understanding of the organ's role in overall health and disease. In FY 2015, NIH launched the Human Placenta Project, a collaborative initiative to understand normal and abnormal placental development, identify biomarkers that predict adverse pregnancy outcomes, and examine the effects of environmental factors on the placenta. Moreover, researchers will be encouraged to develop technologies or innovative applications of existing technologies to assess the structure and function of the human placenta in real time, monitor placental health during pregnancy, and design interventions to prevent abnormal placental and fetal development. In fact, researchers already have developed a tiny device that mimics the functions of the placenta outside the body to enable more rapid and cost effective studies of the placenta. These and other technologies will contribute to the fundamental understanding of how the placenta receives blood and oxygen, attaches to the uterine wall, and conveys nutrients to the fetus. This new knowledge will lead to improved maternal, prenatal, and neonatal health.

Theme 2: The Promise of Precision Medicine

Turning basic science discoveries into applications for health is a high priority for NIH. To this end, President Obama announced the Precision Medicine Initiative® (PMI) in January 2015. Capitalizing on the alignment of scientific opportunities created by advances in genomics, the widespread adoption of electronic health records, the recent revolution in mobile health technologies, and the emergence of computational tools for analyzing large biomedical data sets, precision medicine could usher in a new era in how we treat and diagnose disease. Historically, physicians have generally had to use a one-size-fits-all approach to make recommendations about disease prevention and treatment based on the expected response of the average patient. Precision medicine takes into account individual variability in genes, environment, and lifestyle for each person. NIH has a leading role in the multi-agency PMI, with a specific $200 million budget in FY 2016, as well as an additional $100 million requested in FY 2017 to support NIH's efforts. The $100 million increase in FY 2017 will continue the ramp-up of the cohort toward one million or more volunteer participants. These funds will support several related activities: 1) informatics; 2) building a biorepository; 3) enrolling and consenting participants; 4) staffing; 5) genome analysis; and 6) core phenotyping. This additional funding is critical to achieving the planned scope of PMI.

National Research Cohort

PMI has two major research aims, both of which are progressing at a rapid pace. The first major research aim of the PMI is the development of a national research cohort of one million or more U.S. volunteers. Increasingly, individuals are interested in taking part in biomedical research and their own health care decision-making, and they will be valuable partners both in developing the framework for sharing their biological, environmental, and lifestyle data, as well as their electronic health records, and in advancing effective treatments and prevention measures. This may be facilitated by new mobile technology platforms. Due to the personal and confidential nature of the data to be collected and shared, focused attention will be paid to ensuring

appropriate data protections for the cohort participants. A cohort of this size will capture data on a wide range of diseases and be large enough to detect genetic and environmental effects that are difficult to discern among smaller groups of people. Scientists will be able to use data from this cohort to identify trends and understand health and disease on a much larger scale that will lead to new ideas for diagnostic tests, treatment options, medical devices, and prevention strategies. With FY 2016 funds, NIH issued several PMI Cohort Program funding opportunities to build a solid infrastructure for the PMI Cohort Program, including a national coordinating center, biobank, network of participating healthcare provider organizations, direct volunteer enrollment, and participant mobile technologies. In November 2015, NIH launched a search for a PMI Cohort Program Director and assembled an external Advisory Panel to guide the PMI Cohort Program over the next several years. FY 2017 funds will be used to continue the implementation of this bold initiative to build a research resource that will be a national treasure trove of information for decades to come.

Precision Medicine Initiative for Oncology

Accelerating the field of precision medicine in oncology is the PMI's second research aim. The National Cancer Institute (NCI) is devoting $70 million in FY 2016 funding to the Precision Medicine Initiative for Oncology (PMI-O). The PMI-O seeks to expand significantly on current efforts in cancer genomics to inform prognosis and treatment choice for people with cancer, as well as to enhance precision screening and prevention approaches. A central component of the PMI-O involves expanding support for clinical trials that select targeted drug therapy based on a patient's molecular abnormalities (rather than on the site of the tumor's origin) when standard therapy is not effective. Enhanced precision oncology clinical trials will perform genomic analyses on individual tumors to discern what gene mutations are driving the malignancy. The genomic information will be matched with available targeted drugs provided by pharmaceutical industry partners to optimize responses for the individual. This strategy is already being tested in NCI's Molecular Analysis for Therapy Choice (NCI-MATCH) clinical trial, launched in 2015 and involving participants with a range of cancer types. A similar trial, Pediatric MATCH, expected next year, will test this approach in children with cancer.

Other important components of the PMI-O include intensive efforts to understand the molecular basis of single agent cancer treatment resistance and to overcome resistance through a combination of therapies; to significantly expand the number of available human cancer models through genomics-based preclinical studies; and to build a national information platform or database to support the integration of genomic information with clinical responses and outcomes for use by scientists and other professionals. FY 2017 funding continues at $70 million and will support the continuation and expansion of these and other similar precision oncology research projects.

Enabling Current Advances in Precision Medicine

Although the Precision Medicine Cohort is still in development, NIH already is engaged in research related to precision medicine for many diseases, and in FY 2017, NIH will support initiatives across its Institutes and Centers (ICs) to take advantage of this unprecedented opportunity. For example, the National Heart, Lung, and Blood Institute recently launched its

Trans-Omics for Precision Medicine (TOPMed) program. TOPMed combines whole-genome sequencing and molecular measurements (e.g., metabolites, proteins, RNA) with behavioral, environmental, and clinical data, to facilitate discovery of factors that may affect individual risk for heart, lung, blood, and sleep disorders.

In another example, as mental health research moves toward understanding the underlying biology affecting normal and abnormal behavior, we may be able to identify subgroups of individuals with these brain circuit disorders through converging data from biological, behavioral, familial, cultural, and environmental factors. This is the aim of the National Institute of Mental Health's Research Domain Criteria project, which will develop more precise diagnostic categories that could lead to better, more individualized treatment for mental health disorders. Similarly, the National Institute on Alcohol Abuse and Alcoholism has launched a new program to develop the Alcohol Addiction Research Domain Criteria (AARDoC) framework to better understand and address the biological, cognitive, and behavioral factors that cause individual variation in alcohol misuse and alcohol use disorders.

NIH also plans to support research to explore the promise of precision medicine to improve minority health and reduce or eliminate health disparities. The first wave of these awards, anticipated in FY 2016, will create Transdisciplinary Collaborative Centers to use innovative approaches that combine population science – which focuses on reducing the burden of disease through translation, implementation, and dissemination – with precision medicine. Research projects will examine the relationship between biological, behavioral, social, and environmental predictors of disease susceptibility, and patients' responses to different therapies. All of these efforts will help realize the goal of precision medicine: getting the right treatment to the right person at the right time.

Theme 3: Applying Big Data and Technology to Improve Health

As biomedical science generates larger and more complex datasets through precision medicine and other research projects, it is increasingly important to develop methods for storing, organizing, and analyzing these datasets. Utilizing optimal data methods could enable researchers to gain insights into heretofore unidentified relationships among genes, environment, and behavior that may help explain susceptibility to and progression of disease. These bioinformatics methods stand at the intersection of biomedical science and cutting-edge computing and use innovative, trans-disciplinary thinking to provide new insights into basic science and to envision new strategies for disease diagnosis, prevention, and treatment. Understanding how to glean insights into these vast amounts of data will be key to driving advances in precision medicine and all areas of disease research. In addition to innovations in data science and computing, NIH also is leveraging rapid growth in the technology sector to spur technological innovation to improve biomedical research and practice.

Big Data Initiatives

All NIH ICs support the Big Data to Knowledge (BD2K) initiative, which has expanded since its inception in 2012. This program now includes 11 Centers of Excellence for Big Data Computing as well as NIH-funded scientists across the country working to develop new software, methods,

and other solutions to solve the puzzles presented by collecting, analyzing, and sharing large biomedical datasets. In FYs 2014-2015, NIH issued several funding announcements designed to bring together experts in disparate fields to develop, optimize, and disseminate technologies for biomedical computing, informatics, and big data science. The BD2K program also aims to make data accessible for widespread use and to maximize community engagement. To that end, in FY 2015, NIH issued a funding announcement to develop interactive digital media that uses crowdsourcing to engage the public in analyzing biomedical research.

NIH also is committed to data science training within the biomedical research workforce with programs like the NIH Data Science Workforce Development Center, which will include both online and in-person courses that allow researchers to upgrade their data skillset. In addition, as part of the BD2K program, NIH currently sponsors grants that support the development of data training resources and the training of big-data-literate scientists who will be positioned to become the next generation of cutting-edge researchers. In FY 2017, NIH will continue to invest in methods and technologies for big data computing, as well as continued training resources for the growing workforce needs in this area.

mHealth: Leveraging Mobile Technology to Improve Health and Health Research

In recent years, mobile technology has developed at an exponential rate, with more than 7 billion cellular phone subscriptions worldwide as of 2014.[6] A 2013 Pew survey found that, in the United States, 91 percent of adults have a mobile phone, and 58 percent have a smart phone.[7] Research has shown a growing interest in using phones and related devices to obtain health information, and there is a fast-growing market for smart phone "apps" that track health and fitness. This movement towards using personal electronics for health applications, called "mHealth," presents an opportunity to advance research and diagnostics, prevent disease, reduce disparities, and increase access to health care services and information. NIH is committed to using mobile technology to improve research and health care, while maintaining rigorous standards for evaluating the information and utility they provide.

For example, mHealth shows great promise for encouraging healthy behaviors that could reduce obesity, but recent studies found that most commercially available weight loss interventions did not use minimally best practices.[8] NIH currently funds work on creating sensors and activity measures for mobile applications that accurately measure energy metabolism and diet, both through extramural funding opportunities and the Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) program. NIH also supports work on mobile applications that can monitor markers of health and disease, improve adherence to treatment regimens, provide medical information, and support the treatment of substance abuse. In addition, mHealth offers the opportunity for collecting and storing an abundance of real-world data about the behavior and health of consenting individuals in a clinical trial, without participants having to report to a researcher in-person on a regular basis. NIH is working to

[6] http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx
[7] Duggan, M. *Cell Phone Activities 2013*. PewResearchCenter Sept 2013. http://www.pewinternet.org/2013/09/19/cell-phone-activities-2013/
[8] Pagoto et al. Evidence-Based Strategies in Weight-Loss Mobile Apps. Am. J. Prev. Med. 2013

develop new sensors and validate existing commercial sensors, and exploring possibilities for recruiting and monitoring clinical trial subjects remotely through their mobile devices.

The Future of the National Library of Medicine

As part of its efforts to build data infrastructure that will support the future of biomedical research, NIH has conceived a long-term scientific vision for the National Library of Medicine (NLM) as a unifying force in biomedicine that promotes and accelerates knowledge generation, dissemination, and understanding in the United States and internationally. In the past, the NLM has been at the forefront of the collection, sharing, and analysis of biomedical and health information, and the NLM pioneered free Internet access to published biomedical literature (PubMed), genetic and genomic data, clinical trial registration and results, and NIH-funded biomedical research as part of the Public Access Policy. NLM's PubMed/MEDLINE is now the most frequently used scientific and medical database in the world, with more than 700 million visits in 2014 by researchers, medical practitioners, and the general public accessing more than 22 million available journal citations. NLM also is engaged in advanced R&D on biomedical informatics through the National Center for Biotechnology Information (NCBI), which received direct funding through FY 2016 appropriations to better address the increasing challenges of collecting, organizing, analyzing, and disseminating the large amounts of data generated by biomedical research.

Recognizing the rapid pace of change in biomedical data science, increasing use of big data, and growing diversity of data types and sources, the NIH ACD was tasked to review the NLM's current mission, organization, and program priorities. In June 2015, the ACD articulated a strategic vision for maintaining NLM's status as an international leader in biomedical and health information that recognizes the need to position the NLM as the epicenter for biomedical data science across the biomedical research enterprise and expand its activities beyond the walls of NIH to funded extramural institutions.

Theme 4: Stewardship to Inspire Public Trust

NIH strives to invest wisely in research that will drive new discoveries that could lead to improving the public's health. As the Nation's biomedical research agency, NIH is acutely aware of its responsibility to be an efficient and effective steward of the resources provided by the American people.

Optimize Priority Setting and Carefully Marshal Resources

Setting clear goals and objectives that are shared across NIH will enable the Agency to prioritize the areas of science that are ripe for advancement or in most need of additional support. To that end, NIH recently released an NIH-Wide Strategic Plan that emphasizes the importance of balancing basic and applied science, transparency in the process of setting research priorities, practicing good stewardship of its resources, and managing for results.[9] To develop this plan, NIH sought extensive input from the public through a Request for Information and webinars in

[9] http://www.nih.gov/sites/default/files/about-nih/strategic-plan-fy2016-2020-508.pdf

addition to feedback from the NIH ACD and the Advisory Councils of individual Institutes and Centers (ICs). The strategic plans of each IC eventually will be linked to this overarching strategic plan to ensure a cohesive priority setting process. Recent advances in portfolio analysis methods will aid efforts to prioritize NIH investments by helping NIH identify emerging scientific opportunities and optimize future scientific investments.

In addition to prioritizing its investments, NIH takes seriously its role as a leader in the biomedical research enterprise. As the primary funder of biomedical research in the United States, it is important for NIH to take the lead in promoting rigorous experimental design, analysis, and reporting as well as emphasizing the importance of reproducible research results. NIH has released principles and guidelines for reporting preclinical research that are intended to enhance rigor and support research that is reproducible, robust, and transparent. These guidelines will reinforce scientific practices that engender confidence in research results within the scientific community and the public. Additionally, in 2014 and 2015, NIH held a series of workshops to examine issues around reproducibility of data collection and analysis with advanced technologies. The workshops were designed to educate intramural researchers about the potentials and pitfalls of these technologies from the perspective of data reproducibility to inform scientists' use of these techniques and also to aid them in interpreting others' results using these methods. NIH also has created materials to enhance training of graduate students and fellows on approaches to enhance the reproducibility of science and currently is supporting development of curriculum on experimental design that will be shared freely.[10] Finally, NIH has implemented a grant policy for enhancing reproducibility through rigor and transparency. Beginning in January 2016, research and career development applications must address scientific premise, scientific rigor, consideration of relevant biological variables such as sex, and authentication of key resources.

NIH bears responsibility for the oversight of its clinical trials portfolio. NIH is making a number of policy and programmatic changes to enhance the quality, relevance, and feasibility of NIH-funded clinical trials. NIH also is establishing a policy for multi-site studies to use a single Institutional Review Board (IRB) for review. This policy will eliminate duplicate IRB reviews and speed up the initiation of clinical research. Another policy initiative aims to enhance clinical trial information dissemination by calling for all NIH-funded clinical trials to register and submit results to ClinicalTrials.gov, a publicly available repository of clinical trials managed by the NIH NLM. Implementation of these reforms, which will continue in FY 2017 and beyond, will enhance the efficiency and effectiveness of NIH-funded clinical trials.

Enhance NIH Prioritization Through Partnerships

To optimize its use of taxpayer funds, NIH leverages resources through key partnerships across ICs, with other Federal agencies, and with the private sector. For example, the NIH Common Fund supports programs that bring together several ICs and are designed to achieve a set of well-defined, high-impact goals within a relatively short timeframe. These projects range from defining the composition of the human microbiome, (the collection of bacteria, fungi, and viruses that live naturally in and on the human body), to developing reliable, easy-to-use patient-

[10] http://www.nih.gov/science/reproducibility/index.htm

centered measurement tools for clinicians and researchers to assess dimensions of health and well-being that are not captured by clinical and laboratory tests. The Common Fund will continue to support ongoing programs and develop new ideas in FY 2017.

NIH also is forging novel interagency partnerships that benefit from the strengths and mission focus of other Federal agencies. One such collaboration is the Tissue Chip for Drug Screening initiative, which aims to create 3-D chips with living cells and tissues that model the function of human organs such as the lung, liver, and heart. Ultimately, the goal of this partnership with FDA and DARPA is to assemble ten different organoids on a single chip to simulate many functions of the human body. This human biochip could be used to test drug toxicity and accelerate the process by which the safety and efficacy of potential drugs are assessed.

Innovative public-private partnerships enable NIH to use expertise in other sectors to advance research further than it could alone. For example, the Accelerating Medicines Partnership seeks to identify new drug targets for Alzheimer's disease, type 2 diabetes, and the autoimmune disorders lupus and rheumatoid arthritis. NIH is partnering with ten pharmaceutical companies and non-profits, as well as FDA, in a way that taps each collaborator's strength to ensure the best contributions to science. With FY 2017 funds, these ongoing partnerships will be bolstered, and new partnerships in other disease areas may be possible.

Strengthen and Sustain the Biomedical Workforce

The biomedical research workforce is the backbone of scientific discovery. NIH continually seeks to cultivate a diverse, creative, innovative, and productive group of scientists who are dedicated to their research and whose work reflects NIH's mission. To fully support and sustain the best scientists in the biomedical workforce, NIH will expand ways to revitalize physician-scientist training, encourage early stage investigators, enhance workforce diversity, and support more person-centered grants that focus on an investigator's entire research program and their history of success rather than a specific project.

Some of these efforts already are underway, and more are planned for FY 2017 and beyond. For example, in order to continue to attract the brightest minds to biomedical research, NIH is committed to enhancing the diversity of its funded workforce. The Enhancing the Diversity of the NIH-funded Workforce program aims to transform the culture and effectiveness of biomedical research training and mentoring to attract and retain individuals from underrepresented groups in biomedical research. This program consists of three integrated initiatives. The Building Infrastructure Leading to Diversity (BUILD) initiative focuses on training awards designed to learn how to attract students from diverse backgrounds into the biomedical research workforce and encourage their persistence in this career field. The National Research Mentoring Network (NMRN) addresses the need for increased access to high quality research mentorship and networking opportunities by establishing a nationwide, interconnected set of skilled mentors linked to mentees. NMRN also will develop best practices for mentoring, provide training for mentors, and provide professional opportunities for mentees. All of the initiatives in this program are coordinated by a central evaluation center that will track effective training and mentoring approaches and serve as a focal point for dissemination of best practices.

To allow scientists more freedom to innovate and explore new lines of inquiry, NIH is piloting longer grant awards to provide more stable support for investigators. This includes the National Cancer Institute's Outstanding Investigator Award, which will provide long-term support to investigators who have extraordinary records of cancer research productivity and who propose to conduct exceptional research, as well as the National Institute of General Medical Science's Maximizing Investigators' Research Award (MIRA). By supporting an investigator's research through a single, unified grant rather than through a series of separate, individual research project grants, MIRA will allow scientists the flexibility to explore new research ideas that arise during the course of their work. Many ICs are piloting similar grant programs to foster creativity and scientific discovery. Collectively, through these high-risk, high reward programs and other efforts, NIH strives to facilitate the best opportunities for researchers to contribute to the scientific enterprise and create a productive, sustainable workforce.

Reduce Administrative Burden to Grantees

NIH grantees must comply with numerous reporting requirements designed to protect humans and animals in research, the public's health and safety, and appropriate expenditure of tax dollars. However, NIH recognizes the significant workload that these administrative requirements produce. In support of the extramural community, NIH is committed to streamlining these reporting processes to ensure that scientists spend as much time as possible in the lab, conducting research, and training the next generation of innovators.

For example, to streamline the pre-award process, NIH introduced the web-based Application Submission System & Interface for Submission Tracking (ASSIST) to prepare and submit grant applications electronically. This user-friendly system simplifies the application process by allowing several processes to occur automatically, including populating many data fields from established profiles, generating a table of contents, and validating the application based on certain business rules prior to submission. While maintaining oversight of the funds it awards is vital, NIH will continue to pursue optimizing processes that relieve administrative burden.

NIH also supported an *ad hoc* committee of the National Academy of Sciences that convened to examine Federal research regulations and reporting requirements and to identify regulations and requirements that are burdensome, as well as to articulate improved approaches to reduce such burdens. Part I of the committee's report, "*Optimizing the Nation's Investment in Academic Research: A New Regulatory Framework for the 21st Century* was released in September 2015. Part II of the report is due in 2016. Additionally, NIH participates in the Federal Demonstration Partnership and the interagency Research Business Models working group of the President's National Science and Technology Council, which provide valuable platforms for discussion and developing solutions for ways to reduce administrative burdens.

Conclusion

The Nation's investment in NIH has led to countless advances in the sciences of human health and disease. Each year, approximately 83 percent of NIH's budget is awarded through more than 57,000 research and training grants to the Nation's finest institutions, small businesses, and

scientists.[11] An additional 11 percent is used to support the exceptional cadre of scientists who conduct research in the NIH intramural program.

NIH-funded research not only extends lives and improves the health of Americans but also provides significant benefits to the U.S. economy. NIH research helps to reduce health care spending by producing better, more cost-effective therapies, preventive strategies, and appropriate clinical guidelines.

The economic benefits of improved health are enormous. Research-related gains in average life expectancy for the period from 1970 to 2000 have an economic value estimated at $95 trillion, about $3.2 trillion per year. Investment in one NIH-funded study on postmenopausal hormone therapy resulted in long-term financial and health outcomes worth an estimated $37.1 billion, a return of nearly $140 for each dollar of funding.[12] The promise of NIH research is exemplified by its pursuit of a universal flu vaccine. Such a vaccine could reduce incidence and deaths significantly and potentially reduce the estimated $87.1 billion in annual medical costs, loss of lives, and lost productivity.

Researchers in every State hold a share of NIH's investment. According to a report from United for Medical Research, in 2012, NIH funding directly supported more than 400,000 jobs across all 50 States and the District of Columbia.[13] Indirectly, NIH-funded discoveries serve as the foundations for the biotechnology, pharmacological, and research tools technology industries, which provide jobs for millions of Americans. The influence of public-sector discoveries on the economy is significant as well: the *Impact of Genomics on the U.S. Economy* study estimates that the $12.3 billion investment by the United States in the Human Genome Project (HGP) and its follow up research programs has resulted in nearly $1 trillion of economic growth – a 178-fold return on investment – at a cost of only $2 per year for each U.S. resident.[14]

Since 1992, the United States has fallen from second to tenth in overall R&D intensity (R&D investment/GDP = 2.8 percent) – now ranking behind Israel, Sweden, Finland, Japan, South Korea, Switzerland, Taiwan, Denmark, and Germany.[15] The United States continues to be the largest public funder of biomedical research worldwide, with more than $117 billion in medical research expenditures, from both public and private sources, in 2011.[16] Recognizing the large role that biomedical science plays in innovation and economic growth, many countries around the world have increased their investment substantially. NIH received a $2 billion (6.6 percent)

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[11] http://officeofbudget.od.nih.gov/pdfs/FY16/Supplementary%20Tables.pdf

[12] J.A. Roth et al. "Economic return from the Women's Health Initiative estrogen plus progestin clinical trial: a modeling study" Ann. Intern. Med. 2014. http://annals.org/article.aspx?articleid=1867051

[13] United for Medical Research. 2012. *NIH's Role in Sustaining the U.S. Economy*. http://www.unitedformedicalresearch.com/wp-content/uploads/2012/07/NIHs-Role-in-Sustaining-the-US-Economy-2011.pdf

[14] Battelle. 2013. *The Impact of Genomics on the U.S. Economy*. http://web.ornl.gov/sci/techresources/Human_Genome/publicat/2013BattelleReportImpact-of-Genomics-on-the-US-Economy.pdf

[15] "Science and Engineering Indicators 2014" National Science Foundation, February 2014. http://www.nsf.gov/statistics/seind14/index.cfm/chapter-4/c4h.htm#s2

[16] Moses et al., "The Anatomy of Medical Research: US and International Comparisons" Journal of the American Medical Association, 2015. http://jama.jamanetwork.com/article.aspx?articleid=2089358.

increase in FY 2016. The requested budget, while a substantial investment, is nevertheless lower than the purchasing power NIH had in FY 2003 when adjusted for the biomedical research and development price index (developed for NIH primarily to facilitate analysis of purchasing power). One way NIH and its grantees can make resources go further is to improve productivity and take advantage of the many research techniques and mechanisms, such as human genome sequencing, whose costs have decreased dramatically over the past decade. The FY 2017 Budget provides an increase of $825 million to NIH to continue making progress on the cutting edge frontiers on biomedical research.

Relative to major countries in North America, Europe, and Asia, the United States now has the slowest annual growth rate in medical research investment at 1.0 percent; China (16.9 percent), Australia (9.3 percent), Japan (6.8 percent), Canada (4.5 percent), Europe (4.1 percent), and other Asian countries (20.8 percent) are all increasing their annual investments in medical research at a faster pace.[17] China alone accounts for about one-fourth of the total global growth of R&D. These trends have resulted in the restructuring of the scientific workforce and the share of total global investment in medical research. From 1996 to 2011, China's workforce increased 6 percent annually to reach 1.31 million workers, now making it the largest national science and technology workforce in the world.[18]

Increased global investment in biomedical research is a positive trend for science and for health. With more bright minds focused on the health and disease issues that confront us, the chances of productive partnerships and innovative solutions will reach new heights. However, the country that makes the investments in research traditionally enjoys the greatest benefits in health and economic growth. As the largest funder of biomedical research in the world, NIH must continue as a leader in the biomedical research enterprise, investing in the most promising scientific opportunities in basic science, precision medicine, big data computing, and emerging scientific horizons. By investing wisely in research and maintaining good stewardship of its resources, NIH will remain at the forefront of scientific discovery.

[17] Moses et al., "The Anatomy of Medical Research: US and International Comparisons" Journal of the American Medical Association, 2015. http://jama.jamanetwork.com/article.aspx?articleid=2089358.
[18] "Science and Engineering Indicators 2014" National Science Foundation, February 2014. http://www.nsf.gov/statistics/seind14/index.cfm/chapter-4/c4h.htm#s2

IMPACT OF BUDGET LEVEL ON PERFORMANCE

Programs and Measures (Dollars in Millions, except where noted)	FY 2016 Enacted[1]	FY 2017 President's Budget[2]	FY 2017 +/- FY 2016
Research Project Grants	$17,820.973	$18,206.620	2.2%
Competing Average Cost (in thousands)	$470.846	$468.489	-0.5%
Number of Competing Awards (whole number)	10,753	9,946	-7.5%
Estimated Competing RPG Success Rate (absolute rate)	19.2%	17.5%	-8.9%
Research Centers	$2,644.811	$2,589.224	-2.1%
Other Research	$2,010.924	$2,083.762	3.6%
Training	$830.430	$848.649	2.2%
Research & Development Contracts	$2,915.243	3,173.386	8.9%
Intramural Research	$3,581.878	3,614.558	0.9%
Research Management and Support	$1,685.252	$1,719.314	2.0%
Common Fund (non-add)	*$675.639*	*$775.639*	*14.8%*
Buildings & Facilities Appropriation	$128.863	$128.863	0.0%
Other Mechanisms[3]	$692.974	$771.973	11.4%
Total, Program Level[4]	**$32,311.349**	**$33,136.349**	2.6%

[1] Excludes Ebola related funding.

[2] Includes mandatory financing.

[3] Includes Office of the Director-Other, building repair & improvement (R&I) funds allocated for the NCI-Frederick facility, and Superfund Research activities funded from the Interior appropriation.

[4] Includes discretionary budget authority received from Labor/HHS appropriations (ICs) and the Interior appropriation (Superfund). Also includes mandatory budget authority derived from the Special Type 1 Diabetes account, Program Evaluation Financing, and other mandatory financing.

OVERVIEW OF PERFORMANCE

The NIH mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability. Investments in basic biomedical and behavioral research make it possible to understand the causes of disease onset and progression, design preventive interventions, develop better diagnostics, and discover new treatments and cures. Realizing the benefits of fundamental biomedical discoveries depends on the translation of that knowledge into the development of new diagnostics, therapeutics, and preventive measures to improve health. Investments in translational research are leading to the identification of new targets and pathways for the development of new therapeutics.

The FY 2017 budget request reflects the Agency's longstanding commitment to invest strategically using performance-based analysis, as emphasized in the GPRA Modernization Act of 2010 (P.L. 111-352). Through the continuous evaluation and strategic management of its research portfolio, NIH focuses on funding research that shows the greatest promise for improving the overall health of the American people. In addition, NIH continually seeks to identify and address high-priority scientific opportunities and emerging public health needs. By managing its research portfolio to support key research priorities, NIH ensures the most effective use of funds to achieve the greatest impact on the health and welfare of the Nation. In particular, NIH's strong peer-review process, site visits, performance monitoring, program evaluation, and performance-based contracting enable the Agency to ensure that its investments generate results for the American people.

NIH strives to achieve transparency and accountability by regularly reporting results, achievements, and the impact of its activities. To increase transparency and promote effective use of resources, NIH began reporting the amount of indirect costs paid per grant on its Research Portfolio Online Reporting Tools website in October 2013. NIH supports a wide spectrum of biomedical and behavioral research and engages in a full range of activities that enable research, its management, and the communication of research results. Because of this diversity and complexity, NIH uses a set of performance measures that is representative of its activities and is useful for tracking progress in achieving performance priorities. This representative approach has helped NIH to share progress of its performance priorities with HHS, the rest of the Executive Branch, the Congress, and the public.

The NIH performance measures reflect the Agency's overall goals to advance basic biomedical and behavioral science, support translational research, and enhance the development of human capital, and strengthen the scientific workforce. All of NIH's measures support the goals and objectives of the HHS Strategic Plan 2014-2018. In particular, NIH substantially contributes to the HHS Strategic Goal 2–Advance Scientific Knowledge and Innovation. For example, in FY 2017, in support of Objective A (Accelerate the process of scientific discovery to improve health) under Goal 2, NIH will support promising biomedical research and human capital investment with the goals of: 1) identifying two molecular-targeted therapies for disorders of the immune system in children, 2) completing pre-commercial development of a point-of-care technology targeted for use in primary care setting, and 3) providing research training for predoctoral trainees and fellows as well as postdoctoral fellows to promote greater retention and long-term success in research careers.

Performance Management

Performance management at NIH is an integrated and collaborative process to ensure that the Agency is achieving its mission to conduct and support research to improve public health. At the Agency level, the NIH Director sets priorities, monitors performance, and reviews results across the 27 ICs and OD. OD is the central office responsible for setting policy for NIH, and for planning, managing, and coordinating the programs and activities of all NIH components. The NIH Director provides leadership to the ICs and helps identify needs and opportunities, especially for efforts that involve multiple ICs. Each IC and OD office carries out priority setting, performance monitoring, progress reviews, and makes adjustments based on progress achieved in their respective areas of science. In addition to the performance management processes that occur for the NIH research program, there are equivalent processes for administrative management functions.

The NIH performance framework includes: 1) priority setting with input from key stakeholders; 2) implementation and management of activities that support priorities; 3) monitoring and assessment of progress, and identification of successes and challenges; 4) oversight by IC leadership and OD office directors in assessing overall progress toward priorities and identification of best practices, appropriate next steps, and corrective actions (as needed); 5) incorporation of regular feedback from IC and OD office leadership to enhance activities; 6) regular reviews of priorities, progress, and outcomes by the NIH Director and IC Directors; and 7) regular review of performance and priorities by external expert review groups including grant peer-review groups, Advisory Councils, and ad hoc working groups.

Qualitative and quantitative information is used to monitor progress and help to identify successes, as well as obstacles in achieving short and long-term goals. Supporting high-performing research is a process of adapting to new developments or newly identified barriers, or shifting resources to pursue promising unanticipated results that may provide critical new information. Moreover, the impact of research may not be immediately known and may depend on additional development or on advances in other fields. Despite these challenges, NIH leadership is able to manage performance effectively by using the best available information to assess progress toward achieving priorities and making appropriate adjustments.

Research is an inherently collaborative endeavor, and partnerships are crucial to achieving scientific research outcomes. The role of the extramural research community (the scientists at universities and hospitals across the country and around the world) as NIH's partner in research is well known. However, of increasing importance are partnerships with private companies, not-for-profit institutions, non-governmental organizations, other Federal agencies, and state and international entities. Joint research and training activities and other exchanges with such groups increase the leverage of NIH resources and support vibrant partnerships to help NIH achieve its mission. Moreover, such partnerships facilitate valuable information feedback loops that identify emerging needs, suggest important new research questions, and otherwise inform priority setting. Partnerships also provide access to populations that are essential to advancing knowledge.

All scientific research carried out through NIH support is subjected to a rigorous and consistently applied review process. For example, the Extramural Research Program, which includes the largest category of NIH-funded research, utilizes two levels of peer review. The first level consists of chartered scientific review groups composed of outside experts in particular scientific disciplines. The second level is the National Advisory Councils of the ICs. For the Intramural Research Program, the progress of individual scientists and their laboratories is evaluated once every four years by Boards of Scientific Counselors composed of external experts. These reviews enable ongoing assessments of all intramural labs and the accomplishments of the scientists who contribute to them. It is through this well-honed system of peer review that NIH maintains its focus on supporting research of the highest possible quality.

The NIH approach to performance management is undergirded by the NIH Governance Structure. That structure includes the NIH Steering Committee and seven standing Working Groups.[19,20] Ad-hoc working groups are established, as needed, to address emerging issues. The premise of the structure is that shared governance, which depends on the active participation of the IC Directors with the NIH Director, will foster the collaborative identification of corporate issues and a transparent decision-making process. With active participation by the IC Directors in NIH-wide governance, NIH can maximize its perspective and expertise in the development and oversight of policies common to NIH and its ICs. Through the governance process, corporate decisions are made; these may be long-term and strategic (e.g., facilities planning, budget strategy, research policy direction) or short-term and tactical (e.g., stipend levels, resource allocations, and compliance oversight). This process does not include issues related to the setting of scientific priorities, which is reserved for meetings of all IC Directors. The NIH Director meets with the IC Directors on a bi-weekly basis, and scientific initiatives are discussed, as well as major management issues that affect the Agency. In addition, scientists – from within and outside the Agency – are invited to present on new or emerging research opportunities. The NIH Director stays informed of priorities through regular meetings with IC and OD Office Directors. Similarly, the IC Directors monitor performance through regular meetings with the Division Directors and Scientific/Clinical Directors in their respective ICs.

Based on these reviews, leadership and their staff take appropriate actions to support research activities. For example, the reviews may lead to the development of new award programs for early-career researchers, the development of new funding announcements for promising research areas, or new collaborations across NIH and/or with other Federal and non-Federal partners. The NIH Director and senior leadership receive regular updates on the progress of the priorities, provide feedback, and incorporate the latest information into the NIH's overall planning and management efforts. This constant feedback loop enables NIH to make critical adjustments periodically to align activities and target resources in support of its research priorities.

[19] The NIH Steering Committee is composed of the NIH Director, Deputy Director (ex-officio), the Directors of NCI, NHLBI, and NIAID, as well as a balance of Directors from the smaller and medium-sized institutes.
[20] The seven standing working groups are: Extramural Activities, Diversity, Facilities, Management and Budget, Scientific Data Council, Administrative Data Council, and Clinical Center Governing Board.

BUDGET BY HHS STRATEGIC OBJECTIVE

(Dollars in Millions)	FY 2015 Actual[1]	FY 2016 Enacted[1]	FY 2017 President's Budget[2]
1.Strengthen Health Care			
1.A Make coverage more secure for those who have insurance, and extend affordable coverage to the uninsured			
1.B Improve health care quality and patient safety			
1.C Emphasize primary and preventive care, linked with community prevention services			
1.D Reduce the growth of health care costs while promoting high-value, effective care			
1.E Ensure access to quality, culturally competent care, including long-term services and supports, for vulnerable populations			
1.F Improve health care and population health through meaningful use of health information technology			
2. Advance Scientific Knowledge and Innovation	**30,174**	**32,166**	**32,957**
2.A Accelerate the process of scientific discovery to improve health	30,174	32,166	32,957
2.B Foster and apply innovative solutions to health, public health, and human services challenges			
2.C Advance the regulatory sciences to enhance food safety, improve medical product development, and support tobacco regulation			
2.D Increase our understanding of what works in public health and human services practice			
2.E Improve laboratory, surveillance, and epidemiology capacity			
3. Advance the Health, Safety and Well-Being of the American People			
3.A Promote the safety, well-being, resilience, and healthy development of children and youth			
3.B Promote economic and social well-being for individuals, families, and communities			
3.C Improve the accessibility and quality of supportive services for people with disabilities and older adults			
3.D Promote prevention and wellness across the life span			
3.E Reduce the occurrence of infectious diseases			
3.F Protect Americans' health and safety during emergencies, and foster resilience to withstand and respond to emergencies			
4. Ensure Efficiency, Transparency, Accountability, and Effectiveness of HHS Programs	**137**	**145**	**179**
4.A Strengthen program integrity and responsible stewardship by reducing improper payments, fighting fraud, and integrating financial, performance, and risk management			
4.B Enhance access to and use of data to improve HHS programs and to support improvements in the health and well-being of the American people			
4.C Invest in the HHS workforce to help meet America's health and human services needs			
4.D Improve HHS environmental, energy, and economic performance to promote sustainability	137	145	179
TOTAL	**30,311**	**32,311**	**33,136**

[1] Excludes Ebola-related funding.

[2] Includes mandatory financing.

BUDGET MECHANISM TABLE

(Dollars in Thousands)[1]	FY 2015 Actual[3]		FY 2016 Enacted[3]		FY 2017 President's Budget[4]		FY 2017 +/- FY 2016	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	23,261	$11,219,523	23,367	$11,770,028	24,608	$12,530,526	1,241	$760,498
Administrative Supplements	*(1,595)*	193,500	*(1,538)*	183,451	*(1,282)*	153,882	*(-256)*	-29,569
Competing:								
Renewal	1,771	919,382	2,080	1,104,786	1,908	1,030,599	-172	-74,187
New	7,737	3,368,395	8,639	3,942,891	8,011	3,617,296	-628	-325,595
Supplements	32	22,921	34	15,331	27	11,700	-7	-3,630
Subtotal, Competing	9,540	$4,310,698	10,753	$5,063,008	9,946	$4,659,596	-807	-$403,412
Subtotal, RPGs	32,801	$15,723,721	34,120	$17,016,487	34,554	$17,344,004	434	$327,517
SBIR/STTR	1,578	717,951	1,720	804,487	1,886	862,616	166	58,129
Research Project Grants	34,379	$16,441,672	35,840	$17,820,973	36,440	$18,206,620	600	$385,646
Research Centers:								
Specialized/Comprehensive	1,093	$1,879,582	1,151	$1,883,688	1,139	$1,862,491	-12	-$21,197
Clinical Research	68	424,704	59	410,660	57	399,319	-2	-11,341
Biotechnology	97	171,994	96	173,457	84	151,600	-12	-21,857
Comparative Medicine	52	132,143	48	119,821	47	118,628	-1	-1,193
Research Centers in Minority Institutions	23	54,641	27	57,185	27	57,185	0	0
Research Centers	1,333	$2,663,064	1,381	$2,644,811	1,354	$2,589,224	-27	-$55,587
Other Research:								
Research Careers	3,593	$608,205	3,700	$632,270	3,700	$641,318	0	$9,049
Cancer Education	85	28,026	87	28,626	91	29,876	4	1,250
Cooperative Clinical Research	369	421,734	349	447,848	335	442,187	-14	-5,661
Biomedical Research Support	110	66,863	106	64,891	106	64,891	0	0
Minority Biomedical Research Support	278	103,446	283	107,398	282	106,858	-1	-540
Other	1,803	574,449	2,222	729,892	2,342	798,632	120	68,740
Other Research	6,238	$1,802,722	6,747	$2,010,924	6,856	$2,083,762	109	$72,838
Total Research Grants	41,950	$20,907,458	43,968	$22,476,709	44,650	$22,879,605	682	$402,896
Ruth L Kirchstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	3,161	$136,979	3,346	$149,840	3,411	$154,142	65	$4,302
Institutional Awards	12,429	621,038	12,850	680,590	13,010	694,507	160	13,916
Total Research Training	15,590	$758,017	16,196	$830,430	16,421	$848,649	225	$18,218
Research & Develop. Contracts	2,238	$2,827,544	2,263	$2,915,243	2,281	$3,173,386	18	$258,142
(SBIR/STTR) (non-add)[2]	*(122)*	*(71,236)*	*(128)*	*(80,582)*	*(149)*	*(90,960)*	*(21)*	*(10,378)*
Intramural Research	6,912	$3,410,354	6,956	$3,581,878	6,956	$3,614,558	0	$32,681
Res. Management & Support	5,579	1,620,334	5,658	1,685,252	5,658	1,719,314	0	34,062
Res. Management & Support (SBIR Admin) (non-add)[2]	*(1)*	*(4,362)*	*(3)*	*(7,333)*	*(3)*	*(3,794)*	*0*	*(-3,539)*
Office of the Director - Appropriation[2,5]		*(1,413,734)*		*(1,571,200)*		*(1,716,200)*		*(145,000)*
Office of the Director - Other		573,430		599,625		644,625		45,000
ORIP/SEPA (non-add)[2,5]		*(294,665)*		*(295,936)*		*(295,936)*		*0*
Common Fund (non-add)[2,5]		*(545,639)*		*(675,639)*		*(775,639)*		*(100,000)*
Buildings and Facilities[6]		136,863		144,863		178,863		34,000
Appropriation		*128,863*		*128,863*		*128,863*		*0*
Type 1 Diabetes[7]		-150,000		-150,000		-150,000		0
Program Evaluation Financing[8]		-715,000		-780,000		-847,489		-67,489
Cancer Initiative Mandatory Financing						-680,000		-680,000
Other Mandatory Financing						-1,145,000		-1,145,000
Subtotal, Labor/HHS Budget Authority		**$29,369,000**		**$31,304,000**		**$30,236,511**		**-$1,067,489**
Interior Appropriation for Superfund Research		77,349		77,349		77,349		0
Total, NIH Discretionary B.A.		**$29,446,349**		**$31,381,349**		**$30,313,860**		**-$1,067,489**
Type 1 Diabetes		150,000		150,000		150,000		0
Proposed Law Funding								
Cancer Initiative Mandatory Financing						680,000		680,000
Other Mandatory Financing						1,145,000		1,145,000
Total, NIH Budget Authority		**$29,596,349**		**$31,531,349**		**$32,288,860**		**$757,511**
Program Evaluation Financing		715,000		780,000		847,489		67,489
Total, Program Level		**$30,311,349**		**$32,311,349**		**$33,136,349**		**$825,000**

1 All Subtotal and Total numbers may not add due to rounding.
2 All numbers in italics and brackets are non-add.
3 Excludes Ebola related funding.
4 Includes mandatory financing.
5 Number of grants and dollars for the Common Fund, ORIP and SEPA components of OD are distributed by mechanism and are noted here as a non-add. The Office of the Director - Appropriations also is noted as a non-add since the remaining funds are accounted for under OD - Other.
6 Includes B&F appropriation and funds for facilities repairs and improvements at the NCI Federally Funded Research and Development Center in Frederick, Maryland.
7 Number of grants and dollars for mandatory Type I Diabetes are distributed by mechanism above; therefore, Type I Diabetes amount is deducted to provide subtotals only for the Labor/ HHS Budget Authority.
8 Number of grants and dollars for Program Evaluation Financing are distributed by mechanism above; therefore, the amount is deducted to provide subtotals only for the Labor/HHS Budget Authority.

