Statement of Dr. Tyler Jacks, PhD
Director, Koch Institute for Integrative Cancer Research at MIT
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For the Hearing entitled:

Federally Funded Cancer Research: Coordination and Innovation

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Chairman Chaffetz, Ranking Member Cummings and other members of the Committee, thank you for the opportunity to appear before you to discuss the state of cancer research in our country today and the transformation in cancer care that we are witnessing owing to the federal investment in our understanding and treatment of this disease over the past four decades.

My name is Tyler Jacks, and I am the Director of the Koch Institute for Integrative Cancer Research at the Massachusetts Institute of Technology (MIT), a National Cancer Institute (NCI)-designated Cancer Center. I was previously the Chairman of the National Cancer Advisory Board, and I have served as President of the American Association of Cancer Research (AACR). I am also a member of the Board of Directors of Amgen and Thermo Fisher Scientific. I have been actively participating in cancer research for the past 36 years, including overseeing a research laboratory at MIT currently focused on cancer genetics and immuno-oncology. I am not here as a representative of MIT nor as a representative of the NCI but as an experienced cancer researcher.

Along with my colleagues, Dr. Elizabeth Jaffee, who is also testifying today, and Dr. Dinah Singer, Acting Deputy Director of the NCI, I co-chaired the Cancer Moonshot Blue Ribbon Panel. This Panel was charged in the spring of 2016 by President Obama and Vice President Biden to establish the research agenda for the Cancer Moonshot. Dr. Mary Beckerle (also testifying today) was a member of the Panel as well. We are all pleased to talk about the recommendations laid out in the Panel's report (1), which describe several exciting areas of opportunity in cancer research, treatment and prevention.

This hearing is particularly timely given the considerable uncertainty in the biomedical research community regarding the recent release of President Trump's preliminary budget proposal for FY18, which recommends a nearly 18% cut in the budget for the NIH (2). Such a budget decrease would have devastating effects on our nation's efforts to make progress against cancer and

other diseases and imperil the training of the next generation of biomedical researchers.

President's Trump's budget follows recent bi-partisan support for the NIH and the NCI in Congress. This includes a significant budget increase for NIH in the FY16 appropriations after a 13-year period of decline as well as proposed further increases during in the FY17 budget negotiations. As this committee is well aware, the FY17 budget bill has not been passed, and the NIH is currently operating under a continuing resolution. Another indication of bi-partisan endorsement for the federal investment in biomedical research was the passage of 21st Century Cures Act, which was supported by margins of 392-26 in the House of Representatives and 94-5 in the Senate and signed into law by President Obama on December 13, 2016. A key part of this Act was the funding of the Beau Biden Cancer Moonshot, which provides dedicated support for the research priorities identified by the Blue Ribbon Panel. The Cancer Moonshot funding for FY2017 is $300M. While highly valued, it is important to note that the Cancer Moonshot funds represent a fraction of the total budget of the NCI ($5.21B in the FY2016 budget) (3). Sustained and robust support of the NIH and NCI budgets are required to fund the discovery research breakthroughs that enable projects such as the Cancer Moonshot as well as provide the resources necessary to train our Nation's cancer researchers of the future.

As outlined below, cancer research discoveries have led to powerful new classes of cancer medicines, which are impacting patient lives today. Other discoveries have led to new methods to detect the disease at earlier stages when conventional treatments are more effective. New insights into cancer etiology and risk factors are paving the way for new forms of cancer prevention and disease interception. Still, despite this progress, based on current statistics, over the next decade it is estimated that more than 15 million Americans will be diagnosed with cancer, including 150,000 children (1). In 2017 alone, more than 600,000 people will die from the disease in this country (4). Cancer is the second leading cause of death in the United States, following closely behind heart disease. Globally, cancer causes more deaths each year than HIV/AIDS, malaria, and tuberculosis combined (5). Thus, although we have come a long way in our detailed understanding of cancer and have begun to apply that knowledge in the form of better ways to treat and control the disease, there is much more to be done.

