

DEPARTMENT OF HEALTH AND HUMAN SERVICES

NATIONAL INSTITUTES OF HEALTH

Fiscal Year 2011 Budget Request

Witness appearing before the

Senate Subcommittee on Labor – HHS – Education Appropriations

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Good morning, Mr. Chairman and distinguished Members of the Subcommittee:

It is a great honor to appear before you today to present the Fiscal Year 2011 budget request for the National Institutes of Health (NIH), and to discuss my vision for the future of biomedical research.

First, I'd like to thank each of you for your steadfast support of NIH's mission: discovering fundamental knowledge about living systems and then applying that knowledge to fight illness, reduce disability, and extend healthy life. In particular, I want to thank the committee for the FY 2010 budget level of \$31 billion, and the \$10.4 billion provided to NIH through the American Recovery and Reinvestment Act. I was very grateful for the committee's interest and support over the course of my 15 years as Director of the National Human Genome Research Institute, most notably during our successful effort to sequence the human genome. Now, as steward of NIH's entire research portfolio, I truly believe that the opportunities for us to work together to improve America's health have never been greater.

One of my first actions upon being named NIH Director was to scan the vast landscape of biomedical research for areas ripe for major advances that could yield substantial benefits downstream. I found many of the most exciting opportunities could be grouped under five main themes: taking greater advantage of high-throughput technologies; accelerating translational science, that is, turning discovery into health; helping to reinvent health care; focusing more on global health; and reinvigorating the biomedical research community.

The Administration's request of \$32.1 billion for NIH's biomedical research efforts in FY 2011 would help more researchers take greater advantage of these unprecedented opportunities, all with the aim of helping people live longer, healthier, more rewarding lives. We at NIH are fortunate to have a very solid foundation upon

which to build, established by such extraordinary leaders as James Shannon, Nobel laureate Harold Varmus, Elias Zerhouni, and the late and much missed Ruth Kirschstein.

THE RESEARCH MARATHON

In his FY 2009 budget remarks, Dr. Zerhouni warned that our nation's biomedical research effort is in a race that we cannot afford to lose. I wholeheartedly agree, and want to provide a few more insights about what that race involves.

Science is not a 100-yard dash. It is a marathon – a marathon run by a relay team that includes researchers, patients, industry experts, lawmakers, and the public.

Thanks to discoveries funded through NIH appropriations, we have covered a lot of ground in this marathon. Let us take a moment to look back at a few of the advances made possible by NIH-supported research, and then look ahead to some of our nation's biggest health challenges and how NIH intends to meet them.

HOW FAR WE'VE COME

U.S. life expectancy has increased dramatically over the past century and still continues to improve, gaining about one year of longevity every six years since 1990. A baby born today can look forward to an average life span of 77.7 years, almost three decades longer than a baby born in 1900.

Not only are people living longer, they are staying active longer. From 1982 through 2005, the proportion of older people with chronic disabilities dropped by almost a third, from 27% to 19%.

Some of the most impressive gains have been made in the area of cardiovascular disease. In the mid-20th century, cardiovascular disease caused half of U.S. deaths, claiming the lives of many people still in their 50s or 60s. Today, the death rate for coronary heart disease is more than 60% lower -- and the death rate for stroke, 70% lower – than in the World War II era.

What fueled these improvements? One major contributor has been the insights from the NIH-funded Framingham Heart Study, which began in the late 1940s and is still going strong. This population-based study, which changed the course of public health by defining the concept of disease risk factors, continues to break new ground with its recent move to add a genetic component to its analyses.

Other factors include NIH-supported research that led to minimally invasive techniques to prevent heart attacks and to highly effective drugs to lower cholesterol, control high blood pressure, and break up artery-clogging blood clots. Science also played a crucial role in formulating approaches to help people make lifestyle changes that promote cardiovascular health, such as eating less fat, exercising more, and quitting smoking.

Many chronic conditions have their roots in the aging process. One such disease, osteoporosis, can lead to life-threatening bone fractures among older people. NIH-funded research has led to new medications and management strategies for osteoporosis that have reduced the hospitalization rate for hip fractures by 16% since 1993. Science has also transformed the outlook for people with age-related macular degeneration, a major cause of vision loss among the elderly. Twenty years ago, little could be done to prevent or treat this disorder. Today, because of new treatments and procedures based on NIH research, 750,000 people who would have gone blind over the next five years will continue to have useful vision.