APPROPRIATIONS LANGUAGE

NATIONAL CANCER INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to cancer, [$5,214,701,000]*$5,097,287,000*, of which up to [$16,000,000]*$50,000,000* may be used for facilities repairs and improvements at the National Cancer Institute—Frederick Federally Funded Research and Development Center in Frederick, Maryland.

NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to cardiovascular, lung, and blood diseases, and blood and blood products, [$3,115,538,000]*$3,069,901,000*.

NATIONAL INSTITUTE OF DENTAL AND CRANIOFACIAL RESEARCH

For carrying out section 301 and title IV of the PHS Act with respect to dental and craniofacial diseases, [$415,582,000]*$404,560,000*.

NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

For carrying out section 301 and title IV of the PHS Act with respect to diabetes and digestive and kidney disease, [$1,818,357,000]*$1,786,086,000*.

NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE

For carrying out section 301 and title IV of the PHS Act with respect to neurological disorders and stroke, [$1,696,139,000]*$1,659,416,000*.

NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

For carrying out section 301 and title IV of the PHS Act with respect to allergy and infectious diseases, [$4,629,928,000]*$4,700,548,000*.

NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES

For carrying out section 301 and title IV of the PHS Act with respect to general medical sciences, [$2,512,073,000]*$2,434,144,000*, of which [$780,000,000]*$847,489,000* shall be from funds available under section 241 of the PHS Act [: *Provided*, That not less than $320,840,000 is provided for the Institutional Development Awards program].

EUNICE KENNEDY SHRIVER NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

For carrying out section 301 and title IV of the PHS Act with respect to child health and human development, [$1,339,802,000]*$1,316,607,000*.

NATIONAL EYE INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to eye diseases and visual disorders, [$715,903,000]*$687,249,000*.

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

For carrying out section 301 and title IV of the PHS Act with respect to environmental health sciences, [$693,702,000]*$681,613,000*.

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

For necessary expenses for the National Institute of Environmental Health Sciences in carrying out activities set forth in section 311(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9660(a)) and section 126(g) of the Superfund Amendments and Reauthorization Act of 1986, $77,349,000.

NATIONAL INSTITUTE ON AGING

For carrying out section 301 and title IV of the PHS Act with respect to aging, [$1,600,191,000]*$1,265,133,000*.

NATIONAL INSTITUTE OF ARTHRITIS AND MUSCULOSKELETAL AND SKIN DISEASES

For carrying out section 301 and title IV of the PHS Act with respect to arthritis and musculoskeletal and skin diseases, [$542,141,000]*$532,753,000*.

NATIONAL INSTITUTE ON DEAFNESS AND OTHER COMMUNICATION DISORDERS

For carrying out section 301 and title IV of the PHS Act with respect to deafness and other communication disorders, [$423,031,000]*$416,146,000*.

NATIONAL INSTITUTE OF NURSING RESEARCH

For carrying out section 301 and title IV of the PHS Act with respect to nursing research, [$146,485,000]*$143,942,000*.

NATIONAL INSTITUTE ON ALCOHOL ABUSE AND ALCOHOLISM

For carrying out section 301 and title IV of the PHS Act with respect to alcohol abuse and alcoholism, [$467,700,000]*$459,578,000*.

NATIONAL INSTITUTE ON DRUG ABUSE

For carrying out section 301 and title IV of the PHS Act with respect to drug abuse, [$1,077,488,000]*$1,020,459,000*.

NATIONAL INSTITUTE OF MENTAL HEALTH

For carrying out section 301 and title IV of the PHS Act with respect to mental health, [$1,548,390,000]*$1,459,700,000*.

NATIONAL HUMAN GENOME RESEARCH INSTITUTE

For carrying out section 301 and title IV of the PHS Act with respect to human genome research, [$518,956,000]*$509,762,000*.

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, [$346,795,000]*$334,025,000*.

NATIONAL CENTER FOR COMPLEMENTARY AND INTEGRATIVE HEALTH

For carrying out section 301 and title IV of the PHS Act with respect to complementary and integrative health, [$130,789,000]*$126,673,000*.

NATIONAL INSTITUTE ON MINORITY HEALTH AND HEALTH DISPARITIES

For carrying out section 301 and title IV of the PHS Act with respect to minority health and health disparities research, [$279,718,000]*$279,680,000*.

JOHN E. FOGARTY INTERNATIONAL CENTER

For carrying out the activities of the John E. Fogarty International Center (described in subpart 2 of part E of title IV of the PHS Act), [$70,447,000]*$69,175,000*.

NATIONAL LIBRARY OF MEDICINE

For carrying out section 301 and title IV of the PHS Act with respect to health information communications, [$394,664,000]$395,110,000: *Provided*, That of the amounts available for improvement of information systems, $4,000,000 shall be available until September 30, [2017]*2018*: *Provided further*, That in fiscal year [2016]*2017*, the National Library of Medicine may enter into personal services contracts for the provision of services in facilities owned, operated, or constructed under the jurisdiction of the National Institutes of Health (referred to in this title as "NIH").

NATIONAL CENTER FOR ADVANCING TRANSLATIONAL SCIENCES

For carrying out section 301 and title IV of the PHS Act with respect to translational sciences, [$685,417,000]*$660,131,000*: *Provided*, That up to $25,835,000 shall be available to implement section 480 of the PHS Act, relating to the Cures Acceleration Network [: *Provided further*, That at least $500,000,000 is provided to the Clinical and Translational Sciences Awards program].

OFFICE OF THE DIRECTOR
(INCLUDING TRANSFER OF FUNDS)

For carrying out the responsibilities of the Office of the Director, NIH, [$1,558,600,000]*$1,432,859,000*, of which up to [$30,000,000]*$40,000,000* may be used to carry out section [215]*213* of this Act: *Provided*, That funding shall be available for the purchase of not to exceed 29 passenger motor vehicles for replacement only: *Provided further*, That all funds credited to the NIH Management Fund shall remain available for one fiscal year after the fiscal year in which they are deposited: [*Provided further*, That $165,000,000 shall be for the National Children's Study Follow-on: *Provided further*, That NIH shall submit a spend plan on the next phase of the study in the previous proviso to the Committees on Appropriations of the House of Representatives and the Senate not later than 90 days after the date of enactment of this Act:]*Provided further*, That [$663,039,000]*$553,039,000* shall be available for the Common Fund established under section 402A(c)(1) of the PHS Act: *Provided further*, That of the funds provided, $10,000 shall be for official reception and representation expenses when specifically approved by the Director of the NIH: *Provided further*, That the Office of AIDS Research within the Office of the Director of the NIH may spend up to $8,000,000 to make grants for construction or renovation of facilities as provided for in section 2354(a)(5)(B) of the PHS Act: *Provided further*, That up to [$130,000,000]*$20,000,000* of the funds provided to the Common Fund are available to support the trans-NIH Precision Medicine Initiative: [*Provided further*, That of the amount provided to the NIH, the Director of the NIH shall enter into an agreement with the National Academy of Sciences, as part of the studies conducted under section 489 of the PHS Act, to conduct a comprehensive study on policies affecting the next generation of researchers in the United States:] *Provided further*, That, [of the funds from Institute, Center, and Office of the Director accounts within "Department of Health and Human

Services, National Institutes of Health,"] in order to strengthen privacy protections for human research participants, NIH shall require investigators receiving NIH funding, from amounts appropriated in this Act to NIH accounts, for new and competing research projects designed to generate and analyze large volumes of data derived from human research participants to obtain a certificate of confidentiality: *Provided further, That the Director may direct up to 1 percent of the total made available in this or any other Act to all National Institutes of Health discretionary appropriations to activities that the Director may so designate: Provided further, That no such appropriation shall be decreased by more than 1 percent by any such transfers and that the Congress is promptly notified of the transfer*.

In addition to other funds appropriated for the Common Fund established under section 402A(c) of the PHS Act, $12,600,000 is appropriated to the Common Fund from the 10-year Pediatric Research Initiative Fund described in section 9008 of title 26, United States Code, for the purpose of carrying out section 402(b)(7)(B)(ii) of the PHS Act (relating to pediatric research), as authorized in the Gabriella Miller Kids First Research Act.

BUILDINGS AND FACILITIES

For the study of, construction or demolition of, renovation of, and acquisition of equipment for, facilities of or used by NIH, including the acquisition of real property, $128,863,000, to remain available through September 30, [2020]*2021*.

LANGUAGE ANALYSIS

Language Provision	Explanation/Justification
NATIONAL CANCER INSTITUTE For carrying out section 301 and title IV of the PHS Act with respect to cancer, $4,950,396,000, of which up to [$8,000,000]*$50,000,000* may be used for facilities repairs and improvements at the National Cancer Institute—Frederick Federally Funded Research and Development Center (FFRDC) in Frederick, Maryland. (Department of Health and Human Services Appropriations Act, 2017.)	NIH requests the NCI repairs and improvement cap for the Fort Detrick campus be increased to $50 million. In recent years, NCI has allocated a larger share of its overall appropriations to meet the needs of the Fort Detrick campus. The increase would allow NCI to complete priority projects, maintain FFRDC operations, and provide high-value support to the NCI mission, the research community, and to patients diagnosed with cancer.
NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES [Provided, That not less than $273,325,000 is provided for the Institutional Development Awards program.]	NIH requests this specific language be removed because it is no longer needed.
NATIONAL LIBRARY OF MEDICINE Provided, That of the amounts available for improvement of information systems, $4,000,000 shall be available until September 30, [2017]*2018*:	NIH requests this language change to ensure continuation of two-year funding availability. The proposed language change helps to clarify that the $4 million level is meant to be a ceiling only for the purposes of the two-year funding availability.
NATIONAL CENTER FOR ADVANCING TRANSLATIONAL SCIENCES [Provided further, That at least $500,000,000 is provided to the Clinical and Translational Sciences Awards program]	NIH requests this specific language be removed because it is no longer needed.
OFFICE OF THE DIRECTOR *Provided further, that the Director may direct up to 1 percent of the total made available in this or any other Act to all National Institutes of Health discretionary appropriations to activities that the Director may so designate: Provided further, That no such appropriation shall be decreased by more than 1 percent by any such transfers and that the Congress is promptly notified of the transfer.*	NIH requests this specific language in order to provide clarity regarding the NIH Director's ability to use the one percent transfer authority, as provided in authorizing language.

Language Provision	Explanation/Justification
BUILDINGS AND FACILITIES For the study of, construction *or demolition* of, renovation of, and acquisition of equipment for, facilities of or used by NIH, including the acquisition of real property, $128,863,000, to remain available through September 30, [2020]*2021*.	NIH requests that the word 'demolition' be added to the appropriations language.

AUTHORIZING LEGISLATION

(Dollars in Thousands)	FY 2016 Amount Authorized	FY 2016 Appropriations Act	FY 2017 Amount Authorized	FY 2017 President's Budget
National Institutes of Health:				
Section 3330B(b)(2)(C) of the PHS Act	$32,311,349	$32,311,349	$33,136,349	$33,136,349
Section 330B(b)(2) of the PHS Act[1]	$150,000	$150,000	$150,000	$150,000
Section 311(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, and Section 126(g) of the Superfund Amendments and Reauthorization Act of 1986	$77,349	$77,349	$77,349	$77,349

[1] This represents a mandatory appropriation under Public Law 114-10, the Medicare Access and CHIP Reauthorization Act of 2015 that was extended through 2017.

APPROPRIATIONS HISTORY

Fiscal Year	Budget Request to Congress	House Allowance	Senate Allowance	Appropriation [1]
FY 2008	$28,849,675,000	$29,899,004,000	$30,129,004,000	$29,312,311,000 [2]
FY 2008 Supp.				$150,000,000
FY 2009	$29,457,070,000	$30,607,598,000	$30,404,524,000 [3]	$30,545,098,000
FY 2009 ARRA				$10,400,000,000
FY 2010	$30,988,000,000	$31,488,000,000	$30,988,000,000	$30,934,413,000 [4]
FY 2011	$32,136,209,000		$31,989,000,000	$30,935,000,000 [5]
FY 2012	$31,979,000,000		$30,630,423,000	$30,852,187,000 [6]
FY 2013				
Base	$30,852,187,000		$30,810,387,000	$30,929,977,000 [7]
Sequestration				-1,552,593,211
Subtotal	$30,852,187,000		$30,810,387,000	$29,377,383,789
FY 2014	$31,323,187,000		$31,176,187,000	$30,142,653,000
FY 2015	$30,353,453,000		$30,084,304,000	$30,311,349,000 [8]
FY 2016	$31,311,349,000 [9]	$31,411,349,000	$32,311,349,000	$32,311,349,000 [10]
FY 2017	$33,136,349,000 [11]			

[1] Does not include comparability adjustments. Superfund and Type 1 Diabetes are included except where indicated.

[2] Reflects: a) $2,928,345,000 appropriated to the ICs for HIV research, b) NIH share of the Government-wide rescission of $520,929,000, c) transfer of $294,759,000 to the Global Fund.

[3] Excludes funding for Superfund Research activities for which the Appropriations Committee did not mark up a figure.

[4] Reflects Labor/HHS appropriation of $30,705,201,000; transfer of $300,000,000 to Global AIDS funds; $1,000,000 transfer from HHS for the Interagency Autism Coordinating Committee and Secretary's 1 percent transfer to HHS of $4,587,000.

[5] Reflects: $3,059,277,000 appropriated to the ICs for HIV research; $998,000 transfer from HHS to the Interagency Autism Coordinating Committee.

[6] Reflects: $3,074,921,000 appropriated to the ICs for HIV research; Omnibus across-the-board rescission of $58,130,567 and the Secretary's transfer of $8,726,791.

[7] Reflects: Full-year continuing resolution base. Does not include Section 3004 OMB 0.2 percent across-the-board

[8] Excludes Ebola-related funding. Includes Program Evaluation Financing of $715,000,000.

[9] Includes Program Evaluation Financing of $847,489,000.

[10] Includes Program Evaluation Financing of $780,000,000. Excludes Ebola-related funding.

[11] Includes Program Evaluation Financing of $847,489,000. Includes mandatory financing.

NARRATIVE BY ACTIVITY TABLE

(Dollars in Millions)	FY 2015 Actual[1]	FY 2016 Enacted[1]	FY 2017 President's Budget	FY 2017 Request +/- FY 2016 Enacted
Program Level[2]	$30,311	$32,311	$33,136	$825
FTE	17,824	18,000	18,000	0

[1] Excludes Ebola-related funding.

[2] Includes Mandatory Type 1 Diabetes and Superfund in FY 2015, FY 2016, and FY 2017; NIGMS Program Evaluation funding of $715 million in FY 2015, $780 million in FY 2016, and $847 million in FY 2017, and mandatory financing in FY 2017.

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

Allocation Methods: Competitive Grants; Contract; Intramural; Other

PROGRAM DESCRIPTION AND ACCOMPLISHMENTS

Long-Range NIH Research Contributions to Improvements in Health Care and Public Health: Selected Examples

NIH has supported biomedical research to enhance health, lengthen life, and reduce illness and disability for more than 100 years. Between 1970 and 2010, the life expectancy of the average American increased by 7.9 years.[21] Older Americans are not just living longer; they are staying healthy and active longer. Rates of reported risk factors for chronic disease (uncontrolled LDL or high blood pressure, smoking, etc.) have dropped by more than 10 percent since 1999. At age 65, Americans today can expect to live 19.2 more years, or 40 percent longer than in 1950, and the vast majority of these adults continue to live without any activity limitations, a major improvement in just the past 30 years.[22] The largest growing demographic group in the United States consists of individuals living beyond the age of 85. We can attribute these remarkable improvements, in part, to NIH research. NIH-funded projects have made many contributions that have advanced health care and enhanced public health. The following are some selected examples.

Heart Disease

At the outset of the 20th century, the three leading causes of death in the United States were pneumonia, tuberculosis, and infectious diarrhea, but by 1950, heart disease had surpassed all other maladies to become the leading cause of death. Through research advances supported in large part by NIH, deaths from heart disease and stroke decreased by approximately 78 percent between 1968 and 2013.[23] The Framingham Heart Study introduced the concept of risk factors, identifying factors that lead to heart disease, such as smoking, high blood pressure, and high cholesterol, and generating research findings that have led to more than 3,000 publications. This research, along with NIH-supported clinical trials, has led to the development of effective pharmacological and behavioral interventions and prevention strategies, including safe and effective surgical and catheter-based procedures to open clogged coronary arteries. Current NIH research focuses on elucidating new biological pathways, new treatment and prevention models, dissecting the genetic vs. environmental contributions, developing and understanding the value of new diagnostic and imaging tests, resolving the contributing role of social networks to disease, and enhancing device technologies for treatment.

Diabetes

In the recent past, adults diagnosed with diabetes during middle age lived on average 10 years less than adults without diabetes. Thanks to the development of early screening methods and treatments that enable better control of diabetes-related complications, adults with diabetes are

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[21] Calculated from Health, United States, 2013: with Special Feature on Socioeconomic Status and Health, http://www.cdc.gov/nchs/data/hus/hus13.pdf

[22] Calculated from Health, United States, 2010: with Special Feature on Death and Dying http://www.cdc.gov/nchs/data/hus/hus10.pdf and National Vital Statistics Reports Deaths: Preliminary Data for 2011 Vol. 61, Number 6 http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf.

[23] National Vital Statistic Reports, Volume 64, Number 2. Forthcoming. Deaths: Final Data for 2013. http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf.

now living longer and healthier lives. Between 1969 and 2013, the death rate among adults with diabetes declined by 16.5 percent, and from 1990 to 2010 the rates of major diabetes complications dropped dramatically, particularly for heart attacks related to diabetes, which declined by 68 percent, and stroke related to diabetes, which declined by 53 percent.[24,25] These remarkable improvements are due largely to clinical trials supported by NIH. In addition, basic science research has unveiled genes that may be involved in the development and progression of diabetes. NIH research also is generating important insights into the prevention and management of diabetes, highlighting the importance of family support. Studies funded through the Diabetes Prevention Program also have shown that lifestyle changes, such as diet and physical activity, can lower the risk of developing type 2 diabetes by 58 percent in adults at high risk for the disease. For type 1 diabetes, progress toward the development of a fully reliable artificial pancreas provides hope for an end to the daily routine of finger sticks and insulin injections.

Stroke

Fewer people are dying of stroke today—the age-adjusted stroke mortality rate has decreased by 78 percent since 1950 due to both treatment and prevention strategies based on NIH-funded research.[26] In 1995, an NIH-funded clinical trial established the first and only FDA-approved treatment for acute ischemic stroke. The drug tissue plasminogen activator (tPA) reduces the risk of disability and maximizes the potential for patient recovery. A recent analysis estimated that tPA can provide considerable cost savings – nearly $74 million annually for the first post-stroke year alone – if used in just 20 percent of all ischemic stroke patients in the United States. However, tPA must be administered quickly after the onset of symptoms. Current estimates suggest that fewer than ten percent of stroke patients are treated with the drug. Recent NIH-funded research has led to the revision of tPA administration guidelines to extend the timing from three hours to four and a half hours in some cases.[27,28] NIH researchers are currently working to improve public awareness of stroke and to educate high risk populations on the importance of seeking immediate medical attention in order to increase the number of those receiving this life-saving and disability-reducing treatment.

Lung Cancer

Lung cancer is the second most common cancer and is the primary cause of cancer-related death in both men and women in the United States. However, both incidence rates and mortality rates continue to decline for both men and women. NIH-funded research has contributed to the

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[24] Ma, Jiemin et al. "Temporal Trends in Mortality in the United States, 1969-2013" JAMA. 2015;314(16):1731-1739. http://jama.jamanetwork.com/article.aspx?articleid=2466136&linkid=18099832

[25] Gregg EW, Li Y, Wang J, Burrows NR, Ali MK, Rolka D, et al. Changes in diabetes-related complications in the United States, 1990-2010. N Engl J Med 2014 http://www.ncbi.nlm.nih.gov/pubmed/24738668

[26] http://www.cdc.gov/nchs/fastats/stroke.htm

[27] Jauch, EC et al. Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2013 Mar;44(3):870-947. http://www.ncbi.nlm.nih.gov/pubmed/23370205

[28] Bankhead C. Clot-busting drugs used more often in stroke. *MedPage Today*. August 23, 2013. http://www.medpagetoday.com/Cardiology/Strokes/41156

decrease in mortality, lowering the death rate by 20 percent from 1990 to 2010.[29] The recent development of targeted therapies, such as erlotinib and crizotinib, has led to dramatic responses in individuals whose lung cancers harbor particular genetic mutations. Advances in genetic screening techniques have helped NIH funded researchers identify genes that may influence the risk for lung cancer development and genetic errors that cause lung cancer, and new precision medicine clinical trials are targeting some types of this disease.

HIV/AIDS

HIV, the virus that causes AIDS, was first recognized more than 30 years ago. In that time, NIH has established the world's leading AIDS research program. Each year, 50,000 people in the United States still become infected with HIV. Currently, there are more than 1 million people in the United States and over 35 million people globally who are living with HIV infection. In the early 1980s when the HIV/AIDS epidemic began, those infected with the virus were not likely to live longer than a few years. Now, thanks to research funded in large part by NIH, there are powerful treatments that can suppress the virus to undetectable levels, allowing those infected with it to live for many years. As a result, death rates dropped more than 50 percent between 1987 and 2010, and in the United States, a 20-year-old with HIV who is receiving treatment can expect to live into their 70s.[30,31] These treatments, combined with encouraging advances toward the development of an HIV vaccine and research to find a cure, mean that a future AIDS-free generation is possible with sustained effort.

Childhood Vaccine Development: Haemophilus influenzae type b

Vaccines represent one of the most powerful tools used today to prevent disease, save lives, and reduce health care expenditures. Between 1994-2013, the CDC estimates that childhood vaccination prevented 322 million illnesses, 21 million hospitalizations, and 732 thousand deaths, with savings of $295 billion in direct costs and $1.38 trillion in total societal costs.[32] Included in this analysis was the vaccine against Haemophilus influenzae type b (Hib), which was FDA-approved and CDC-recommended for use in infants in the late 1980s. Prior to the vaccine, this bacterium was the leading cause of meningitis and acquired mental retardation in children less than 5 years of age in the United States. Even with effective antibiotic treatment, 5 percent of patients died and about 30 percent had residual central nervous system damage. NIH support, including critical research performed in the NICHD intramural program and NIAID-funded clinical trials, played a major contributing role in the development of the Hib vaccine. As a result, the incidence of Hib has dropped by more than 98 percent from ~20,000 cases annually in the early 1980s to less than 30 per year today.[33] The CDC has estimated that Hib vaccination has prevented 361,000 illnesses, 334,000 hospitalizations, and 13,700 deaths.

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[29] http://www.cdc.gov/cancer/lung/statistics/
[30] http://www.cdc.gov/hiv/pdf/statistics_surveillance_hiv_mortality.pdf
[31] Samji et al "Closing the gap: increases in life expectancy among treated HIV-positive individuals in the United States and Canada." PLoS One. 2013 Dec 18;8(12):e81355 http://www.ncbi.nlm.nih.gov/pubmed/24367482
[32] Whitney, MMWR , 2014
[33] CDC MMWR 2014: Prevention and Control of *Haemophilusinfluenzae* Type b Disease Recommendations of the Advisory Committee on Immunization Practice

Breast Cancer

Primarily because of NIH-supported research, multiple breast cancer susceptibility genes have now been identified, including BRCA1, BRCA2, TP53, and PTEN/MMAC1. Genetic testing now allows for tailored, safer, and more efficient treatments. Recent research studies also identified 55 genes linked to a tumor suppressor gene that can predict breast cancer survival as well as a natural compound that can attack human epidermal growth factor receptor 2 (HER2) positive breast cancer cells. Scientists also conducted studies in mice in which they found a protein that reduces the risk that breast cancer will spread. In addition, a new imaging technique to improve diagnosis in women with dense breast tissue has been developed. As a result of these and many other advances, the relative 5-year survival from breast cancer in women has increased from 74.8 percent in 1980 to greater than 91 percent in 2012.[34.]

Prostate Cancer

Prostate cancer is one of the most common cancers and the second leading cause of cancer-related death for men in the United States. NIH-supported research on the treatment of prostate cancer has improved surgical approaches as well as radio-, chemo-, and hormonal therapies. The success of these advances has contributed to the significant decline in the death rate. Between 1990 and 2010, prostate cancer deaths per 100,000 men dropped from 38.4 to 21.9, with a 5-year survival rate approaching 99 percent.[35] Current research focuses on increasing understanding of the epidemiology and genetics of prostate cancer and improving treatment and diagnostic options.

Cervical Cancer

Cervical cancer is a deadly cancer in women. It is usually a slow-growing cancer that may or may not have symptoms, but it can be detected during routine gynecologic examinations. Nearly all cervical cancer is caused by human papillomavirus (HPV). Due to groundbreaking NIH research, two FDA-approved vaccines (Cervarix and Gardasil) are now available to prevent infection by HPV types 16 and 18, which cause about 70 percent of cervical cancer. In the first few years of HPV vaccine use, the prevalence of the types of HPV covered by the vaccine decreased from 11.5 percent to 5.1 percent among 14-19 year old women.[36] Ongoing efforts to scale up the use of the vaccines both in the United States and abroad are underway.

Roots of Precision Medicine

NIH-supported research has built an understanding of the processes underlying health and disease that enable us to think beyond decades-old models of organ systems. Thanks to a deep understanding of biology and behavior from the molecule to society, we can now begin to

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[34] NCI Surveillance, Epidemiology, and End Results Program (SEER). http://seer.cancer.gov/statfacts/html/breast.html

[35] NCI Surveillance, Epidemiology, and End Results Program (SEER). http://seer.cancer.gov/statfacts/html/prost.html

[36] Markowitz L et al. Reduction in HPV prevalence among young women following HPV vaccine introduction in the United States, National Health and Nutrition Examination Surveys, 2003-2010. *J Infect Dis.* 2013 Aug 1;208(3):385-93. http://www.ncbi.nlm.nih.gov/pubmed/23785124

approach disease treatment in a more precise way. Approved by the FDA in 2001, an early hallmark of this new approach is Gleevec® (imatinib), a highly effective treatment for the rare cancer chronic myelogenous leukemia (CML). Using DNA sequencing methods and molecular biology techniques to isolate the underlying genetic cause of CML, Gleevec® was developed in large part through NIH funding to target the specific, mutated signaling molecule (a tyrosine kinase) that causes the cancerous CML cells to grow uncontrollably. By inhibiting the tyrosine kinase, the cancerous cells cease to grow and die. The result is a remarkable change in prognosis for those diagnosed with CML. Prior to the development of Gleevec®, overall survival of patients was less than 50 percent with available treatment. With Gleevec®, five year survival rates exceed 89 percent, with minimal relapses or side effects, and patients with a new diagnosis of CML are now expected to live 30 years post-diagnosis, essentially a normal lifespan. Gleevec® now has been approved to treat several other cancers, including GIST (gastrointestinal stromal tumor); together, more than 100,000 patients with CML or GIST have received Gleevec®. Gleevec®'s effectiveness paved the way for a new industry of drugs; by the end of 2014, more than 39 drugs targeting different kinds of kinases were approved by the FDA.

Infant Health

In 1960, 26 of every 1,000 babies born in the United States died before their first birthday. By 2010, the infant mortality rate was 6.1 per 1,000 births, considerably less than a generation before.[37] A sustained, long-term effort, informed in large part by NIH research to reduce preterm births, neonatal mortality, and other complications that increase the risk of infant death, contributed to these substantial improvements in the survival rates of infants born preterm and to advances in care for all newborns.

Adolescent Risk Behavior

In the last three decades, biological, epidemiological, and social science discoveries funded by NIH have produced a detailed understanding of the risks and mechanisms that lead to drug abuse and addiction in adolescents. This knowledge in turn has informed several new science-based prevention approaches. Today, the rate of cigarette smoking by teenagers is at its lowest point since the NIH-funded Monitoring the Future survey began tracking drug use and attitudes of teens in 1975. Alcohol use by teenagers also has steadily declined since the 1970s, and continued to decline in 2014.[38,39]

Age-Related Macular Degeneration (AMD)

A major cause of blindness and the leading cause of new cases of blindness in people over age 65, AMD was largely untreatable prior to the 1990s. In 1991, an NIH-funded clinical trial established the value of laser treatment for advanced AMD to stabilize the condition. In 2001, NIH researchers announced that a daily dietary regimen of antioxidant vitamins and minerals

[37] http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/InfantMortality.htm#note1
[38] http://monitoringthefuture.org/pressreleases/14drugpr.pdf
[39] http://www.drugabuse.gov/news-events/news-releases/2014/12/teen-prescription-opioid-abuse-cigarette-alcohol-use-trends-down

may delay the onset of advanced AMD by 25 percent. In 2012, a clinical trial supported by NIH showed that long-term treatment of AMD with either the drug Avastin or the drug Lucentis resulted in dramatic and lasting improvement in vision, such that two-thirds of patients had driving vision (20/40 vision or better). More recently, researchers have begun to understand epigenetic changes that can occur in individuals and to identify genes that result in an increased risk of AMD. Scientists are also developing new technologies to improve imaging methods for diagnosis.

Hearing Loss

As a result of NIH efforts that led to statewide screening for hearing loss in newborns and infants, nearly all infants born in U.S. hospitals in 2010 were screened for hearing loss, up from as few as one-tenth of infants screened in 1993. NIH-supported research also has driven the development of hearing aids from the first electronic hearing devices invented in the 1950s to the sophisticated digital devices available today. Innovative collaborations between NIH, the Department of Veterans Affairs, and the National Aeronautics and Space Administration have significantly improved hearing aid technology over the past 20 years. In addition to amplifying sound, today's hearing aids are able to address the challenges of understanding speech, localizing sound, and hearing in noisy environments. Furthermore, many children born with congenital deafness can now be successfully treated with cochlear implants, giving them a lifetime of hearing. According to the FDA, approximately 324,000 cochlear implants have been implanted worldwide, including about 58,000 U.S. adults and 38,000 U.S. children.[40] Studies have shown that screening and implantation before the age of 18 months allows more than 80 percent of children with hearing loss to join mainstream classes with their normal-hearing peers, and saves society more than $30,000 per child.[41]

Burns and Traumatic Injury

NIH funded research on fluid resuscitation, wound cleaning, skin replacement, infection control, and nutritional support has greatly improved the chances of surviving catastrophic burns and traumatic injuries. In the mid-1970s, burns that covered even 25 percent of the body were almost always fatal. Today, people with burns covering 90 percent of their bodies can survive, although often with some impairments. From 1990 to 2010, the death rate per 100,000 people from motor vehicle traffic injury decreased from 18.5 to 11.3, and firearm fatalities dropped from 14.6 to 10.1. These dramatic increases in survival rates, as well as increased health, functioning, and quality of life of survivors, are due in large part to research findings that have transformed clinical practice.

[40] http://www.nidcd.nih.gov/health/hearing/pages/coch.aspx
[41] Semenov et al. Age-Dependent Cost-Utility of Pediatric Cochlear Implantation. *Ear Hear*. 2013 Jul-Aug; 34(4): 402–412.

Alzheimer's Disease

Alzheimer's disease is a progressive, irreversible brain disease that slowly destroys memory and thinking skills, and eventually even the ability to carry out the simplest tasks of daily living. Alzheimer's disease is currently the sixth leading cause of death in the United States and affects as many as 5 million Americans age 65 and older. As recently as 30 years ago, very little was known about Alzheimer's disease, but research supported by NIH and other organizations has greatly expanded knowledge and understanding of brain function, risk factors, treatment, and prevention. NIH-supported imaging studies have provided dramatic insights into disease pathogenesis, and the need to initiate clinical trials at the earliest stages of disease (ideally even before symptoms have appeared) has become increasingly clear. While much more remains to be discovered in each of these areas, recent research has led to more than 90 drugs in clinical trials for Alzheimer's disease with many more in the pipeline awaiting FDA approval to enter human testing. In addition, the Accelerating Medicines Partnership, an NIH-led public-private partnership to transform and accelerate drug development, recently launched a new Alzheimer's Big Data portal for use by the research community.

Parkinson's Disease

Parkinson's disease is a neurodegenerative disorder, caused by the death of dopamine-producing brain cells that affect the ability of individuals to move. As many as one million Americans and an estimated 7-10 million people worldwide are living with Parkinson's, with ~60,000 Americans diagnosed with a new case every year.[42] Though there is currently no cure for Parkinson's disease, a variety of medications exist that can provide relief for the symptoms, though the effectiveness of these drugs varies from case to case.[43] In cases where the disease does not respond to drugs, NIH has supported the development of a therapy called Deep Brain Stimulation (DBS), in which electrodes are implanted directly into the brain to stimulate some of the affected areas. DBS can provide relief from many of the symptoms of Parkinson's, and in some cases can even reduce the need for other drugs, allowing patients to avoid the burden of those drugs' side effects.[44] DBS has been FDA-approved for Parkinson's disease since 2002, and NIH continues to support research into understanding how to improve the process of both selecting appropriate patients and providing the best possible treatment.

Chronic Obstructive Pulmonary Disease (COPD)

COPD is a progressive disease which includes two main conditions that coexist: emphysema and chronic bronchitis. COPD, which in many cases may be undiagnosed, is the third leading cause of death in the United States and a major cause of disability.[45] The majority of COPD sufferers are current or former smokers over 40 years old. Large, multi-center NIH-funded clinical trials are evaluating the efficacy of several treatments in order to reduce the disability and costs associated with COPD. In addition, new studies are examining the genetic contributions,

[42] http://www.pdf.org/en/parkinson_statistics
[43] http://www.ninds.nih.gov/disorders/parkinsons_disease/parkinsons_disease.htm
[44] Weaver et al. Bilateral Deep Brain Stimulation vs Best Medical Therapy for Patients With Advanced Parkinson Disease: A Randomized Controlled Trial. *JAMA*. 2009;301(1):63-73.
[45] http://www.cdc.gov/copd/index.html

susceptibility factors, and disease progress of COPD, as well as attempting to understand the mechanisms that link COPD to cardiovascular health.

Science Advances from NIH Research

NIH-funded scientists report thousands of new findings every year across the spectrum of biomedical science, from basic, translational, and clinical research studies. A few of the many recent NIH research accomplishments are listed below.

Drug Re-purposed for Alzheimer's Disease

Drugs that are being developed or have been approved for use to treat particular symptoms or diseases may have usefulness for entirely new, and often unexpected, diseases. However, drugs that are in development but do not show positive early results may be shelved and forgotten. As a result of a unique public-private partnership supported by NIH, scientists are "rescuing" these drugs and testing them for potential use to treat other diseases. One such rescued drug is saracatinib, which was developed to treat cancer but did not progress well in clinical trials. Now, NIH-funded researchers, in partnership with AstraZeneca, the maker of the drug, have shown promising results using saracatinib to treat animal models of Alzheimer's disease. Researchers found that mice treated with the experimental drug had a complete reversal of spatial learning and memory loss, and the brains of the mice showed a restoration of the synapse loss typically seen in Alzheimer's disease. Clinical trials have commenced, and early results show that the drug is safe in humans. Additional clinical trials are underway to begin testing the efficacy of the drug to treat Alzheimer's disease.

Promising Results with a New Ebola Vaccine

The outbreak of Ebola Virus Disease (EVD) in West Africa was devastating, not only because of its toll on human life but also because of the rapidity of its spread. In response to this crisis, NIH accelerated its long-standing support for EVD vaccine development. Two vaccines emerged: cAd3-EBOZ, which uses a chimpanzee-derived cold virus to deliver genetic material from the Ebola virus to generate immunity, and VSV-ZEBOV, which uses an animal virus that affects cattle (vesicular stomatitis virus) to carry the Ebola virus gene segment. Because the vaccines do not contain the entire Ebola virus, they are not capable of causing the disease. However, using pieces of the Ebola virus in the vaccine can stimulate the human immune system to create anti-Ebola antibodies that will protect the patient from the disease. Both vaccines proved to be safe in early phase clinical trials, and the vaccines are being tested in controlled clinical trials in Liberia with results expected in late 2015.

Two New Medical Devices Enable Personalized Drug Testing in Patients

For the promise of personalized medicine to become reality, biomedical science must join with technology to produce solutions that address each individual patient's specific needs. One step along this road is to eliminate the guesswork and lost time due to failed cancer treatments. Two NIH-funded research groups recently developed devices to allow doctors to try multiple treatments simultaneously on the same tumor. One device, called CIVO, includes up to eight needles arranged in an array, and each can be loaded with a different drug or drug combination.

The needles are injected into solid tumors that are near the skin's surface, and pieces of the tumor can be removed a few days later to examine the tissue around each injection site to see which treatment had the most profound effect. This device has been tried successfully in animals and a trial in four lymphoma patients demonstrated feasibility in humans and reported no adverse events.

A second device about the size of a rice grain can be implanted in a tumor to study the tumor's response to various anticancer treatments simultaneously. The device contains many tubes that can release micro doses of up to 16 drugs or drug combinations into a tumor. The tumor response is then assessed a day or two later via a minimally invasive biopsy of a small region of the tumor. This device has been tested successfully in mice thus far. These two devices could help optimize drug therapies before a full treatment regimen begins, improve drug response prediction, or even gather efficacy data on new drug compounds.

Digging Up New Antibiotics

Manufacturing antibiotics began about 75 years ago, and bacteria have been evolving to evade these efforts ever since. Antibacterial resistance is a growing public health threat, with antibiotic-resistant infections claiming the lives of 23,000 Americans each year. NIH-funded scientists recently made progress in the battle against antibiotic resistance with the discovery of a new class of antibiotic drugs developed from ordinary soil – one of the most fertile places for the discovery of new antibiotics. Researchers used a new technology called a microfluidic "iChip," an apparatus roughly the size of a standard microscope slide which can assay approximately 10,000 different species of bacteria for antimicrobial activity at once. Using the iChip, researchers discovered the new antibiotic teixobactin, which was then used successfully to combat 19 types of bacteria in test tube experiments as well as to treat two different antibiotic-resistant infections in mice. Teixobactin uses a different mechanism to kill bacteria than other kinds of antibiotics, and scientists were unable to create strains of bacteria that would resist this drug. This promising development is just one angle of NIH's efforts to fight antibiotic-resistant infections.

Peanut Allergies: Prevention by Early Exposure?

A growing number of parents and schools are contending with children with peanut allergies. In the United States, peanut allergies have quadrupled over the past 13 years and now affect more than 2 percent of Americans. Many parents have been advised not to introduce peanuts into their child's diet until at least two years of age. But in a recent NIH-funded study, researchers found that adding peanut-based foods to an infant's diet reduced the risk of peanut allergy between 70 and 80 percent. Feeding infants peanut-rich foods helped their immune system learn to tolerate peanuts and avoid an allergy later in life. Researchers did not report any adverse events from the study, indicating that the method is relatively safe. A second study, which dovetails with this work, involves a search for genes that increase the risk of peanut allergy. In this NIH-funded study, investigators examined the DNA of more than 2,700 individuals – including parents and children with and without clearly defined food allergies – and discovered

that a region on chromosome 6 harbors genetic risk factors for peanut allergy.[46] These findings represent long-awaited developments in understanding the causes and the potential means of prevention for peanut allergy.