Cancer research is the foundation for clinical progress

At the time of the passing of National Cancer Act of 1971, the understanding of how cancer cells arose in the human body, how they spread to distant sites in the process of metastasis, and how they responded to treatments was extremely limited. Since that time, the federal investment in fundamental cancer research,

which occurs largely through NIH/NCI grants to academic investigators as well as the support of government laboratories, has led to dramatic advances in our understanding of all of these processes. As an example, in 1971 we did not know the identity of a single gene implicated in cancer development. Today, more than 500 cancer-associated genes have been identified, in which alterations promote the initiation or progression of cancer. Federal investments such as the Human Genome Project provided a roadmap to find and explore the function of these genes. The NCI's Cancer Genome Atlas Project has supported the detailed analysis of thousands of cancer samples across multiple cancer types to provide an increasingly clear picture of the diversity of mutations and other alterations that underlie tumor development (6). The functional characterization of these genes and cellular processes is likewise primarily the product of discovery research programs funded by the federal government. These efforts have been greatly facilitated by the establishment of the NCI Cancer Centers Program, which is composed of 69 NCI-designated Cancer Centers located across the United States, which are engaged in both cancer research and cutting-edge cancer care. To facilitate the dissemination of the latest advances to patients outside of the reach of these Cancer Center and improve access of rural and underserved populations, the NCI has also established the Community Oncology Research Program (NCORP), which is a large network of cancer research and clinical centers.

Owing to these efforts, we are witnessing a revolution in the treatment of cancer. An increasing number of cancer patients are now being treated with forms of "precision medicine," drugs that act on specific molecular alterations in an individual's cancer cells. Because cancers differ from organ to organ and from patient to patient, a detailed understanding of the genetic and other changes present in a given patient's cancer allows for the use of the most appropriate therapy for them. Drugs such as Herceptin (Genentech/Roche), used in the treatment of a subset of women with breast cancer, and Gleevec (Novartis), used in the treatment of a form of leukemia, are two well-known examples of powerful precision cancer medicines. New treatments for lung cancer have also been developed that target the products of specific mutant genes. Several more of these precision cancer medicines have been approved by the Food and Drug Administration (FDA) and many more are in clinical testing. While the development of these drugs requires significant research and development investment from private industry as well as the involvement of clinical investigators, they are almost always rooted in basic science discoveries made in academic or government laboratories supported by the NIH and the NCI.

The characterization of genetic profile of an individual's cancer at the time of diagnosis is becoming a routine practice in major medical centers today. This genetic analysis complements more traditional methods in pathology, with the goal of tailoring the therapy to a well-defined subtype of a given cancer type. The

NCI has recently launched the Molecular Analysis for Therapy Choice (NCI-MATCH) trial to test the clinical benefit of assigning patients to specific drug regiments based on the genetic profile of their tumor (7). Multiple NCI-designated Cancer Centers and NCORP sites are participating in the NCI-MATCH trial. The results of this and similar clinical trials will inform clinical practice for all cancer patients in the future.

Basic research into the function of the immune system and its interaction with cancer has allowed for the development of a series of new medicines that stimulate immune responses against cancer cells. Several of these drugs have been approved by the FDA, and they are having remarkable effects for patients with multiple types of cancer. Hundreds of clinical trials are ongoing to test new immuno-oncology drugs and other forms of treatment, which are also showing great promise. The development of this new class of medicines, which are expected to be the backbone of cancer treatment of many forms of cancer in the future, can be traced back to research funded by the NIH and the NCI.

Recommendations of the Cancer Moonshot Blue Ribbon Panel

Over the first half of 2016, the Cancer Moonshot Blue Ribbon Panel engaged more than 150 scientists, clinicians, medical professionals, industry representatives and patient advocates to develop a set of recommendations that would form the basis of the Moonshot research effort, if funded. The Panel was tasked by Vice President Biden to define opportunities that would allow the field to achieve in five years that would have otherwise taken ten without this dedicated funding. Through various outreach efforts, the Panel also considered more than 1,600 suggestions submitted by the cancer research community. The product of this effort is the Blue Ribbon Panel Report, which lists ten major recommendations (1). Importantly, the Panel envisioned that the research efforts undertaken by the Moonshot to address these recommendations would involve the collaborative efforts of academic laboratories, government laboratories and administrators as well as industry. Moreover, these “mission-focused” efforts were expected to complement the ongoing discovery research programs funded through the NCI research portfolio from its annual appropriation.

Of these important recommendations, I will focus here on just one: the establishment of National Cancer Data Infrastructure for Sharing and Analysis. In an era of increasingly complex and high throughput data related to cancer, it is critical that this information be stored in a fashion where it can be readily accessed and analyzed by researchers, clinicians, and, where appropriate, patients. This recommendation anticipates the development of a series of interconnected and interoperable databases as well as analytical methods that would store cancer-related information and improve data access and analysis. Although efforts to achieve related goals are underway in many centers in the

country, as well as at the NCI, the Panel recommended that a national resource was necessary to ensure appropriate access to data and improve the interoperability of the stored data. The successful execution of this recommendation will require the cooperativity and collaboration of the public and private sectors, with the NCI playing a critical coordinating role.