Biomedical research also has benefitted those at the other end of the age spectrum. NIH-funded research has given hearing to thousands of children who were born profoundly deaf. This hearing is made possible through a cochlear implant, an electronic device that mimics the function of cells in the inner ear. Since the Food and Drug Administration (FDA) approved cochlear implants for pediatric use in 2000, more than 25,000 children have received the devices, enabling many to develop normal language skills and succeed in mainstream classrooms.

Then, there are the infectious diseases – diseases that often know no boundaries when it comes to age, sex, or physical fitness. One of NIH's greatest achievements over the past 30 years has been to lead the global research effort against the human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) pandemic. With discovery building upon discovery, researchers first gained fundamental insights about how HIV works, and then went on to develop rapid HIV tests, identify a new class of HIV-fighting drugs, and, finally, figure out how to combine those drugs in life-saving ways in the clinic. As a result, HIV infection has changed from a virtual death sentence into a manageable, chronic disease. Today, HIV-infected people in their 20s who receive combination therapy may expect to live to age 70 or beyond.

HOW FAR WE HAVE TO GO

Although we have accomplished much, and as tempting as it may be for NIH to rest upon its laurels, we all know that biomedical research still has an enormous amount of ground to cover before discovery is turned into health for all Americans.

Consider the challenge posed by cancer. This disease still claims the lives of more than 500,000 Americans annually – about one every minute. But in 2007, for the first time in our nation's history, the absolute number of cancer deaths in the U.S. went down. And, over the past 15 years, cancer death rates have dropped 11.4% among

women and 19.2% among men, which translates into some 650,000 lives saved – more than the population of Washington, D.C. These are very encouraging milestones, but they are not nearly enough.

NIH-funded research has revolutionized how we think about cancer. A decade or two ago, cancer treatment was mostly reactive, diagnosis was based on the organ involved and treatment depended on broadly aimed therapies that often greatly diminished a patient's quality of life. Today, basic research in cancer biology is moving treatment toward more effective and less toxic therapies tailored to the genetic profile of each patient's cancer.

Among the early success stories in this area is the drug trastuzumab (Herceptin) for breast cancer. An NIH-sponsored clinical trial found that when breast cancer patients whose tumors were genetically matched to trastuzumab received the drug, along with standard chemotherapy, their risk of cancer recurrence fell 40%. That improvement is the best ever reported in post-surgical treatment of breast cancer. Studies also have found that the chemotherapy drugs gefitinib (Iressa) and erlotinib (Tarceva) work much better in the subset of lung cancer patients whose tumors have a certain genetic change.

To accelerate the development of more individualized strategies for more types of cancer, NIH has tapped into the promise of high-throughput technologies to launch The Cancer Genome Atlas (TCGA). Over the next few years, TCGA's research team will build comprehensive maps of the key genomic changes in 20 major types and subtypes of cancer. This information, which is being made rapidly available to the worldwide scientific community, will provide a powerful new tool for all those striving to develop better ways to diagnose, treat, and prevent cancer.

Already, TCGA has produced a comprehensive molecular classification system for ovarian cancer and glioblastoma, the most common form of brain cancer. The survey of glioblastoma recently revealed five new molecular subtypes of the disease. In addition, researchers found that responses to aggressive therapies for glioblastoma varied by

subtype. The findings hold promise for matching the most appropriate therapies with brain cancer patients and may also lead to therapies directed at the molecular changes underlying each subtype, as has already happened for some types of breast cancer.

Diabetes is another disease that is inflicting much damage on U.S. health. More than 23 million Americans currently have diabetes – nearly 8% of the population. Another 57 million have blood sugar levels that indicate they are at serious risk of developing the disease, which is a major cause of kidney failure, stroke, heart disease, lower-limb amputations, and blindness.