Insights into Energy-Burning Fat Cells

White fat, one of two main types found in humans, tends to be located under the skin and around internal organs, and it stores excess calories. Too much white fat is characteristic of obesity and increases the risk of several metabolic disorders. In contrast, the second main type, brown fat, burns energy to create heat and help maintain body temperature. The darker color of brown fat is due to the presence of energy-generating mitochondria. Recently, researchers identified a third type of fat cell in humans called beige fat cells, which appear within white fat in response to triggers such as cold. The beige fat cells burn energy rather than store it, but it is not yet clear whether these cells are generated by a conversion of white cells into a more brown-like state or if they are newly produced in response to a stimulus (or a combination). Because beige and brown cells can burn calories, the finding may lead to new targets for therapies or new ways to engineer fat cells to fight obesity and its associated disorders.

3-D Lasers Used to 'Print' New Airways

On the cutting edge of medical technology and regenerative medicine, doctors used a 3-D laser printer to create custom-made plastic airway splints to help three small children with a rare condition called tracheobronchomalacia, which causes weak, constantly collapsing airways. The printed splints, developed by NIH-funded researchers and made from materials that will be absorbed by the body over time, were attached to the children's tracheas, enabling them to breathe on their own. The splints are fitted precisely to each child, and they will expand as the children grow until they are reabsorbed by the body in about three years, by which time the children's airways will be able to function on their own. The pioneering device and procedure will now be tested on a variety of patients to gauge its breadth of applicability. This could be the first of many medical needs met by the new techniques made possible by 3-D printing technology.

Human Tissue-specific Networks Provide Comprehensive View of Disease Biology

Big data analyses are opening new doors in understanding how diseases work. Most studies of disease concentrate on understanding the disease process only in the affected cell type, but the advent of genomic sequencing provides new opportunities to explore other interactions that may play an important role. Investigators from seven institutions across the country collaborated in an NIH-funded study to combine big data from numerous disease and normal tissue sources to understand how genes work together to carry out functions in 144 different tissue and cell types. The researchers first pinpointed functional genetic interconnections for specific tissue types and then combined that information with the DNA-based genome-wide association studies from the

[46] Hong X et al. Genome-wide association study identifies peanut allergy-specific loci and evidence of epigenetic mediation in U.S. children. *Nature Communications* 2015 Feb 24;6:6304. http://www.ncbi.nlm.nih.gov/pubmed/25710614

relevant disease. This cross-referencing technique, called a network-guided association study, or NetWAS, allowed researchers to identify associations between genes and diseases that were undetectable with previous methods. The resulting functional gene interaction networks for the kidney, brain, and other organs could provide maps for scientists looking to better understand the underlying causes of diseases or for possible drug targets or pathways. The researchers also produced an online resource that allows other scientists to explore interacting genes in hundreds of human tissues and cell types.

Nanotechnology Provides Means to Identify and Treat Brain Tumors

Neurological symptoms can be similar for different diseases, and standard techniques such as X-rays and MRI may not be sufficient to distinguish between one diagnosis and another. In cases such as brain tumors, a biopsy for definitive diagnosis may be risky or impossible. Realizing that a more accurate image of the tumor could aid diagnosis, an international consortium of NIH-funded academic investigators and industry representatives created a novel type of nano-imaging agents. They created the imaging agent by chemically attaching an MRI tracer molecule, which allows visualization, to microscopic nano-beads capable of crossing into the brain. This enabled the group to generate an "MRI virtual biopsy" that specifically targets tumor cells for efficient imaging. Using this non-invasive method, the investigators were able to use the same targeting agents in a therapeutic way by attaching the imaging agents to a treatment molecule that could be delivered directly to the tumor site. This novel method allows for the diagnosis and treatment of tumors without the necessity of biopsy in those cancers where biopsy is difficult to perform.

Early Detection of Pancreatic Cancer

Pancreatic cancer is one of the most deadly forms of cancer—of the nearly 50,000 Americans diagnosed in 2015, only 7 percent are expected to survive after 5 years.[47] Part of what makes this disease so lethal is that it is very difficult to detect at a stage that is early enough for effective treatment. In July 2015, NIH-funded researchers published the results of a search for markers in the blood that could act as an early warning for pancreatic cancer. One protein in particular, called Glypican-1, was found at high levels in patients with both breast cancer and pancreatic cancer, and patients with more severe, later-stage disease tended to have more of this protein in their blood. This research presents a promising opportunity for physicians to diagnose some of the most deadly cancers before the disease has a chance to turn deadly, and uses a simple, non-invasive blood test to do so. If confirmed, these results would allow for earlier diagnosis and treatment that could increase survival rates for pancreatic cancer.

Lymphatic Vessels Discovered in Central Nervous System

For years, textbooks have described the brain as the only major organ lacking a direct connection to the lymphatic system, which carries immune cells and other cells or molecules (including proteins, bacteria, and fats) that occupy the space between tissues throughout the body. Given the widespread availability of advanced imaging techniques, the assumption that

[47] http://seer.cancer.gov/statfacts/html/pancreas.html

human anatomy has long been mapped, and a lack of evidence to the contrary, it came as quite a surprise when NIH-funded researchers discovered a pathway that carries fluid and immune cells from cerebrospinal fluid in the brain to nearby lymph nodes. These lymphatic vessels lay next to larger blood vessels that previously had obscured them from view. This discovery reveals a gap in our understanding of the human body that could have significant health implications, particularly for neurological diseases that are associated with immune system dysfunction, including Alzheimer's diseases, meningitis, and multiple sclerosis.

Big Potential in Tiny 3D Heart Chambers

The heart is essential to keeping human beings alive, and defects in the development of the heart can cause serious problems in children. However, the development of the heart is difficult to study in isolation, both because it is a complex, three-dimensional, moving structure and because it is required for life. Recently, a group of NIH-funded scientists created a model for studying the human heart in miniature. Using skin cells from adult patients, the researchers genetically reprogrammed them into induced pluripotent stem cells and then used those cells to produce cardiac tissue. While previous studies had succeeded in producing cardiac tissue, this group introduced a 3D structure that caused the cells to form tiny, pulsating microchambers that beat very similarly to the chambers of a full-size heart, and with a similar cellular organization. The researchers also showed that drugs which cause cardiac birth defects in children can cause similar defects in their miniature model heart, suggesting that this method may be useful for screening drugs for cardiac side effects in the future. This new "heart in a dish" model allows scientists to study the development of human heart cells more accurately than before, without having to use animal models, and could lead to a better understanding of how current and future drugs might affect the heart of a developing fetus.

CRISPR Used in Wide-Ranging Applications

CRISPR (clustered regularly interspaced short palindromic repeats) is a genome-editing technique hailed as the 2015 Breakthrough of the Year by Science magazine. Using a DNA-cutting enzyme called Cas9, it can make sequence-specific edits – a vast improvement on the precision, speed and throughput of the technology. This transformative development is having a huge impact on a wide range of research studies, and is revealing new targets for therapy and clinical trials related to genetic abnormalities.

Non-invasive Glioblastoma Characterization to Help Predict Patient Outcomes

Glioblastoma is a highly lethal brain cancer and the most common brain cancer in adults. One of the inherent challenges in treating glioblastoma is the lack of non-surgical options for predicting the success of treatment. Magnetic resonance imaging (MRI) provides clinicians with the location and size of a tumor; however, multiple biopsy samples must be taken in order to truly assess a patient's specific disease state. Seeking to develop a non-invasive diagnostic approach, scientists attempted to detect MR image-based biomarkers to identify different types of glioblastoma. Building off of work from previous groups that have linked imaging features with gene expression data, this NIH-funded team was able to classify tumors into three distinct categories. These encouraging findings point the way for future non-invasive methods for identifying particular subtypes of disease, which could inform targeted therapies for

glioblastoma. This technique also could expand options to monitor disease progression and treatment response, thus enabling a more tailored approach to treating glioblastoma.

Non-invasive Spinal Cord Stimulation to Address Paralysis

An estimated 1.2 million people in the United States live with paralysis due to spinal cord injury. NIH is funding leading research on understanding severe spinal cord injuries (SCI) and improving outcomes for SCI patients. Previous NIH-funded research enabled four patients with complete paralysis to regain some voluntary movement via physiotherapy and spinal cord stimulation through a device implanted on the spinal cord. In a recent study, some of the same researchers successfully enabled voluntary leg movement through physiotherapy plus a non-invasive method called trans-cutaneous spinal stimulation, in which electrodes are strategically placed on the skin of the lower back. By the end of the study, these patients were able to move their legs without electrical stimulation. Future studies will determine if this type of spinal stimulation will allow patients to bear weight and regain autonomic functions that were lost due to paralysis. These advances offer options for patients that may not be able to endure additional surgery to implant a stimulation device and are helping to change the outlook for spinal cord injuries.

FUNDING HISTORY

Fiscal Year	Amount[1]
2013 [2]	
Base	$30,695,855,975
Sequestration	-$1,552,593,211
Total Post-Sequestration	$29,143,262,764
2014 [3]	$30,061,862,000
2015 Actual [4]	$30,311,349,000
2016 Enacted [4]	$32,311,349,000
2017 Budget Request [5]	$33,136,349,000

[1] Appropriated amounts include discretionary budget authority received from both Labor/HHS appropriations that fund ICs as well as the Interior, Environment & Related Agencies appropriation that supports NIH Superfund Research activities. Includes mandatory budget authority derived from the Special Type 1 Diabetes account; also includes NLM Program Evaluation ($8.20 million) in FY 2014, and NIGMS Program Evaluation financing of $715 mllion in FY 2015, $780 million in FY 2016, and $847.489 million in FY 2017.

[2] FY 2013 appropriation includes the effect of sequestration, 0.2 percent across-the-board rescission, and Secretary's Transfers.

[3] FY 2014 appropriation includes the effect of Secretary's Transfers, and it also reflects sequestration of the mandatory funding for Type 1 Diabetes.

[4] Excludes Ebola-related funding.

[5] Includes mandatory financing.

SUMMARY OF THE REQUEST NARRATIVE

The FY 2017 President's Budget request would provide $33.1 billion to NIH, which is $0.8 billion above the FY 2016 Enacted level. It would include $30.3 billion in discretionary funding, $0.8 billion in Program Evaluation financing, and $2.0 billion in mandatory funding.

The following summary references program level funding, which includes discretionary budget authority in the Department of Labor, Health and Human Services, and Education, and Related Agencies appropriation and in the Department of the Interior, Environment, and Related Agencies appropriation (dedicated to the Superfund Research program), mandatory budget authority (including the Special Type 1 Diabetes account), and National Institute of General Medical Sciences funding under Section 241 of the Public Health Service Act.

Research Project Grants (RPGs)

The FY 2017 President's Budget would provide $18.2 billion for RPGs, which is $386 million more than the FY 2016 Enacted level estimate. This amount would fund 9,946 Competing RPGs, or 807 less than estimated for the FY 2016 Enacted level. It also supports 24,608 Noncompeting RPGs, 1,241 more than the FY 2016 Enacted level. To sustain the maximum practicable number of new awards, the Competing RPG average cost of approximately $469,000 for FY 2017 is essentially the same as the average cost reflected in the FY 2016 Enacted level.

- **Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).** The FY 2017 President's Budget would provide $863 million for SBIR/STTR program grants, which is $58 million above the FY 2016 Enacted level. The statutory minimum set-aside requirement will increase from 3.45 percent in FY 2016 to 3.65 percent in FY 2017.

Research Centers

The FY 2017 President's Budget would provide $2.6 billion for Research Centers, which is $56 million less than the FY 2016 Enacted level. It would fund 1,354 grants, which is 27 less than the FY 2016 Enacted level.

Other Research

The FY 2017 President's Budget would provide slightly under $2.1 billion for this mechanism, which is $73 million more than the FY 2016 Enacted level. It would fund 6,856 grants, which is 109 more than the FY 2016 Enacted level.

Training

The FY 2017 President's Budget would provide $849 million for training, which is $18 million more than the FY 2016 Enacted level. A two-percent increase to stipend rates is proposed to maintain the stipend's purchasing power and offset the effects of anticipated inflation. It would fund 16,421 Full-Time Trainee Positions (FTTPs), which is 225 more than the FY 2016 Enacted level.

Research & Development (R&D) Contracts
The FY 2017 President's Budget would provide $3.2 billion for R&D contracts, which is $258 million more than the FY 2016 Enacted level. It would fund an estimated 2,281 contracts, which is 18 more than the FY 2016 Enacted level.

- **Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR).** Approximately $91 million is identified within the R&D Contracts mechanism for support of qualified SBIR/STTR contracts consistent with NIH adherence to applicable statutory threshold targets.

Intramural Research (IR)
The FY 2017 President's Budget would provide $3.6 billion for IR, which is $33 million more than the FY 2016 Enacted level. It accommodates required pay cost increases for Federal civilian employees and military personnel as well as employer-paid health insurance premium adjustments.

Research Management and Support (RMS)
The FY 2017 President's Budget would provide $1.7 billion for RMS, which is $34 million above the FY 2016 Enacted level. The amount covers mandatory pay cost increases for Federal civilian employees and military personnel attributable to the same factors described for the IR mechanism, such as the proposed 2017 pay raise and projected growth in health insurance premium costs.

Office of the Director (OD)
The FY 2017 President's Budget would provide $1.7 billion for OD, which is $145 million more than the FY 2016 Enacted level.

- **Other than Common Fund**
  The $930 million allocated for OD elements other than the Common Fund is $45 million more than the FY 2016 Enacted level, due to an increase for the BRAIN initiative.

- **Common Fund (CF)**
  Approximately $776 million is allocated for CF-supported programs. This amount is $100 million more than the FY 2016 Enacted level, due to an increase for the PMI Cohort Program, and represents about 2.6 percent of NIH total FY 2017 discretionary budget authority (exclusive of program evaluation financing resources).

Building & Facilities (B&F)
The FY 2017 President's Budget provides $179 million for infrastructure sustainment projects associated with the B&F program, which is $34 million above the FY 2016 Enacted level. This amount includes $50 million for facility repair and improvement activities at the National Cancer Institute's Frederick, Maryland, facility.

Superfund Research Program
The FY 2017 President's Budget would provide $77 million which is the same amount as the FY 2016 Enacted level.

Type 1 Diabetes
The FY 2017 President's Budget would provide $150 million in mandatory funding for Type 1 Diabetes research grants, which is the same as the FY 2016 Enacted level.

Program Evaluation Financing
The FY 2017 President's Budget would provide $847 million for Program Evaluation Financing purposes, which is $67 million above the FY 2016 Enacted level.

OUTPUTS AND OUTCOMES

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
SRO-1.1 By 2016, explore biological or bio behavioral pathways through which physical activity and weight control may affect cancer prognosis and survival. (Output)	FY 2015: NIH supported several studies (1) to identify potential pathways through which physical activity interventions, weight control interventions, or a combination of these interventions affect cancer prognosis among cancer survivors, and (2) to test these effects on relevant biomarkers. Target: Identify potential pathways through which physical activity interventions, weight control interventions, or a combination of these interventions affect cancer prognosis among cancer survivors, or conduct intervention studies to test these effects on relevant biomarkers. (Target Met)	Evaluate promising strategies for obesity prevention and treatment in real-world settings, and harness technology and tools to advance obesity research, and to improve health and survival among cancer patients.	N/A	N/A
SRO-1.2 By 2016, compare the effectiveness of two treatments for over active bladder syndrome among women. (Outcome)	FY 2015: 250 women in this study have been randomly assigned to receive either an injection of Botox A® into the bladder or the Interstim® device. All women are being asked to complete bladder symptom diaries and questionnaires, and to undergo examinations every 6 months for 2 years after treatment. Target: Evaluate any changes in urine biomarker levels in approximately 250 women that may be associated with one of the two treatments. (Target Met)	Analysis completed for Overactive Bladder Questionnaire Short form and Treatment Satisfaction Survey.	N/A	N/A
SRO-1.3 By 2017,	FY 2015: Identified 14	Initiate testing of	Complete testing	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
complete testing of the hypothesized mechanism of treatment effect of three novel treatment approaches for mental disorders, and advance one promising intervention into further clinical trial testing (e.g., pilot studies or efficacy trials). (Output)	hypothesized mechanisms of treatment effect for novel interventions from emerging neuroscience or basic behavioral science of mental disorders. Target: Identify one hypothesized mechanism of treatment effect for novel interventions that is based on emerging neuroscience or basic behavioral science of mental disorders. (Target Exceeded)	hypothesized mechanism of treatment effect of one novel intervention, and determine whether the intervention should progress further to clinical testing.	of the hypothesized mechanism of treatment of three novel treatment approaches for mental disorders, and advance one promising intervention into further clinical trial testing (pilot study or efficacy trial).	
SRO-1.4 By 2016, advance a novel drug candidate for a disease that affects the nervous system to the point of preparedness for human studies. (Output)	FY 2015: The Blueprint Neurotherapeutics Network team initiated three preclinical studies to enable filing Investigational New Drug (IND) applications with the Food and Drug Administration (FDA) in FY 2015. Target: Initiate toxicology studies enabling an Investigational New Drug (IND) application for a Blueprint Neurotherapeutics Network project. (Target Met)	File an Investigational New Drug application with the FDA for a Blueprint Neurotherapeutics Network project.	N/A	N/A
SRO-2.1 By 2015, evaluate islet transplantation in combination with immune modulation strategies for the treatment of type 1 diabetes in clinical trials. (Outcome)	FY 2015: Confirmed the efficacy of Purified Human Pancreatic Islet product transplant for treatment of severe hypoglycemia and achievement of tight glycemic control in patients with type 1 diabetes and severe hypoglycemic events. Target: Evaluate islet transplantation in combination with immune modulation strategies for the treatment of type 1 diabetes in clinical trials.	N/A	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	(Target Met)			
SRO-2.2 By 2019, assess the efficacy of one to two anti-inflammatory therapy for cardiovascular disease (CVD) in HIV-infected individuals. (Output)	FY 2015: Cumulative enrollment of 160 patients was achieved and follow-up visits are being conducted. Target: Achieve cumulative enrollment of 140 patients and conduct follow-up visits. (Target Exceeded)	Complete enrollment of 200 subjects and conduct follow-up visits.	Conduct follow-up visits of enrolled subjects.	N/A
SRO-2.3 By 2018, evaluate the impact of two community-level combination prevention packages (which include universal HIV testing and intensified provision of HIV antiretroviral therapy and care) on population-level HIV incidence in the developing world. (Outcome)	FY 2015: Enrollment for the study, Population Effects of Antiretroviral Therapy to Reduce HIV Transmission, also known as "PopART," ended in March 2015 with a total of 38,382 participants. Target: Complete target enrollment of 52,500 in the population cohort. (Target Not Met)	Complete first annual follow-up visits of participants enrolled in the first year of the study.	Complete second annual follow-up visits for Year 1 participants and first annual visits for those enrolled in Year 2.	N/A
SRO-2.4 By 2020, increase the number of potential treatment options for communication disorders that are being tested in clinical trials by adding one new treatment option per year. (Outcome)	FY 2015: An NIH-supported clinical trial has begun recruiting patients to test a new treatment for balance problems. Target: Initiate testing one new potential treatment option for a balance disorder. (Target Met)	Initiate testing one new potential treatment option for a hearing disorder.	Initiate testing one new potential treatment option for a communication disorder.	N/A
SRO-2.6 By 2020, investigate the pathways and mechanisms of how seven environmental agents can alter epigenetic processes such as DNA methylation, recruitment of specific histone modifications, and chromatin remodeling to better determine if these changes can be inherited.	FY 2015: Epigenomic maps were generated for three cell types, exposed to four environmental chemicals. Target: Generate epigenomic maps of three cell types, exposed to four environmental chemicals. (Target Met)	Assess transgenerational effects of 6 exposures in 3 generations of animals.	Analyze the impact of how 2-6 distinct/individual environmental exposures alter epigenetic processes in animal models.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
(Output)				
SRO-2.9 By 2015, advance understanding of social determinants of health and health disparities using multilevel, transdisciplinary team science approaches by developing intervention models of how various factors affect individual health outcomes and their distribution in populations. (Outcome)	FY 2015: NIH implemented intervention models for reducing health disparities/inequities in various populations and is currently analyzing data to identify commonalities for interventions in various underserved populations. Target: Implement intervention models for reducing health disparities/inequities in various populations and identify commonalities for interventions in various underserved populations. (Target Not Met but Improved)	N/A	N/A	N/A
SRO-2.11 By 2016, conduct studies of young children to determine whether the plant estrogens in soy formula produce hormone-like effects. (Outcome)	FY 2015: 16 datasets were finalized including: Ultrasound, Anthropometrics and Physical exam, Maternal 2 and 12 week questionnaires after all data management tasks were completed. Analyses of the datasets are ongoing. Target: Finalize 8 datasets (including ultrasound, anthropometry and physical exam data) and begin analyses of these datasets. (Target Exceeded)	Continue analyses of IFED datasets and prepare a draft manuscript regarding the estrogenic effects of soy formula on infant development.	N/A	N/A
SRO-3.4 By 2015, evaluate an HIV vaccine candidate in a test of concept (phase IIB) efficacy trial in order to move towards an HIV/AIDS vaccine. (Outcome)	FY 2015: In February 2015, NIH initiated HVTN 100, a Phase I/II study to evaluate the safety and immunogenecity of a vaccine regimen consisting of ALVAC-HIV and a gp120 protein subunit.	N/A	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	Target: Initiate a suite of studies to support efficacy evaluation and licensure of an HIV vaccine. (Target Met)			
SRO-3.8 By 2018, determine the optimal tailored treatment regimen for patients with early stage breast cancer that maximizes the benefits of chemotherapy while minimizing the side-effects of unnecessary treatment. (Outcome)	FY 2015: Hormone receptor scoring for 75% of all cases was completed. Target: Complete hormone receptor scoring for 75% of all cases. (Target Met)	During the patient monitoring phase (N=7,000), the number of patients who exhibit recurrence will be reported. Any actions taken by program based on the recommendations of the independent data monitoring committee (IDMC) following their analysis of interim statistical data will also be reported.	During the patient monitoring phase (N=7,000), the number of patients who exhibit recurrence will be reported. Any actions taken by program based on the recommendations of the independent data monitoring committee (IDMC) following their analysis of interim statistical data will also be reported.	N/A
SRO-3.9 By 2020, identify two molecular-targeted therapies for disorders of the immune system in children. (Outcome)	FY 2015: Researchers have completed a compassionate use study to evaluate treatment with Janus Kinase (JAK) inhibitors in pediatric patients with the immune disorder CANDLE. Target: Complete a clinical pilot study in a cohort of pediatric patients with a disorder of the immune system. (Target Met)	Identify at least one molecular pathway based on genetic analysis suitable for therapeutic targeting in a pediatric cohort of patients with an immune-mediated disease.	Design a clinical study testing an agent for a disorder of the immune system in children.	N/A
SRO-3.10 By 2017, advance two candidate medications for treatment of substance use disorders to clinical studies in humans. (Outcome)	FY 2015: NIH initiated a Phase II clinical trial to test the effectiveness of an extended release formulation of gabapentin (HORIZANT®) in reducing heavy drinking in individuals with moderate to severe	Complete phase 2 clinical studies of a candidate compound.	Complete one human laboratory study on a new candidate compound.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	alcohol use disorder. Target: Conduct Phase 2 clinical testing of a novel compound. (Target Met)			
SRO-3.11 By 2017, advance the discovery of high need cures through innovations in the therapeutics discovery and development process, by developing 3-D human tissue chips that accurately model the structure and function of human organs. (Outcome)	FY 2015: Eleven of the twelve organ platform teams advanced to the integration phase and are working within the Tissue Chip Consortium, which includes other NIH and DARPA investigators, on organ connection. Target: Advance three projects to integration of individual organ or system chips into a multiple tissue chip or organ microsystem. (Target Met)	Complete integration of organ chip systems.	Demonstrate that integrated organ chip systems model the structure and function of human organs.	N/A
SRO-4.1 By 2017, enable 1-3 Bridging Interventional Development Gaps (BrIDGs) projects to have sufficient pre-clinical data for therapeutic agents in order to apply for Investigational New Drug (IND) approval from the FDA. (Output)	FY 2015: The BrIDGs program has awarded two toxicology contracts for projects selected in 2014. Target: Complete contracts for and initiate 1-3 projects that were selected. (Target Met)	Acquire drug material for and complete dose range finding toxicology studies for 1-3 projects.	Generate data to enable IND application on the 1-3 compounds for the projects that were selected.	N/A
SRO-4.2 By 2017, develop, adapt, and test the effectiveness of health promotion and disease prevention interventions in Native American (NA) populations that are culturally appropriate and promote the adoption of healthy lifestyles. (Outcome)	FY 2015: NIH supported the identification, development, and adaptation of three interventions for testing in Native American communities in FY 2015. Target: Identify, develop, and adapt three multilevel interventions for testing in Native American communities.	Test three interventions in NA communities using rigorous study designs to test the effectiveness or efficacy of interventions.	Continue to develop, adapt, and test the effectiveness of culturally appropriate health promotion and disease prevention interventions in NA populations. Begin analyzing preliminary data from testing	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	(Target Met)		interventions in NA communities, and adapt community interventions based on initial finding.	
SRO-4.4 By 2016, discover the molecular basis for 30 rare diseases. (Output)	FY 2015: The molecular bases of 15 rare diseases were discovered. Target: Discover the molecular bases of 15 rare diseases. (Target Met)	Discover the molecular bases of an additional 15 rare diseases.	N/A	N/A
SRO-4.5 By 2016, test a targeted nanoparticle for imaging and drug delivery to atherosclerotic plaque in animal models. (Output)	FY 2015: Data are currently being analyzed to correlate imaging and histochemistry. Target: Correlate rabbit inflammation imaging studies with histochemistry to confirm efficacy of nanoparticle treatment. (Target Not Met)	Extend the studies into a pre-clinical pig model to assess targeted delivery and efficacy in reducing inflammation.	N/A	N/A
SRO-4.6 By 2016, use animal models to identify 3 new targets and/or molecular mechanisms that could be used in the development of interventions that enhance male fertility. (Output)	FY 2015: Identification of one new pathway/mechanism that regulates spermatogenic stem cells in their decision making process governing cell renewal vs. cell differentiation. Target: Identify one new pathway/mechanism that regulates spermatogenic stem cells in their decision making process governing cell renewal vs. cell differentiation. (Target Met)	Identify one epigenetic mechanism regulating spermatogenesis.	N/A	N/A
SRO-4.7 By 2016, determine the safety and effectiveness of two first-in-class treatments for nonalcoholic fatty liver	FY 2015: NIH finished data collection in obeticholic acid treatment trial of adult patients with NASH.	Analyze data from pediatric and adult NAFLD treatment trials.	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
disease in adults and children. (Outcome)	Target: Finish data collection in obeticholic acid treatment trial of adult patients with NASH. (Target Met)			
SRO-5.2 By 2018, (a) identify genetic factors that enhance or reduce the risk of development and progression of chronic obstructive pulmonary disease (COPD) and (b) validate new genetic and clinical criteria that may be added to COPD classification and contribute to better and/or earlier diagnosis or prognosis of the disease. (Output)	FY 2015: Identified four clusters that show robust associations with clinical characteristics of COPD and known COPD-associated genetic variants. Target: Using analysis of genetic and clinical data from the original 10,000 subjects, identify 1-3 COPD sub-classes that can then be tested for prognostic potential. (Target Met)	Analyze longitudinal data for the first 1000 five year follow-up visits to identify 1-3 predictors of disease progression.	Complete exome chip genotyping of 10,171 COPDGene subjects and identify 1 to 5 new rare and common genetic determinants of COPD.	N/A
SRO-5.3 By 2020, identify risk and protective alleles that lead to one novel therapeutic approach, drug target, or pathway to prevention for late-onset Alzheimer's disease. (Output)	FY 2015: Sample selection for whole genome sequencing on additional multiply affected families was initiated. Planning of the Replication Phase has begun. Target: Initiate Replication Phase to validate genes / regions of interest identified from case-control and family sequencing in ~50,000 samples from well phenotyped individuals by targeted sequencing and/or genotyping. (Target Met)	Begin confirmation of genomic regions of interest identified in the Discovery Phase using samples from the Replication phase. Begin harmonization of data from Discovery phase datasets with data from Replication Phase for confirmation of regions of interest.	Continue confirmation of genomic regions of interest in the Discovery and Replication phase datasets. Continue harmonization of Discovery Phase and Replication Phase datasets.	N/A
SRO-5.4 By 2017, address the growing public health problem of antimicrobial resistance by discovering four to six new therapeutic candidates and assessing two novel approaches/ regimens designed to	FY 2015: Optimized treatment strategies to reduce the risk of antimicrobial resistance were evaluated. Target: Evaluate optimized treatment strategies to reduce the risk of antimicrobial resistance.	Discover two additional new candidate therapeutics for infections where resistance poses a significant public health threat.	Assess two novel approaches/regimens designed to preserve existing antimicrobials.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
preserve existing antimicrobials. (Output)	(Target Met)			
SRO-5.5 By 2018, complete pre-commercial development of a point-of-care technology targeted for use in primary care setting. (Output)	FY 2015: Identified and established the feasibility of 3 technologies through preliminary testing for potential use as point of care technology in the primary care setting. Target: Establish feasibility of use of 3 to 4 identified technologies through preliminary testing. (Target Met)	Complete pilot clinical studies on 1 to 2 prototype devices.	Support research on continued development of one or two prototype devices that will begin to initiate the regulatory process.	N/A
SRO-5.6 By 2017, develop, evaluate, refine, and/or promote strategies for preventing prescription drug abuse and its consequences. (Output)	FY 2015: Promising results were obtained from development of tools to overcome opioid overdoses, development of analgesics and compounds to block side effects from pain medication for cancer, assessment of vaporized cannabis for neuropathic pain from spinal cord injury, and the implementation of opioid therapy guidelines to improve primary care among providers. Target: Develop, test or disseminate strategies to prevent prescription drug abuse, including the development of pain medications with reduced abuse potential. (Target Met)	Develop, test or disseminate strategies to enhance the use of naloxone for overdose prevention.	In basic research identify new targets or refine existing ones in the endocannabinoid system for the development of treatments of chronic pain without development of tolerance or dependence; in clinical research develop, evaluate, and/or refine two to four treatment strategies that target co-morbid opioid addiction and chronic pain; in translation research identify the impact of state level prescription monitoring programs (PMP) on prescriber behavior and patient outcomes.	N/A
SRO-5.7 By 2016, the members of the National	FY 2015: Twenty studies nominated and approved by	By 2016, contribute to	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
Dental Practice-based Research Network will contribute to the scientific basis for common dental procedures and improve the quality of dental care in community practices by conducting research studies in dental practices. (Output)	practitioners are completed, underway, or in progress. Target: By 2015, design 10 studies nominated by practitioners as relevant to their practices. (Target Exceeded)	clinical decision-making based on evidence gained by the NPBRN studies.		
SRO-5.9 By 2017, determine the potential contributions of infectious agents to the underlying etiology of urologic chronic pelvic pain syndromes (UCPPS). (Outcome)	FY 2015: 150 biological samples were assessed through complementary methods to characterize urologic microbial profiles of UCPPS patients and control subjects, and, through linking to associated clinical data, the profiles were related to patient characteristics, including symptoms and risk factors. Target: Assess 150 biological samples through complementary methods to characterize urologic microbial profiles of UCPPS patients and control subjects and through linking to associated clinical data relate profiles to patient characteristics, including symptoms and risk factors. (Target Met)	Complete analyses of differences in the urologic microbiome of UCPPS patients/controls by sex and according to stratification based on symptom profiles, correlations of flare events, and profiles of inflammatory markers.	Determine the potential contributions of infectious agents to the underlying etiology and symptom profiles for urologic chronic pelvic pain syndromes in males and females.	N/A
SRO-5.10 By 2020, assess the effectiveness of five to seven interventions that focus on eliminating health disparities by utilizing community partnerships to conduct intervention research that will foster sustainable efforts at the	FY 2015: Phase I is underway and the 33 projects in the planning phase are building strong partnerships, generating baseline data, and completing pilot interventions. In 2015, NIH solicited applications for the intervention phase and 28 of the 33 participants applied.	Identify adaptive strategies and collect first year assessment variables.	Assess intervention progress and collect second year assessment variables.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
community level that will impact disparate conditions. (Output)	Target: Initiate the implementation of the Phase I plan and pilot, including baseline data. (Target Met)			
SRO-5.11 By 2018, develop and test three to five strategies for symptom management that reduce the effects of acute and chronic illness. (Output)	FY 2015: NIH-supported research developed: strategies to reduce insomnia in patients with heart failure and relieve pain after cardiac surgery, and a new instrument for the measurement of fatigue. Target: Develop one novel strategy for managing symptom clusters and that improves health outcomes such as HRQoL. (Target Met)	Test one novel strategy for managing symptom clusters and that improves health outcomes such as HRQoL.	Assess the efficacy of one strategy that improves health outcomes through symptom self-management.	N/A
SRO-5.13 By 2015, establish and evaluate a process to prioritize compounds that have not yet been adequately tested for more in-depth toxicological evaluation. (Outcome)	FY 2015: A formal process for evaluating HTS results for use in prioritization of compounds for additional testing has been developed, and a model was developed to evaluate the estrogenic potential of chemicals and has been proposed for use. Target: A formal process of prioritizing compounds for more extensive toxicological testing will be evaluated and used. (Target Met)	N/A	N/A	N/A
SRO-5.15 By 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance use, abuse, addiction and their consequences in underage populations. (Outcome)	FY 2015: NIH supported six studies to evaluate the effectiveness of the youth guide for alcohol screening and brief intervention in a variety of settings. Target: Evaluate the effectiveness of screening	Disseminate the newly released College Alcohol Interventions Matrix (CollegeAIM) and continue to disseminate the youth screening	Promote existing resources and develop new resources to address underage substance use, abuse, and addiction in subpopulations of	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	and brief intervention for alcohol and other drug use in a variety of settings. (Target Met)	guide.	youth.	
SRO-6.1 By 2023, perform comparative effectiveness studies to test five therapies for prevention or treatment of type 2 diabetes. (Outcome)	FY 2015: The data on complications in the Diabetes Prevention Program Outcomes Study was analyzed. Target: Analyze data on complications in the Diabetes Prevention Program Outcomes Study. (Target Met)	Enroll at least 2200 participants in Glycemia Reduction Approaches in Diabetes: A Comparative Effectiveness Study.	Complete enrollment for at least one Restore Insulin Secretion protocol.	N/A
SRO-6.4 By 2015, identify and characterize two molecular pathways of potential clinical significance that may serve as the basis for discovering new medications for preventing and treating asthma exacerbations. (Outcome)	FY 2015: Identified and characterized two molecular pathways of potential clinical significance that may serve as the basis for discovering new medications for preventing and treating asthma exacerbations. Target: Identify and characterize two molecular pathways of potential clinical significance that may serve as the basis for discovering new medications for preventing and treating asthma exacerbations. (Target Met)	N/A	N/A	N/A
SRO-6.6 By 2015, provide at least one new or significantly improved minimally-invasive treatment for clinical use in patients using image-guided interventions. (Outcome)	FY 2015: NIH-supported research has led to development of several image-guided interventions that reduce the risk of adverse outcomes, shorten patient recovery time, and improve precision of procedures, especially related to brain, spinal cord, and nerves. Target: Support new or	N/A	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	significantly improved human subject research for image-guided interventions to reduce the risk of adverse outcomes to structures such as the brain, spinal cord, or nerves that are within or near the operating field. (Target Met)			
SRO-7.1 By 2016, assess the efficacy of a novel microbicide delivery system for the prevention of HIV. (Output)	FY 2015: The ASPIRE (A Study to Prevent Infection with a Ring for Extended Use) study completed participant follow-up of the phase III trial of a novel microbicide delivery system. Target: Complete follow up of a phase III trial of a novel microbicide delivery system. (Target Met)	Complete data analysis on the safety and/or efficacy of a novel microbicide delivery system and release results publicly.	N/A	N/A
SRO-7.2 By 2018, develop an evidence-based, online resource to help people who have low back pain and their health care providers apply clinical evidence to individual circumstances when weighing treatment options. (Output)	FY 2015: The benefits of surgery remain for up to 8 years for patients who have a herniated lumbar disc; the benefits of surgery for people who had surgery for spinal stenosis decrease with time. Target: Collect data on pain and function from Spine Patient Outcomes Research Trial participants 8 years after joining the study. (Target Met)	Develop individualized models of patient outcomes following surgical or non-operative treatment for common causes of surgery for low back pain (e.g., intervertebral disc herniation, lumbar spinal stenosis, and degenerative spondylolisthesis).	Integrate the individualized outcome models into an outcomes calculator and assess its use in a web-based environment.	N/A
SRO-7.3 By 2016, develop and/or evaluate one to four interventions using mobile technology to improve treatment delivery and adherence for addiction and related health consequences. (Output)	FY 2015: Studies examined the efficacy of mobile technology-based treatments to enhance treatment for patients with mental illness, and for interactive treatment of patients with drug addiction; and the feasibility of improving HIV antiretroviral treatment adherence with cell phone	Identify next steps for testing or deployment of 2-4 substance abuse treatment or medication adherence interventions using mobile technology.	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	reminders, counseling, and two-way personalized text messaging. Target: Continue to develop and/or test substance abuse treatment or medication adherence interventions using mobile technology. (Target Met)			
SRO-8.2 By 2017, identify circuits within the brain that mediate reward for 1) drugs, 2) non-drug rewards such as food or palatable substances, and 3) aversion to drug effects, and 4) determine the degree of overlap between these circuits. (Output)	FY 2015: NIH-funded researchers defined circuits and portions of circuits that are important for the perception of reward that are activated in the presence or absence of drugs of abuse. Target: Identify non-drug activated reward circuits and compare with drug-activated reward circuits. (Target Met)	Support research to compare and contrast rewarding versus aversive pathways in response to substances of abuse.	Identify morphological and functional neuroplastic modifications due to drugs at the level of dendritic spines and electrophysiological indices and their persistence during the development of drug dependence (or during repeated intermittent drug administration).	N/A
SRO-8.7 By 2018, identify three effective system interventions generating the implementation, sustainability and ongoing improvement of research-tested interventions across health care systems. (Outcome)	FY 2015: NIH researchers identified three key factors that influence the scaling up of research-tested interventions across large services systems such as child welfare, primary care, specialty care and community practice. These key factors include the utilization of technological approaches to enhance validation and scale-up; optimization of treatment fidelity in the delivery of research-based treatment; and the development of research community partnerships to promote research-tested interventions.	Initiate testing of hypothesized mechanism of treatment effect of one novel intervention, and determine whether the intervention should progress further to clinical testing.	Establish one research-practice partnerships to improve dissemination, implementation, and continuous improvement of evidence-based mental health care services.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	Target: Identify three (3) key factors influencing the scaling up of research-tested interventions across large networks of services systems such as primary care, specialty care and community practice. (Outcome) (Target Met)			
SRO-9.2 By 2018, identify culturally appropriate, effective stroke prevention/intervention programs in minority communities. (Outcome)	FY 2015: Recruitment was initiated in three studies (and completed in one of these) testing various culturally tailored interventions to reduce health disparities in stroke. Target: Initiate enrollment in two studies testing culturally tailored interventions to reduce health disparities in stroke. (Target Exceeded)	Complete patient follow-up in a study testing a clinical program for improved blood pressure control in racial/ethnic minority populations.	Complete data analysis for a study that tested culturally tailored interventions to address major contributors to stroke disparities in racial/ethnic minority populations.	N/A
SRO-9.5 By 2015, assess the efficacy of long-term oxygen treatment in patients with COPD and moderate hypoxemia. (Outcome)	FY 2015: A publication reporting the results of the trial was submitted to a major peer-reviewed journal in December 2015. A second publication reporting on the design of the trial is in an advanced state of preparation. Target: Complete data analysis and prepare results for publication on the efficacy of long-term oxygen treatment in patients with COPD and moderate hypoxemia. (Target Met)	N/A	N/A	N/A

Functional Area: Communication and Transfer of Results (CTR)

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
CTR-2 By 2017, reach 500,000 visits to the website Genome: Unlocking Life's Code. (Outcome)	FY 2015: As of July 30, 2015, ULC visits totaled 185,000. Target: By 2015, reach 150,000 visits. (Target Exceeded)	By 2016, reach 300,000 total visits.	By 2017, reach 500,000 total visits.	N/A
CTR-3 By 2016, partner with 20 state and local mental health nonprofit organizations to facilitate awareness among the general public about the brain, mental health disorders, research-tested interventions and findings, and clinical trials research. (Outcome)	FY 2015: Selected 48 Outreach Partner organizations to conduct science-based education and outreach projects aimed at reaching the general public and a variety of targeted audiences, including populations that experience mental health disparities. Target: Support 20-25 state and local mental health nonprofit organizations in conducting science-based education and outreach projects addressing the needs of populations that experience mental health disparities as defined by race or ethnicity, age, education or income, disability status, geographic location, and risk status related to sex and gender. (Target Exceeded)	Partner with 20-25 state and local mental health nonprofit organizations to facilitate awareness among the public about the role of basic, translational, and clinical research, and opportunities to participate in clinical research.	N/A	N/A
CTR-4 By 2017, expand and implement the broad use of Common Data Elements for 17 neurological disorders among investigators conducting clinical research. (Output)	FY 2015: Two NIH-funded stroke clinical trials, one focused on stroke prevention and another on rehabilitation, began using the NINDS Common Data Elements in FY 2015. Target: Utilize common data elements in two new clinical trials. (Target Met)	Develop a clinical research training module on utilization of Common Data Elements tools.	Develop collaborative model to enable implementation of the CDE project as a long-term sustainable resource for the clinical research community.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
CTR-5 By 2017, increase the number of computer-indexed MEDLINE journals by 409 titles, thereby increasing indexing efficiency for MEDLINE. (Output)	FY 2015: The number of computer-indexed MEDLINE journals was increased by 149 titles, thereby increasing indexing efficiency for MEDLINE. Target: Increase the number of journals indexed automatically by the Medical Text Indexer First Line (MTIFL) process by 96 titles over the previous year. (Target Exceeded)	Increase the number of journals indexed automatically by the Medical Text Indexer First Line (MTIFL) process by 121 titles over the previous year.	Increase the number of journals indexed automatically by the Medical Text Indexer First Line (MTIFL) process by 96 titles over the previous year.	N/A
CTR-6 By 2017, improve NIH's ability to identify outcomes that result from NIH funded research projects and report to the public on research outcomes. (Outcome)	FY 2015: NIH applicants can gather information from My Bibliography, eRA Commons, FastLane and ORCID into SciENcv to generate biosketches. Target: By 2015, introduce ScienCV, an electronic repository where NIH grant applicants and grantees can gather and store personalized information about their professional accomplishments, and select information from their repository to generate biographical sketches that will be accepted by NIH. (Target Met)	By 2016, expand NIH's electronic infrastructure to support grantees' reporting of products and research results that result from NIH research grants.	By 2017, establish an electronic closeout process for NIH research grants which includes a Project Outcomes Report for the general public summarizing the project outcomes or findings that expand fundamental knowledge, enhance health, lengthen life, reduce illness and disability, and otherwise fulfill the programmatic goals of the research activity.	N/A