Across all of the recommendations of the Blue Ribbon Panel, there is a strong emphasis on the importance of technology development in advancing progress against cancer. This is an area of particular interest to me, in part because the Koch Institute for Integrative Cancer Research was formed to bring together cancer scientists and cancer-oriented engineers at MIT. Thus, we have a strong emphasis on technology development as well. Of note, the formation of the Koch Institute was inspired by grants from the NCI that funded interdisciplinary teams of investigators in areas such as computational and mathematical modeling of complex processes in cancer and nanotechnology applications to cancer treatment and early detection. The continued funding of interdisciplinary, collaborative approaches to cancer is critical to achieving the goals of the Cancer Moonshot and for advancement of cancer research discoveries more generally.

The passage of the 21st Century Cures Act provides $1.7 billion to support the Cancer Moonshot, with $300 million allocated for FY2017. The NCI has formed a series of implementation teams to begin to plan for use of these funds in support of research to pursue the recommendations of the Blue Ribbon Panel. The funding structures, collaborative mechanisms, and review and oversight processes that are used to launch and monitor this effort will be key to its success. Because of the need for flexibility in funding through this program, Congress should consider granting Other Transaction Authority to the NCI in the use of these funds.

The importance of investment in biomedical research on training and the economy

Federal support for biomedical research is essential for improving the health of our citizens. It is also critical to economic welfare of the country. For example, it is estimated that for every 1% reduction on cancer death rates there is an approximately $500 billion value to current and future generations of Americans; effectively curing or preventing cancer is estimated to be worth $50 trillion to the US economy (8). Advances in biomedical research broadly and cancer research more specifically leads to massive investment from the private sector, including research and development investment in established companies and venture capital investment in the formation of new companies. In Massachusetts alone, there are more than 60,000 jobs in the biopharmaceutical industry.

The Koch Institute at MIT is located in Kendall Square in Cambridge. This area has undergone a remarkable economic revitalization over the past three decades and is now the leading center of biomedical research and development in the world. The numerous companies that have located their headquarters and research operations in the Kendall Square and Greater Boston area have chosen to do so because of the proximity of great research universities such as MIT and Harvard. These universities depend on the NIH to support their biomedical research enterprise. Biomedical research in academic laboratories is an engine in the innovation economy in the United States. The NIH budget is its major source of fuel.

Most biomedical researchers—whether they work in academic, government or industry laboratories—receive their training at research universities. Graduate students, post-doctoral fellows, MD/PhD students, and technical staff are trained though their involvement in research projects in academic laboratories. The bulk of the projects that they pursue are funded through NIH grants. Thus, the NIH is a critical component of readying the American workforce to participate in this sector of the innovation economy. Reductions in funding, like those proposed in President Trump's preliminary FY2018 budget document, would have a direct and devastating effect on the number of trainees that could be supported. Such cuts would lead to significantly fewer grants funded and the likely closure of many biomedical research laboratories around the country. This is especially striking since the support of science in other countries is increasing at this time. As one example, the 13th five-year plan recently announced by the Chinese government includes a proposed 9.1% increase in science funding (9). These developments threaten to undermine the dominant position that the biomedical research in the United States currently maintains.

The increase in funding for the NIH in the FY2016 budget was a welcome relief for our field after 13 years of stagnant budgets. This period saw the success rates of grant applications drop into the low double digits or, in some cases, single digits. Grant awards were cut and overall budgets were not sufficient to keep pace with inflation. Collectively, this trend in funding led many young people to question the wisdom of a career in academic biomedical research, thus threatening the pipeline of talent for years to come. The FY2016 increase for NIH and the positive negotiations for the FY2017 budget were widely seen as a bi-partisan reaffirmation of the importance of biomedical research for the health and economy of the United States. The passage of the 21st Century Cures Act was similarly positive. The President's preliminary FY2018 budget document has had a chilling effect on our colleagues and on our trainees. If it were to stand, the effects on the American biomedical research enterprise would be felt for years to come.

Concluding remarks

The federal investment in cancer research in the United States that has occurred since the launching of Richard Nixon's War on Cancer has produced a deep understanding of a wide range of cellular and physiological processes that are dysregulated during cancer development. These insights have enabled the development of powerful classes of new anti-cancer agents that are benefitting thousands of cancer patients today. In the not-too-distant future, targeted therapies, immune-stimulating agents, nanotechnology-based drugs and more will be the mainstays of cancer treatment, leading to improved response rates, longer response times and, increasingly, cures. The United States has led the way in achieving this progress, and we are poised to do a great deal more.

I would suggest now is the time to redouble our efforts, not retreat.

References:

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