For type 2 diabetes, prevention appears to be the name of the game. This form of the disease, which accounts for more than 90% of diabetes among adults, often can be averted or delayed by lifestyle factors. The NIH-funded Diabetes Prevention Program (DPP) trial showed that one of the most effective ways to lower the risk of type 2 diabetes is through regular exercise and modest weight loss. There is good reason to believe that such efforts may lead to a lifetime of health benefits. A recent follow-up study of DPP participants found the protective effects of weight loss and exercise persist for at least a decade. The United Health Group has recently announced a partnership with Walgreen's and the YMCA to implement the results of this groundbreaking NIH-funded research on a broad scale.

More than one-third of adults in the U.S. are obese, according to the latest data from the National Health and Nutrition Examination Survey which is conducted by the Centers for Disease Control and Prevention (CDC). And there are signs that the next generation may face an even greater struggle. Over the past 30 years, obesity has more than doubled among U.S. children ages 2 through 5 and nearly tripled among young people over the age of 6. Those statistics translate into tens of millions of Americans who face an increased risk of type 2 diabetes, as well as cardiovascular disease, high blood pressure, certain cancers, osteoarthritis, and other serious health problems associated with excess body fat.

To address America's growing problem with obesity, NIH has launched a variety of initiatives aimed at developing innovative approaches for weight control. One such effort, called the National Collaborative on Childhood Obesity Research, has pulled together experts from four NIH institutes, the CDC, and the Robert Wood Johnson Foundation. One example of their work is the Trial of Activity for Adolescent Girls, a national study to develop and test school- and community-based interventions to get girls more involved in gym class, organized sports, or recreational activities. Another NIH program, called *We Can!*, provides families with practical tools for weight control at more than 1,000 community sites nationwide. How to get more people to lose weight is also among the questions being explored by OppNet, a new trans-NIH initiative for basic behavioral and social sciences research.

Meanwhile, other NIH-funded researchers are busy uncovering information about genes and environment that may pave the way for more personalized, targeted strategies for controlling weight and preventing diabetes. For example, in just the past few years, we have identified more than 30 genetic risk factors for type 2 diabetes.

A better understanding of genetic and environmental factors may also help solve a longstanding medical puzzle: the causes of autism. Children with autism spectrum disorders experience a range of problems with language and social interactions, sometimes accompanied by repetitive behaviors or narrow, obsessive interests. Recent studies funded by NIH have associated autism risk with several genes involved in the formation and maintenance of brain cells, but much more work is needed to follow up on these clues.

In FY 2011, NIH will support comprehensive and innovative approaches to piece together the complex factors that contribute to autism spectrum disorders. One ambitious effort will involve sequencing the complete genomes of 300 people with autism and their parents. Other researchers will examine a mother's exposure during

pregnancy to identify possible environmental contributions. NIH hopes to use these insights to develop new molecular and behavioral therapies for such disorders, as well as to identify possible strategies for prevention.

Another brain disorder, depression, presents a different set of challenges. Although researchers have made significant progress in understanding the biology of depression, improving treatment, and lessening the social stigma associated with mental illnesses, suicide still claims the lives of twice as many Americans as homicide. And it does not end there -- untreated depression also increases the risk of heart disease and substance abuse.

How can medical research reduce depression's tragic toll? One way may be getting people into treatment more quickly. Researchers today are using functional magnetic resonance imaging and other innovative technologies to see how the brains of people with depression differ from those without the disorder. Rapid diagnosis is just part of the equation. Finding the right antidepressant drug for any particular patient currently is a lengthy, trial-and-error process that can take weeks before symptoms are relieved. NIH supports laboratory research aimed at developing quicker-acting antidepressants, as well as genetic studies that will help to match individuals with the drugs most likely to work for them.

In 2008, 143 soldiers died by suicide – the highest rate since the Army began keeping records three decades ago. To address this problem, NIH and the U.S. Army recently partnered to launch the largest study ever of suicide and mental health among military personnel. The Army Study to Assess Risk and Resilience in Service Members (Army STARRS) will identify risk factors that may inform efforts to develop more effective approaches to suicide prevention.

TRANSFORMING DISCOVERY INTO HEALTH

Whatever the disease, be it depression, diabetes, or something much rarer, NIH's emphasis in FY 2011 and beyond will be on translating basic discoveries into new diagnostic and treatment advances in the clinic.