Functional Area: Capacity Building and Research Resource (CBRR)

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
CBRR-1.1 Provide research training for predoctoral trainees and fellows that promotes greater retention and long-term success in research careers. (Output)	FY 2015: Award rate to comparison group reached 10%. Target: N ≥10% (Target Met)	N ≥ 10%	N ≥ 10%	N/A
CBRR-1.2 Provide research training for postdoctoral fellows that promotes greater retention and long-term success in research careers. (Output)	FY 2015: Award rate to comparison group reached 14% and exceeded the target by 4%. Target: N ≥ 10% (Target Exceeded)	N ≥ 10%	N ≥ 10%	N/A
CBRR-2 Promote data sharing and provide information in real time through the NIH Business System (NBS) by developing, integrating, deploying and maintaining business modules. (Output)	FY 2015: Completed integration for Oracle 12i Upgrade. Target: (Integration [Int]) Complete integration activities for full functionality and usability of priority modules for successful development efforts within 3 years of development. * Planned - Oracle 12i Upgrade [Dev.2012, 2014-15/Dep.2016] (Target Met) FY 2015: Completed development for Oracle 12i Upgrade. Target: Development [Dev]) Initiate development of planned business modules to build capacity and functionality of the NIH Business System. * Planned - Oracle 12i Upgrade [continuation from 2014/Int.2015-16] (Target Met)	(Maintenance [Mat]) Maintain deployed business modules. * Planned - Oracle 12i [Dep.2016]	(Development [Dev]) Initiate development of planned business modules to build capacity and functionality of the NIH Business System. * Planned - NBS Hosting to Oracle Cloud	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
CBRR-3 By 2016, develop diagnostic definitions and outcome measures for use in clinical research studies on chronic lower back pain (cLBP). (Output)	FY 2015: Subsequent to the Task Force issuing its report on the NIH Pain Consortium website, the dissemination of the report, including the recommended minimum dataset for all subsequent clinical studies on chronic low back pain, has been accomplished through a total of 9 peer-reviewed journals. Target: Disseminate information about development and validation of standardized research diagnostic measures for cLBP. (For example, report to NIH Pain Consortium and publication in peer reviewed journal.) (Target Met)	Test standardized research diagnostic measures for cLBP.	N/A	N/A
CBRR-5 By 2015, implement and evaluate leadership forums in cancer control planning in select low and middle income countries. (Outcome)	FY 2015: Developed, implemented, and began evaluation on leadership forums in 3 regions of the world in FY 2015. Target: Organize, implement, and evaluate leadership forums in two regions of the world. (Target Exceeded)	N/A	N/A	N/A
CBRR-7 By 2017 expand the scope and reach of the National Ophthalmic Diseases Genotyping and Phenotyping Network (eyeGENE®), a national genetics research resource for rare inherited ocular diseases, by adding new patient records to the database, augmenting and refining the phenotypic data collected, and by increasing the number of	FY 2015: The eyeGENE network has collected detailed phenotypic data, including diagnostic imaging and/or electrophysiology results for 1900 patients to enable precision diagnostics. Target: Collect comprehensive phenotyping data from 500 patients, by using precision diagnostic, imaging tools and electrophysiological methods.	Create international collaborations for Network, extending into 3 foreign countries.	Increase the number of registered eyeGene users to 900.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
registered researchers to 900. (Output)	(Target Exceeded)			
CBRR-8 By 2017, characterize the three-dimensional atomic structure of 400 proteins of biomedical interest related to infectious agents. (Output)	FY 2015: 134 three-dimensional structures were characterized to enhance the biomedical research community's understanding of these proteins and to assist with the development of structure-based vaccines, diagnostics, and therapeutics. Target: Characterize the three-dimensional structure of an additional 100 protein targets or other molecules of biomedical interest with regard to bacterial, viral, and eukaryotic pathogens. (Target Exceeded)	Characterize the three-dimensional structure of an additional 100 protein targets or other molecules of biomedical interest with regard to bacterial, viral, and eukaryotic pathogens.	Characterize the three-dimensional structure of an additional 100 protein targets or other molecules of biomedical interest with regard to bacterial, viral, and eukaryotic pathogens.	N/A
CBRR-10 By 2015, make freely available to researchers the results of 400 high-throughput biological assays screened against a library of 300,000 unique compounds, and the detailed information on the molecular probes that are developed through that screening process. (Outcome)	FY 2015: The Molecular Libraries Program (MLP) completed 448 HTS assays screened against a library of 300,000 compounds and generated 382 small molecule probes. The information on the probes and assays was deposited in PubChem. Target: Make freely available to researchers the results of 400 high-throughput biological assays screened against a library of 300,000 unique compounds, and the detailed information on the molecular probes that are developed through that screening process. (Target Exceeded)	N/A	N/A	N/A
CBRR-11 By 2016, collect and make available for distribution 600 well-characterized, high-quality human cell	FY 2015: Four hundred and eighty-eight new human cell lines were accepted by the NIH Human Genetic Cell Repository in FY 2015.	Accept and make available to scientific researchers an additional 200	N/A	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
lines for use in genetic and genomic research. (Output)	Target: Accept and make available to scientific researchers an additional 400 new human cell lines. (Target Met)	new human cell lines.		
CBRR-12 Produce x-ray diffraction data for new protein structures that will enhance an existing x-ray resource for understanding basic biological processes. (Output)	FY 2015: During FY 2015, 172 x-ray data sets from protein crystal structures were measured at the GM/CA beamlines, exceeding the target. Target: Provide x-ray crystallographic data for 160 new structures of macromolecules of biomedical relevance to researchers worldwide. (Target Exceeded)	Provide x-ray crystallographic data for 180 new structures of macromolecules of biomedical relevance to researchers worldwide.	Provide x-ray crystallographic data for 190 new structures of macromolecules of biomedical relevance to researchers worldwide.	N/A
CBRR-13 By 2017, archive and annotate new protein structures to support research in human health and disease and drug development. (Output)	FY 2015: During FY 2015, 9211 protein structures were archived and annotated at the Protein Data Bank and made available to the community, exceeding the target. Target: Annotate and archive 9,000 new protein structures. (Target Exceeded)	Annotate and archive 9,500 new protein structures.	Annotate and archive 9,500 new protein structures.	N/A
CBRR-14 By 2018, establish and utilize a national clinical network to conduct five stroke clinical trials using shared infrastructure and efficient processes. (Output)	FY 2015: To date, NIH StrokeNet has contributed 30% of the subject enrollment in the MISTIE 3 stroke trial, and is also assisting with recruitment in two additional NIH-funded stroke trials (CREST 2 and iDEF). Target: Use the network's Regional Coordinating Centers for patient recruitment in a stroke trial. (Target Exceeded)	Initiate the first new trial to be conducted in the Stroke Network.	To broaden the network's scope across stroke research, initiate one new trial in stroke prevention or stroke treatment within the stroke network.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
CBRR-15 By 2016, establish a resource database and tissue bank of 30 reference tissues (e.g., liver, skin, heart, bone) in which the relationship between genetic variation and gene expression is quantified and 3 additional molecular analyses are performed. (Output)	FY 2015: GTEx Expression Quantitative Trait Loci (eQTL) data from blood samples were compared to results from previously published studies and GTEx demonstrated that a greater than 75% consensus list of replicated eQTLs were significant in multiple GTEx tissues. Target: Demonstrate that at least 75% of a consensus list of replicated eQTLs are significant in at least 1 GTEx tissue. (Target Met)	Enroll 300 donors annually.	N/A	N/A
CBRR-16 By 2016, demonstrate the use of an efficient, cost-effective pipeline characterizing (phenotype) 2500 genetically modified mice. (Outcome)	FY 2015: All KOMP2 centers have completed their production goals. KOMP generated 2500 knockout lines and phenotyped 1500 lines. Target: By the end of FY15, produce 2500 knockout lines and phenotype 1500 lines. (Target Met)	Complete phenotyping the 2500 knockout lines.	N/A	N/A
CBRR-17 By 2017, take steps to improve the quality and availability of information to inform decisions about the size of the NIH training programs and the number of people in training to address future needs for the nation's biomedical research workforce. (Output)	FY 2015: Progress report instructions have been modified to direct NIH grantees to report on whether their institution uses Individual Development Plans to manage the training of graduate students and postdoctorates, and if so, to describe how. Target: Communicate widely the expectation for grantees to develop an institutional policy requiring Individual Development Plans (IDP) be implemented for every	Implement the collection of information from grantees on career outcomes for graduate students closely associated with training grants.	Adopt a system for reporting training grant data and trainee outcomes electronically.	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	graduate student and post-doctorate supported by any NIH grant, and reportable on the grant progress report. (Target Met)			

Functional Area: Management and Program Oversight (MPO)

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
MPO-1 By 2016, decrease by 10% the costs associated with trans-NIH recruitment strategies for intramural research group leaders. (Efficiency)	FY 2015: There was a 2% decrease in the budget (comparing FY13 to FY14) and there were over 530 applications for the combined programs. Target: A 2% decrease in the budget and a minimum of 400 applicants in the combined programs of the Earl Stadtman Investigator search, the Lasker Clinical Research Scholars, and the Early Independent Scientist program. (Target Met)	A 2% decrease in the budget and a minimum of 400 applicants in the combined programs of the Earl Stadtman Investigator search, the Lasker Clinical Research Scholars, and the Early Independent Scientist program.	N/A	N/A
MPO-2 Provide opportunities for enhanced leadership skills to meet the challenges of workforce management and/or individual advancements. (Ongoing)	FY 2015: NIH's leadership development programs have been evaluated for their effectiveness and to identify specific technological improvements to increase access for students and improve engagement and retention. These include iPads, online meeting tools, and audience response systems. Target: Examine [EX] key area to enhance leadership skills * Assess best practices	Examine [EX] key area to enhance leadership skills NIH will examine the outcomes of the Executive Leadership Program (ExLP) to determine whether it is effective in meeting its long-term goals, and	Examine [EX] key area to enhance leadership skills NIH will examine best practices in supervisory onboarding to determine how to best prepare new NIH supervisors for their roles and ensure that they	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	and review the literature regarding incorporating the latest technologies into leadership development programs to determine which are most effective and practicable to create efficiencies and/or enhance learning [IM 2016/ AS 2017] (Target Met) FY 2015: NIH's administrative intern and fellowship programs have been designed to implement rotations based on identified "future" competencies for development from previously conducted evaluations and literature review. Target: Implement [IM] recommendation from prior year assessments * Implement recommendations from study of NIH's administrative intern and fellows program [EX 2014/ AS 2016] (Target Met) FY 2015: To ensure the NIH Training Center is providing NIH executive employees with valuable coaching experiences, a multi-level evaluation approach has been implemented in the executive coaching program. Mid-point check-ins with the coach and employee ensures objectives are met and a closeout survey at the end of the engagement helps to evaluate the overall effectiveness of the engagement. This data is used continuously to assess the program's executive	validate whether the program should continue with its current content [IM 2017/ AS 2018] Implement [IM] recommendation from prior year assessments * Assess best practices and review the literature regarding incorporating the latest technologies into leadership development programs to determine which are most effective and practicable to create efficiencies and/or enhance learning [EX 2015 /AS 2017] Assess [AS] results of implementation * Implement recommendations from study of NIH's administrative intern and fellows program [EX 2014/ IM 2015]	are engaged and committed to NIH. [IM 2018/ AS 2019] Implement [IM] recommendation from prior year assessments NIH will examine the outcomes of the Executive Leadership Program (ExLP) to determine whether it is effective in meeting its long-term goals, and validate whether the program should continue with its current content [IM 2017/ AS 2018] Assess [AS] results of implementation * Assess best practices and review the literature regarding incorporating the latest technologies into leadership development programs to determine which are most effective and practicable to create efficiencies and/or enhance	

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	coaches. Target: Assess [AS] results of implementation * Assess results from implementing best practices in implementing and evaluating executive coaching programs in the federal sector. [IM 2014/EX2013] (Target Met)		learning [EX 2015 /AS 2017]	
MPO-3 Address diverse workforce recruitment needs to ascertain highly qualified staff to conduct or support biomedical research. (Ongoing)	FY 2015: NIH has utilized the Pathways Program to hire a cohort of individuals who are provided rotational opportunities throughout the organization. They are provided extensive training, knowledge assessments and research assignments. Target: Examine [EX] key area to enhance recruitment *Launch a robust OHR succession planning effort to ensure OHR staff are available to meet the recruitment needs of NIH. [IM 2016] [AS 2017] (Target Met) FY 2015: Increased outreach efforts within the Washington Metro area disabilities organizations to promote the NIH opportunities. Target: Examine [EX] key area to enhance recruitment *Increase the use of Community Recruitment Efforts. [IM 2016] [AS 2017] (Target Met) FY 2015: NIH established an in depth process for	Examine [EX] key area to enhance recruitment *Expansion of the Pathways Program to STEM career path for focused students and supporting of succession planning efforts. [IM 2017] [AS 2018] Implement [IM] key area to enhance recruitment *Launch a robust OHR succession planning effort to ensure OHR staff are available to meet the recruitment needs of NIH. [AS 2017] Implement [IM] key area to enhance recruitment *Increase the use of Community	Examine [EX] key area to enhance recruitment *Create a comprehensive program that incorporates SMEs during the recruitment process, as appropriate. [IM 2018] [AS 2019] Implement [IM] key area to enhance recruitment *Expansion of the Pathways Program to STEM career path for focused students and supporting of succession planning efforts. [IM 2017] [AS 2018] Assess [AS] results of implementation *Launch a robust OHR succession planning effort to ensure OHR	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	exhausting Title V prior to utilizing Title 42. A number of peer and pay review provisions were established as well to meet HHS requirements and ensure pay alignment between pay systems. Target: Assess [AS] results of implementation *Establish increased oversight and review of Title 42 recruitment. [IM 2014] (Target Met) FY 2015: NIH hired 201 Interns, 43 Recent Grads, and 9 PMFs. NIH continues to effectively utilize the Pathways Program to support succession planning efforts which resulted in 37 conversions to permanent and/or term positions in FY 2015. Target: Assess [AS] results of implementation *Implement Pathways Program to establish a focused student and entry level recruitment plan that supports succession planning efforts at NIH. [IM 2014] (Target Met) FY 2015: NIH increased membership to a total of 24 people. Conducted 10 specific recruitment /outreach events to underrepresented communities to promote scientific training and careers at the NIH. Target: Assess [AS] results	Recruitment Efforts. [AS 2017]	staff are available to meet the recruitment needs of NIH. [AS 2017] Assess [AS] results of implementation *Increase the use of Global Recruitments. [AS 2017]	

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	of implementation *Create the Scientific and Medical Recruitment Forum (SMRF) to attract world-class scientists and medical professionals to drive discovery and innovation at NIH. [IM 2014] (Target Met)			
MPO-4 Reallocate laboratory resources based on external reviews by Boards of Scientific Counselors. (Ongoing)	FY 2015: 25% of Principal Investigators were reviewed resulting in 25% of resources recommended to be reallocated. Target: Conduct BSC reviews of 25% of principal Investigators to assess quality of science in order to prioritize resources. (Target Met)	Conduct BSC reviews of 25% of Principal Investigators to access quality of science in order to prioritize resources.	Conduct BSC reviews of 25% of Principal Investigators to access quality of science in order to prioritize resources.	N/A
MPO-5 Improve facility conditions in order to reach and maintain a Condition Index (CI) weighted average of 85 or above (CIwa=85). (Ongoing)	FY 2015: The condition of the facilities portfolio reached a CIwa of 82.5. Target: CIwa = 79.9 (Target Exceeded)	CIwa = 79.39	CIwa = 78.40	N/A
MPO-6 By 2017, maintain the annual condition of buildings and facilities portfolio so that no less than 95% of occupied gross square feet (GSF) will have a CI greater than 65. (Output)	FY 2015: 82.8% of occupied gross square feet (GSF) reached a CI greater than 65. Target: 73.5% (Target Exceeded)	Target = 85.7%	Target = 85.68%	N/A
MPO-7 Manage all Buildings and Facilities (B&F) line item projects so it is completed within 100% of the final approved project cost. (Ongoing)	FY 2015: One (1) of the two (2) active Recovery Act funded projects at the Facility Project Approval Agreement (FPAA) level was managed effectively to ensure completion within	15 - Active Projects	16 - Active Projects	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
	100% of the final approved project cost. Target: 2 Active RA Project (Target Not Met) FY 2015: Nine (9) of the original eleven (11) active non-Recovery Act projects at the Facility Project Approval Agreement (FPAA) level threshold were effectively managed to ensure completion within 100% of the final approved project cost. Target: 11 - Active Projects (Target Not Met)			
MPO-8 Manage design and construction of capital facility projects funded by B&F so that no more than 10% of the projects may incorporate plus or minus 10% adjustments of the approved scope. (Ongoing)	FY 2015: The design and construction of one (1) of the two (2) active Recovery Act funded projects was managed effectively so that no more than 10% of the portfolio incorporated a plus or minus 10% adjustments of the approved scope. Target: 2 Active RA Project (Target Not Met) FY 2015: The design and construction of ten (10) of the initial eleven (11) active projects in the portfolio was managed effectively under this target goal that focuses on ensuring that no more than 10% of the portfolio incorporated a plus or minus 10% adjustment of the approved scope. Target: 11 - Active Projects (Target Not Met)	15 - Active Projects	16 - Active Projects	N/A

Measure	Year and Most Recent Result / Target for Recent Result / (Summary of Result)	FY 2016 Target	FY 2017 Target	FY 2017 Target +/-FY 2016 Target
MPO-9 Utilize performance-based contracting (PBC). (ongoing)	FY 2015: Awarded 47% of eligible service contracting dollars employing the performance-based contracting principle. Target: Obligate the FY 2015 OMB/OFPP goal of eligible service contracting dollars to PBC. (Target Met)	Obligate the FY 2016 NIH goal of eligible service contracting dollars to PBC.	Obligate the FY 2017 goal of eligible service contracting dollars to PBC.	N/A
MPO-10 By 2015, report the percent of extramural construction projects that are in compliance with the post award 20 year usage requirement to conduct research. (Output)	FY 2015: 99% of the extramural construction projects were in compliance with the post award 20 year usage requirement. Target: 95% of 212 projects are in compliance. (Target Met)	N/A	N/A	N/A

BUDGET REQUEST BY INSTITUTE AND CENTER

(Dollars in Thousands)	FY 2015 Actual[1]	FY 2016 Enacted[1]	FY 2017 President's Budget[5]
NCI	$4,953,028	$5,213,509	$5,893,509
NHLBI	$2,995,865	$3,113,533	$3,113,533
NIDCR	$397,700	$413,396	$413,396
NIDDK[2]	$1,899,140	$1,966,310	$1,966,310
NINDS	$1,604,607	$1,695,180	$1,695,180
NIAID	$4,417,558	$4,715,697	$4,715,697
NIGMS[3]	$2,372,301	$2,512,437	$2,512,437
NICHD	$1,286,869	$1,338,348	$1,338,348
NEI	$676,764	$707,998	$707,998
NIEHS[4]	$744,682	$770,882	$770,882
NIA	$1,197,523	$1,598,246	$1,598,246
NIAMS	$521,528	$541,662	$541,662
NIDCD	$405,207	$422,936	$422,936
NIMH	$1,433,651	$1,518,673	$1,518,673
NIDA	$1,015,705	$1,050,550	$1,050,550
NIAAA	$447,153	$467,445	$467,445
NINR	$140,852	$145,912	$145,912
NHGRI	$498,677	$513,227	$513,227
NIBIB	$327,243	$343,506	$343,506
NIMHD	$270,969	$280,680	$280,680
NCCIH	$124,062	$129,941	$129,941
NCATS	$632,710	$685,417	$685,417
FIC	$67,634	$70,117	$70,117
NLM	$337,324	$395,684	$395,684
B&F	$128,863	$128,863	$128,863
OD	$1,413,734	$1,571,200	$1,716,200
TOTAL, NIH Program Level	**$30,311,349**	**$32,311,349**	**$33,136,349**
Mandatory Type 1 Diabetes Research	-$150,000	-$150,000	-$150,000
PHS Program Evaluation	-$715,000	-$780,000	-$847,489
Cancer Initiative Mandatory Financing			-$680,000
Other Mandatory Financing			-$1,145,000
Interior Budget Authority	-$77,349	-$77,349	-$77,349
Total, NIH Labor/HHS Budget Authority	**$29,369,000**	**$31,304,000**	**$30,236,511**

[1]Excludes Ebola-related funding.

[2]Includes Mandatory Type 1 Diabetes Research funding.

[3]Includes Program Evaluation financing of $715 million in FY 2015, $780 million in FY 2016, and $847.489 million in FY2017.

[4]Includes Interior Appropriation for Superfund research.

[5]Includes mandatory financing.

APPROPRIATIONS ADJUSTMENT TABLE BY INSTITUTE AND CENTER FOR FY 2015

(Dollars in Thousands)	FY 2015 Enacted[4]	HIV/AIDS Transfer	FY 2015 Final[4]
NCI	$4,950,396	$2,632	$4,953,028
NHLBI	$2,997,870	-$2,005	$2,995,865
NIDCR	$399,886	-$2,186	$397,700
NIDDK[1]	$1,899,681	-$541	$1,899,140
NINDS	$1,605,205	-$598	$1,604,607
NIAID	$4,358,841	$58,717	$4,417,558
NIGMS	$2,371,476	$825	$2,372,301
NICHD	$1,286,571	$298	$1,286,869
NEI	$684,191	-$7,427	$676,764
NIEHS[2]	$744,851	-$169	$744,682
NIA	$1,199,468	-$1,945	$1,197,523
NIAMS	$521,665	-$137	$521,528
NIDCD	$405,302	-$95	$405,207
NIMH	$1,463,036	-$29,385	$1,433,651
NIDA	$1,028,614	-$12,909	$1,015,705
NIAAA	$447,408	-$255	$447,153
NINR	$140,953	-$101	$140,852
NHGRI	$499,356	-$679	$498,677
NIBIB	$330,192	-$2,949	$327,243
NICHD	$269,154	$1,815	$270,969
NCCIH	$124,681	-$619	$124,062
NCATS	$635,230	-$2,520	$632,710
FIC	$67,786	-$152	$67,634
NLM[3]	$336,939	$385	$337,324
OD	$1,413,734	---	$1,413,734
B&F	$128,863	---	$128,863
Total, NIH Program Level	**$30,311,349**	---	**$30,311,349**
Less funds allocated from different sources:			
Mandatory Type 1 Diabetes Research	-$150,000		-$150,000
PHS Program Evaluation	-$715,000		-$715,000
Total, NIH Discretionary Budget Authority	**$29,446,349**	---	**$29,446,349**
Interior Budget Authority	-$77,349		-$77,349
Total, NIH Labor/HHS Budget Authority	**$29,369,000**	---	**$29,369,000**

[1] Includes Mandatory Type 1 Diabetes research funding.

[2] Includes Interior Appropriation for Superfund

[3] Includes Program Evaluation funding of $8.2 million in FY 2015.

[4] Excludes Ebola-related funding.

APPROPRIATIONS ADJUSTMENT TABLE BY INSTITUTE AND CENTER FOR FY 2016

(Dollars in Thousands)	FY 2016 Enacted[3]	FY 2016 HIV/AIDS Transfer	FY 2016 Operating Level
NCI	$5,214,701	-$1,192	$5,213,509
NHLBI	$3,115,538	-$2,005	$3,113,533
NIDCR	$415,582	-$2,186	$413,396
NIDDK[1]	$1,968,357	-$2,047	$1,966,310
NINDS	$1,696,139	-$959	$1,695,180
NIAID	$4,629,928	$85,769	$4,715,697
NIGMS	$2,512,073	$364	$2,512,437
NICHD	$1,339,802	-$1,454	$1,338,348
NEI	$715,903	-$7,905	$707,998
NIEHS[2]	$771,051	-$169	$770,882
NIA	$1,600,191	-$1,945	$1,598,246
NIAMS	$542,141	-$479	$541,662
NIDCD	$423,031	-$95	$422,936
NIMH	$1,548,390	-$29,717	$1,518,673
NIDA	$1,077,488	-$26,938	$1,050,550
NIAAA	$467,700	-$255	$467,445
NINR	$146,485	-$573	$145,912
NHGRI	$518,956	-$5,729	$513,227
NIBIB	$346,795	-$3,289	$343,506
NICHD	$279,718	$962	$280,680
NCCIH	$130,789	-$848	$129,941
NCATS	$685,417	---	$685,417
FIC	$70,447	-$330	$70,117
NLM	$394,664	$1,020	$395,684
OD	$1,571,200		$1,571,200
B&F	$128,863		$128,863
Total, NIH Program Level	**$32,311,349**	---	**$32,311,349**
Less funds allocated from different sources:			
Mandatory Type 1 Diabetes Research	-$150,000		-$150,000
PHS Program Evaluation	-$780,000		-$780,000
Total, NIH Discretionary Budget Authority	**$31,381,349**	---	**$31,381,349**
Interior Budget Authority	-$77,349		-$77,349
Total, NIH Labor/HHS Budget Authority	**$31,304,000**	---	**$31,304,000**

[1] Includes Mandatory Type 1 Diabetes Research funding.

[2] Includes Interior Appropriation for Superfund research.

[3] Excludes Ebola-related funding.

BUDGET MECHANISM TABLE

(Dollars in Thousands)[1]	FY 2015 Actual[3]		FY 2016 Enacted[3]		FY 2017 President's Budget[4]		FY 2017 +/- FY 2016	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	23,261	$11,219,523	23,367	$11,770,028	24,608	$12,530,526	1,241	$760,498
Administrative Supplements	*(1,595)*	193,500	*(1,538)*	183,451	*(1,282)*	153,882	*(-256)*	-29,569
Competing:								
Renewal	1,771	919,382	2,080	1,104,786	1,908	1,030,599	-172	-74,187
New	7,737	3,368,395	8,639	3,942,891	8,011	3,617,296	-628	-325,595
Supplements	32	22,921	34	15,331	27	11,700	-7	-3,630
Subtotal, Competing	9,540	$4,310,698	10,753	$5,063,008	9,946	$4,659,596	-807	-$403,412
Subtotal, RPGs	32,801	$15,723,721	34,120	$17,016,487	34,554	$17,344,004	434	$327,517
SBIR/STTR	1,578	717,951	1,720	804,487	1,886	862,616	166	58,129
Research Project Grants	34,379	$16,441,672	35,840	$17,820,973	36,440	$18,206,620	600	$385,646
Research Centers:								
Specialized/Comprehensive	1,093	$1,879,582	1,151	$1,883,688	1,139	$1,862,491	-12	-$21,197
Clinical Research	68	424,704	59	410,660	57	399,319	-2	-11,341
Biotechnology	97	171,994	96	173,457	84	151,600	-12	-21,857
Comparative Medicine	52	132,143	48	119,821	47	118,628	-1	-1,193
Research Centers in Minority Institutions	23	54,641	27	57,185	27	57,185	0	0
Research Centers	1,333	$2,663,064	1,381	$2,644,811	1,354	$2,589,224	-27	-$55,587
Other Research:								
Research Careers	3,593	$608,205	3,700	$632,270	3,700	$641,318	0	$9,049
Cancer Education	85	28,026	87	28,626	91	29,876	4	1,250
Cooperative Clinical Research	369	421,734	349	447,848	335	442,187	-14	-5,661
Biomedical Research Support	110	66,863	106	64,891	106	64,891	0	0
Minority Biomedical Research Support	278	103,446	283	107,398	282	106,858	-1	-540
Other	1,803	574,449	2,222	729,892	2,342	798,632	120	68,740
Other Research	6,238	$1,802,722	6,747	$2,010,924	6,856	$2,083,762	109	$72,838
Total Research Grants	41,950	$20,907,458	43,968	$22,476,709	44,650	$22,879,605	682	$402,896
Ruth L Kirchstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards	3,161	$136,979	3,346	$149,840	3,411	$154,142	65	$4,302
Institutional Awards	12,429	621,038	12,850	680,590	13,010	694,507	160	13,916
Total Research Training	15,590	$758,017	16,196	$830,430	16,421	$848,649	225	$18,218
Research & Develop. Contracts	2,238	$2,827,544	2,263	$2,915,243	2,281	$3,173,386	18	$258,142
(SBIR/STTR) (non-add)[2]	*(122)*	*(71,236)*	*(128)*	*(80,582)*	*(149)*	*(90,960)*	*(21)*	*(10,378)*
Intramural Research	6,912	$3,410,354	6,956	$3,581,878	6,956	$3,614,558	0	$32,681
Res. Management & Support	5,579	1,620,334	5,658	1,685,252	5,658	1,719,314	0	34,062
Res. Management & Support (SBIR Admin) (non-add)[2]	*(1)*	*(4,362)*	*(3)*	*(7,333)*	*(3)*	*(3,794)*	*0*	*(-3,539)*
Office of the Director - Appropriation[2,5]		*(1,413,734)*		*(1,571,200)*		*(1,716,200)*		*(145,000)*
Office of the Director - Other		573,430		599,625		644,625		45,000
ORIP/SEPA (non-add)[2,5]		*(294,665)*		*(295,936)*		*(295,936)*		*0*
Common Fund (non-add)[2,5]		*(545,639)*		*(675,639)*		*(775,639)*		*(100,000)*
Buildings and Facilities[6]		136,863		144,863		178,863		34,000
Appropriation		*128,863*		*128,863*		*128,863*		*0*
Type 1 Diabetes[7]		-150,000		-150,000		-150,000		0
Program Evaluation Financing[8]		-715,000		-780,000		-847,489		-67,489
Cancer Initiative Mandatory Financing						-680,000		-680,000
Other Mandatory Financing						-1,145,000		-1,145,000
Subtotal, Labor/HHS Budget Authority		**$29,369,000**		**$31,304,000**		**$30,236,511**		**-$1,067,489**
Interior Appropriation for Superfund Research		77,349		77,349		77,349		0
Total, NIH Discretionary B.A.		**$29,446,349**		**$31,381,349**		**$30,313,860**		**-$1,067,489**
Type 1 Diabetes		150,000		150,000		150,000		0
Proposed Law Funding								
Cancer Initiative Mandatory Financing						680,000		680,000
Other Mandatory Financing						1,145,000		1,145,000
Total, NIH Budget Authority		**$29,596,349**		**$31,531,349**		**$32,288,860**		**$757,511**
Program Evaluation Financing		715,000		780,000		847,489		67,489
Total, Program Level		**$30,311,349**		**$32,311,349**		**$33,136,349**		**$825,000**

1 All Subtotal and Total numbers may not add due to rounding.
2 All numbers in italics and brackets are non-add.
3 Excludes Ebola related funding.
4 Includes mandatory financing.
5 Number of grants and dollars for the Common Fund, ORIP and SEPA components of OD are distributed by mechanism and are noted here as a non-add. The Office of the Director - Appropriations also is noted as a non-add since the remaining funds are accounted for under OD - Other.
6 Includes B&F appropriation and funds for facilities repairs and improvements at the NCI Federally Funded Research and Development Center in Frederick, Maryland.
7 Number of grants and dollars for mandatory Type I Diabetes are distributed by mechanism above; therefore, Type I Diabetes amount is deducted to provide subtotals only for the Labor/ HHS Budget Authority.
8 Number of grants and dollars for Program Evaluation Financing are distributed by mechanism above; therefore, the amount is deducted to provide subtotals only for the Labor/HHS Budget Authority.

BUDGET AUTHORITY BY OBJECT CLASSIFICATION INCLUDING TYPE 1 DIABETES

Object Classes[1] (Dollars in Thousands)	FY 2016 Enacted	FY 2017 President's Budget[2]	FY 2017 +/- FY 2016
Personnel Compensation			
Full-Time Permanent (11.1)	$967,877	$978,296	$10,419
Other Than Full-Time Permanent (11.3)	472,006	475,744	3,738
Other Personnel Compensation (11.5)	35,500	35,847	347
Military Personnel (11.7)	19,972	20,194	222
Special Personnel Services Payments (11.8)	164,686	165,598	912
Subtotal Personnel Compensation (11.9)	**$1,660,040**	**$1,675,678**	**$15,638**
Civilian Personnel Benefits (12.1)	479,037	489,266	10,229
Military Personnel Benefits (12.2)	13,669	13,833	165
Benefits to Former Personnel (13.0)	0	0	0
Total Pay Costs	**$2,152,746**	**$2,178,778**	**$26,032**
Travel & Transportation of Persons (21.0)	50,815	51,417	602
Transportation of Things (22.0)	4,948	5,024	76
Rental Payments to GSA (23.1)	22,486	22,845	359
Rental Payments to Others (23.2)	364	371	6
Communications, Utilities & Misc. Charges (23.3)	25,930	26,695	765
Printing & Reproduction (24.0)	728	743	14
Consultant Services (25.1)	118,310	136,113	17,803
Other Services (25.2)	1,099,423	1,174,633	75,210
Purchase of goods and services from government accounts (25.3)	3,068,187	3,234,346	166,159
Operation & Maintenance of Facilities (25.4)	228,651	240,238	11,587
R&D Contracts (25.5)	1,589,573	1,701,386	111,813
Medical Care (25.6)	28,348	28,391	43
Operation & Maintenance of Equipment (25.7)	101,437	102,698	1,260
Subsistence & Support of Persons (25.8)	0	0	0
Subtotal Other Contractual Services (25.0)	**$6,233,929**	**$6,617,804**	**$383,875**
Supplies & Materials (26.0)	197,765	199,726	1,961
Equipment (31.0)	161,866	165,140	3,274
Land and Structures (32.0)	6	6	0
Investments & Loans (33.0)	0	0	0
Grants, Subsidies & Contributions (41.0)	22,602,384	22,942,931	340,546
Insurance Claims & Indemnities (42.0)	1	1	0
Interest & Dividends (43.0)	31	31	0
Refunds (44.0)	0	0	0
Subtotal Non-Pay Costs	**$29,301,254**	**$30,032,734**	**$731,479**
Total Budget Authority	**$31,454,000**	**$32,211,511**	**$757,511**

[1] Excludes the Superfund Research account under the jurisdiction of the Interior & Related Agencies Appropriations Subcommittee, Ebola-related funding, and Program Evaluation Financing.

[2] Includes mandatory financing.

BUDGET AUTHORITY BY OBJECT CLASSIFICATION INCLUDING SERVICE AND SUPPLY FUND AND MANAGEMENT FUND

Object Classes[1]	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
Personnel Compensation			
Full-Time Permanent (11.1)	$1,317,911	$1,333,931	$16,020
Other Than Full-Time Permanent (11.3)	543,368	548,176	4,809
Other Personnel Compensation (11.5)	60,308	61,014	706
Military Personnel (11.7)	29,065	29,410	344
Special Personnel Services Payments (11.8)	171,589	172,570	981
Subtotal Personnel Compensation (11.9)	**$2,122,240**	**$2,145,101**	**$22,861**
Civilian Personnel Benefits (12.1)	620,398	632,606	12,208
Military Personnel Benefits (12.2)	19,833	20,072	239
Benefits to Former Personnel (13.0)	0	0	0
Total Pay Costs	**$2,762,471**	**$2,797,778**	**$35,307**
Travel & Transportation of Persons (21.0)	53,894	54,530	635
Transportation of Things (22.0)	6,581	6,673	92
Rental Payments to GSA (23.1)	85,558	86,863	1,305
Rental Payments to Others (23.2)	90,566	91,655	1,088
Communications, Utilities & Misc. Charges (23.3)	141,023	142,939	1,916
Printing & Reproduction (24.0)	755	770	15
Consultant Services (25.1)	298,682	321,175	22,493
Other Services (25.2)	1,462,732	1,547,615	84,883
Purchase of goods and services from government accounts (25.3)	1,215,478	1,348,156	132,678
Operation & Maintenance of Facilities (25.4)	314,563	327,010	12,447
R&D Contracts (25.5)	1,589,780	1,701,601	111,821
Medical Care (25.6)	34,378	34,571	193
Operation & Maintenance of Equipment (25.7)	233,008	235,966	2,958
Subsistence & Support of Persons (25.8)	0	0	0
Subtotal Other Contractual Services (25.0)	**$5,148,621**	**$5,516,093**	**$367,472**
Supplies & Materials (26.0)	326,649	330,973	4,324
Equipment (31.0)	235,398	240,208	4,810
Land and Structures (32.0)	13	13	0
Investments & Loans (33.0)	0	0	0
Grants, Subsidies & Contributions (41.0)	22,602,385	22,942,931	340,546
Insurance Claims & Indemnities (42.0)	3	4	0
Interest & Dividends (43.0)	83	83	1
Refunds (44.0)	0	0	0
Subtotal Non-Pay Costs	**$28,691,529**	**$29,413,733**	**$722,204**
Total Budget Authority	**$31,454,000**	**$32,211,511**	**$757,511**

[1] Excludes the Superfund Research account under the jurisdiction of the Interior & Related Agencies Appropriations Subcommittee, Ebola-related funding, and Program Evaluation Financing.

SALARIES AND EXPENSES

Object Classes (Dollars in Thousands)	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
Personnel Compensation			
Full-Time Permanent (11.1)	$967,877	$978,296	$10,419
Other Than Full-Time Permanent (11.3)	472,006	475,744	3,738
Other Personnel Compensation (11.5)	35,500	35,847	347
Military Personnel (11.7)	19,972	20,194	222
Special Personnel Services Payments (11.8)	164,686	165,598	912
Subtotal Personnel Compensation (11.9)	**$1,660,040**	**$1,675,678**	**$15,638**
Civilian Personnel Benefits (12.1)	479,037	489,266	10,229
Military Personnel Benefits (12.2)	13,669	13,833	165
Benefits to Former Personnel (13.0)	0	0	0
Total Pay Costs	**$2,152,746**	**$2,178,778**	**$26,032**
Travel & Transportation of Persons (21.0)	50,815	51,417	602
Transportation of Things (22.0)	4,948	5,024	76
Rental Payments to Others (23.2)	364	371	6
Communications, Utilities & Misc. Charges (23.3)	25,930	26,695	765
Printing & Reproduction (24.0)	728	743	14
Other Contractual Services:			
Consultant Services (25.1)	99,610	101,378	1,768
Other Services (25.2)	1,099,423	1,174,633	75,210
Purchase of goods and services from government accounts (25.3)[2]	2,037,016	2,087,955	50,939
Operation & Maintenance of Facilities (25.4)	207,113	208,312	1,199
Operation & Maintenance of Equipment (25.7)	101,437	102,698	1,260
Subsistence & Support of Persons (25.8)	0	0	0
Subtotal Other Contractual Services	**$3,544,599**	**$3,674,975**	**$130,376**
Supplies & Materials (26.0)	197,765	199,726	1,961
Subtotal Non-Pay Costs	**$3,825,150**	**$3,958,951**	**$133,801**
Total Salaries and Expense / Administrative Costs	**$5,977,896**	**$6,137,729**	**$159,833**

[1] Excludes the Superfund Research account under the jurisdiction of the Interior & Related Agencies Appropriations Subcommittee, Ebola-related funding, and Program Evaluation Financing.

[2] Excludes obligations from accounts (OC 25.1, 25.3 and 25.4) supporting Program Evaluations and Inter-agency Agreements related to the Research and Development Contracts mechanism.