In the past, some have complained that NIH has been too slow to convert fundamental observations into better ways to diagnose, treat, and prevent disease. Although some of that criticism may have been deserved, most of the delay has stemmed from the lack of good ideas about how to traverse the long and winding road from molecular insight to therapeutic benefit.

That is now changing. For many disorders, there are new opportunities for NIH to shorten and straighten the pathway from discovery to health. This expectation is grounded in several recent developments: the dramatic acceleration of our basic understanding of hundreds of diseases; the establishment of NIH-supported centers that enable academic researchers to use such understanding to screen thousands of chemicals for potential drug candidates; and the emergence of public-private partnerships to aid the movement of drug candidates identified by academic researchers into the commercial development pipeline.

Let me give you one example of how NIH plans to implement this strategy: the Therapeutics for Rare and Neglected Diseases (TRND) program. This effort will bridge the wide gap in time and resources that often exists between basic research discoveries and the human testing of new drugs.

A rare disease is one that affects fewer than 200,000 Americans. However, if all 6,800 rare diseases are considered together, they afflict more than 25 million Americans. Private companies seldom pursue new therapies for these types of diseases because of the high cost of research and low likelihood of recovering their investments. Effective drugs exist for only about 200, or less than 3%, of rare diseases. Unlike rare diseases,

neglected diseases may be quite common in some parts of the world, especially in developing countries. However, there also is a dire shortage of effective, affordable treatments for many of these major causes of death and disability.

Working in an open environment in which all of the world's top experts on a disease can be involved, TRND will enable certain promising compounds to be taken through the preclinical development phase – a time-consuming, high-risk phase often referred to as “the valley of death” by pharmaceutical firms focused on the bottom line. Besides speeding development of drugs for rare and neglected diseases, TRND will serve as a model for therapeutic development for common diseases, many of which are being resolved into smaller, molecularly distinct subtypes.

NIH will also take other steps to build a more integrated pipeline that connects all of the steps between identification of a potential therapeutic target by a basic researcher and the point when the FDA approves a therapeutic for clinical use. Among the tools at our disposal is the NIH Clinical and Translational Sciences Award program, which currently funds 46 centers and has awardees in 26 states and plans to add even more in FY 2011. This national network is pulling together interdisciplinary clinical research teams to work in unprecedented ways to develop and deliver tangible health benefits. We also need to take advantage of the nation's largest research hospital, the Mark O. Hatfield Clinical Research Center, located on the NIH campus in Bethesda, Md. Just as they blazed a trail for safe and effective human gene therapy, NIH clinical researchers may be well positioned to move the ball forward for other pioneering approaches, such as those using human embryonic stem cells or induced pluripotent stem cells derived from skin cells.

To make the most of these new opportunities, the NIH and FDA recently forged a landmark partnership with the formation of a Joint Leadership Council. Members of this Leadership Council will work together to ensure that regulatory considerations form an integral component of biomedical research planning, and that the latest science is integrated into the regulatory review process. Such collaboration will advance the

development of products to treat, diagnose and prevent disease, as well as enhance the safety, quality, and efficiency of clinical research and medical product approval.

BIOMEDICAL RESEARCH PROPELS U.S. ECONOMY

It is crucial to keep in mind that investing in NIH not only improves America's health and strengthens our nation's biomedical research potential, it empowers the entire U.S. economy. Consider the following statistics:

- A report issued by Families USA calculated that in 2007, every \$1 in NIH funding resulted in an additional \$2.11 in economic output in the U.S.¹
- In FY 2007, a typical NIH grant supported the salaries of about 7 high-tech jobs in full or in part.²
- The 351,000 jobs resulting from NIH awards paid an average annual wage of more than \$52,000 per annum and account for more than \$18 billion in wages for FY 2007.³
- Long term, NIH funded R&D sparks U.S. economic innovation in the high-technology and high value-added pharmaceutical and biotechnology industries. For example, between 1982 and 2006, one-third of all drugs and nearly 60 percent of promising new molecular entities approved by the FDA cited either an NIH-funded publication or an NIH patent.⁴
- Gains in average U.S. life expectancy from 1970-2000 were worth an estimated \$95 trillion.⁵

IMAGINE THE FUTURE

If our nation is bold enough to act today upon the many unprecedented opportunities now offered by biomedical research, we may be amazed at what tomorrow will bring.