DETAIL OF FULL-TIME EQUIVALENT EMPLOYMENT (FTE)

Institutes and Centers (ICs)	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
NCI	2,998	3,029	3,029
NHLBI	917	926	926
NIDCR	232	234	234
NIDDK	631	637	637
NINDS	517	522	522
NIAID	1,952	1,972	1,972
NIGMS	181	183	183
NICHD	549	554	554
NEI	248	250	250
NIEHS	656	662	662
NIA	399	403	403
NIAMS	237	239	239
NIDCD	133	134	134
NIMH	536	541	541
NIDA	396	400	400
NIAAA	237	239	239
NINR	92	93	93
NHGRI	332	335	335
NIBIB	97	98	98
NCATS	129	130	130
NCCIH	72	73	73
NIMHD	63	64	64
FIC	61	62	62
NLM	803	811	811
OD	673	679	679
Central Services[1]	4,683	4,730	4,730
Total	**17,824**	**18,000**	**18,000**
PHS Trust Fund (non-add)[2]	*4*	*4*	*4*
CRADA (non-add)[3]	*5*	*5*	*5*
Grand Total	**17,824**	**18,000**	**18,000**

[1] Reflects FTE associated with Central Services positions whose payroll costs are covered from NIH Management Fund and NIH Service and Supply Fund resources.

[2] PHS Trust Fund positions are incorporated within the IC's Direct-funded civilian FTE category and are treated as non-add values.

[3] CRADA positions are distributed across multiple ICs and are treated as non-add values.

HISTORY OF OBLIGATIONS BY INSTITUTE AND CENTER

(Dollars in Thousands)	FY 2008 Actual	FY 2009 Actual	FY 2010 Actual	FY 2011 Actual	FY 2012 Actual	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual[1]	FY 2016 Enacted[1]	FY 2017 President's Budget[6]
NCI	$4,827,552	$4,966,927	$5,098,147	$5,058,105	$5,067,342	$4,789,014	$4,932,368	$4,944,593	$5,213,509	$5,893,509
NHLBI	$2,937,333	$3,014,552	$3,093,501	$3,069,550	$3,050,959	$2,903,768	$2,988,415	$2,995,546	$3,113,533	$3,113,533
NIDCR	$391,136	$402,011	$412,527	$409,549	$410,279	$387,309	$397,833	$397,672	$413,396	$413,396
NIDDK[2]	$1,862,188	$1,911,795	$1,958,905	$1,942,155	$1,945,289	$1,837,027	$1,884,377	$1,899,088	$1,966,310	$1,966,310
NINDS	$1,549,543	$1,590,781	$1,633,568	$1,622,001	$1,624,786	$1,533,793	$1,588,899	$1,604,581	$1,695,180	$1,695,180
NIAID	$4,286,410	$4,400,398	$4,515,426	$4,478,595	$4,486,470	$4,235,094	$4,401,185	$4,417,529	$4,715,697	$4,715,697
NIGMS[3]	$1,942,783	$1,994,426	$2,048,112	$2,033,663	$2,427,578	$2,293,044	$2,366,429	$2,372,199	$2,512,437	$2,512,437
NICHD	$1,259,435	$1,292,929	$1,327,349	$1,317,682	$1,320,087	$1,246,140	$1,283,314	$1,286,797	$1,338,348	$1,338,348
NEI	$669,534	$687,350	$705,792	$700,781	$701,992	$657,055	$675,551	$676,726	$707,998	$707,998
NIEHS[4]	$729,088	$746,107	$774,008	$762,602	$763,737	$721,331	$743,002	$745,533	$770,882	$770,882
NIA	$1,050,998	$1,079,004	$1,108,208	$1,100,445	$1,121,340	$1,040,565	$1,171,656	$1,197,459	$1,598,246	$1,598,246
NIAMS	$510,358	$523,887	$538,028	$534,260	$535,200	$505,206	$520,314	$521,480	$541,662	$541,662
NIDCD	$395,515	$406,516	$418,001	$415,104	$415,835	$392,540	$404,237	$405,168	$422,936	$422,936
NIMH	$1,414,541	$1,454,377	$1,493,510	$1,477,257	$1,478,843	$1,396,006	$1,419,632	$1,433,603	$1,518,673	$1,518,673
NIDA	$1,007,295	$1,039,561	$1,066,909	$1,050,519	$1,052,368	$993,404	$1,017,957	$1,015,695	$1,050,550	$1,050,550
NIAAA	$437,839	$449,524	$461,544	$458,257	$459,079	$433,247	$446,282	$447,152	$467,445	$467,445
NINR	$137,990	$141,660	$145,420	$144,369	$144,631	$136,516	$140,553	$140,837	$145,912	$145,912
NHGRI	$505,380	$507,210	$524,131	$511,469	$512,700	$483,650	$498,076	$498,648	$513,227	$513,227
NIBIB	$299,726	$307,701	$316,028	$313,787	$338,010	$319,062	$326,989	$327,223	$343,506	$343,506
NIMHD	$200,252	$205,616	$211,194	$209,693	$276,144	$260,671	$268,439	$270,480	$280,680	$280,680
NCRR	$1,153,911	$1,224,629	$1,267,021	$1,257,641	---	---	---	---	---	---
NCCIH	$122,013	$125,265	$128,615	$127,706	$127,924	$120,767	$124,368	$124,046	$129,941	$129,941
NCATS	---	---	---	---	$574,564	$542,598	$633,571	$632,629	$685,417	$685,417
FIC	$66,828	$68,607	$69,957	$69,413	$69,540	$65,627	$67,575	$67,576	$70,117	$70,117
NLM[5]	$331,585	$337,814	$348,467	$344,860	$336,733	$325,088	$334,383	$336,653	$395,684	$395,684
ORIP & SEPA	---	---	---	---	$304,039	$290,042	$294,486	$294,662	$295,936	$295,936
Common Fund	$498,240	$541,133	$544,028	$543,017	$544,884	$513,461	$531,146	$545,607	$675,639	$775,639
OD - Other	$613,454	$706,295	$632,966	$623,887	$609,357	$608,584	$477,293	$573,328	$599,625	$644,625
B&F	$127,227	$88,815	$203,056	$62,161	$102,413	$106,676	$88,880	$123,464	$128,863	$128,863
Total, NIH Program Level	**$29,328,154**	**$30,214,890**	**$31,044,418**	**$30,638,528**	**$30,802,123**	**$29,137,284**	**$30,027,205**	**$30,295,974**	**$32,311,349**	**$33,136,349**
Less funds allocated from different sources:										
Mandatory Type 1 Diabetes Research	-$150,000	-$150,000	-$150,000	-$150,000	-$150,000	-$142,350	-$139,200	-$150,000	-$150,000	-$150,000
PHS Program Evaluation	-$8,200	-$8,200	-$8,200	-$8,200	-$8,200	-$8,200	-$8,200	-$715,000	-$780,000	-$847,489
Cancer Initiative Mandatory Financing										-$680,000
Other Mandatory Financing										-$1,145,000
Total, NIH Discretionary Budget Authority	**$29,169,954**	**$30,056,690**	**$30,886,218**	**$30,480,328**	**$30,643,923**	**$28,986,734**	**$29,879,805**	**$29,430,974**	**$31,381,349**	**$30,313,860**
Interior Budget Authority	-$77,531	-$78,070	-$79,201	-$79,045	-$78,920	-$74,864	-$77,345	-$77,349	-$77,349	-$77,349
Total, NIH Labor/HHS Budget Authority	**$29,092,423**	**$29,978,620**	**$30,807,017**	**$30,401,283**	**$30,565,003**	**$28,911,870**	**$29,802,460**	**$29,353,625**	**$31,304,000**	**$30,236,511**

[1] Excludes Ebola-related funding.

[2] Includes Mandatory Type 1 Diabetes Research funding.

[3] Includes PHS Program Evaluation financing of $715 million in FY 2015, $780 million in FY 2016, and $847.489 million in FY 2017.

[4] Includes Interior Appropriation for Superfund research.

[5] Includes PHS Program Evaluation financing of $8.2 million except in FY 2015, FY 2016, and FY 2017.

[6] Includes mandatory financing.

HISTORY OF OBLIGATIONS BY TOTAL MECHANISM

(Dollars in Thousands)[1]	FY 2008 Actual	FY 2009 Actual	FY 2010 Actual	FY 2011 Actual	FY 2012 Actual	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual[3]	FY 2016 Enacted[3]	FY 2017 President's Budget[3,4]
Research Project Grants	$15,688,339	$16,124,554	$16,501,300	$16,428,047	$16,550,486	$15,445,463	$16,168,246	$16,441,843	$17,820,973	$18,206,620
Research Centers	$2,946,346	$3,018,710	$3,082,914	$3,009,480	$3,040,375	$2,708,744	$2,723,203	$2,663,064	$2,644,811	$2,589,224
Other Research	$1,779,990	$1,775,387	$1,794,148	$1,802,937	$1,808,138	$1,783,481	$1,846,841	$1,802,719	$2,010,924	$2,083,762
Subtotal, Research Grants	$20,414,675	$20,918,651	$21,378,362	$21,240,464	$21,398,999	$19,937,688	$20,738,290	$20,907,625	$22,476,709	$22,879,605
Research Training	$770,480	$776,193	$775,186	$771,766	$761,934	$733,524	$738,429	$758,017	$830,430	$848,649
R & D Contracts	$2,934,858	$3,069,412	$3,143,929	$2,996,640	$2,937,188	$2,927,077	$2,990,037	$2,826,971	$2,915,243	$3,173,386
Intramural Research	$3,091,240	$3,222,852	$3,306,312	$3,330,815	$3,401,506	$3,247,193	$3,373,601	$3,409,362	$3,581,878	$3,614,558
Res. Mgt. & Support	$1,372,225	$1,428,138	$1,509,287	$1,517,630	$1,530,874	$1,485,575	$1,527,131	$1,619,784	$1,685,252	$1,719,314
Office of the Director	$523,798	$616,639	$632,966	$623,887	$609,530	$608,584	$477,293	$573,328	$599,625	$644,625
Subtotal	**$29,107,276**	**$30,031,885**	**$30,746,042**	**$30,481,202**	**$30,640,031**	**$28,939,641**	**$29,844,781**	**$30,095,088**	**$32,089,137**	**$32,880,137**
Buildings & Facilities[2]	$135,147	$96,735	$210,975	$70,081	$133,228	$114,580	$96,880	$123,464	$144,863	$178,863
Interior- Superfund	$77,531	$78,070	$79,201	$79,045	$78,928	$74,864	$77,345	$77,332	$77,349	$77,349
Total	**$29,319,954**	**$30,206,690**	**$31,036,218**	**$30,630,328**	**$30,852,187**	**$29,129,085**	**$30,019,005**	**$30,295,884**	**$32,311,349**	**$33,136,349**

[1] Obligations for actual years exclude lapse and include Type 1 Diabetes.

[2] B&F mechanism amounts include the B&F appropriation plus dollars associated with repair and improvement (R&I) related construction for the Frederick, Maryland facility appropriated to NCI.

[3] Amounts include use of Program Evaluation financing resources in FY 2015 totaling $715.0 million with an estimated $780.0 million and $847.489 million allocated by mechanism for FY 2016 and FY 2017, respectively. The FY 2017 column reflects estimates that incorporate $1.825 billion in new mandatory budget authority requested to support expanded Cancer research and other purposes. Excludes Ebola-related funding.

[4] Includes mandatory financing.

PHYSICIANS' COMPARABILITY ALLOWANCE WORKSHEET

		FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
1) Number of Physicians Receiving PCAs		169	169	169
2) Number of Physicians with One-Year PCA		24	24	24
3) Number of Physicians with Multi-Year PCA		145	145	145
4) Average Annual PCA Physician Pay (without PCA payment)		$154,943	$156,841	$159,233
5) Average Annual PCA Payment		$14,248	$14,423	$14,643
6) Number of Physicians Receiving PCAs by Category (non-add)	Category I Clinical Position			
	Category II Research Position	167	167	167
	Category III Occupational Health			
	Category IV-A Disability Evaluation			
	Category IV-B Health and Medical Admin.	2	2	2

8) Provide the maximum annual PCA amount paid to each category of physician in your agency and explain the reasoning for these amounts by category.

Maximum annual PCA amount for category II and IV-B vary based on grade level, amount of federal service and length of the PCA agreement. The monetary range is between $10,000 and $30,000. These flexible amounts are necessary to recruit and retain the caliber of physician needed to carry out the NIH mission which directly impacts the health of the nation.

9) Explain the recruitment and retention problem(s) for each category of physician in your agency (this should demonstrate that a current need continues to persist).(Please include any staffing data to support your explanation, such as number and duration of unfilled positions and number of accessions and separations per fiscal year.)

NIH strives to make progress recruiting and retaining qualified physicians to the Federal service. However, due to competition and more lucrative compensation in the private sector it continues to be challenging. NIH consistently has had a high turnover rate for physicians. NIH physicians require unique and specialized qualifications that make it difficult to fill vacancies.

10) Explain the degree to which recruitment and retention problems were alleviated in your agency through the use of PCAs in the prior fiscal year. (Please include any staffing data to support your explanation, such as number and duration of unfilled positions and number of accessions and separations per fiscal year.)

In FY 2015, there was a total of 169 PCA recipients across NIH. In FY 2016 and beyond, a critical need will continue to exist for highly qualified, specialized physicians to support the NIH mission. NIH still requires compensation flexibilities such as PCA to attract and retain qualified physicians.

STATISTICAL DATA: DIRECT AND INDIRECT COSTS AWARDED

(Dollars in Thousands)	Direct Cost Awarded	Indirect Cost Awarded	Percent of Total		Percent Change	
			Direct Cost Awarded	Indirect Cost Awarded	Direct Cost Awarded	Indirect Cost Awarded
FY 2005	$15,419,089	$5,795,178	72.7%	27.3%	3.5%	2.6%
FY 2006	$15,219,138	$5,781,293	72.5%	27.5%	-1.3%	-0.2%
FY 2007	$15,387,745	$5,876,060	72.4%	27.6%	1.1%	1.6%
FY 2008	$15,295,950	$5,903,730	72.2%	27.8%	-0.6%	0.5%
FY 2009	$15,683,872	$6,027,543	72.2%	27.8%	2.5%	2.1%
FY 2010	$16,040,991	$6,193,567	72.1%	27.9%	2.3%	2.8%
FY 2011	$15,849,082	$6,173,769	72.0%	28.0%	-1.2%	-0.3%
FY 2012	$15,978,032	$6,182,900	72.1%	27.9%	0.8%	0.2%
FY 2013	$14,915,599	$5,755,617	72.2%	27.8%	-6.7%	-6.9%
FY 2014	$15,568,553	$5,908,275	72.5%	27.5%	4.4%	2.7%
FY 2015	$15,709,570	$5,955,905	72.5%	27.5%	0.9%	0.8%
FY 2016 Enacted	$16,899,936	$6,407,203	72.5%	27.5%	7.6%	7.6%
FY 2017 President's Budget	$17,205,285	$6,522,969	72.5%	27.5%	1.8%	1.8%

Note: FY 2016 and FY 2017 data represent estimates and will change as actual data is received.

RESEARCH PROJECT GRANTS: TOTAL NUMBER OF AWARDS AND FUNDING

(Dollars in Thousands)	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016 Enacted[1]	FY 2017 Request[1]
No. of Awards:										
Competing	9,714	9,121	9,386	8,706	8,986	8,234	9,168	9,540	10,753	9,946
Noncompeting	26,610	26,217	25,738	26,166	25,631	25,140	23,504	23,261	23,367	24,608
Subtotal	36,324	35,338	35,124	34,872	34,617	33,374	32,672	32,801	34,120	34,554
SBIR/STTR	1,838	1,740	1,685	1,494	1,642	1,466	1,660	1,578	1,720	1,886
Total	**38,162**	**37,078**	**36,809**	**36,366**	**36,259**	**34,840**	**34,332**	**34,379**	**35,840**	**36,440**
Average Annual Cost:										
Competing	$377	$427	$417	$427	$421	$418	$489	$452	$471	$468
Total RPGs[2]	$414	$438	$450	$453	$459	$444	$474	$479	$499	$502
Percent Change over prior year Average Costs:										
Competing RPGs	2.8%	13.2%	-2.4%	2.5%	-1.5%	-0.8%	17.0%	-7.5%	4.2%	-0.5%
Total RPGs[2]	2.2%	5.8%	3.0%	0.5%	1.4%	-3.3%	6.7%	1.2%	4.0%	0.6%
Average Length[3] of Award in Years	3.8	3.8	3.8	3.7	3.5	3.5	3.5	3.4	3.4	3.4

[1] Numbers of grants identified in the FY 2016 and the FY 2017 are estimates, and will change as applications are received and selected for funding.

[2] Includes Noncompeting RPGs and Administrative Supplements and excludes SBIR/STTR grants.

[3] Durations are estimated for FY 2016 and FY 2017 based on FY 2015 grant award results.

RESEARCH PROJECT GRANTS: SUCCESS RATES

INSTITUTES & CENTERS*,1,2	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016 Enacted	FY 2017 Request
NCI	21.0%	19.0%	17.1%	13.8%	13.6%	13.7%	14.1%	13.0%	12.4%	17.0%
NHLBI	22.0%	22.0%	19.9%	17.4%	14.7%	16.9%	18.2%	21.9%	22.2%	24.3%
NIDCR	20.0%	19.0%	22.2%	22.5%	21.2%	19.9%	21.5%	22.0%	19.1%	17.4%
NIDDK	25.0%	23.0%	25.9%	20.7%	19.8%	21.0%	22.9%	20.3%	18.5%	17.3%
NINDS	21.0%	21.0%	22.6%	21.1%	19.5%	19.8%	18.7%	20.5%	17.0%	15.0%
NIAID	23.0%	19.0%	23.9%	20.2%	23.2%	18.8%	22.0%	21.5%	24.9%	18.5%
NIGMS	27.0%	27.0%	26.9%	23.1%	24.4%	19.9%	24.8%	29.6%	31.2%	24.6%
NICHD	17.0%	15.0%	15.2%	12.4%	12.5%	10.8%	12.5%	11.5%	13.7%	12.1%
NEI	30.0%	30.0%	26.9%	28.8%	29.8%	23.7%	26.7%	21.4%	23.3%	20.3%
NIEHS	18.0%	18.0%	25.1%	14.7%	14.3%	15.3%	15.0%	14.7%	17.8%	16.8%
NIA	20.0%	18.0%	14.5%	16.1%	15.5%	13.6%	15.9%	17.7%	29.8%	18.3%
NIAMS	21.0%	20.0%	21.4%	14.9%	15.6%	15.9%	18.1%	16.7%	18.7%	17.5%
NIDCD	29.0%	32.0%	30.2%	27.5%	26.6%	22.5%	25.8%	24.9%	26.3%	20.5%
NIMH	21.0%	22.0%	22.1%	17.1%	21.6%	18.7%	19.4%	20.4%	20.1%	19.1%
NIDA	24.0%	22.0%	19.8%	18.2%	21.2%	19.5%	18.0%	19.6%	15.0%	15.0%
NIAAA	26.0%	24.0%	26.5%	18.6%	18.4%	19.5%	19.2%	16.4%	16.7%	17.5%
NINR	20.0%	21.0%	13.2%	8.5%	13.0%	9.1%	11.6%	8.0%	8.5%	7.2%
NHGRI	32.0%	34.0%	33.6%	27.4%	23.9%	20.5%	17.7%	18.8%	19.2%	13.3%
NIBIB	19.0%	18.0%	16.0%	12.9%	12.1%	13.7%	13.1%	12.0%	15.8%	11.0%
NIMHD[3]	N/A	11.0%	8.0%	11.9%	9.9%	4.3%	11.9%	13.7%	11.8%	11.8%
NCCIH[4]	12.0%	12.0%	11.0%	9.1%	9.5%	11.6%	8.7%	10.8%	15.4%	12.2%
NCATS[5]	N/A	N/A	N/A	N/A	0.0%	0.0%	16.7%	66.7%	29.5%	14.1%
FIC	28.0%	21.0%	26.1%	11.9%	16.0%	14.6%	9.1%	9.7%	15.8%	10.7%
NLM[6]	21.0%	12.0%	21.1%	16.1%	12.8%	12.3%	19.4%	19.8%	17.9%	17.1%
ORIP & SEPA[7,8]	15.0%	22.0%	22.0%	21.3%	18.6%	20.0%	19.6%	21.5%	23.8%	20.7%
Common Fund	12.0%	17.0%	11.1%	11.3%	8.0%	9.2%	10.0%	12.1%	11.7%	12.2%
NIH[9]	**21.3%**	**21.0%**	**21.0%**	**20.5%**	**17.5%**	**16.7%**	**18.0%**	**18.3%**	**19.2%**	**17.5%**

[1] Includes Special type 1 Diabetes administered by NIDDK. Excludes NIEHS Superfund Research account administered by NIEHS.

[2] Application success rates represent the percentage of applications that are awarded during the fiscal year.

[3] NIMHD (formally NCMHD) success rates are not available due to co-funding agreements with other ICs through FY 2008. NIMHD only co-funded competing RPGs with other ICs until FY 2009.

[4] The National Center for Complementary and Alternative Medicine (NCCAM) was renamed in December 2014 to the National Center for Complementary and Integrative Health (NCCIH) consistent with enactment of the Consolidated and Further Continuing Appropriations Act, 2015 (P.L. 113-235).

[5] The National Center for Advancing Translational Sciences (NCATS) was established concurrent with the dissolution of National Center for Research Resources (NCRR) effective FY 2012.

[6] NLM success rate is displayed for FY 2008 and forward due to change in the reporting requirements. As of FY 2007, NLM funding is no longer reflected as an individual line item on the NIH Budget Mechanism Table.

[7] Success rate data associated with grants funded from the OD appropriation unrelated to the Common Fund or ORIP & SEPA is not included. Collection of this information was initiated in FY 2012.

[8] SEPA program was proposed for termination in FY 2014 as part of a government-wide initiative to reconfigure Science, Technology, Engineering, and Mathematics (STEM) activities.

[9] NIH success rate exludes application and grant data from OD Non-Common Fund and OD Non-ORIP & SEPA accounts.

* Success Rates identified in FY 2016 and FY 2017 are estimates, and will change as applications are received and selected for funding.

MANAGEMENT FUND

General Statement

The NIH Management Fund (MF) was established on June 29, 1957, by Public Law 85-67. The MF was created to finance a variety of centralized support services and administrative activities that are required for the efficient and effective operation of all NIH programs and facilities. The services provided by the MF include a research hospital and outpatient clinic, receipt, review and referral of research and training grant applications, police, fire, security and general administrative support services. Funds credited to the NIH Management Fund remain available for one fiscal year after the fiscal year in which they are deposited.

Budget Authority by Activity (Dollars in Thousands)	**FY 2015 Actual**		**FY 2016 Enacted**		**FY 2017 President's Budget**		**Change**	
Detail:	**FTEs**	**Amount**	**FTEs**	**Amount**	**FTEs**	**Amount**	**FTEs**	**Amount**
Clinical Center	1,860	$433,767	1,879	$444,612	1,879	$453,332	0	$8,720
Center for Scientific Review	383	125,095	388	128,222	388	130,832	0	2,610
Research Support and Administrative Services, OD	59	23,285	64	23,867	64	24,354	0	487
Office of Research Services, Facilities, Development & Operations	571	82,412	550	84,216	550	85,901	0	1,685
TOTAL	**2,873**	**$664,559**	**2,881**	**$680,917**	**2,881**	**$694,419**	**0**	**$13,502**

Budget Authority by Object
(Dollars in Thousands)

	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
Total compensable workyears:			
Full-time employment	2,881	2,881	0
Full-time equivalent of overtime and holiday hours	0	0	0
Average ES salary	$183,560	$183,915	$355
Average GM/GS grade	11.5	11.5	0.0
Average GM/GS salary	$96,168	$97,084	$916
Average salary, grade established by act of July 1, 1944 (42 U.S.C. 207)	$86,083	$86,170	$87
Average salary of ungraded positions	143,457	145,608	2,151

	OBJECT CLASSES	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
	Personnel Compensation:			
11.1	Full-time permanent	$173,237,198	$176,008,994	$2,771,795
11.3	Other than full-time permanent	62,544,817	63,482,990	938,172
11.5	Other personnel compensation	15,735,749	15,963,918	228,168
11.7	Military personnel	6,774,802	6,866,262	91,460
11.8	Special personnel services payments	6,316,823	6,379,991	63,168
	Total, Personnel Compensation	**264,609,390**	**268,702,154**	**4,092,764**
12.0	Personnel benefits	76,188,543	77,255,182	1,066,640
12.2	Military personnel benefits	5,020,192	5,080,435	60,242
13.0	Benefits for former personnel	0	0	0
	Subtotal, Pay Costs	**345,818,125**	**351,037,771**	**5,219,646**
21.0	Travel and transportation of persons	2,178,933	2,200,722	21,789
22.0	Transportation of things	697,523	704,498	6,975
23.1	Rental payments to GSA	6,526	6,624	98
23.2	Rental payments to others	10,130	10,252	122
23.3	Communications, utilities and miscellaneous charges	6,316,634	6,379,800	63,166
		0	0	0
24.0	Printing and reproduction	306	309	3
25.1	Consulting services	10,634,962	10,911,471	276,509
25.2	Other services	107,035,429	110,032,420	2,996,991
25.3	Purchase of goods and services from government accounts	88,400,000	90,698,400	2,298,400
25.4	Operation and maintenance of facilities	16,010,000	16,170,100	160,100
25.5	Research and development contracts	207,580	214,845	7,265
25.6	Medical care	5,551,244	5,690,026	138,781
25.7	Operation and maintenance of equipment	13,424,094	13,621,354	197,260
25.8	Subsistence and support of persons	0	0	0
25.0	**Subtotal, Other Contractual Services**	**241,263,308**	**247,338,615**	**6,075,307**
26.0	Supplies and materials	71,589,206	73,378,936	1,789,730
31.0	Equipment	13,026,030	13,351,681	325,651
32.0	Land and structures	0	0	0
33.0	Investments and loans	0	0	0
41.0	Grants, subsidies and contributions	378	0	(378)
42.0	Insurance claims and indemnities	189	189	0
43.0	Interest and dividends	9,932	10,031	99
44.0	Refunds	0	0	0
	Subtotal, Non-Pay Costs	**335,099,095**	**343,381,657**	**8,282,562**
	Total Budget Authority by Object	**680,917,221**	**694,419,430**	**13,502,209**

Detail of Positions

GRADE	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
Total, ES Positions	5	5	5
Total, ES Salary	$915,160	$917,800	$919,574
GM/GS-15	130	129	130
GM/GS-14	298	317	317
GM/GS-13	383	390	393
GS-12	479	476	480
GS-11	471	482	486
GS-10	22	22	22
GS-9	141	145	146
GS-8	116	113	114
GS-7	217	220	221
GS-6	53	56	57
GS-5	28	29	29
GS-4	13	10	10
GS-3	12	8	8
GS-2	8	8	8
GS-1	1	0	0
Subtotal	2,372	2,405	2,421
Grades established by Act of July 1, 1944 (42 U.S.C. 207):			
Assistant Surgeon General	1	1	1
Director Grade	18	18	19
Senior Grade	21	22	23
Full Grade	17	18	19
Senior Assistant Grade	26	25	26
Assistant Grade	4	4	4
Subtotal	87	88	92
Ungraded	563	564	570
Total permanent positions	2,440	2,490	2,506
Total positions, end of year	3,025	3,062	3,088
Total full-time equivalent (FTE) employment, end of year	2,873	2,881	2,881
Average ES salary	183,032	183,560	183,915
Average GM/GS grade	11.3	11.5	11.5
Average GM/GS salary	93,414	96,168	97,084

SERVICE AND SUPPLY FUND

General Statement

The NIH Service and Supply Fund (SSF) was established on July 3, 1945, under 42 U.S.C. 231. The SSF was created to finance a variety of centralized research support services and administrative activities that are required for the efficient and effective operation of all NIH programs and facilities. The SSF provides a single means for consolidating the financing and accounting of business-type operations, including the sales of services and commodities to customers. The services provided through the SSF include mainframe computing, enterprise IT software planning and development, facilities engineering, planning, and design, facility use and maintenance including leased buildings, printing, telecommunications, procurement, shipping and receiving, motor pool, research animals, fabrication and maintenance of scientific equipment, utilities and plant maintenance, finance and accounting operations, government-wide contracting for IT, biomedical engineering, security, consolidated human resources, and other administrative support services.

Budget Authority by Activity (Dollars in Thousands)	**FY 2015 Actual**		**FY 2016 Enacted**		**FY 2017 President's Budget**		**Change**	
	FTEs	**Amount**	**FTEs**	**Amount**	**FTEs**	**Amount**	**FTEs**	**Amount**
Detail:								
Research Support and Adminstrative	840	$768,536	844	$789,157	844	$800,025	0	$10,868
Office of Research Facilities	680	438,805	713	449,775	713	461,020	0	11,245
Development & Operations								
Information Technology	287	405,426	290	415,561	290	425,950		10,389
Clinical Center	2	121	2	124	2	126		2
TOTAL	**1,809**	**$1,612,888**	**1,849**	**$1,654,617**	**1,849**	**$1,687,121**	**0**	**$32,504**

Budget Authority by Object Class
(Dollars in Thousands)

	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
Total compensable workyears:			
Full-time employment	1,849	1,849	0
Full-time equivalent of overtime and holiday hours	0	0	0
Average ES salary	$174,891	$175,258	$367
Average GM/GS grade	11.5	11.5	0.0
Average GM/GS salary	$94,714	$95,188	$474
Average salary, grade established by act of July 1, 1944 (42 U.S.C. 207)	$94,575	$95,378	$803
Average salary of ungraded positions	113,495	115,197	1,702
OBJECT CLASSES	**FY 2016 Enacted**	**FY 2017 President's Budget**	**FY 2017 +/- FY 2016**
Personnel Compensation:			
11.1 Full-time permanent	$176,797,008	179,625,760	$2,828,752
11.3 Other than full-time permanent	8,817,224	8,949,482	132,258
11.5 Other personnel compensation	9,072,293	9,203,841	131,548
11.7 Military personnel	2,318,287	2,349,584	31,297
11.8 Special personnel services payments	586,015	591,875	5,860
Total, Personnel Compensation	197,590,827	200,720,542	3,129,715
12.0 Personnel benefits	$65,172,097	66,084,506	912,409
12.2 Military personnel benefits	1,144,046	1,157,774	13,728
13.0 Benefits for former personnel	0	0	0
Subtotal, Pay Costs	263,906,970	267,962,822	4,055,852
21.0 Travel and transportation of persons	900,200	911,633	11,433
22.0 Transportation of things	934,905	944,254	9,349
23.1 Rental payments to GSA	63,065,282	64,011,261	945,979
23.2 Rental payments to others	90,191,548	91,273,847	1,082,299
23.3 Communications, utilities and miscellaneous charges	108,776,650	109,864,417	1,087,767
24.0 Printing and reproduction	26,382	26,646	264
25.1 Consulting services	169,736,805	174,149,962	4,413,157
25.2 Other services	256,273,679	262,949,340	6,675,661
25.3 Purchase of goods and services from government accounts	394,426,220	404,653,433	10,227,213
25.4 Operation and maintenance of facilities	69,902,138	70,601,624	699,486
25.5 Research and development contracts	0	0	0
25.6 Medical care	478,576	490,541	11,965
25.7 Operation and maintenance of equipment	118,146,344	119,646,803	1,500,459
25.8 Subsistence and support of persons	0	0	0
25.0 Subtotal, Other Contractual Services	1,008,963,762	1,032,491,703	23,527,941
26.0 Supplies and materials	57,294,658	57,867,606	572,948
31.0 Equipment	60,506,033	61,716,153	1,210,120
32.0 Land and structures	6,616	6,682	66
33.0 Investments and loans	0	0	0
41.0 Grants, subsidies and contributions	4	4	0
42.0 Insurance claims and indemnities	2,775	2,803	28
43.0 Interest and dividends	41,750	42,168	418
44.0 Refunds	0	0	0
Subtotal, Non-Pay Costs	1,390,710,565	1,419,159,177	28,448,612
Total Budget Authority by Object	1,654,617,535	1,687,121,999	32,504,464

Detail of Positions

GRADE	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
Total, ES Positions	5	5	5
Total, ES Salary	$873,962	$874,455	$866,200
GM/GS-15	78	89	90
GM/GS-14	245	250	251
GM/GS-13	486	461	462
GS-12	279	300	300
GS-11	98	108	109
GS-10	1	2	2
GS-9	83	89	89
GS-8	34	34	34
GS-7	83	94	94
GS-6	12	20	20
GS-5	19	16	16
GS-4	10	7	7
GS-3	24	12	12
GS-2	12	8	8
GS-1	4	2	2
Subtotal	1,468	1,492	1,496
Grades established by Act of July 1, 1944 (42 U.S.C. 207):			
Assistant Surgeon General	0	0	0
Director Grade	5	4	4
Senior Grade	3	2	2
Full Grade	3	4	4
Senior Assistant Grade	2	4	4
Assistant Grade	1	1	1
Subtotal	14	15	15
Ungraded	371	368	368
Total permanent positions	1,761	1,827	1,827
Total positions, end of year	1,858	1,883	1,887
Total full-time equivalent (FTE) employment, end of year	1,809	1,849	1,849
Average ES salary	174,792	174,891	175,258
Average GM/GS grade	11.8	11.8	11.8
Average GM/GS salary	92,585	94,714	95,188

BUDGET MECHANISM TABLE

NATIONAL INSTITUTES OF HEALTH
FY 2017 Congressional Justification
Common Fund

Budget Mechanism - Total[1]

(Dollars in Thousands)

MECHANISM	FY 2015 Actual		FY 2016 Enacted		FY 2017 President's Budget[3]		FY 2017 +/- FY 2016	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	264	$162,896	281	$173,095	339	$208,948	58	$35,853
Administrative Supplements	*(66)*	11,549	*(47)*	8,262	*(37)*	6,436	*(-10)*	-1,826
Competing:								
Renewal								
New	155	151,807	171	167,326	171	167,449		123
Supplements								
Subtotal, Competing	155	$151,807	171	$167,326	171	$167,449		$123
Subtotal, RPGs	419	$326,253	452	$348,683	510	$382,833	58	$34,150
SBIR/STTR								
Research Project Grants	419	$326,253	452	$348,683	510	$382,833	58	$34,150
Research Centers:								
Specialized/Comprehensive	35	$78,163	28	$62,159	28	$62,480		$321
Clinical Research	10	22,715						
Biotechnology	3	5,773	1	2,651	1	3,000		349
Comparative Medicine	3	9,237						
Research Centers in Minority Institutions								
Research Centers	51	$115,887	29	$64,810	29	$65,480		$670
Other Research:								
Research Careers	31	$4,727	28	$4,237	17	$2,617	-11	-$1,620
Cancer Education								
Cooperative Clinical Research								
Biomedical Research Support								
Minority Biomedical Research Support								
Other	95	41,932	309	136,449	365	161,397	56	24,948
Other Research	126	$46,659	337	$140,686	382	$164,014	45	$23,328
Total Research Grants	596	$488,799	818	$554,179	921	$612,327	103	$58,148
Ruth L Kirchstein Training Awards:	FTTPs		FTTPs		FTTPs		FTTPs	
Individual Awards								
Institutional Awards	81	12,681	169	26,381	191	29,823	22	3,442
Total Research Training	81	$12,681	169	$26,381	191	$29,823	22	$3,442
Research & Develop. Contracts		$11,387		$50,063		$86,676		$36,612
(SBIR/STTR) (non-add)[2]								
Intramural Research		$15,008		$17,419		$15,900		-$1,519
Res. Management & Support		17,764		27,598		30,914		3,316
Res. Management & Support (SBIR Admin) (non-add)[2]								
Office of the Director - Appropriation[2]								
Office of the Director - Other								
ORIP/SEPA (non-add)[2]								
Common Fund (non-add)[2]								
Buildings and Facilities								
Appropriation								
Type 1 Diabetes								
Program Evaluation Financing								
Cancer Initiative Mandatory Financing								
Other Mandatory Financing						-210,000		-210,000
Subtotal, Labor/HHS Budget Authority		**$545,639**		**$675,639**		**$565,639**		**-$110,000**
Interior Appropriation for Superfund Res.								
Total, NIH Discretionary B.A.		**$545,639**		**$675,639**		**$565,639**		**-$110,000**
Type 1 Diabetes								
Proposed Law Funding								
Cancer Initiative Mandatory Financing								
Other Mandatory Financing						210,000		210,000
Total, NIH Budget Authority		**$545,639**		**$675,639**		**$775,639**		**$100,000**
Program Evaluation Financing								
Total, Program Level		**$545,639**		**$675,639**		**$775,639**		**$100,000**

[1] All Subtotal and Total numbers may not add due to rounding.
[2] All numbers in italics and brackets are non-add.
[3] Includes mandatory financing.

MAJOR CHANGES IN THE FISCAL YEAR 2017 PRESIDENT'S BUDGET REQUEST

Major changes by budget mechanism and/or budget activity detail are briefly described below. Note that there may be overlap between budget mechanisms and activity detail and these highlights will not sum to the total change for the FY 2017 President's Budget for the Common Fund, which is $100.000 million more than the FY 2016 Enacted level, for a total of $775.639 million. The increase is requested to expand the Precision Medicine Initiative Cohort Program.

Research Project Grants (+$34.150 million; total $382.833 million): The Common Fund expects to support a total of 510 Research Project Grant (RPG) awards in FY 2017. Noncompeting RPGs will increase by 58 awards and $35.853 million. New RPGs will be awarded in Common Fund programs to be launched in FY 2017 as well as in new initiatives within ongoing Common Fund programs, including the Precision Medicine Initiative Cohort Program.

Other Research (+$23.328 million; total $164.014 million): The estimated increase in Common Fund support for the Other Research mechanism includes a request to increase use of Other Transaction Authority (OTA) by the Precision Medicine Initiative Cohort Program and the Stimulating Peripheral Activity to Relieve Conditions (SPARC) Program.

Research and Development Contracts (+$36.612 million; total $86.676 million): The estimated increase in Common Fund support for Research and Development Contracts is intended to support efforts under the Precision Medicine Initiative Cohort Program.