In the world I envision just a few decades from now, we will use stem cells to repair spinal cord injuries; bioengineered tissues to replace worn-out joints; genetic information to tailor health outcomes with individualized prescriptions; and nanotechnology to deliver therapies with exquisite precision. I also dream of a day when, in ways yet to be discovered, we will be able to prevent Alzheimer's, Parkinson's, and other diseases that rob us much too soon of family and friends.

Just imagine what such a future would mean for our nation and all humankind. This is what keeps NIH in the research marathon, and why we ask you to go the distance with us.

Thank you Mr. Chairman. That concludes my formal remarks.

¹ FamiliesUSA (2008). In Your Own Backyard: How NIH Funding Helps Your State's Economy. Washington, DC. <http://www.familiesusa.org/issues/global-health/publications/in-your-own-backyard.html>

² McGarvey, W. E., P. Morris, et al. (2008). How Many Scientists Do the NIH Support? Improving Estimates of the Workforce. <http://report.nih.gov/FileLink.aspx?rid=530>

³ FamiliesUSA (2008). In Your Own Backyard: How NIH Funding Helps Your State's Economy. Washington, DC. <http://www.familiesusa.org/issues/global-health/publications/in-your-own-backyard.html>

⁴ Lichtenberg, F. R. and B. Sampat (2008). The Contribution of NIH-supported research to pharmaceutical-embodied technological progress. NIH Office of Science Policy Analysis.

⁵ Murphy, K. M. and R. H. Topel (2006). "The value of health and longevity." Journal of Political Economy **114**(5): 871-904.

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

The National Institutes of Health

Francis S. Collins M.D., Ph.D., was officially sworn in on Monday, August 17, 2009 as the 16th director of the National Institutes of Health (NIH). Dr. Collins was nominated by President Barack Obama on July 8, and was unanimously confirmed by the U.S. Senate on August 7.

Dr. Collins, a physician-geneticist noted for his landmark discoveries of disease genes and his leadership of the Human Genome Project, served as director of the National Human Genome Research Institute (NHGRI) at the NIH from 1993-2008. With Dr. Collins at the helm, the Human Genome Project consistently met projected milestones ahead of schedule and under budget. This remarkable international project culminated in April 2003 with the completion of a finished sequence of the human DNA instruction book. On March 10, 2010, Dr. Collins was named a co-recipient of the Albany Medical Center Prize in Medicine and Biomedical Research for his leading role in this effort. While accepting the honor, Dr. Collins declined his portion of the \$500,000 prize in order to comply with government ethics rules.

In addition to his achievements as the NHGRI director, Dr. Collins' own research laboratory has discovered a number of important genes, including those responsible for cystic fibrosis, neurofibromatosis, Huntington's disease, a familial endocrine cancer syndrome, and most recently, genes for type 2 diabetes and the gene that causes Hutchinson-Gilford progeria syndrome.

Dr. Collins has a longstanding interest in the interface between science and faith, and has written about this in *The Language of God: A Scientist Presents Evidence for Belief* (Free Press, 2006), which spent many weeks on *The New York Times* bestseller list. He is the author of a new book on personalized medicine, *The Language of Life: DNA and the Revolution in Personalized Medicine* (HarperCollins, 2010).

Dr. Collins received a B.S. in chemistry from the University of Virginia, a Ph.D. in physical chemistry from Yale University, and an M.D. with honors from the University of North Carolina at Chapel Hill. Prior to coming to the NIH in 1993, he spent nine years on the faculty of the University of Michigan, where he was a Howard Hughes Medical Institute investigator. He is an elected member of the Institute of Medicine and the National Academy of Sciences. Dr. Collins was awarded the Presidential Medal of Freedom in 2007. In a White House ceremony on October 7, 2009, Dr. Collins received the National Medal of Science, the highest honor bestowed on scientists by the United States government.