BUDGET BY INITIATIVE

National Institutes of Health
Common Fund by Initiative
(Dollars in Thousands)

(Dollars in Thousands)	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
Big Data to Knowledge (BD2K)			
Big Data to Knowledge (BD2K)	40,792	62,961	69,136
Pediatric Research Program			
Gabriella Miller Kids First Research Act	12,726	13,108	12,994
Genotype-Tissue Expression (GTEx) Resources			
Genotype-Tissue Expression (GTEx) Resources	11,101	4,114	1,289
Global Health			
Medical Education Partnership Initiative (MEPI)	3,000	3,000	3,000
Human Heredity and Health in Africa (H3Africa)	9,602	8,478	3,262
Cookstoves Initiative	0	1,825	2,325
Subtotal, Global Health	12,602	13,303	8,587
Glycoscience			
Accelerating Translation of Glycoscience: Integration and Accessibility	9,337	19,862	19,877
Health Economics			
Changing Incentives for Consumers, Insurers, and Providers	70	84	167
Science of Structure, Organization, and Practice Design in the Efficient Delivery of Healthcare	2,346	2,474	1,547
Economics of Prevention	2,622	2,392	1,180
Data Infrastructure to Enable Research on Health Reform	78	415	525
Subtotal, Health Economics	5,117	5,365	3,419
High-Risk Research			
NIH Director's Pioneer Award	23,984	10,877	10,871
NIH Director's New Innovator Award Program	87,723	91,797	90,300
Transformative R01's	44,486	39,432	30,748
NIH Director's Early Independence Award Program	21,069	19,217	21,546
Subtotal, High-Risk Research	177,262	161,323	153,465
Illuminating the Druggable Genome			
Knowledge Management Network	3,305	3,222	0
Technology Development	3,046	2,586	0
Subtotal, Illuminating the Druggable Genome	6,351	5,808	0
Knockout Mouse Phenotyping Program			
Production, Characterization, and Cryopreservation	9,693	0	0
Phenotyping and Data Release	6,507	0	0
Data Coordination	525	1,262	1,262
Production, Characterization, Cryopreservation, Phenotyping, and Data Release	0	6,738	9,738
Subtotal, Knockout Mouse Phenotyping Program	16,725	8,000	11,000
Metabolomics			
Comprehensive Metabolomics Research Cores	10,917	9,890	4,785
Interdisciplinary Training in Metabolomics	4,409	3,555	2,001
Metabolomics Technology Development	2,503	1,927	0
Metabolomics Reference Standards Synthesis	1,926	1,929	1,981
Metabolomics Data Sharing and Program Coordination Core	1,049	2,264	1,614
Subtotal, Metabolomics	20,804	19,565	10,381

National Institutes of Health
Common Fund by Initiative
(Dollars in Thousands)

(Dollars in Thousands)	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
Molecular Transducers of Physical Activity			
Study Coordination and Data Management	0	0	887
Molecular Transducers of Physical Activity in Humans – Clinical Study	0	0	1,213
Chemical Analysis of Biological Samples	0	0	609
Characterization of Human Molecular Transducers of Physical Activity in Model Systems	0	0	113
Subtotal, Molecular Transducers of Physical Activity	0	0	2,821
Precision Medicine Initiative Cohort Program			
Precision Medicine Initiative Cohort Program	0	130,000	230,000
Protein Capture			
Antigen Production	71	50	50
Production of anti-TF antibodies	3,010	96	4,099
New Reagent Technology Development and Piloting	58	60	33
Subtotal, Protein Capture	3,138	207	4,182
Science of Behavior Change			
Mechanisms of Change	0	0	0
Science of Behavior Change 2	6,964	5,782	13,085
Subtotal, Science of Behavior Change	6,964	5,782	13,085
Single Cell Analysis			
Pilot Studies to Evaluate Cellular Heterogeneity	6,219	6,027	0
Exceptionally Innovative Tools and Technologies for Single Cell Analysis	4,535	2,893	0
Accelerating the Integration and Translation of Technologies to Characterize Biological Processes at the Single Cell Level	7,600	5,335	0
Single Cell Analysis Challenges	96	0	0
Subtotal, Single Cell Analysis	18,449	14,255	0
S.P.A.R.C. - Stimulating Peripheral Activity to Relieve Conditions			
Functional and Anatomical Mapping of Five Organ Systems	9	11,064	19,905
Next Generation Tools	3,092	8,077	11,079
Off-Label Use of Existing Market-Approved Technology for Small Markets	205	207	3,205
Data Coordination	79	83	2,079
Subtotal, S.P.A.R.C. - Stimulating Peripheral Activity to Relieve Conditions	3,385	19,431	36,268
4D Nucleome			
Technology Development, Biological Validation, Modeling and Pilot Mapping	10,646	10,163	10,038
Nucleomic, Imaging, and Computational Tool Development	9,939	10,075	10,068
4D Nucleome Coordination and Integration	4,699	7,710	7,834
Subtotal, 4D Nucleome	25,285	27,948	27,940
Enhancing the Diversity of the NIH-Funded Workforce			
BUILD Initiative	44,508	47,786	48,419
National Research Mentoring Network (NRMN)	3,061	2,696	2,298
Coordination and Evaluation Center (CEC)	2,026	1,311	2,287
Subtotal, Enhancing the Diversity of the NIH-Funded Workforce	49,595	51,794	53,004
Epigenomics			
Mapping Centers	22	0	0
Human Health and Disease	2,960	54	0
Technology Development in Epigenetics	0	0	0
Pharmacology	4,519	3,946	4,000
Subtotal, Epigenomics	7,500	4,000	4,000

National Institutes of Health
Common Fund by Initiative
(Dollars in Thousands)

(Dollars in Thousands)	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget
Extracellular RNA Communication			
Data Management and Resource/Repository (DMRR)	3,437	2,513	2,375
Reference Profiles of Human Extracellular RNA	4,357	4,075	4,078
Extracellular RNA Biogenesis, Biodistribution, Uptake, and Effector Function	7,019	7,179	7,173
Clinical Utility of Extracellular RNAs as Biomarkers and Therapeutic Agents	13,927	16,057	16,132
Subtotal, Extracellular RNA Communication	28,740	29,823	29,757
Gulf Long-term Follow-up of Workers Study			
Gulf Long-term Follow-up of Workers Study	3,000	0	0
Health Care Systems Research Collaboratory			
NIH-HMORN Coordinating Center	2,384	2,445	1,800
Expansion Activities	10,427	9,985	10,285
Subtotal, Health Care Systems Research Collaboratory	12,811	12,430	12,085
Human Microbiome			
Sequence a Reference Set of Genomes	0	0	0
Evaluation of multi-'omic data in understanding the microbiome's role in health and disease	11,321	171	133
Subtotal, Human Microbiome	11,321	171	133
Library of Integrated Network-Based Cellular Signatures (LINCS)			
Perturbation-Induced Data and Signature Generation Centers (U54)	11,007	10,000	10,000
Nanomedicine			
Nanomedicine Development Centers	115	40	0
NIH Center for Regenerative Medicine (NCRM)			
NIH Center for Regenerative Medicine (NCRM)	206	0	0
Cell Therapy Projects	1,249	1,250	1,250
Cell-Based Screenings	3,000	6,750	6,750
Subtotal, NIH Center for Regenerative Medicine (NCRM)	4,455	8,000	8,000
Regulatory Science			
Microphysiological Systems for Drug Efficacy and Toxicity Testing	4,000	4,000	0
Undiagnosed Disease Program			
Undiagnosed Diseases Program Network	29,079	29,900	28,700
Training in the Use of Contemporary Genomic Approaches to Rare Disease Diagnostics	900	900	900
Subtotal, Undiagnosed Disease Program	29,979	30,800	29,600
Strengthening the Biomedical Research Workforce			
Director’s Workforce Innovation Award to Enhance Biomedical Research Training	6,256	6,750	6,750
Strategic Planning Funds	6,824	6,800	6,800
Subtotal Common Fund	545,639	675,639	764,572
New Initiatives in Common Fund	0	0	11,067
Total Common Fund	545,639	675,639	775,639

JUSTIFICATION OF BUDGET REQUEST

Common Fund

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

Budget Authority (BA):

	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
BA	$545,639,000	$675,639,000	$775,639,000	$100,000,000
FTE	0	0	0	0

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

Overview

The NIH Common Fund (CF) supports research in areas of emerging scientific opportunities, rising public health challenges, and knowledge gaps that deserve special emphasis; that would benefit from strategic coordination and planning across NIH ICs; and that are designed to address specific, high-impact goals and milestones within a 5- to 10-year timeframe.[48] Collectively, these programs represent strategic investments aimed at solving problems or building resources to affect research throughout the entire biomedical research enterprise. CF programs attempt to change the way science is conducted through the establishment of new scientific fields or paradigms, the development of new and innovative technologies that change the way scientists approach their work, or the generation of comprehensive data sets or other resources that catalyze all research and enable discovery.

Many CF programs support the NIH Director's priority themes for FY 2017:

1) Foundation for Discoveries: Basic Research
2) The Promise of Precision Medicine
3) Applying Big Data and Technology to Improve Health
4) Stewardship to Inspire Public Trust

Significant efforts are being made to evaluate programs during their lifetime, and outcomes are assessed as programs end. Funds freed as programs end or move to other sources of support will be available in FY 2017 for new challenges and opportunities.

[48] https://commonfund.nih.gov/

Overall Budget Policy: The FY 2017 President's Budget Request for CF is $775.639 million, an increase of $100.000 million or 14.8 percent compared to the FY 2016 Enacted level. CF will continue to support high-priority research with trans-NIH relevance in FY 2016. As mature programs transition out of CF, new programs are being established through strategic planning activities that identify potentially transformative areas of research where limited-term Common Fund investment can have a catalytic impact.

Selected Program Descriptions and Accomplishments

CF supports approximately 30 programs, most of which consist of a series of integrated initiatives that collectively address a set of goals that aim to transform the way research is conducted, the way that health and disease are understood, and/or the way that diseases are diagnosed or treated. These programs span a wide range of biomedical research fields, and encompass both basic and translational research. Highlighted below are programs that exemplify the science supported in FY 2017, and which involve budget shifts of $3 million or more compared to FY 2016. Also included are CF programs that may be supported in a second stage to address additional scientific challenges and opportunities.

Big Data to Knowledge (BD2K)

As biomedical tools and technologies rapidly improve, researchers are producing and analyzing an ever-expanding amount of complex biological data called "big data." As one component of an NIH-wide strategy, CF, in concert with NIH ICs, is supporting the Big Data to Knowledge (BD2K) program. The program goal is to facilitate broad use of biomedical big data, develop and disseminate analysis methods and software, enhance training in techniques associated with big data usage, and establish a network of collaborating centers of excellence.[49] The expectation is that implementation of BD2K will result in sweeping cultural changes in the way the biomedical research community shares, accesses, queries, cites, and analyzes data. In FY 2017, the program will support development of big data software, reference datasets, and data analysis and dissemination methods. The program will work to make big data software innovations available and user-friendly. It will also support innovative approaches to advance biomedical science using crowdsourcing and interactive digital media. The CF is also supporting NIH efforts through BD2K to create a comprehensive data commons for NIH data resources.

Budget Policy: The FY 2017 President's Budget Request is $69.136 million for the BD2K program from the Common Fund, an increase of $6.175 million or 9.8 percent compared to the FY 2016 Enacted level. This estimated increase in funding will be used to support activities described above.

Gabriella Miller Kids First Pediatric Research

In FY 2015, in accordance with the Gabriella Miller Kids First Research Act, Congress appropriated $12.600 million to the CF to support pediatric research. The Gabriella Miller Kids First Pediatric Research (Kids First) program is using big data approaches that will ultimately enable a more precise understanding of pediatric conditions. It is developing a "big data"

[49] https://commonfund.nih.gov/bd2k/index

resource for the pediatric research community that will also stimulate basic research.[50] This data resource will consist of well-curated clinical and genetic sequence data that will allow scientists to identify pathways underlying specific pediatric conditions and also to uncover shared pathways between seemingly disparate conditions. The Kids First program focuses on childhood cancers and structural birth defects. The fields of pediatric oncology and developmental biology, which studies disorders like birth defects, have made major discoveries that have advanced our understanding of disease and development. However, while we know that genetic mutations can lead to both cancer and birth defects, relatively few specific mutations that lead to these conditions in children have been identified. We also have a poor understanding of how the mutations result in disease. The pediatric data resource will put genetic data and clinical data for these conditions together and researchers will be able to mine the data for insights into the complex role of genetics in childhood cancer and structural birth defects. In FY 2017, the program intends to support activities to establish and grow the data resource. This includes a call for applications to sequence the genomes of participants in childhood cancer or structural birth defect research cohorts as well as support for the DNA sequencing center. It also includes an initiative to develop, build, and maintain a user-friendly interface that will facilitate data mining by the scientific community.

Budget Policy: The FY 2017 President's Budget Request is $12.994 million for Pediatric Research, a decrease of $0.114 million or 0.9 percent below the FY 2016 Enacted level. This estimated decrease in funds reflects lower anticipated program administration costs. Programmatic funding remains at the $12.600 million statutory level.

Genotype-Tissue Expression (GTEx)

The GTEx program provides data on how human DNA variation (or genotype) correlates with differences in gene expression levels in various tissues.[51] This information is important because many diseases involve changes in DNA where it is difficult to determine how the change leads to disease, especially for variants that lie outside of protein-coding regions but that can nonetheless affect gene expression levels. GTEx data show which tissues are most affected by a particular DNA variant, and researchers can use these data to identify potential pathways that lead to disease and possible new targets for therapies. The GTEx program has been highly successful in recruiting samples, extracting high quality RNA from tissues, and obtaining data from its gene expression array and RNA sequencing experiments. Data and biospecimens are being made available to the research community. The GTEx program aims to achieve its goals in FY 2017, delivering biospecimens, gene variation and expression data, and statistical methods for use by the research community.

Budget Policy: The FY 2017 President's Budget Request is $1.289 million for the GTEx program, a decrease of $2.825 million or 68.7 percent compared to the FY 2016 Enacted level. The estimated decrease reflects the planned winding down of the program and will support activities related to archiving and preserving GTEx resources.

[50] https://commonfund.nih.gov/KidsFirst/
[51] https://commonfund.nih.gov/GTEx/index

Global Health

NIH has a longstanding commitment to address both infectious and noninfectious diseases around the world, including in low- and middle-income nations that face a persistent cluster of infectious disease, malnutrition, and a growing incidence of chronic diseases and disabilities. Strategic investment by the Global Health program is intended to build capacity for research in Africa, since research in Africa is vital not only for health of Africans but for our understanding of human genetic diversity and the impact this has on health and disease everywhere.[52] This program fosters teamwork among scientists and health organizations, builds infrastructure, and increases capacity to improve medical training and retention of trained personnel to understand and treat disease more aggressively. It is supporting the development of a robust genetics and genomics research community in Africa, enabling big data approaches to the analysis of communicable and non-communicable diseases. It also provides support for medical education with an emphasis on research as part of the training program, and supports high priority research projects.

Budget Policy: The FY 2017 President's Budget Request is $8.587 million for the Global Health program, a decrease of $4.716 million or 35.5 percent compared to the FY 2016 Enacted level. This level of funding reflects the planned completion of several initiatives, including collaborative centers individual research grants, and a bioinformatics network. Additional initiatives may be launched in FY 2017 if an NIH review determines a second stage would allow the initiative to address new and important scientific challenges and opportunities.

Health Economics

The Health Economics program aims to support basic and applied research to understand how innovations in treatments, diagnosis, and preventive strategies can be most effectively implemented in a health care setting.[53] Research supported by this program falls within the objectives identified through a recent effort to develop an NIH taxonomy of high priority Health Economics research topics. This program will identify factors determining diffusion and optimal adoption and implementation of highly effective health technologies, innovations, and discoveries, so that past and future investments by NIH may have greater public health impact. The program seeks to analyze factors that are likely to affect the adoption of personalized medicine approaches, including research to understand individual characteristics and preferences of patients and their families, as well as factors influencing health care provider decisions. Understanding these responses will inform the development of future treatments, diagnostic, and preventive strategies to ensure that innovations are implementable in a real world environment. The Health Economics program also aims to build research capacity in health economics so that future NIH-supported research can be informed by economic analysis of factors that influence health and the uptake and adoption of NIH-supported innovations.

Budget Policy: The FY 2017 President's Budget Request is $3.418 million for the Health Economics program, a decrease of $1.947 million or 36.3 percent compared to the FY 2016 Enacted level. This level of funding reflects the planned completion of two awards and reductions in five other awards as they enter their final year.

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[52] https://commonfund.nih.gov/globalhealth/index
[53] https://commonfund.nih.gov/Healtheconomics/index

High-Risk, High-Reward Research

Research that aims to transform science is inherently difficult and risky but necessary to accelerate the pace of scientific discovery and advance human health. While all CF programs encourage risk-taking to overcome significant challenges in biomedical research, most programs designate funds for particular high-risk objectives or methods. The High-Risk, High-Reward Research program takes a different approach by supporting exceptionally creative scientists proposing innovative and transformative research in any scientific area within the NIH mission through four complementary initiatives: the Pioneer Award, New Innovator Award, Transformative Research Award, and Early Independence Award.[54] The Pioneer Award supports extraordinarily creative scientists who propose bold approaches to addressing major challenges in biomedical and behavioral research. The New Innovator Award supports exceptionally creative, early career investigators who propose innovative, high-impact projects. The Transformative Research Award supports unconventional, paradigm-shifting research projects that are inherently risk and untested and allows teams of principal investigators when appropriate. The Early Independence Award bypasses the traditional post-doctoral training period by helping establish independent scientific careers for newly graduated scientists with the intellect, creativity, drive, and maturity to flourish independently.

In part as a response to an evaluation of the Pioneer program that demonstrated high levels of innovation and impact, we initiated a budget policy for the HRHR program in 2013 in which Pioneer and Transformative Research Awards were to be co-funded between the Common Fund and the ICs. This led to a gradual decrease in the Common Fund HRHR budget, as ICs paid non-competing commitments on new awards. Although this policy reflected enthusiasm voiced by IC Directors about these initiatives, the budget policy has been difficult to implement in practice, since the work supported by these grants often falls at the interface of multiple ICs. In addition, some ICs have been more focused on developing their own HRHR awards. To stabilize the HRHR budget, the Common Fund is beginning in FY 2016 to once again fully fund Pioneer and Transformative Research Awards. As new awards are issued each year, costs for each cohort will build on top of commitments from prior year awards. This will result in a gradual increase in the HRHR budget over the next few years to reach a steady state of approximately $192 million in FY 2020.

Budget Policy: The FY 2017 President's Budget Request is $153.465 million for the High-Risk High-Reward program, a decrease of $7.858 million or 4.87 percent compared to the FY 2016 Enacted level. This will support competing costs for FY 2017 awards as well as all non-competing commitments for FY 2016 awards. However, since ICs will continue to provide non-competing costs for prior year cohorts, the HRHR budget shows a small decrease.

Illuminating the Druggable Genome (IDG)

The overarching goal of the Illuminating the Druggable Genome (IDG) program is to improve knowledge of the properties and functions of understudied proteins that are related to known drug targets, and are thus likely candidates to be drug targets themselves.[55] This program is

[54] https://commonfund.nih.gov/highrisk/index
[55] https://commonfund.nih.gov/idg/index

focusing on hundreds of understudied proteins within four protein families that are commonly targeted for drug development – G-protein-coupled receptors, nuclear receptors, ion channels, and protein kinases. Designed as a two-phase program, the pilot phase of the program is creating a data resource that will catalog known information about these protein families and establish strategies for obtaining further information about the function of these proteins so that investigators can determine whether a given protein is a likely target for a disease or condition of interest. Ultimately, this program will catalyze discovery of truly new biological pathways and targets and provide a wealth of new candidates for therapeutic development.

Budget Policy: The FY 2017 President's Budget Request does not fund the Illuminating the Druggable Genome program, which reflects the planned completion of the pilot stage of the program. However, IDG is being considered for a second stage of support in FY 2017. Pending a favorable review, a second stage is anticipated to encompass data coordination and high throughput approaches to analyze protein function.

Knockout Mouse Phenotyping Program (KOMP2)

Recognizing the value and utility of a readily-accessible, genome-wide collection of mouse mutants for determining how mammalian genes function, several international programs were launched to develop mutant mouse strains. Collectively, these basic research programs have generated more than 8,000 mutant mouse strains, in which individual genes have been removed or "knocked out" to allow researchers to determine their function. The CF has joined together with multiple NIH ICs to support the Knockout Mouse Phenotyping Program (KOMP2), which builds upon this existing resource by expanding the efforts to characterize, or phenotype, the mutant strains, including mutations that result in embryonic lethality.[56] The data are being made rapidly available to the entire research community through an international data coordinating center as a way to catalyze additional analyses of how or whether specific genes contribute to health and disease conditions. Some of the genes to be characterized are expected to suggest novel drug targets and increase understanding of genetic pathways that drugs may affect. In FY 2017, CF will continue to support a second stage of KOMP2 that builds upon the success of the first stage, expanding the program to add 3,000 more knockouts. This will be accomplished using a broad-based phenotyping platform, studying male and female mice in all tests, continued embryo phenotyping where applicable, and adding a cohort of older mice that are more reflective of human disease development times. To meet program goals and manage costs, the program is shifting to newly developed technology, called Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR). CRISPR technology has the ability to induce mutations in a variety of species, including mice, and has sparked a transformation in genetic research by offering significant savings in time and cost.

Budget Policy: The FY 2017 President's Budget Request is $11.000 million for the KOMP2 program, an increase of $3.000 million or 37.5 percent compared to the FY 2016 Enacted level. This level of funding reflects the planned increase to the mouse production and phenotyping awards.

[56] https://commonfund.nih.gov/KOMP2/index

Metabolomics

Metabolites are small molecules that are produced or consumed in the chemical reactions that take place in the body to sustain life. The sum of all metabolites at any given moment – the metabolome – is a form of big data "chemical read out" of the state of health of the cell or system, and provides a wealth of information about nutrition, environmental insult, infection, health, and disease status. Recent advances in metabolomics technology have yielded important clues about disease mechanisms which suggest new treatment strategies. However, the use of these technologies is limited by the number of research centers that have the necessary equipment and expertise to conduct the studies, and the lack of uniform standards for identifying unknown metabolites. The Metabolomics program is intended to establish the needed resources, training, technology development, and standards to catalyze the field of metabolomics to advance basic scientific discovery and clinical practice.[57] It also facilitates the dissemination of data generated by the program through an informatics component and through the establishment of an international consortium. This consortium will ensure that CF investments are also leveraging investments made in other countries, resulting in increased data sharing, reduced redundancy of effort, and faster translation toward improvements in health.

Budget Policy: The FY 2017 President's Budget Request is $10.381 million for the Metabolomics program, a decrease of $9.184 million or 46.9 percent compared to the FY 2016 Enacted level. The estimated decrease in funding reflects the planned completion of initiatives in training, technology development, and operations of the Data Repository and Coordinating Center.

Program Portrait: Molecular Transducers of Physical Activity in Humans

FY 2016 Level: $0.000 million
FY 2017 Level: $2.199 million
Change: +$2.199 million

Physical activity has been demonstrated to contribute to health via a wide variety of measures, and lack of physical activity is at the root of many common chronic health problems. Despite this, we have a poor understanding of the molecular mechanisms by which the benefits of physical activity are realized. The development of a "molecular map" of physical activity is a daunting task but is now made possible because of recent advances in several powerful high-throughput analytic approaches, including metabolomics, proteomics, genomics, transcriptomics, and epigenomics. The Molecular Transducers of Physical Activity in Humans Consortium (MoTrPAC) will leverage these advances to improve our understanding of the molecular mechanisms by which physical activity improves health.[58] Support for the program will be slightly delayed from initial plans so that awards will start in early FY 2017 rather than late FY 2016..

[57] https://commonfund.nih.gov/metabolomics/index
[58] https://commonfund.nih.gov/MolecularTransducers

Program Portrait: Precision Medicine Initiative Cohort Program

FY 2016 Level: $130.000 million
FY 2017 Level: $230.000 million
Change: +$100.000 million

The PMI Cohort Program will build a national research cohort of one million or more U.S. volunteers, providing a transformative platform for expanding our knowledge of precision medicine approaches. Precision medicine is an approach to disease prevention and treatment that seeks to maximize effectiveness by taking into account individual variability in genes, environment, and lifestyle. Precision medicine seeks to redefine our understanding of disease onset and progression, effective prevention, treatment response, and health outcomes through the more precise measurement of molecular, environmental, and behavioral factors that contribute to health and disease. This understanding will lead to more accurate diagnoses, more rational disease prevention strategies, better treatment selection, and the development of novel therapies. Coincident with advancing the science of medicine is a changing culture of medical practice, and research that engages individuals as active partners – not just as patients or research subjects. The combination of a highly engaged population and rich biological, health, behavioral, and environmental data will usher in a new and more effective era of American healthcare. FY 2016 marks the start of the Cohort Program and the budget reflects partial year funding in a pilot (startup) phase. Support for the program will increase significantly in FY 2017 as awardees move toward full implementation of the required infrastructure and programmatic operations needed for the cohort to support initial enrollees.

Protein Capture Reagents

The Protein Capture Reagents program is developing resources and tools necessary to better understand the critical role the multitude of cellular proteins play in development, health, and disease. Monoclonal antibodies are currently used to capture proteins, but many monoclonal antibodies do not target a single specific protein, are not reliably reproduced, and only represent a small subset of proteins comprising the human proteome. A renewable resource of protein capture reagents – specifically designed to meet research and clinical demands ranging from protein isolation and high-throughput assays to diagnostics and biomarker development – is needed to advance the field of proteomics and fuel biomedical research. To have the maximum benefit, such reagents would need to be high quality, affordable, reliable, and represent the wide range of possible proteins within cells and tissues. The Protein Capture Reagents program piloted an effort focused on producing such reagents for human transcription factors and tested renewable, next generation capture technologies. The effort produced sorely needed reagents and established a community resource capable of generating protein capture reagents for future research. Currently, the program is focused on validating the generated human transcription factor reagents and disseminating them to the research community.

Budget Policy: The FY 2017 President's Budget Request is $4.182 million for the Protein Capture Reagents program, an increase of $3.975 million compared to the FY 2016 Enacted level. This level of funding reflects an effort to enhance the utility of the reagents generated by the program by having these reagents validated by anindependent contractor.

Science of Behavior Change

Unhealthy human behaviors, such as smoking, drug and alcohol abuse, over-eating, and a failure to exercise, all contribute to negative health outcomes and common diseases. However, it is extremely difficult not only to implement healthy behavior changes, but also to maintain positive changes over an extended period of time. Uncovering the basic foundations of how motivation changes across a broad array of health-related behaviors can lead to more effective and efficient

approaches to behavioral interventions, with the ultimate goal of improving the Nation's health. The first stage of the Science of Behavior Change (SOBC) program aimed to improve understanding of the basic mechanisms of human behavior change across a broad range of health-related behaviors and use this knowledge to develop more effective behavioral interventions. Research funded by the first phase led to the identification of three broad classes of intervention targets that are highly relevant to understanding the mechanisms of behavior change: self-regulation, stress reactivity and resilience, and interpersonal and social processes. The second stage of the SOBC program, which began in FY 2015, is developing measures and techniques that afford a more mechanistic, experimental medicine approach to behavior change, where interventions are designed to engage the putative targets identified in stage one and engagement of those targets is routinely assessed via reliable and validated assays. The program will also include an important new focus on adherence to medical regimens and other high priority health behaviors that could benefit from this target engagement approach.

Budget Policy: The FY 2017 President's Budget Request is $13.085 million for the Science of Behavior Change program, an increase of $7.303 million or 126.31 percent compared to the FY 2016 Enacted level. This level of funding reflects the planned expansion of the program and builds upon ongoing efforts, including new awards to improve adherence interventions and to facilitate the transition of lead projects from the CF to the ICs.

Single Cell Analysis

Cells are the basic unit of life, yet individual cells are difficult to study in their natural environments. Most analyses in cell biology and biochemistry are performed using groups of cells because of limitations with the sensitivity of the techniques; however, individual cells within the same population may differ dramatically from one another with important consequences for the health and function of the entire population. In order to uncover fundamental biological principles and ultimately improve the detection and treatment of disease, new approaches that permit analyses at the single cell level are needed. The Single Cell Analysis program seeks to overcome the scientific and technological hurdles in understanding how cells vary and operate within cell populations in tissue.[59] In particular, the program addresses basic research challenges in systematically describing cell "states," defining normal cell-to-cell variation, measuring the impact of environmental changes, understanding cellular responses within tissues, and overcoming limitations in measurement approaches.

Budget Policy: The FY 2017 President's Budget Request does not fund the Single Cell Analysis, which reflects the planned completion of the program.

Stimulating Peripheral Activity to Relieve Conditions (SPARC)

Modulation of peripheral nerve signals to control organ function has been recognized as a potentially powerful way to treat many diseases and conditions, such as hypertension, heart failure, gastrointestinal disorders, type II diabetes, inflammatory disorders, and more. However, the mechanisms of action for neuromodulation therapies are poorly understood, and consequently efficacy is minimal and side effects are frequent. The Stimulating Peripheral Activity to Relieve Conditions (SPARC) program is a high-risk, goal-driven basic research

[59] https://commonfund.nih.gov/Singlecell/index

endeavor to develop foundational knowledge and technologies for an entirely new class of neural control devices that have the potential to precisely treat a wide variety of diseases and conditions.[60] Launched in FY 2015, the SPARC program supports interdisciplinary teams of investigators to deliver neural circuit maps of several organ systems, novel electrode designs, minimally invasive surgical procedures, and stimulation protocols, driven by an end goal to develop new neuromodulation therapies. The program is designed to be iterative and dynamic, with the novel technologies informing mapping efforts, and mapping results defining new technology requirements. This program uses Other Transaction Authority for selected initiatives, which allows high levels of flexibility, responsiveness to adjust program components, and ability to engage with non-traditional partners as needed to address specific, high-risk goals within this complex, interdisciplinary, and rapidly evolving area of science. While distinct from the NIH BRAIN initiative, SPARC shares approaches with BRAIN and both initiatives will likely benefit from innovations made in the other; these initiatives are therefore being closely coordinated by NIH staff.

Budget Policy: The FY 2017 President's Budget Request is $36.268 million for the SPARC program, an increase of $16.837 million or 86.65 percent compared to the FY 2016 Enacted level. This increase reflects plans for SPARC to expand ongoing efforts to develop neural circuit maps and generate next generation tools to stimulate peripheral nerves. Additionally, SPARC will augment existing and launch new activities to explore the utility of existing neuromodulation devices to address new indications.

Strategic Planning and Evaluation

The CF's 10-year restriction on support for any given program is designed to create a churn of funds so that new challenges and opportunities may be addressed each year. Strategic planning is therefore a critical activity for the CF. Conducted annually, the strategic planning process allows CF to be nimble and adaptive to the changing scientific landscape. This process is a collaborative activity between the Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI)/Office of Strategic Coordination (OSC) and the ICs. CF strategic planning encompasses both the identification of broadly relevant scientific challenges and opportunities for strategic investments using the CF (Phase I planning), and the articulation of specific goals, milestones, and implementation plans for each broadly defined potential program topic identified in Phase I (Phase II planning). Phase I strategic planning involves gathering broad input from external stakeholders with diverse expertise as well as internal discussions about shared challenges and emerging opportunities. Phase II strategic planning involves more specific consultations with external experts, analysis of NIH and worldwide portfolios of research on the given topic, and literature reviews to articulate specific gaps and areas of research where opportunities for transformative progress are possible.

Since CF programs are goal driven, evaluation is critical and increasingly important as more programs near the end of their support period. Evaluation is conducted as a partnership between DPCPSI/OSC and the ICs, and it includes both formal and informal evaluative activities. Informal evaluation involves convening grantees and NIH-wide teams to review progress,

[60] https://commonfund.nih.gov/sparc/index

discuss new challenges, and develop strategies to adapt as part of routine program management. It also involves gathering input from external consultants and using their input, together with internal analysis, to help guide the implementation of the program. Formal evaluations involve the development of baseline data for new programs and the development of multiple metrics of outcomes. The utility of data, resources, technologies, and other program outputs is assessed through surveys and the analysis of bibliometric data such as citation analyses.

Budget Policy: The FY 2017 President's Budget Request is $6.80 million, which is the same as the FY 2016 Enacted level. The funds will be used to implement a strategic planning process to identify areas of scientific opportunity that are ripe for short-term, catalytic support from the Common Fund. Funds will also be used to evaluate the outputs and outcomes of both ongoing and mature programs and to fund the operating cost for OSC to manage the Common Fund.

Funds Available for New Programs

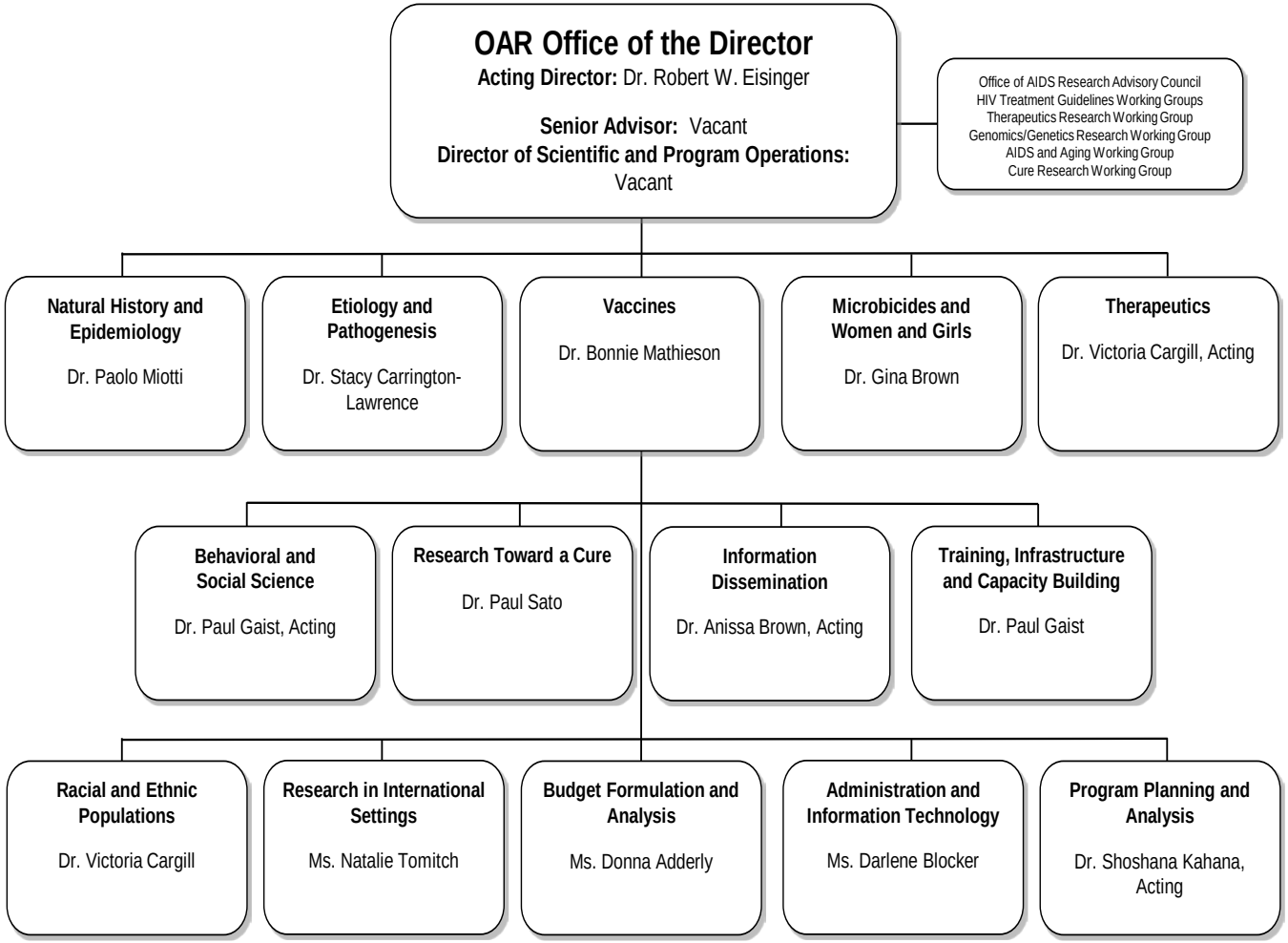
As mature initiatives end or transition out of the CF, funds are available to address new challenges. As described above, two existing CF programs will be considered for a second stage of support beginning in FY 2017 (H3Africa and Illuminating the Druggable Genome). These programs are undergoing assessments with respect to achievements of the initial support period, and proposals for a second phase of support will be considered pending available funds.

Budget Policy: The FY 2017 President's Budget Request is $11.067 million to support new programs and initiatives within the Common Fund and/or to provide a second phase of funding for those initiatives completing an initial phase.

OFFICE OF AIDS RESEARCH

Trans-NIH AIDS Research Budget

NOTE: The FY 2016 Enacted funding amounts cited throughout this chapter reflect the effects of OAR HIV/AIDS Transfers.


OAR Office of the Director
Acting Director: Dr. Robert W. Eisinger
Senior Advisor: Vacant
Director of Scientific and Program Operations: Vacant
Office of AIDS Research Advisory Council
HIV Treatment Guidelines Working Groups
Therapeutics Research Working Group
Genomics/Genetics Research Working Group
AIDS and Aging Working Group
Cure Research Working Group
Natural History and Epidemiology
Dr. Paolo Miotti
Etiology and Pathogenesis
Dr. Stacy Carrington-Lawrence
Vaccines
Dr. Bonnie Mathieson
Microbicides and Women and Girls
Dr. Gina Brown
Therapeutics
Dr. Victoria Cargill, Acting
Behavioral and Social Science
Dr. Paul Gaist, Acting
Research Toward a Cure
Dr. Paul Sato
Information Dissemination
Dr. Anissa Brown, Acting
Training, Infrastructure and Capacity Building
Dr. Paul Gaist
Racial and Ethnic Populations
Dr. Victoria Cargill
Research in International Settings
Ms. Natalie Tomitch
Budget Formulation and Analysis
Ms. Donna Adderly
Administration and Information Technology
Ms. Darlene Blocker
Program Planning and Analysis
Dr. Shoshana Kahana, Acting

NATIONAL INSTITUTES OF HEALTH
Office of AIDS Research
Budget Authority by Institute and Center
(Dollars in Thousands)

Institute / Center	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
NCI	$269,660	$266,422	$266,422	$0
NHLBI	64,974	67,020	67,020	0
NIDCR	17,465	18,015	18,015	0
NIDDK	30,031	29,471	29,471	0
NINDS	45,465	46,536	46,536	0
NIAID	1,586,804	1,663,823	1,663,823	0
NIGMS	64,963	53,194	53,194	0
NICHD	142,016	144,736	144,736	0
NEI	1,360	925	925	0
NIEHS	5,179	5,342	5,342	0
NIA	5,465	5,637	5,637	0
NIAMS	4,779	4,587	4,587	0
NIDCD	1,821	1,878	1,878	0
NIMH	156,687	161,289	161,289	0
NIDA	298,862	294,244	294,244	0
NIAAA	27,537	28,404	28,404	0
NINR	12,266	12,180	12,180	0
NHGRI	6,380	1,531	1,531	0
NIBIB	713	395	395	0
NIMHD	21,839	21,674	21,674	0
NCCIH	975	777	777	0
NCATS	64,287	0	0	0
FIC	23,520	24,083	24,083	0
NLM	7,937	8,822	8,822	0
OD				
OAR	61,923	62,256	62,256	0
ORIP	77,153	76,820	76,820	0
Subtotal, OD	139,076	139,076	139,076	0
TOTAL, NIH	**$3,000,061**	**$3,000,061**	**$3,000,061**	**$0**

NATIONAL INSTITUTES OF HEALTH
Office of AIDS Research
Budget Mechanism - AIDS [1]

(Dollars in Thousands)

MECHANISM	FY 2015 Actual		FY 2016 Enacted		FY 2017 President's Budget		FY 2017 +/- FY 2016	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Research Projects:								
Noncompeting	1,643	$1,241,614	1,679	$1,311,454	1,698	$1,390,186	19	$78,732
Administrative Supplements	*(82)*	9,798	*(45)*	7,039	*(47)*	7,139	*(2)*	100
Competing	634	374,740	587	376,337	491	305,823	-96	-70,514
Subtotal, RPGs	2,277	$1,626,152	2,266	$1,694,830	2,189	$1,703,148	-77	$8,318
SBIR/STTR	62	33,237	62	31,381	68	29,018	6	-2,363
Research Project Grants	2,339	$1,659,389	2,328	$1,726,211	2,257	$1,732,166	-71	$5,955
Research Centers:								
Specialized/Comprehensive	180	$131,550	172	$123,086	169	$119,240	-3	-$3,846
Clinical Research	1	59,553	0	0	0	0	--	--
Biotechnology	0	240	0	246	0	246	--	--
Comparative Medicine	18	61,460	29	61,769	29	61,769	--	--
Research Centers in Minority Institutions	12	6,396	9	5,279	7	2,897	-2	-2,382
Research Centers	211	$259,199	210	$190,380	205	$184,152	-5	-$6,228
Other Research:								
Research Careers	257	$42,510	261	$41,702	246	$44,245	-15	$2,543
Cancer Education	0	0	0	0	0	0	--	--
Cooperative Clinical Research	5	11,382	5	11,382	5	11,382	--	--
Biomedical Research Support	1	1,989	1	1,644	1	1,644	--	--
Minority Biomedical Research Support	1	375	1	375	1	375	--	--
Other	164	58,029	174	64,233	175	61,674	1	-2,559
Other Research	428	$114,285	442	$119,336	428	$119,320	-14	-$16
Total Research Grants	2,978	$2,032,873	2,980	$2,035,927	2,890	$2,035,638	-90	-$289
Ruth L. Kirschstein Training Awards:	FTTPs		FTTPs		FTTPs			
Individual Awards	114	$4,661	104	$4,874	101	$4,769	-3	-$105
Institutional Awards	618	32,915	298	16,083	296	15,875	-2	-208
Total Research Training	732	$37,576	402	$20,957	397	$20,644	-5	-$313
Research & Develop. Contracts	94	$395,597	98	$399,991	100	$401,065	2	$1,074
(SBIR/STTR) (non-add)	*(6)*	*(2,707)*	*(9)*	*(5,197)*	*(9)*	*(5,197)*	--	--
Intramural Research		$346,998		$352,115		$351,545		-$570
Res. Management and Support		125,094		128,815		128,913		98
Res. Management & Support (SBIR Admin) (non-add)								
Office of the Director - Appropriation		*139,076*		*139,076*		*139,076*		--
Office of the Director - Other [2]		61,923		62,256		62,256		--
ORIP (non-add) [2]		*77,153*		*76,820*		*76,820*		--
Total, NIH Discretionary B.A.		**$3,000,061**		**$3,000,061**		**$3,000,061**		**$0**

[1] All items in italics and brackets are non-add entries.

[2] Number of grants and dollars for the ORIP components of OD are distributed by mechanism and are noted here as a non-add.

NATIONAL INSTITUTES OF HEALTH
Office of AIDS Research
Budget Authority by Activity
(Dollars in Thousands)

Area of Emphasis	FY 2013 Actual	FY 2014 Actual	FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget	FY 2017 +/- FY 2016
Vaccines	$518,170	$532,671	$534,987	$552,803	$553,910	$1,107
HIV Microbicides	111,240	107,843	106,104	109,656	108,881	(775)
Behavioral and Social Science	397,377	411,723	411,359	421,669	421,395	(274)
Etiology and Pathogenesis	625,027	666,569	597,518	602,180	599,106	(3,074)
Therapeutics						
Therapeutics as Prevention	*69,375*	*75,638*	*71,698*	*79,775*	*78,617*	*-1,158*
Drug Discovery, Development, and Treatment	*632,123*	*660,194*	*595,543*	*570,534*	*566,670*	*(3,864)*
Total, Therapeutics	701,498	735,832	667,241	650,309	645,287	(5,022)
Toward a Cure [1/]	-	-	161,045	187,280	198,723	11,443
Natural History and Epidemiology	243,454	228,830	232,078	237,440	237,630	190
Training, Infrastructure, and Capacity Building	261,921	259,866	249,376	199,973	196,855	(3,118)
Information Dissemination	39,178	34,245	40,353	38,751	38,274	(477)
Total	$2,897,865	$2,977,579	$3,000,061	$3,000,061	$3,000,061	$0

[1/] **Beginning in FY 2017, Toward a Cure will be a separate activity. Dollars for Toward a Cure were previously included within other science areas, such as Therapeutics, Etiology and Pathogenesis, and Vaccines. The FY 2015 and FY 2016 amounts are comparable budget figures.**

The AIDS Epidemic

According to the latest UNAIDS statistics reported in 2015 (in summary):

- 15.8 million people accessing antiretroviral therapy
- 36.9 million [34.3 million–41.4 million] people globally were living with HIV
- 2 million [1.9 million–2.2 million] people became newly infected with HIV
- 1.2 million [980 000–1.6 million] people died from AIDS-related illnesses
- TB-related deaths in people living with HIV have fallen by 32% since 2004. However, TB remains the leading cause of death among people living with HIV.
- 73% [68%-79%] of pregnant women living with HIV had access to antiretroviral medicines to prevent transmission of HIV to their babies in 2014; new HIV infections among children were reduced by 58% from 2000 to 2014.

According to the latest CDC statistics reported in 2015 (in summary):

- Roughly 1.2 million people in the U.S. were living with HIV
- Approximately 40,000 new HIV infections diagnosed each year
- From 2005-2014, the annual number of HIV diagnoses in the U.S. declined 19% – driven by substantial declines among heterosexuals (down 35%) and people who inject drugs (down 63%).
- **Among women**- African American women have achieved the largest decreases, with a 42% decline since 2005 and a 25% decline in the most recent five-year period alone. Despite these recent gains, African American women continue to be disproportionately affected by HIV, accounting for 6 in 10 diagnoses among women in 2014. Diagnoses among Latino and white women have also declined steadily over the decade (35% and 30%, respectively).
- **Among men-** Gay, bisexual, and other MSM continue to be the group most heavily affected by HIV in the U.S. MSM represent approximately 2% of the U.S. population, but they accounted for nearly 67% of all persons with HIV diagnosed in 2014. From 2005-2014, diagnoses among MSM overall increased by roughly 6% (25,155 to 26,612), driven by increases among black and Latino MSM.
- **Among racial and ethnic populations-** While African Americans represent approximately 13% of the total U.S. population, they accounted for almost half (44%) of all HIV diagnoses in 2014. Similarly, Latino men and women accounted for 23% of all new HIV diagnoses, while only representing 17% of the population.
- **Among the southern region**- Southern states bear the greatest burden of HIV infection, illness, and death. Southern states account for an estimated 44% of all people living with an HIV diagnosis, despite making up roughly one-third (37%) of the national population. In addition, people living with HIV in the South are less likely to be aware of their infection than those living in other U.S. regions.
- **Among individuals over 50**- In 2013, people aged 50 and over accounted for 21% (8,575) of an estimated 47,352 HIV diagnoses in the United States. Of these, the largest number (44%, 3,747) were among those aged 50 to 54.
- **Among youth**- An estimated 9,961 youth were diagnosed with HIV infection in the U.S. in 2013, representing 21% of an estimated 47,352 people diagnosed during that year. 81% of these diagnoses occurred in those aged 20 to 24, the highest number of HIV diagnoses of any age group.

Justification of Budget Request

Office of AIDS Research

Trans-NIH AIDS Research Budget Justification

(see also: OAR section in Office of the Director/DPCPSI)

Budget Authority (BA):

FY 2015 Actual	FY 2016 Enacted	FY 2017 President's Budget	FY 2017+/- FY 2016
$3,000,061,000	$3,000,061,000	$3,000,061,000	---

Acting Director's Overview

Groundbreaking Accomplishments with Unprecedented Scientific Opportunities: In more than three decades since the first cases of AIDS were reported, NIH has been the global leader in sponsoring research to prevent, diagnose, and treat HIV and its associated comorbidities, coinfections, and other complications. NIH has established a comprehensive and coordinated AIDS research program that has demonstrated unprecedented progress against this global AIDS epidemic. NIH-sponsored research has led to groundbreaking advances in understanding the HIV life cycle, development of safe and effective antiretroviral drugs and drug regimens for the treatment of HIV-infected individuals, and strategies to prevent HIV transmission/acquisition. While significant progress has been made, the AIDS pandemic continues to spread in the United States and worldwide representing the most serious global public health crisis of our time. NIH will continue to build on the scientific advances and knowledge that has been gained to address the unprecedented scientific opportunities that we now face to successfully develop a safe and effective AIDS vaccine, a cure for AIDS, and ultimately, lead to an AIDS-free generation and an end to the AIDS pandemic.

Coordinated Trans-NIH AIDS Research Program: The Trans-NIH AIDS research program that produced these critical accomplishments is coordinated and managed by the Office of AIDS Research (OAR), which functions as an "institute without walls" with responsibility for HIV/AIDS research supported by nearly every NIH IC. It is essential to point out that because HIV/AIDS affects virtually every organ system, with a myriad of HIV-associated co-infections, malignancies, co-morbidities and other clinical complications, NIH-sponsored HIV/AIDS research supports a comprehensive portfolio that also includes research on these related health conditions in the context of HIV disease, including tuberculosis, hepatitis C, and AIDS-defining and non-AIDS defining cancers, neurologic complications, metabolic abnormalities, and cardiovascular conditions. OAR coordinates the scientific, budgetary, and policy elements of this diverse trans-NIH research program. OAR has established comprehensive trans-NIH AIDS planning, budgeting, and portfolio analysis processes to identify the highest-priority areas of scientific opportunity, enhance collaboration, minimize duplication, and ensure that precious research dollars are invested effectively. OAR also identifies specific funding for emerging scientific opportunities and public health challenges that require focused attention; manages and facilitates multi-Institute and trans-Institute activities to address those needs; fosters research by designating funds and supplements for pilot program areas; facilitates international AIDS research and training; and sponsors scientific agenda setting workshops to identify new cutting-edge initiatives.

Annual Trans-NIH Strategic Plan and Budget: OAR plans and coordinates this research through the development of an annual Trans-NIH Plan for HIV-Related Research (Strategic Plan) that identifies

overarching HIV/AIDS research priorities and specific research objectives and strategies. This comprehensive and unique annual strategic planning process involves scientists from across NIH and other Federal agencies, non-government experts, and representatives from community constituency groups. OAR also is legislatively mandated to develop an annual Trans-NIH AIDS research budget explicitly tied to the Strategic Plan. OAR's AIDS research allocation to each NIH IC is not based on a formula, but on the overarching HIV/AIDS research priorities identified in the Notice in the *NIH Guide for Grants and Contracts* on August 12, 2015 (NOT-OD-15-137), taking into account the current and emerging scientific opportunities, the evolving clinical profile of the epidemic, and the Institutes and Centers capacity to absorb and expend resources for the most meritorious science. This process reduces redundancy, promotes harmonization, and ensures cross-Institute collaboration to conduct and support research in domestic and international settings.

Priority-Setting Review: The overarching priorities were developed based on the OAR Advisory Council HIV/AIDS Research Portfolio Review Working Group Report, the FY 2015 Trans-NIH Plan for HIV-Related Research, and NIH leadership input. The priorities are also aligned with the NIH Director's themes as indicated below.

- **Foundation for Discoveries - Basic Research**: NIH-sponsored basic research provides the critical foundation, tools, and building blocks for the development and testing of new and better strategies to prevent and treat HIV infection and AIDS. The focus on basic research will lead to the development of AIDS vaccine candidates, potential microbicides, approaches to achieving a cure for AIDS, and innovative HIV prevention interventions.
- **The Promise of Precision Medicine**: NIH will continue to support research leading to improved treatments for HIV disease that have fewer side effects and toxicities, easier adherence, and longer and sustained acting anti-HIV drugs. Research will focus on how sex, gender, race, age, genetic determinants, treatment during pregnancy, nutritional status, and other factors interact with anti-HIV treatment. Another key priority is the development of strategies to prevent and treat HIV-associated coinfections, including hepatitis C and tuberculosis, and comorbidities such as malignancies, neurologic, metabolic, cardiovascular, and other complications.
- **Applying Big Data and Technology to Improve Health:** NIH will provide support to expand the development and use of new research tools including geo-spatial mapping and geo-statistical analysis to better understand the spatio-temporal evaluation of the AIDS pandemic. These tools and techniques also will provide critical insight on monitoring and maximizing access to care and treatment, as well as delineate new HIV-associated comorbidities and adverse events associated with antiretroviral treatment.
- **Stewardship to Inspire Public Trust:** NIH is utilizing a unique portfolio review process to annually assess all grants, contracts, and intramural projects supported with AIDS funding. This new process ensures that precious AIDS resources are directed to the new overarching NIH HIV/AIDS research priorities.

OAR will continue to allocate and redirect resources across NIH ICs and across the key areas of science to address these priorities.

Challenges and Opportunities for FY 2017: The overarching priorities for NIH AIDS research reflected in this Trans-NIH AIDS research budget request are:

- **Reducing Incidence of HIV/AIDS** including: developing and testing promising vaccines, developing and testing microbicides and pre-exposure prophylaxis candidates and methods of delivery, especially those that mitigate adherence issues; and developing, testing, and implementing strategies to improve HIV testing and entry into prevention services.

- **Next generation of HIV therapies with better safety and ease of use** that are: developing and testing HIV treatments that are less toxic, longer acting, have fewer side effects and complications, and easier to take and adhere to than current regimens. Additionally, implementation research to ensure initiation of treatment as soon as diagnosis has been made, retention and engagement in these services, and achievement and maintenance of optimal prevention and treatment responses.
- **Research toward a cure** includes: developing novel approaches and strategies to identify and eliminate viral reservoirs that could lead toward a cure or lifelong remission of HIV infection, including studies of viral persistence, latency, reactivation, and eradication.
- **HIV-associated comorbidities, coinfections, and complications** that are: addressing the impact of HIV-associated comorbidities, including tuberculosis, malignancies, cardiovascular, neurological, and metabolic complications; and premature aging associated with long-term HIV disease and antiretroviral therapy.
- **Cross cutting areas**:
    - **Basic Research**: understanding the basic biology of HIV transmission and pathogenesis; immune dysfunction and chronic inflammation; host microbiome and genetic determinants; and other fundamental issues that underpin the development of high priority HIV prevention, cure, co-morbidities, and treatment strategies.
    - **Research to Reduce Health Disparities** in the incidence of new HIV infections or in treatment outcomes of those living with HIV/AIDS.
    - **Research Training** of the workforce required to conduct high-priority HIV/AIDS or HIV/AIDS-related research.

Overall Budget Policy:
To address these critical AIDS research priorities, the FY 2017 President's Budget estimate for the trans-NIH AIDS research program is $3,000.061 million, the same amount that was provided at the FY 2016 Enacted level. The OAR is authorized to allocate all dollars associated with this area of research across the NIH. Therefore, the total for AIDS research includes both extramural and intramural research (including research management support, management fund, and service and supply fund); buildings and facilities; and training and evaluation. The total also includes basic, clinical, behavioral, social science, and translational research on HIV/AIDS and the many HIV-associated malignancies, coinfections, comorbidities, and complications, including TB, hepatitis C, and HIV-associated cancers. Thus, the total for HIV/AIDS research is not comparable to spending reported for other individual diseases. This request provides funding to support high priority vaccine research as well as a significant increase in the area of research toward a cure to fulfill the final installment on the Presidential Initiative started in FY 2015, while maintaining the same level of funding as provided in FY 2016.

Program Descriptions and Accomplishments

Vaccines: The best long-term hope for controlling the AIDS pandemic is the development of safe, effective, and affordable AIDS vaccines that may be used in combination with other prevention strategies. NIH supports a broad AIDS vaccine research portfolio encompassing basic, preclinical, and clinical research, including studies to identify and better understand potentially protective immune responses in HIV-infected individuals and studies of improved animal models for the preclinical evaluation of vaccine candidates. New developments in HIV vaccine research have radically changed our thinking concerning the design of novel immunogens and strategies to employ them. Since the modest success of the RV144 trial in Thailand using a pox virus vector and HIV envelope protein boosts, NIH has supported unprecedented international collaborative investigations to identify how specific immune responses may protect against HIV acquisition. To build on the knowledge gained from these studies, clinical trials are ongoing to test the RV144 vaccine with different inserts to elicit specific protection in a high-risk

population in South Africa. In parallel, an alternative adenovirus/poxvirus vectored vaccine with HIV protein boosts developed for global coverage of diverse HIV subtypes, will begin at sites in the United States and around the world. Discovery of new HIV envelope-specific broadly neutralizing antibodies (bnAbs) – capable of neutralizing multiple strains of HIV have been accelerated with the advent of new technologies for detection and isolation. New bnAbs have been extensively characterized, structurally mapped, and together, shown to bind to almost the entire surface of the HIV envelope. A new prevention study designated "AMP" will begin late 2015/early 2016 in the United States and Africa using one of these promising bnAbs, identified as VRC01. Results from this study will inform prophylactic vaccine trials as to the concentration of antibody required to prevent HIV acquisition. Promising pre-clinical vaccine candidates include a virus-vectored vaccine administered to rhesus macaques (rhesus cytomegalovirus, rhCMV) and designed to elicit only T cell immunity that successfully eradicated SIV in 50 percent of animals despite transient infection and viremia. In addition, an adenovirus poxvirus vector-based vaccine prime, protein boost strategy also showed 50 percent complete protection from SIV infection in non-human primates. Immune correlates associated with this vaccine candidate were predominately functional binding antibodies. These unprecedented results have led to exploration of new basic and translational immunological paradigms. While progress has been made, many knowledge gaps remain and additional studies are essential to build a safe and effective vaccine platform.

Budget Policy:
The FY 2017 President's Budget request for Vaccine research is $553.910 million, an increase of $1.107 million or 0.20 percent compared to the FY 2016 Enacted level. Resources will be directed toward the development and testing of improved vaccine candidates in additional clinical studies, both in the United States and abroad. NIH will provide additional resources for the development and production of several vaccine immunogens and further clinical trial site development. Innovative basic HIV vaccine research studies also will be supported to inform the development of new vaccine concepts that may induce higher levels of protective antibodies and prevent HIV infection more efficiently than vaccines already tested. Increased support will be provided for clinical trials that evaluate the ability of monoclonal antibodies from HIV-infected individuals to protect from acquisition, delay disease progression or eliminate HIV infected cells. In FY 2017, NIH will support development of improved animal models, including new models for critical vaccine challenge studies in non-human primates to test vaccine concepts and to inform testing of HIV vaccine candidates in clinical trials. NIH also will provide support for new initiatives to integrate systems biology with HIV vaccine discovery and the development of new approaches to measuring immune responses to HIV vaccine candidates that will more closely predict outcomes of parallel preclinical animal and human clinical studies. The increase provided to vaccine research reflect OAR's redirection of funds from other scientific areas to support critical research opportunities in this area.

HIV Microbicides: A safe and effective microbicide will be an important asset to the HIV prevention tool kit. Microbicides are compounds, including antiretroviral (ARV) drugs and other agents that could be applied topically or administered locally to prevent acquisition of HIV and other sexually transmitted infections. Microbicides could be used alone or in combination with other HIV prevention strategies. NIH supports a comprehensive and innovative microbicide research program that includes the screening, discovery, development, formulation, preclinical testing, and clinical evaluation of microbicide candidates. NIH supports basic research including studies in animal models aimed at understanding the mechanisms by which HIV crosses mucosal membranes and infects cells and innate and acquired immune modulation that facilitates or inhibits HIV acquisition. In addition, NIH supports behavioral and social science research on adherence to and the acceptability and use of, microbicides among various populations. These projects include the safety of microbicide use during pregnancy and menopause; studies in adolescents and in men who have sex with men; and implementation research to better understand how to integrate a potential microbicide into community prevention practices. Basic science and clinical studies have shown promise for the use of ARV-based microbicides as HIV prevention

strategies. Studies are underway and being developed to test: different ARV- and non-ARV-based microbicide candidates; the safety of various microbicide formulations, including long-acting formulations; the safety and pharmacokinetics of microbicides combined with a contraceptive for multipurpose prevention; and microbicides combined with antimicrobial agents to simultaneously prevent HIV and other sexually transmitted infections. Microbicide formulations and new technologies that enhance adherence and do not require pericoital use also are being developed and studied. These include long-acting injectable microbicide candidates, long-acting subcutaneous potential microbicides, ARV and non-ARV containing nanofibers and nanoparticles for local application and injection, ARV-containing films, and intravaginal rings.

Budget Policy:
The FY 2017 President's Budget request for Microbicides research is $108.881 million, a slight decrease of $0.775 million or 0.71 percent compared to the FY 2016 Enacted level for this critical area of prevention research. In FY 2017, NIH will continue to support the development and evaluation of microbicide candidates including a robust pipeline of both ARV and non-ARV potential microbicides. NIH will support research needed for the development of criteria for the selection of candidate microbicides to be advanced through the different phases of preclinical and clinical studies including clinical safety and effectiveness studies, as well as behavioral and social science associated with adherence and acceptability of potential microbicides. NIH will continue to provide crucial support for the NIH-funded Microbicide Trials Network (MTN); basic research on mucosal changes of female and male adolescents during reproductive maturation; and innovative formulation strategies. OAR will continue to foster coordination and collaboration in microbicide research leading to the development and testing of novel microbicide candidates that can prevent HIV transmission and acquisition.

Behavioral and Social Science: Behavioral and Social Science research is an integral component of the overarching NIH HIV/AIDS research priorities. As studies continue to define a role for the use of antiretroviral therapy for HIV prevention, NIH continues to support a comprehensive behavioral and social sciences research program across the spectrum of HIV/AIDS prevention, treatment, care, and cure. This includes expanding its support of the behavioral and social sciences research to encompass research to understand how antiretroviral medications can best be used for prevention in specific populations and social contexts. Research findings continue to show a wide range of individual, interpersonal, social, structural, and other factors that contribute to and drive the AIDS pandemic. NIH-sponsored research has demonstrated that some HIV risk behaviors can be reduced in targeted populations through evidence-based interventions. NIH will continue to study approaches to change HIV risk behaviors and social contexts and to facilitate engagement and retention in HIV testing, prevention, and treatment services. NIH is supporting research to address factors associated with the HIV Care Continuum, and specifically on HIV care outcomes. Studies have highlighted that modifying these variables can promote reduced HIV risk and transmission, early access to medical care, reduce costs, extend life expectancy, and improve quality of life and well-being. NIH will continue to build on current, as well as develop new behavioral and social science research methods, tools, and study approaches including: data collection platform and survey design; module development; and experimentation grounded in behavioral and social science theory. These studies will increase our understanding of related behavioral and social processes; increase recruitment in clinical trials; enhance statistical analyses of behaviors, such as alcohol and illicit drug use, that can affect prevention and medication studies and outcomes; utilize the means to optimize ongoing research in view of emerging results; and identify behavioral issues relevant to genetic or genomic studies that are specifically HIV/AIDS focused. NIH also will continue to foster the integration of biomedical, behavioral, and social science strategies in clinical studies.

Budget Policy:
The FY 2017 President's Budget request for Behavioral and Social Science is $421.395 million, a slight decrease of $0.274 million or 0.06 percent compared to the FY 2016 Enacted level. NIH will continue to

support initiatives integrating behavioral and social science strategies with biomedical modalities. Research on the development of strategies to more effectively encourage HIV testing and engagement in preventive care and/or treatment for youth and racial and ethnic populations is a priority. Implementation science and comparative effectiveness research to: 1) ensure initiation of treatment as soon as diagnosis has been made; 2) engagement and retention in HIV care services; and 3) achievement and maintenance of optimal prevention and treatment responses (e.g., viral suppression) will be emphasized.

Etiology and Pathogenesis (Basic Science): NIH supports a comprehensive portfolio of basic research focused on the transmission, acquisition, establishment, and maintenance of HIV infection and the causes of HIV-associated immune deficiency and severe clinical complications. Research on basic HIV biology and HIV/AIDS pathogenesis has revolutionized the design of new drugs and treatment regimens, methodologies for diagnosis and tools for monitoring disease progression, and the safety and effectiveness of antiretroviral therapies. Ground-breaking strides have been made towards understanding the fundamental steps in the life-cycle of HIV, the host-virus interactions, and the clinical manifestations associated with HIV infection and AIDS. Additional research is needed to further the understanding of the virus and how it causes disease, including studies to delineate how sex, gender, age, ethnicity, race, pregnancy, nutritional status, and other factors interact to influence vulnerability to infection and disease progression; determine the role of immune dysfunction and chronic inflammation in HIV pathogenesis; and further the understanding of the development of HIV-associated co-morbidities, such as cardiovascular, neurological, metabolic, renal, and other clinical complications, malignancies, and co-infections. Research examining the host microbiome as well as the genetic determinants associated with HIV susceptibility, disease progression, and treatment response also is needed. These studies may lead to the development of customized therapeutic and preventive regimens formulated for an individual patient based on his or her genetics. NIH also prioritizes research examining the mechanisms by which HIV establishes and reactivates latent reservoirs of infection and studies that further the understanding of factors that are associated with the ability of the host to restrict HIV infection and/or mitigate HIV disease progression. A better understanding of these processes may help identify key targets for the development of new therapeutic, biomedical, and vaccine strategies to prevent or control HIV infection and possibly lead to a cure for HIV disease.

Budget Policy:
The FY 2017 President's Budget request for the basic research area of Etiology and Pathogenesis is $599.106 million, a decrease of $3.074 million or 0.51 percent compared to the FY 2016 Enacted level. NIH will support studies that elucidate the mechanisms responsible for the pathogenesis of comorbid conditions of various organ systems, including the contribution of the immune system, inflammation, and long-term ARV use on the development of these co-morbidities. In addition, studies that quantify the risk of acquiring HIV-associated coinfections, studying its mechanisms, and evaluating the interaction of co-infecting pathogens on HIV disease progression and vice versa will be supported. NIH will continue its support on HIV-associated comorbidities including AIDS-defining and non-AIDS defining malignancies, metabolic abnormalities, and Project REPRIEVE (Randomized Trial to Prevent Vascular Events in HIV) that is evaluating the use of statin administration to reduce the risk for major adverse cardiovascular events in HIV-infected individuals.

Therapeutics

Drug Discovery, Development, and Treatment: Antiretroviral (ARV) treatment has resulted in profound immune recovery and enhanced immunologic and physiologic function in individuals who can consistently adhere to prescribed HIV treatment regimens and tolerate the associated occasional side effects and toxicities. Expansion of the classes of ARV drugs available has allowed for greater simplification of treatment regimens, thus enhancing adherence and increasing the potential for viral suppression. ARV treatment has not only delayed the progression of HIV infection to AIDS, it has been

shown to be extremely effective at prolonging viral suppression, delaying the development of viral resistance, and reducing HIV-associated comorbidity and comortality. Recent data from the NIH-sponsored Strategies for Management of Anti-Retroviral Therapy, designated the SMART study, confirmed that ART significantly reduced the risk of HIV-associated opportunistic infections and all-cause mortality. Despite these treatment advances, many challenges remain including: 1) maintaining long-term treatment adherence to continue to suppress HIV replication which is critical to maintaining immune competence and prolonging the time to the development of drug resistance; 2) the ongoing morbidity and mortality associated with coinfections, such as hepatitis C, tuberculosis; 3) metabolic dysregulation associated with HIV infection; 4) AIDS-defining and non-AIDS defining cancers; 5) neurologic and other comorbidities associated with HIV disease and ART; and 6) the persistent disparities in HIV treatment outcomes across race, gender, and socioeconomic status. Hepatitis C remains a significant coinfection that affects the immunologic response to ARV therapy. Over the last several years, the development of the directly acting agents (DAA) has made it possible to achieve a virologic suppression in over 90 percent of treated individuals. Despite these advances in the treatment of HIV and hepatitis C coinfection, there remain many challenges including, but not limited to the impact of HIV disease on renal, endocrine, and metabolic functioning; the clearing of viral sanctuaries, and treating individuals with co-morbid mental health, substance abuse, and other conditions. NIH supports a comprehensive therapeutics research program to design, develop, and test drugs and drug regimens. Under development are new combinations of drugs and sustained release formulations and delivery systems to maintain an undetectable viral load, to overcome drug resistance and treatment failure, and to prevent and treat HIV-associated coinfections, comorbidities, and other complications. This program also supports pre-clinical trials of innovative strategies to eliminate viral reservoirs including testing therapeutic anti-HIV monoclonal antibodies with and without antiretroviral drugs. Building on the identification of the critical therapeutic interventions, NIH continues to support research on successful treatment of HIV disease.

Therapeutics as Prevention: A critical area of prevention research is the study of treatment strategies as a method to prevent new HIV infections. This approach builds on NIH-sponsored landmark clinical trials that demonstrated treatment of HIV-infected pregnant women could significantly reduce transmission of HIV from mother to child. Clinical results from a large NIH-sponsored international clinical trial, HIV Prevention Trials Network (HPTN) 052, showed that early initiation of ART in HIV-infected heterosexual individuals resulted in a 96 percent reduction in sexual transmission of HIV to their uninfected partner. Ongoing research continues to build on earlier groundbreaking studies that demonstrated the successful use of oral ARVs to prevent transmission of HIV in specific populations. The first landmark pre-exposure prophylaxis (PrEP) study, *iPrEx: Chemoprophylaxis for HIV Prevention in Men*, demonstrated that a daily tablet containing a combination of two ARV drugs (Truvada-tenofovir/emtricitabine: medications that also are used as part of an HIV treatment regimen), can safely and effectively prevent HIV infection in some high-risk men who have sex with men (MSM) and transgender women who have sex with men. The study showed that uninfected participants who took a daily dose of Truvada experienced an average of 43.8 percent fewer HIV infections than those who received a placebo pill. Participants who adhered most closely to the daily drug regimen showed higher rates of effectiveness, up to 73 percent. Studies among two additional at-risk populations, women in heterosexual HIV serodiscordant couples and injection drug users, have shown PrEP to be effective in preventing HIV acquisition. These studies established the foundation for the clinical guidance supporting widespread use of PrEP to be effective in preventing HIV acquisition. These studies also served as the foundation for the clinical guidance supporting widespread use of PrEP and supported FDA approval for the use of Truvada as PrEP. NIH also is sponsoring additional studies to refine the opportunities and barriers to PrEP in special populations, including HPTN 073 that is studying PrEP in young Black MSM; HPTN 076 and HPTN 077 which are designed to determine the safety and acceptability of an injectable long-acting ARV (rilpivirine) and cabotegravir, respectively. NIH supports basic, translational, clinical, and implementation research to: develop combinations of antiretroviral drugs and compounds that can be

used in sustained release formulations for potential new PrEP strategies; test PrEP in high-risk uninfected populations, including adolescents; evaluate post-exposure prophylaxis, the use of ARV to prevent infection after HIV exposure, including in a healthcare setting; develop improved regimens to prevent mother-to-child transmission; and evaluate a potential innovative prevention strategy known as "test and treat" to determine the impact of increased testing with immediate referral to treatment at the community level.

Budget Policy:
The FY 2017 President's Budget request for Therapeutics research is $645.287 million, a decrease of $5.022 million or 0.77 percent compared to the FY 2016 Enacted level. Funds will be provided to support high priority research on the development of novel anti-HIV therapies (based on identifying new drug targets), as well as the testing of new combinations of ARVs and sustained release formulations that are safe, support adherence, minimize side effects and toxicities, and result in durable suppression of viral activity. NIH will provide critical support for studies on 1) development of formulation strategies for long-acting and sustained release prevention products (e.g., PrEP); 2) nonpharmacological (or behavioral) therapies for ARV adherence; 3); development of new strategies to test and treat patients with HIV-related co-infections, including hepatitis C virus and tuberculosis; 4) conducting clinical studies on cardiovascular and other metabolic complications of HIV disease and ART; and 5) treatment of aging HIV-infected individuals to prevent transmission and reduce HIV-associated comorbidity and comortality.

Research Toward a Cure: While combination antiretroviral therapy (ART) has radically altered the course of HIV disease by improving health, prolonging life, and substantially reducing the risk of HIV transmission, research toward a cure for HIV/AIDS is an overarching priority for NIH. The need for lifelong ARV therapy carries with it a significant burden on HIV-infected individuals, social and family structures, and health care systems due to the risk of side effects and other clinical complications associated with ART. The experience of the "Berlin Patient," has demonstrated that sustained remission of HIV infection is possible. Subsequent research suggests that an intervention inducing sustained HIV remission without ART that is safe, effective, and scalable could be an achievable near-term goal. Lifelong remission or viral eradication will be a more challenging long-term goal. Additional research is critically needed to better understand the mechanisms and dynamics of HIV persistence and latency in long-lived cells, much of it in hard to access tissue sites. Expansion of research on models of HIV infection in humans, including studies in nonhuman primates and small animals is critical. Research to identify robust biomarkers and assays that measure the size of the reservoir; predict viral rebound during an intensively monitored pause in ARV treatment; and/or are predictive of response to cure interventions are critically needed. Further advances in basic research and the development of novel cure interventions in the pipeline, including next generation monoclonal antibodies and/or their derivatives with improved killing of HIV-infected cells, and therapeutic vaccines, as well as other modalities that help enhance the ability of the immune system of HIV-infected individuals to suppress or kill HIV-infected cells, are also high priorities for NIH research toward a cure. Recent advances in this field have led to a better understanding of the cellular, tissue, and molecular biological underpinnings of HIV latency, persistence, and reservoir formation. Studies also have shown that only a small proportion of HIV provirus integrated into the genome of susceptible cells is replication competent, and thus limiting the capability of directing the production of complete virus particles, productively infecting other susceptible cells, and transmitting HIV to others. While a "gold standard" assay for measuring the replication-competent reservoir is critically needed, progress is being made in refining the current assay platforms in advancing this research. A NIH-sponsored small-scale clinical trial has recently demonstrated that the VRC01 broadly neutralizing antibodies can safely reduce HIV plasma viral load in HIV-infected individuals with a susceptible strain. These scientific advances provide the crucial foundation for continued progress in developing strategies to achieving a cure for HIV/AIDS.

Budget Policy:
The FY 2017 President's Budget request for Toward a Cure research is $198.723 million, an increase of $11.443 million or 6.11 percent compared to the FY 2016 Enacted level. As part of the President's Initiative on an HIV Cure, these funds will provide an expansion of programs targeting innovative approaches to control and eradicate HIV infection that may lead to a cure; identifying innovative approaches to quantify latent HIV reservoirs; and develop novel strategies for targeting viral reservoirs in the central nervous system without inducing reactivation. Research will continue to examine the mechanisms by which HIV establishes and reactivates latent reservoirs of infection as well as studies on the factors that are associated with the ability of the host to restrict HIV infection and/or mitigate HIV disease progression. A better understanding of these processes may help identify key targets for the development of new therapeutic and vaccine strategies to prevent or control HIV infection and possibly lead to a cure for HIV disease.

Natural History and Epidemiology: Natural history and epidemiologic research on HIV/AIDS is critical to monitoring epidemic trends, evaluation of prevention modalities, characterization of the clinical manifestations of HIV disease, and measurement of the effects of treatment regimens at the population level. Novel methodologies in the area of biostatistics, mathematical modeling, and laboratory technology have provided the basis for new epidemiological approaches in addressing HIV/AIDS. Geo-spatial methods (geo-mapping) and geo-statistical analysis are new tools that epidemiological research currently utilizes to better understand the spatio-temporal evolution of the HIV epidemic as well as to maximize and monitor access to HIV treatment and care. Through these collaborations of multiple NIH ICs, multi-site epidemiologic studies in the United States have been characterizing new HIV-related comorbidities, identifying unexpected adverse effects resulting from diverse risk factors and/or treatment regimens and differentiating these occurrences from those directly related to HIV disease. These epidemiological studies also continue to provide the basis for generating new scientific hypotheses and are a necessary complement to experimental studies (randomized clinical trials) that establish the effectiveness of an intervention. As the AIDS epidemic continues to evolve, NIH will support carefully designed epidemiologic studies about the varied facets of the HIV epidemic and disease in domestic and international settings. NIH also will sponsor information technology for a broader access to and use of epidemiologic data and metadata. NIH currently supports a comprehensive research portfolio to study the epidemiologic characteristics of populations in which HIV is transmitted and the changing spectrum of HIV-related disease, including the occurrence of co-infections (e.g., tuberculosis, hepatitis C virus), malignancies, metabolic, cardiovascular, neurological, skeletal, and other complications. These studies have delineated the significant health disparities that are critical factors in the epidemic (e.g., racial and ethnic disparities in the United States; between industrialized and resource-constrained nations; between men and women; and health disparities based on sexual identity). Ongoing observational studies are adding focus on at-risk individuals from the rural South in the United States as well as the increasing proportion of individuals who are aging with HIV. Research on HIV-related health disparities and their impact on treatment access and effectiveness, as well as HIV prevention, is an NIH overarching HIV/AIDS research priority.

Budget Policy:
The FY 2017 President's Budget request for Natural History and Epidemiology is $237.630 million, a slight increase of $0.190 million or 0.08 percent compared to the FY 2016 Enacted level. NIH will continue to support and prioritize research to better define networks of HIV transmission among demographic groups at highest risk for HIV infection in the United States, including men who have sex with men (MSM), especially MSM of color, and African American women. In addition, NIH will support research to better understand the physiological aspects of co-infection of sexually transmitted infections and HIV and how that relates to HIV transmission among at risk populations. Population studies on the long-term effects of HIV disease and ART will continue to be supported as will research that capitalizes on "big data" (existing data resources) and the use of sophisticated computational modeling to identify

patterns of HIV and its comorbidities (cardiovascular, neurological, and metabolic) in order to ultimately develop effective preventive and treatment interventions. Initiatives focusing on partnering with community based organizations, nongovernmental organizations, and local agencies to implement and disseminate effective and cost-effective HIV prevention and treatment intervention services will be fostered.

Training, Infrastructure, and Capacity Building: NIH-sponsored training of domestic and international biomedical, behavioral, and social science HIV researchers represents an overarching priority for NIH HIV/AIDS research. NIH also provides infrastructure and capacity building support as integral aspects of its commitment to carrying out scientifically and ethically sound and highly productive HIV-related research. The evolving AIDS pandemic and the global expansion of NIH-funded HIV/AIDS research have necessitated the development of research training, and infrastructure and capacity building efforts in many areas, especially in resource-limited settings throughout the world. The NIH-sponsored programs have increased the number of training positions for HIV-related researchers, including domestic and international programs specifically designed to recruit individuals from populations underrepresented in research into research careers and to build research capacity at minority-serving institutions in the United States. Equipment, shared instrumentation, and tissue and specimen repositories are examples of the research infrastructure and capacity building support that NIH provides to strengthen the conduct of AIDS-related research, both domestically and internationally.

Budget Policy:
The FY 2017 President's Budget estimate for Training, Infrastructure, and Capacity Building is $196.855 million, a decrease of $3.118 million or 1.56 percent compared to the FY 2016 Enacted level. NIH will continue to support training programs and infrastructure development for both U.S. and low-and middle income country (LMIC) researchers to build the critical capacity to conduct AIDS research. NIH will continue to provide support for the training of early stage investigators for careers in HIV-related research. NIH also will support efforts to ensure an adequate number of trained intramural AIDS researchers through the AIDS Research Loan Repayment Program and the Intramural AIDS Research Fellowship program.

Information Dissemination: NIH supports innovative initiatives to enhance the dissemination of research findings; develop and distribute state-of-the-art treatment and prevention guidelines; and enhance recruitment and retention of hard-to-reach populations and at-risk individuals in clinical studies. Effective information dissemination approaches are an integral component of successful HIV prevention, treatment, and cure studies, particularly with respect to issues related to adherence to treatment regimens and prevention strategies, and the need to effectively translate in a timely manner biomedical, behavioral, and social science prevention interventions into practice. Continued progress in treatment and prevention research depends on the transfer of current HIV research findings to researchers, providers, policy makers, the public, and HIV-infected and -affected individuals. These groups have varying needs for evidence-based information that is crucial to the achievement of an AIDS-free generation, therefore making it a priority to appropriately tailor the format and content of scientific information for each community. The diversity of the communities makes it imperative that socially- and culturally-sensitive and responsive approaches address the different levels of health literacy and the various methods information is accessed. The flow of information among researchers, providers, and HIV-affected communities represents new opportunities to utilize new and emerging technologies, including mobile applications, to speed the translation of research results into practice and to shape future research directions aligned with the overarching HIV/AIDS research priorities.

Budget Policy:
The FY 2017 President's Budget estimate for Information Dissemination is $38.274 million, a decrease of $0.477 million or 1.23 percent compared to the FY 2016 Enacted level. Resources will continue to

support dissemination of clinical trials-related information to ensure recruitment of an adequate number of participants, particularly from populations at risk, including women and racial and ethnic populations in the United States. Funding also will be provided to ensure that findings from clinical trials and critical federal guidelines on the use of antiretroviral therapy, as well as guidelines for the management of HIV associated complications for adults and children, are continually updated and rapidly disseminated to healthcare providers and patients through the AIDS*info* website (www.aidsinfo.nih.gov). Other initiatives will focus on expanding community organizations, libraries, and the public health workforce to receive pertinent HIV-related information in a timely manner, and developing specialized tools for HIV sequence analysis.

Global Impact of NIH AIDS Research: Research to address the global AIDS pandemic is essential. Since the early days of the pandemic, NIH has supported research in countries significantly affected by HIV/AIDS, beginning in 1983 with a research project in Haiti. The NIH international HIV/AIDS research portfolio has grown to projects in over 100 countries, focused on priority areas relevant for both the host nation and the United States. HIV/AIDS research represents the largest component of the total NIH global research investment. Implementation studies are critical to translating clinical trial results into community-based interventions that can be operational and sustainable in international settings. Most grants and contracts that include international engagement are awarded to U.S.-based investigators who conduct research in collaboration with in-country scientists; some are awarded directly to investigators in international scientific, academic, or medical institutions, as well as international health organizations and agencies. NIH-sponsored HIV/AIDS research also enhances research infrastructure and training programs of scientists and healthcare providers in international settings. NIH has partnered with international funding agencies to jointly fund and manage bilateral initiatives that address HIV prevention and treatment research areas of mutual interest and shared priority. In addition to advancing scientific knowledge and providing new and unique collaborative opportunities for U.S. investigators, these initiatives provide access to populations and cohorts most affected by the AIDS pandemic, as well as complementary scientific expertise, which may not be available in the United States.

AIDS Research Conducted in International Settings
(Dollars in Millions)

FY 2015 Actual	FY 2016 Enacted	FY 2017 PB
$433.834	$431.101	$431.913

Benefits of AIDS Research to Other Areas: NIH's investment in HIV/AIDS research has resulted in critical scientific accomplishments that benefit not only the nearly 37 million HIV-infected individuals around the world, but has also contributed knowledge to the prevention, diagnosis, and treatment of many other diseases and conditions. HIV/AIDS research broadens the overall understanding of immunology, virology, microbiology, molecular biology, and genetics. HIV/AIDS research is helping to unravel the mysteries surrounding other diseases because of the pace of discovery and the unique nature of HIV (i.e. the way the virus enters a cell, causes infection, affects every organ system, and involves a broad range of opportunistic infections, co-morbidities, cancers, and other complications).

HIV/AIDS research continues to make discoveries that can be applied to other infectious, malignant, neurologic, autoimmune, and metabolic diseases, as well as to the complex issues of aging and dementia. HIV immunology and biology research has informed the understanding of inflammation and aging. Research on HIV-associated neurologic and cognitive manifestations ultimately may benefit millions of patients with Alzheimer's disease and other aging and dementia issues. HIV/AIDS treatment research has led to more effective drugs for multiple bacterial, mycobacterial, and fungal diseases and fostered significant improvements in drug design and delivery technologies that can improve adherence. The treatment of hepatitis C infection, which currently affects more than 185 million people globally, has been revolutionized and curative regimens are now available. AIDS research has led to the development of

new models to test treatments for other diseases in faster, more efficient, and more inclusive clinical trials. Experience gained from the development of protease inhibitors to treat HIV infection, are being applied to treat develop antiviral therapies to treat cytomegalovirus, which is a significant cause of birth defects. Recent observational studies suggest that HIV infection and its treatment lessens the population risk of getting multiple sclerosis (MS). The relationship between this observation and the cause may open new avenues for the care and treatment of MS. AIDS research also has advanced understanding of the relationship between viruses and cancer. New investments in HIV/AIDS research will continue to fuel biomedical advances and breakthroughs that will have profound benefits far beyond the AIDS pandemic.

Conclusion: While significant groundbreaking scientific advances have resulted from NIH's investment in HIV/AIDS research, we are facing unprecedented scientific opportunities. NIH's continued leadership and commitment to build on these advances is essential to successfully develop a safe and effective AIDS vaccine, develop strategies to cure AIDS, and ultimately, achieve an AIDS free generation and an end to the AIDS pandemic. This budget request provides the essential resources to achieving these goals.

DRUG CONTROL PROGRAMS

	Budget Authority (in Millions)		
	FY 2015 Final	FY 2016 Enacted	FY 2017 Request*
Drug Resources by Function			
Research and Development: Prevention	$400.462	$405.880	$405.880
Research and Development: Treatment	$674.767	$698.895	$698.985
Total Drug Resources by Function	**$1,075.229**	**$1,104.775**	**$1,104.775**
Drug Resources by Decision Unit			
National Institute on Drug Abuse	$1,015.695	$1,050.550	$1,050.550
National Institute on Alcohol Abuse and Alcoholism	$59.534	$54.225	$54.225
Total Drug Resources by Decision Unit	**$1,075.229**	**$1,104.775**	**$1,104.775**
Drug Resources Personnel Summary			
Total FTEs (direct only)	396	400	400
Drug Resources as a Percent of Budget			
Total Agency Budget (in Billions)	$30.3	$32.3	$33.1
Drug Resources Percentage	3.4%	3.4%	3.3%

*Includes mandatory financing.

Program Summary

MISSION

The National Institute of Drug Abuse (NIDA) and the National Institute on Alcohol Abuse and Alcoholism (NIAAA), two of the twenty-seven Institutes and Centers of the NIH, support the *Strategy*: NIDA, by funding research on the prevention and treatment of drug use, addiction, and its harmful consequences; and NIAAA, by funding research on the prevention and treatment of underage drinking and its harmful consequences.

The societal impact of substance misuse (alcohol, tobacco, illicit drugs, and nonmedical use of prescription drugs) in this country is daunting, exceeding $700 billion a year in health care, crime-related, and productivity losses. Knowledge is the foundation of the transformative agenda needed to strike at the heart of this stubborn and costly challenge. To provide a comprehensive public health response, NIDA will continue to build on science advances from our investments in genetics, neuroscience, pharmacotherapy, and behavioral and health services research that have led to innovative strategies for preventing and treating substance use disorders (SUDs) in this country and worldwide.

Studying drug use, SUDs, and their causes is a complex challenge compounded by societal stigma and misunderstanding that most other illnesses do not face. The landscape of drug addiction in America evolves from year to year; we are currently seeing the terrible results of a decades-long epidemic of prescription drug abuse that is leading to a rise in heroin use as well as new HIV and Hepatitis C outbreaks. A growing number of states are legalizing marijuana for medical or recreational use, producing natural experiments whose outcomes cannot yet be

predicted. New synthetic drugs as well as new delivery systems such as e-cigarettes are changing how people use drugs. On the bright side, healthcare reform and parity regulations are poised to deliver effective prevention and treatment interventions to larger numbers of Americans. NIDA is supporting research to address today's drug use-related challenges in several key areas, including supporting the Secretary of Health and Human Services to respond to opioid abuse and overdose; spearheading a landmark longitudinal study of adolescent substance use and brain development; studying the impact of the changing marijuana landscape; studying the impact of new synthetic drugs; and contributing to scientific and public understanding of the brain mechanisms underlying addiction.

Alcohol misuse has profound effects on the health and well-being of individuals, families, and communities, with substantial economic costs. Since its creation, NIAAA has led the national effort to define alcohol problems as medical in nature and address them using evidence-based findings. The research supported by the Institute has transformed understanding and treatment of alcohol misuse and its consequences, including alcohol use disorder (AUD). NIAAA is working to reduce the considerable burden of alcohol misuse for individuals at all stages of life by supporting: research on the neurobiological mechanisms underlying AUD and co-occurring disorders; the development of behavioral therapies and medications that promote recovery; studies on the consequences of alcohol misuse, including fetal alcohol spectrum disorders, effects on the developing adolescent brain, and tissue and organ damage; the development of strategies to prevent and intervene with the short- and long-term consequences of alcohol misuse; the translation and implementation of research findings into improved health care for individuals with AUD alone and with co-occurring conditions; and the dissemination of research-based information to health care providers, researchers, policy makers, and the public.

METHODOLOGY

NIDA's entire budget is drug-related and scored as a part of the National Drug Control Budget.

The prevention and treatment components of NIAAA's underage drinking research program are scored as a part of the national drug control budget. Underage drinking research is defined as research that focuses on alcohol use by youth (individuals under the legal drinking age of 21), as well as the negative consequences of underage alcohol use, e.g., alcohol-related injuries, impact on adolescent development, including on the developing brain, and the development of AUD. It includes basic research, epidemiological studies, behavioral research, screening and intervention studies, and the development and testing of preventive interventions. NIAAA's methodology for estimating its portion of the national drug control is a two-step process. First, NIAAA identifies all of its underage drinking projects using the NIH's automated, electronic text mining system for research, condition, and disease categorization (RCDC). Once all underage drinking projects are identified through this process, NIAAA conducts a manual review of the project listing and identifies only those projects and amounts that are relevant to prevention and treatment. This is used to generate the NIAAA drug control budget estimate.

BUDGET SUMMARY

In FY 2017, NIH requests $1,104.775 million for drug control activities, flat to the FY 2016 enacted level.

NIH-supported research has and will continue to provide the scientific basis for budget policy. For example, NIH continues to explore the many biological, behavioral, and environmental influences on drug addiction vulnerability, which will allow the development of more targeted and effective prevention approaches. Research reveals that universal prevention programs not only reduce drug use, underage drinking, and other risky behaviors that can lead to HIV and other adverse outcomes, but can also promote other positive outcomes, such as strengthening young people's sense of community or "connection" to school—key to reducing substance misuse, violence, and mental health problems.

Another top priority continues to be the development of therapeutic interventions to treat SUDs, including medications, biologics, and non-pharmacological interventions such as transcranial magnetic stimulation or neurofeedback. NIH is now poised to capitalize on a greater understanding of the neurobiology underlying addiction, and of newly identified candidate molecules and brain circuits that show promise as potential targets for the treatment of SUDs. NIH is also exploring ways of improving the dissemination and implementation of evidence-based practices (implementation science) in real world settings to improve the prevention and treatment of SUDs and co-occurring conditions such as HIV, thereby enhancing the public health impact of NIH-supported research.

National Institute on Drug Abuse
FY 2017 Request: $1,050.6 million
(Flat to the FY 2016 enacted level)
NIDA's efforts consist of Epidemiology, Services, and Prevention Research, Basic and Clinical Neuroscience Research, Therapeutic and Medical Consequences, Clinical Trials Network, the Intramural Research Program, and Research Management and Support.

Epidemiology, Services, and Prevention Research
FY 2017 Request: $323.4 million
($0.8 million below the FY 2016 enacted level)
This portfolio supports integrated approaches to understand and develop strategies to address the interactions between individuals and environments that contribute to drug abuse-related problems. With a focus on research to inform public health, the program includes large surveys – such as the annual Monitoring the Future survey, which tracks drug use and related attitudes among teens – and surveillance networks to monitor drug-related issues and trends locally and nationally. NIDA's National Drug Early Warning System (NDEWS) monitors emerging trends related to illicit drug use including designer synthetic compounds and heroin. NDEWS generates critical information about new drug trends in specific locations around the country so that rapid, informed, and effective public health responses can be developed and implemented precisely where and when they are needed. NIDA also supports research related to treatment of SUDs in the criminal justice system, including studies that pertain to the implementation of medication-assisted treatment (MAT) and the seek, test, treat, and retain (STTR) model of care for people with SUDs at risk for HIV. Program efforts also guide development of preventive interventions for a variety of populations; as well as research to optimize implementation and service delivery in real-world settings. The program also includes research to better understand the impact of policy changes related to substance use including implementation of health reform and parity regulations and changes in state policies related to marijuana. Specifically, current research is examining the impact of health reform on access to quality treatment for persons with

SUDs, as well as associations between changes in State marijuana policies and trends in use, harm perception, health consequences including trauma and car crashes, and educational outcomes, particularly for adolescents and young adults. Such knowledge can be then used to inform policy and to improve prevention and treatment interventions.

Basic and Clinical Neuroscience Research
FY 2017 Request: $350.0 million
($0.9 million below the FY 2016 enacted level)
The Basic and Clinical Neuroscience portfolio seeks to expand understanding of the fundamental neurological, genetic/epigenetic, and behavioral processes that underlie substance use disorders. Central to this goal are efforts to tease apart the multiple factors that contribute to drug abuse and addiction risk, with particular attention to significant individual differences in risk and responses to drugs, while at the same time expanding basic knowledge of the function of the brain from the molecular to the behavioral level. Key projects are investigating the effects of drugs on gene expression and brain development and function, and exploring gender-related differences in these effects. Risk for addiction is profoundly affected by an individual's genes as well as environmental conditions, such as stress and early exposure to drugs of abuse. Additional studies are exploring the mechanisms underlying these effects, including the role of epigenetic changes that can influence long-term patterns of gene expression in specific brain cells (neuron and glia) without changing DNA sequence. Collectively, this research will improve our understanding of the basic neural and genetic mechanisms that underlie drug abuse and addiction and will provide critical insights toward the development of more effective approaches for the prevention and treatment of SUDs. For example, continuing efforts to improve understanding of the endocannabinoid system are opening up new areas of investigation for the development of novel pain and addiction treatments. Other projects are exploring the basic processes underlying resilience against substance use disorders in childhood and adolescence. In addition, and in line with the goals of the President's Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, NIDA is supporting research to: 1) develop advanced technologies that improve the ability to study the organization and function of the living brain; 2) better understand the interactions of complex neural circuits including those that mediate reward, aversion to drug effects, and related decision-making through development; and 3) develop strategies to therapeutically influence substance use disorder-relevant brain circuits (e.g., transcranial magnetic and deep brain stimulation, neurofeedback, optogenetics). Progress in these combined areas will revolutionize the ability to mitigate or even reverse the deleterious effects of addiction.

Therapeutic and Medical Consequences
FY 2017 Request: $178.4 million
($0.5 million below the FY 2016 enacted level)
Since the pharmaceutical industry has traditionally had limited involvement in the development of medications for SUDs, the responsibility for their development has rested largely with NIDA. NIDA, therefore, has developed a program to develop therapeutics for the treatment of SUDs. To leverage NIDA resources, this program encourages the formation of alliances between strategic partners (pharmaceutical and biotechnology companies as well as academic institutions) with the common goal of advancing therapeutics through the development pipeline toward Food and Drug Administration approval in a timely manner. NIDA supports research to decrease the risk associated with therapeutics development to make it more appealing for

pharmaceutical companies to complete costly phase IIb and III clinical studies. An example of such a project is a partnership with AstraZeneca to explore a novel medication that modulates the activity of glutamate – an excitatory neurotransmitter – to treat drug addiction. Preclinical studies with this class of molecules indicate that it could be effective for treating abuse of various drugs such as tobacco and cocaine. Another example is the partnership with two biotechnology companies to support the development of an intranasal formulation of naloxone, one of which received FDA-approval in November 2015 (NARCAN® Nasal Spray). In addition, NIDA is collaborating with Teva Pharmaceutical Industries on a clinical trial to test the efficacy and safety of a cholinesterase compound that has shown promise in pre-clinical trials for the treatment of cocaine addiction. NIDA continues to actively seek potential partners in the pharmaceutical and biotechnology sectors to develop novel therapeutics for SUDs. For example, NIDA has invested in research supporting the development of vaccines and antibodies for the treatment of SUDs. One example of NIDA's efforts in this area is an ongoing collaboration with Selecta Biosciences to develop a novel nicotine vaccine. NIDA-supported research is working to address the lingering challenge of developing vaccines that stimulate an immune response powerful enough to neutralize high concentrations of a drug before it enters the brain.

Clinical Trials Network
FY 2017 Request: $43.2 million
($0.1 million below the FY 2016 enacted level)
The Clinical Trials Network (CTN) comprises 13 research nodes and more than 240 community treatment programs and/or medical settings in 38 states plus the District of Columbia and Puerto Rico. Current initiatives are emphasizing research to develop and test strategies for the integration of SUD treatment into mainstream general medical settings, embedding research in clinical practice, and enhancing capacity to leverage electronic health record data in research studies. Through collaborations with clinical investigators, the CTN generates research-based strategies needed for the integrated management of patients with substance misuse/SUD in general medical settings and linked specialty care treatment settings. The CTN develops and tests the feasibility and effectiveness of interventions and health system approaches for SUDs and related disorders, such as co-occurring mental health disorders and HIV, in diverse patient populations. The CTN is currently conducting studies evaluating: 1) a comparison of Vivitrol (naltrexone for extended-release injectable suspension) to Suboxone (buprenorphine and naloxone) Sublingual Film for patients addicted to heroin or other opioids, including prescription pain relievers; 2) a combination therapy with Vivitrol plus Wellbutrin XL (bupropion hydrochloride, extended-release tablets) for treatment of methamphetamine addiction; 3) Vivitrol for HIV-positive opioid users in HIV settings; and 4) and a brief screening and assessment instrument to identify patients with substance use disorders in general medical settings. Research under development includes several studies which will utilize electronic health record data from large healthcare systems to enable larger, more efficient research trials.

Intramural Research Program
FY 2017 Request: $91.7 million
($1.4 million above the FY 2016 enacted level)
NIDA's Intramural Research Program (IRP) performs cutting-edge research within a coordinated multidisciplinary framework to: 1) elucidate the nature of the addictive process; 2) evaluate the potential use of emerging new therapies for substance use disorders, both

pharmacological and psychosocial; and 3) describe the long-term consequences of drugs of abuse on systems and organs, with particular emphasis on the brain and its development, maturation, function, and structure. For example, the IRP is collaborating with pharmaceutical industry partners to study a potential medication that can decrease methamphetamine craving. In addition, the IRP is working to understand the impact of long-lasting deficits in the prefrontal cortex – an area of the brain that mediates decision-making – caused by cocaine and heroin use. In an animal model, scientists can reverse this deficit by hyper-stimulating the prefrontal cortex for brief periods. This intervention is being developed as a possible therapy for addiction. The IRP is also working to develop clinically useful indicators (biomarkers) of nicotine addiction severity or treatment efficacy. Scientists are using brain imaging along with genetic and epigenetic data to develop quantitative addiction markers that will support the development of more efficacious treatments and discovery of novel treatment targets. IRP scientists are also working to better understand factors that contribute to cravings and relapse. Memories of items, people, or environments that are present when addicted individuals take drugs become powerful cues that trigger them to relapse again and again. Scientists have shown that these memories are stored in specific patterns of neurons called neuronal ensembles in the brain. Researchers have successfully inactivated these drug-related ensembles and memories in animal models, and are developing similar procedures that might be used in humans to selectively impair harmful addiction memories. In addition, IRP scientists are developing a mobile health toolbox to collect data on the daily-life reality of addiction. These tools can support intensive assessments to help identify individual and environmental influences on drug craving and use to understand when people are most vulnerable to relapse. One of the goals of this research is to deploy a mobile intervention that will automatically predict imminent drug use and deliver help just when a person needs it.

Research Management and Support
FY 2017 Request: $63.9 million
($0.9 million above the FY 2016 enacted level)
Research Management and Support (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. Additionally, the functions of RMS encompass strategic planning, coordination, and evaluation of NIDA's programs, regulatory compliance, international coordination, and liaison with other Federal agencies, Congress, and the public. NIDA currently oversees more than 1,600 research grants and more than 100 research and development contracts. In addition to the infrastructure required to support research and training, NIDA also strives to provide evidence-based resource and educational materials about substance use disorders and to raise awareness of the science relating to cutting edge issues such as opioid overdose prevention, marijuana research, synthetic drug trends and medication-assisted treatments.

In addition, NIDA's Office of Science Policy and Communication leads strategic efforts to inform public health policy and practice by ensuring the institute is the primary trusted source for scientific information on drug abuse and addiction. Healthcare providers are a key target audience for NIDA's outreach efforts. NIDA leads the NIH Pain Consortium Centers of Excellence in Pain Education; these eleven centers work to enhance patient outcomes by improving the education of healthcare professionals about pain and its treatment. The NIH Pain Consortium Centers of Excellence in Pain Education act as hubs for the development,

evaluation, and distribution of pain management curriculum resources for medical, dental, nursing, and pharmacy schools to improve how health care professionals are taught about pain and its treatment.

National Institute on Alcohol Abuse and Alcoholism
FY 2017 Request: $54.2 million
(Flat to the FY 2016 enacted level)

A key priority for NIAAA is preventing and reducing underage drinking. NIAAA recognizes the pervasive use of alcohol among young people and its negative consequences, as well as the association between early initiation of alcohol use and future alcohol problems. NIAAA's investment in underage drinking research includes the National Consortium on Alcohol and Neurodevelopment in Adolescence, a longitudinal study that is following more than 800 participants through adolescence, using state-of-the-art structural and functional brain imaging and extensive behavioral and clinical assessments to identify the short and long-term effects of alcohol exposure on the developing adolescent brain. The program provided the foundation for the recently launched Adolescent Brain Cognitive Development study, a more extensive longitudinal study conducted under the Collaborative Research on Addiction at NIH (CRAN). This initiative will follow approximately 10,000 U.S. adolescents for 10 years to assess the neurodevelopmental consequences of substance use in youth. NIAAA will continue to support complementary studies with animals under the Neurobiology of Adolescent Drinking in Adulthood initiative which investigates the underlying neurobiological mechanisms by which adolescent alcohol exposure affects adult brain function and behavior. Given that many college students who consume alcohol are underage, efforts to prevent and intervene with drinking by college students will continue to be an NIAAA priority in FY 2017.

PERFORMANCE

Information regarding the performance of the drug control efforts of NIH is based on agency GPRAMA documents and other information that measures the agency's contribution to the *Strategy*. NIH's performance measures are "representative" of Institute contributions to NIH's priorities regarding specific scientific opportunities, identified public health needs, and Presidential priorities. Such measures, reflecting NIH's broad and balanced research portfolio, are not Institute-specific. Most measures are trans-NIH, encompassing lead and contributory institutes and centers. This approach reflects NIH's commitment to supporting the best possible research and coordination of research efforts across its institutes and centers. All performance results reported were achieved in FY 2015.

NIDA and NIAAA support a number of trans-NIH measures in the Scientific Research Outcome (SRO) functional area. While NIDA and NIAAA engage in many research and related support activities, two measures best reflect the breadth of their portfolios, specifically, efforts in the prevention and treatment of substance abuse, addiction, and its consequences.

One of these measures is SRO-5.15: "By 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance use, abuse, addiction and their consequences in underage populations." This measure is indicative of NIDA's and NIAAA's efforts to support research to foster the development and implementation of prevention-based strategies for reducing substance abuse and addiction. SRO-5.15 began in FY 2014 and replaces the previous prevention measure, SRO-3.5, which was completed in FY 2013. NIH's prevention

portfolio encompasses a broad range of research on the efficacy and cost effectiveness of primary prevention programs—designed to prevent substance use before it starts, or prevent escalation to abuse or addiction—and how these programs can be enhanced by targeting prevention efforts toward populations with specific vulnerabilities (genetic, psychosocial, or environmental) that affect their likelihood of substance use or substance use disorders.

NIDA and NIAAA also contribute to SRO-8.7: "By 2018, identify three effective system interventions generating the implementation, sustainability and ongoing improvement of research-tested interventions across health care systems." This measure reflects NIH's commitment to supporting research on the implementation of preventive and treatment interventions and improving the translation of research into practice.

National Institute on Drug Abuse		
Selected Measures of Performance	**FY 2015 Target**	**FY 2015 Achieved**
» SRO-5.15, by 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance use, abuse, addiction and their consequences in underage populations.	Assess the effectiveness of at least two strategies for dissemination and implementation of tested, efficacious interventions to prevent youth and young adult drug use, drug use problems, and risk behaviors.	NIH-funded research tested over twenty strategies for improving the dissemination and implementation of evidence-based interventions to prevent drug use, drug use problems, and drug-related risky behaviors including HIV risk behaviors.
» SRO-8.7, by 2018, identify three effective system interventions generating the implementation, sustainability, and ongoing improvement of research-tested interventions across health care systems.	Establish cooperative partnership with at least 3 juvenile justice agencies across the United States to participate with NIH investigators in studies intended to develop and test models that facilitate uptake of evidence-based drug abuse prevention and treatment interventions. The level of achievement from this target is conditional on receiving applications of sufficient scientific merit.	A cooperative partnership has been established with 39 juvenile justice agencies across the US to test two different implementation models designed to facilitate the uptake of evidence-based substance use services.

Prevention – SRO-5.15

NIDA continues to fund a robust theory-based prevention portfolio that builds upon solid epidemiological findings and insights from genetics and neuroscience and applies this knowledge to development of effective strategies to prevent initiation of drug use and escalation of use to addiction in underage youth.

From FY 2015 to the present (FY 2016), multiple studies have been funded to develop and test interventions to prevent drug use, drug use problems, and risk behaviors and to improve the

implementation of these evidence-based interventions. NIDA is supporting research to test culturally and developmentally appropriate strategies to prevent drug use and addiction across the lifespan: for all developmental stages, from birth through adulthood and older age; for diverse racial/ethnic populations, targeted to various settings such as family, school, community, and health care settings; and for high risk populations, such as LGBT, homeless, child welfare involved, juvenile justice system involved, criminal justice involved, individuals with comorbid conditions, and populations at risk for HIV/AIDS.

In FY 2015 multiple publications were released related to this target by NIDA-funded researchers who conducted studies that tested implementation of interventions to prevent drug use, drug use related problems, and risk behaviors. A recent study examined the long-term effects of a partnership-based intervention delivery model called PROSPER (PROmoting School/community-university Partnerships to Enhance Resilience) on adolescent conduct problem behaviors such as substance misuse behaviors, anti-social behaviors and sexual risk behavior.[61] Previous studies have established the effectiveness of PROSPER, with positive effects on young adolescent competencies (e.g., peer refusal skills); parenting effectiveness and family functioning; adolescent conduct problems; and misuse of a wide range of substances through the end of high school. The current research compared adolescents in school districts randomly assigned to PROSPER or to a control condition. Community-based teams in school districts delivering PROSPER utilized selected evidence-based interventions including a family-focused intervention in 6th grade and a school-based intervention the next year; follow-up assessments were conducted through 12th grade. The intervention group exhibited significantly lower levels of conduct problems than controls at each time point from 9th to 12th grade. In addition, the control group reached a reference level of conduct problem behaviors sooner than the intervention group. These results demonstrate the long-term effects of early preventive interventions and establish effective community based implementation strategies.

Another recent publication demonstrated how nonparticipants may benefit from indirect exposure to an intervention as attitudes, knowledge, and behaviors diffuse through friendship networks.[62] Specifically, researchers tested whether the effects of the Strengthening Families Program for Youth 10–14 (SFP10-14) – an evidence-based prevention program – diffused from intervention participants to their friends. They also tested which program effects accounted for this diffusion. Students identified up to seven friends and self-reported past month drunkenness and cigarette use, substance use attitudes, parenting practices, and unsupervised time spent with friends. Three years post-intervention, the odds of getting drunk (odds ratio = 1.4) and using cigarettes (odds ratio = 2.7) were higher among nonparticipants with zero SFP-attending friends compared with nonparticipants with three or more SFP-attending friends. The study also found that nonparticipants with a higher cumulative proportion of SFP-attending friends were less likely than their peers to use drugs. Effects from SFP10-14 primarily diffused through friendship networks by reducing the amount of unstructured socializing (unsupervised time that nonparticipants spent with friends), changing friends' substance use attitudes, and then changing nonparticipants' own substance use attitudes. The results of this study suggest that effects from

[61] Spoth, Richard L., et al. "PROSPER partnership delivery system: Effects on adolescent conduct problem behavior outcomes through 6.5 years past baseline." *Journal of adolescence* 45 (2015): 44-55.
[62] Rulison, Kelly L., et al. "Diffusion of intervention effects: the impact of a family-based substance use prevention program on friends of participants." Journal of Adolescent Health 57.4 (2015): 433-440.

implementation of a family-based prevention program can impact nonparticipating adolescents by diffusing through school-based friendship networks.

Another ongoing study is looking at the long-term effects of the Communities that Care (CTC) prevention system on young adult substance use and misuse; crime, violence, and incarceration. CTC helps communities select and implement tested and effective prevention programs and policies based on a given community's risks and strengths. This research is examining the impacts of CTC 11 and 13 years following initial implementation. Early findings from this study have found that CTC is a cost-effective community-based approach to preventing initiation of delinquency and drug use.[63] This study has the potential to increase knowledge about effective implementation of community prevention programs and their impact on health-risking behaviors among youth from small towns (an understudied and underserved population) during the transition to adulthood.

Collectively these findings demonstrate strategies for effective dissemination and implementation of evidence-based substance use prevention programs and further support key prevention lessons and principles that have emerged from NIDA-funded studies: prevention interventions implemented in early childhood have effects in later developmental stages and into young adulthood; universal interventions can have strong effects in higher risk youth; universal substance use prevention interventions can have effects on other behavioral outcomes, beyond those specifically targeted by the intervention (e.g., social services utilization).

Treatment - SRO-8.7

NIDA funds a broad portfolio of research addressing drug abuse in the context of the criminal justice system. Two of NIDA's signature projects in this area are the Juvenile Justice Translational Research on Interventions for Adolescents in the Legal System (JJ-TRIALS) program and the Seek, Test, Treat, and Retain (STTR) Initiative.

NIDA's JJ-TRIALS initiative was launched in 2013 and is a seven-site cooperative research program designed to identify and test strategies for improving the delivery of evidence-based substance abuse and HIV prevention and treatment services for justice-involved youth. Many evidence-based interventions targeting adolescent substance abuse and HIV screening, assessment, prevention, and treatment currently exist. Unfortunately, implementation of these interventions within juvenile justice settings is variable, incomplete, and non-systematic at best. The JJ-TRIALS initiative features three studies to address these issues.

The first study is a nationally representative survey of the juvenile justice system to ascertain current policies and practices related to substance use assessment and service delivery in juvenile justice settings across the United States. The first wave of this survey was completed in 2015. Juvenile probation departments, judges, and behavioral health providers from over 200 localities responded to this survey, with a >90% response rate. These data are currently being analyzed and we expect findings to be released in 2016.

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[63] Kuklinski, Margaret R., et al. "Benefit–cost analysis of a randomized evaluation of Communities That Care: monetizing intervention effects on the initiation of delinquency and substance use through grade 12." Journal of Experimental Criminology (2015): 1-2 .

The second study is an organizational level intervention that will be field-tested in 36 juvenile justice systems across the country. An additional three systems participated as pilot sites. These systems are being trained on evidence-based practices to target youth substance use, data driven decision making, and goal setting. Data collection began in 2015 and over the next two years, JJ-TRIALS will track the progress of these 36 systems in improving the delivery of evidence-based substance use services to justice-involved youth.
A third study is currently under development to assist an additional six juvenile justice systems improve the delivery of HIV screening and prevention to justice-involved youth. Through these studies, the JJ-TRIALS research program will provide insights into the process by which juvenile justice and other service settings can successfully adopt and adapt existing evidence-based programs and strategies to improve drug abuse and HIV related service delivery for at-risk youth.

Since 2010, NIDA has supported the Seek, Test, Treat, and Retain (STTR) Initiative to empirically test the STTR paradigm with drug abusers in criminal justice populations. Researchers are developing, implementing, and testing strategies to increase HIV testing and the provision of highly active antiretroviral therapy (HAART) to HIV-positive individuals involved with the criminal justice system, with particular focus on continuity of HAART during and after community re-entry following incarceration. During 2015, 15 peer-reviewed journal articles were published reporting on findings from the STTR initiative. Key findings include: linkage to and retention in care are the two most critical elements in engaging patients in the HIV care continuum; an unexpectedly high mortality rates in some studies due to the recruiting of participants at a late stage in their illness; high prevalence of comorbid health conditions such as HCV; structural barriers in the criminal justice setting often hindered research; and the dearth of medication assisted treatments (or even basic substance abuse care) in settings with relatively high HIV prevalence.[64,65,66,67,68,69,70,7172,73,74,75,76,77,78]

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[70] Gwadz M., et al. Strategies to uncover undiagnosed HIV infection among heterosexuals at high risk and link them to HIV care with high retention: a "seek, test, treat, and retain" study. BMC Public Health, May 10, 2015. Vol. 15, issue 1, pp. 481.
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[74] Lorvick J. et. al. Heath service use and social vulnerability in a community-based sample of women on probation and parole, 2011-2013. Health and Justice. 19 Jun 2015 vol3, issue 13. doi:10.1186/s40352-015-0024-4.

In addition, from 2002-2014, NIDA funded the Criminal Justice Drug Abuse Treatment Studies (CJ-DATS) program, a multisite research cooperative. The CJ-DATS program aligned with NIDA's multi-pronged approach to improve existing drug treatment for criminal justice populations, and to inform the development of integrated treatment models. This initiative concluded in 2014, but continued to produce publications in 2015. To date, 14 peer-reviewed publications have been published. [79,80,81,82,83,84,85,86,87,88,89,90,91,92] Through these studies CJ-DATS contributed to a significant body of research describing existing treatment practices in the criminal justice system, developing and testing the effectiveness of specific interventions, and exploring strategies for implementation and quality improvement of drug abuse treatment programs for criminal justice populations.

Research Highlights

Researchers identify new complexities within the brain's reward circuitry that involves two major chemicals involved in drug addiction – dopamine and glutamate. [93] In a recent study, researchers used rodent models to better understand a specific brain circuit where dopamine and glutamate are both released from the same brain cells. They found that dopamine and glutamate were typically stored separately from one another and released from different synapses of the

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[89] Swan H. et al. (in press) Efficacy of a process improvement intervention on inmate awareness of HIV services: A multi-site trial. *Health & Justice*.

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nerve cell. This finding reveals a greater layer of complexity in signaling within brain reward circuits than had previously been recognized. Deficits in brain reward pathways can produce an inability to derive pleasure from natural stimuli, causing the substance user to focus on obtaining drugs at the expense of work, school, or relationships. A better understanding of these circuits will help drive the development of more targeted and effective prevention and treatment interventions for substance use disorders.

Medication plus ongoing care provided in emergency departments is a promising approach for opioid dependence.[94] Emergency department (ED) and primary care screening, brief intervention, and referral to treatment (SBIRT) can reduce unhealthy alcohol and tobacco use, however, this approach has not been applied to patients with opioid use disorder. In a recent study, researchers applied SBIRT to opioid patients who were randomly assigned to one of three intervention groups: 1) screening and referral to treatment; 2) screening, brief intervention and referral; or 3) screening, brief intervention, ED-initiated treatment with buprenorphine/naloxone, and referral. After 30 days, patients in the ED who initiated buprenorphine/naloxone treatment were more likely to participate in specialty substance use disorder treatment, were less likely to need inpatient treatment services and had reduced self-reported illicit opioid use. This adds to the growing body of literature suggesting that opioid-dependent patients may benefit from immediate initiation of medication while awaiting more comprehensive substance use disorder treatment.

A preliminary study shows cocaine abstinence and reduced use are associated with lowered marker of heart disease risk.[95] Previous studies have demonstrated that the protein endothelin-1 (ET-1) is associated with endothelial dysfunction, and that ET-1 levels change with cocaine use. ET-1 is higher in cocaine users than in those who do not use cocaine, and abstinence from cocaine can reduce levels of ET-1. This correlation raises the possibility that ET-1 could function as a biomarker for cocaine use and for cocaine-induced risk of heart disease. A recent study examined ET-1 levels and coronary plaques in a group of African American cocaine users participating in an incentive-based program to reduce cocaine use. In addition to confirming the finding that abstinence from cocaine lowers ET-1, the study found that more mild reductions in cocaine use also lowered levels of ET-1. This change in ET-1 provides evidence that both total abstinence and reduction in cocaine use could protect against endothelial dysfunction. Additionally, the responsiveness of ET-1 to changes in cocaine use could make it a useful biomarker to measure harm-reduction outcomes when developing treatments for cocaine use disorder.

Students who have used electronic cigarettes by the time they start ninth grade are more likely than others to start smoking tobacco products.[96] E-cigarettes deliver nicotine to the lungs by heating a liquid solution that contains nicotine and other chemicals to produce an aerosol that the user inhales. A recently published study compared tobacco use initiation among 222 students

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who had used e-cigarettes, but not combustible tobacco products, and 2,308 who had neither used e-cigarettes or combustible tobacco products when initially surveyed at the start of ninth grade. During the first six months after being surveyed, 30.7 percent of those who had used e-cigarettes started using combustible tobacco products, such as cigarettes, cigars, and hookahs, compared to only 8.1 percent of those who had never used e-cigarettes. Over the following six months leading into the start of 10th grade, 25.2 percent of e-cigarette users had used combustible tobacco products, compared to just 9.3 percent of nonusers.

Animal study suggests marijuana may affect future offspring's susceptibility to heroin.[97] Drugs of abuse have been shown to have epigenetic effects – they influence cross-generational transmission of complex traits without altering the genome sequence. A recent study looked at the effect of adolescent exposure to THC, the main psychoactive compound in marijuana, on susceptibility to heroin self-administration in the next generation. Adolescent male and female rats were administered THC for 3 weeks on an intermittent schedule that corresponded to the amounts consumed by typical recreational marijuana users. Researchers then looked at heroin self-administration in their offspring, conceived after a period of abstinence when the THC could no longer be detected in the rats' bodies and raised by mothers who had not been exposed to THC. When the offspring of these matings reached adulthood, the researchers presented them with a lever that, when pressed, delivered heroin. The offspring of THC-exposed parents were willing to work significantly harder to self-administer heroin. This difference was associated with altered neuronal functioning in the dorsal striatum – a brain region involved in reward and addiction. Neurons in this region were less responsive to stimulation and showed altered expression of N-methyl-D-aspartate (NMDA)-type glutamate receptors. While these results have not yet been replicated, they suggest potential mechanisms involved in determining susceptibility to addiction and highlight the importance of prevention efforts aimed at youth.

Methadone maintenance in prison results in treatment retention and lower drug use following release.[98] A recent NIDA-funded study shows that, among people incarcerated for six months or less, those who received ongoing methadone maintenance while imprisoned were more likely to obtain follow-up drug treatment than those who underwent detoxification from methadone while in jail. The findings show that one month after release, participants who continued to receive doses of methadone while incarcerated were more than twice as likely to continue treatment at a community methadone clinic after their release, compared to those who went through tapered methadone withdrawal. In addition, in the month following their release, opioid use was lower among the methadone maintenance patients, versus the tapered withdrawal group. Because of the high risk of relapse and fatal overdose that often occurs among inmates following release from prison, the study results emphasize the importance of continuing methadone treatment while incarcerated and connecting this population to follow-up treatment upon release.

[97] Szutorisz H. et al. Parental THC exposure leads to compulsive heroin-seeking and altered striatal synaptic plasticity in the subsequent generation. Neuropsychopharmacology. 2014 May;39(6):1315-23.
[98] Methadone continuation versus forced withdrawal on incarceration in a combined US prison and jail: a randomized, open-label trial. Lancet. 2015 July; 386(9991):350-359.

National Institute on Alcohol Abuse and Alcoholism		
Selected Measures of Performance	**FY 2015 Target**	**FY 2015 Achieved**
» SRO-5.15: By 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance use, abuse, addiction and their consequences in underage populations.	Evaluate the effectiveness of screening and brief intervention for alcohol and other drug use in a variety of settings.	NIH supported six studies to evaluate the effectiveness of its youth guide for alcohol screening and brief intervention in a variety of settings.
» SRO-8.7: By 2018, identify three effective system interventions generating the implementation, sustainability and ongoing improvement of research-tested interventions across health care systems.	Penetrate primary care to increase alcohol screening and brief intervention by providing online continuing medical education (CME) for the underage drinking guide and by supporting efforts to enhance medical training curricula.	NIH promoted alcohol screening and brief intervention in primary care by offering online continuing medical education (CME) on the underage guide to primary care providers, and by collaborating with federal and non-federal stakeholders to facilitate integration of prevention and early intervention of alcohol misuse in primary care training and practice.

Prevention – SRO-5.15

NIAAA supported six studies to evaluate the effectiveness of its youth guide for alcohol screening and brief intervention in a variety of settings.

These ongoing studies are evaluating the *Alcohol Screening and Brief Intervention for Youth: A Practitioner's Guide* in practice in various settings: one in a juvenile justice setting, one in a school setting, two in primary care, one in a network of emergency departments, and one with youth who have a chronic health condition (e.g., asthma, diabetes). These studies are also evaluating the effectiveness of the guide as an initial screen for drug use and other behavioral health problems. Released by NIAAA in 2011, this youth alcohol screening guide was designed to help pediatricians and other health care providers quickly identify children at elevated risk for using alcohol, children and adolescents who have already begun to experiment with alcohol, and those who are more heavily involved with alcohol. While this tool was developed for use in the primary care setting, it may also be useful in other settings, which could expand the venues in which at-risk youth can access prevention and intervention services.

Treatment – SRO-8.7

NIAAA continued to provide the online continuing medical education (CME) course, *Alcohol Screening and Brief Intervention for Youth: A Practitioner's Guide*, to primary care and other health care providers. As of September 2015, more than 35,500 health care providers had earned CME credit for completing the course. Recognizing the importance of training health care providers in identifying, preventing, and addressing alcohol misuse and the associated consequences, NIAAA is collaborating with professional organizations and federal stakeholders in efforts to integrate prevention, early intervention, and treatment of alcohol misuse in primary care and preventive medicine training, certification, and practice. In 2015, NIAAA also

sponsored a series of symposia, lectures, workshops, and forums at the American Psychiatric Association annual meeting to update psychiatrists on the latest advances in research on alcohol misuse and AUD, and promote the development of clinical knowledge and skills in identifying and managing alcohol problems.

Research Highlights

Assessing the Impact of Adolescent Alcohol Exposure on the Developing Brain. Adolescence is a period of significant brain maturation and also the time when many individuals initiate and escalate alcohol consumption. Human brain imaging studies have shown that over the course of adolescence, the volume of gray matter in the brain decreases, likely reflecting the normal process of synaptic pruning, whereas the volume of white matter increases, presumably reflecting enhanced brain connectivity. The nature of these rapid changes makes the developing adolescent brain particularly vulnerable to the adverse effects of alcohol. In 2012, NIAAA launched the National Consortium on Alcohol and Neurodevelopment in Adolescence (NCANDA), an ongoing multi-site longitudinal study to address alcohol's effects on normal brain development. The five NCANDA sites have collectively enrolled more than 800 adolescents ages 12 to 21, and are using advanced brain imaging as well as other psychological and behavioral research tools to evaluate brain structure and function, beginning before the participants start to drink. NCANDA's overall objectives are to elucidate the short- and long-term effects of alcohol exposure on the developing brain and to identify the brain characteristics that may predict AUD. In a recent study supported through NCANDA,[99] researchers used neuroimaging to assess the developmental trajectory of 134 adolescents, ages 12-24, over 8 years. Of these youth, 75 transitioned to heavy drinking during a 3.5 year period. The results showed that heavy drinking adolescents had accelerated reductions in gray matter and attenuated increases in white matter compared to non-drinking adolescents, providing additional evidence that heavy drinking during adolescence alters the trajectory of brain development.

Improving implementation of youth alcohol SBIRT in primary care. Screening, brief intervention and referral to treatment (SBIRT) by primary care providers has been shown effective in reducing alcohol misuse and related problems in adults, and a mounting body of evidence has supported the use of SBIRT in preventing the initiation and escalation of substance use by adolescents. However, physicians often face barriers to providing these services, including time constraints and a lack of training in SBIRT. Recently, NIAAA-funded researchers examined SBIRT implementation in a large pediatric clinic.[100] In the study, pediatricians participated in one of three study groups: 1) a pediatrician-only group that received three hours of SBIRT training and then conducted screening and brief interventions by themselves; 2) a second group that received less SBIRT training, screened patients, and referred them to behavioral health care clinicians "embedded" in the practices to conduct the interventions; and 3) a control group of pediatricians who received no SBIRT training and performed usual care only. The researchers found that the pediatrician-only group was about 10 times more likely (16 percent) to conduct brief interventions with at-risk patients than "usual

[99] Squeglia LM, Tapert SF, Sullivan EV, Jacobus J, Meloy MJ, Rohlfling T, Pfefferbaum A. Brain development in heavy drinking adolescents, *Am J. Psychiatry.* 2015 Jun1; 172(6)531-542.

[100] Sterling S, Kline-Simon AH, Satre DD, Jones A, Mertens J, Wong A, Weisner C. Implementation of screening, brief intervention, and referral to treatment for adolescents in pediatric primary care. *JAMA Pediatr. 2015;169(11): e153145. doi:10.1001/jamapediatrics.2015.3145.*

care" pediatricians (1.5 percent). The intervention rate was even higher (24.5 percent) in the pediatrician group that worked in coordination with embedded behavioral health care clinicians. These results suggest that training pediatricians in SBIRT can significantly increase their use of techniques for identifying and treating young people with potential alcohol, substance use, and mental health problems. The results also show that pediatric practices can improve support for patients who need these services by adding behavioral health clinicians to their teams.

Promoting effective interventions to reduce college drinking. The extent of binge drinking and related consequences such as blackouts, physical and sexual assaults, alcohol poisonings, injuries, and deaths on college campuses is alarming. NIAAA-supported research has shown that both individual and environmental approaches to prevention can effectively reduce harmful drinking and its consequences for college students. Working with researchers with expertise in college drinking interventions, NIAAA developed and released the *College Alcohol Intervention Matrix (CollegeAIM*), an easy-to-use, comprehensive tool and website designed to help higher education officials identify effective alcohol interventions.[101] CollegeAIM allows users to compare individual- and environmental-level strategies based on factors such as cost, effectiveness, and ease of implementation, helping them choose those interventions that best fit the needs of their campus. As part of the dissemination effort, CollegeAIM developers and NIAAA staff will present on the tool at meetings of higher education administrators and college health professionals. NIAAA, in collaboration with its College Presidents Working Group, will also be organizing regional workshops to present CollegeAIM to institutional officials and show them how to use it. The interventions highlighted in CollegeAIM are divided into tiers of effectiveness, based on an extensive research and evaluation process. The highest tier – *higher effectiveness* – contains 8 individual level strategies and 5 environmental level strategies; in general, they represent a range of counseling options and policies related to sales and access.

[101] http://www.collegedrinkingprevention.gov/collegeaim/