Testimony of Beth A. Garvy, Ph.D., on behalf of The American Association of Immunologists (AAI), Submitted to the House Appropriations Subcommittee on Labor, Health and Human Services, Education, and Related Agencies, Regarding the Fiscal Year 2018 Budget for the National Institutes of Health (March 6, 2017)

The American Association of Immunologists (AAI), the nation's largest professional society of research scientists and physicians who study the immune system, respectfully submits this testimony regarding fiscal year (FY) 2018 appropriations for the National Institutes of Health (NIH). ***AAI recommends an appropriation of at least $35 billion for NIH for FY 2018*** to fund promising new and important ongoing research; to encourage the world's most talented scientists, trainees, and students to pursue biomedical research careers in the United States; and to enable NIH to continue to serve as an independent voice for, and strong leader of, the nation's biomedical research enterprise.

Why the Immune System – and Immunology Research – Matters

As the body's primary defense against viruses, bacteria, parasites, toxins, and carcinogens, the immune system can protect its host from a wide range of infectious diseases, including influenza, and from chronic illnesses, such as cancer. But the immune system can underperform, leaving the body vulnerable to disease, such as those caused by human immunodeficiency virus (HIV) and Zika virus; and it can go awry, attacking normal organs and tissues and causing autoimmune diseases including allergy, asthma, inflammatory bowel disease, lupus, multiple sclerosis, rheumatoid arthritis, and type 1 diabetes. Immunologists study how the immune system works; how it may be harnessed to help prevent, treat, or cure disease; and how it can be used to protect people and animals from infectious organisms, including antibiotic resistant bacteria, and others, such as anthrax, smallpox, and plague, that could be used as bioweapons.

Recent Discoveries Harness the Power of the Immune System to Prevent and Fight Disease

1. Using the immune system to treat cancer - Immunotherapy, which uses a patient's own immune system to fight disease, is transforming the treatment of cancer. NIH-funded basic researchers identified inhibitory receptors on immune cells that can be blocked, facilitating the immune system's ability to destroy tumor cells; clinical researchers then discovered that immunotherapy could fight cancer with much less toxicity than standard chemotherapy or radiation.[1] This research has contributed to the development of checkpoint inhibitor drugs, such as pembrolizumab (Keytruda®) and nivolumab (Opdivo®), which have recently received Food and Drug Administration (FDA) approval for the treatment of several cancer types, including melanoma, lymphoma, kidney, and head and neck cancer.[2] In October 2016, Keytruda® was approved by the FDA for the treatment of lung cancer, marking the first time that immunotherapy could be used as the initial treatment option for these patients (before standard options such as chemotherapy).[3]

In another promising approach to immunotherapy, NIH-supported clinical trials are examining the use of genetically engineered immune cells to treat many cancers, including kidney, bone, brain, and skin, as well as leukemia and lymphoma.[4] When combined with conventional approaches, these immune cells can enhance treatment results and permit the use of lower doses of conventional therapies, reducing harmful side effects and providing a treatment option for cancers that do not respond solely to conventional drugs.[5]

2. New way to prevent and treat allergies - Peanut allergies, which occur in 1-2% of people in the United States, continue to increase.[6] Death due to peanut allergy remains the number one cause of food-related anaphylaxis, and no treatment or cure exists. An NIH-funded study showed that the early introduction of peanut-containing foods significantly decreased the development of peanut allergy among children at high risk.[7] For individuals who already have peanut allergies, an ongoing NIH-sponsored clinical trial testing a wearable patch that delivers a small amount of peanut protein through the skin is showing great promise. The treatment, called epicutaneous immunotherapy or EPIT, trains the immune system to tolerate peanut-containing foods and has been shown to be safe and well-tolerated.[8] These studies have revealed new insight into the prevention and treatment of peanut - and potentially other - allergies.

3. Development of vaccines and treatments for emerging infectious diseases - NIH-funded research plays a key role in the development of vaccines and treatments to combat epidemics and other major public health threats. Researchers are working urgently to develop a vaccine to protect against the

Zika virus, which can hamper fetal development and cause birth defects (including microcephaly).[9] To contain this virus, which continues to spread (with over 40,000 cases reported within the U.S. and its territories as of February 2017), NIH-funded researchers have developed a promising DNA-based vaccine that is now being tested in a clinical trial.[10] Progress has also been made in developing a therapeutic strategy to protect against Ebola virus, which recently killed more than 11,300 individuals in West Africa.[11] In pre-clinical studies, NIH-funded scientists identified an antibody cocktail that was able to neutralize Ebola and protect against disease, even when administered after viral exposure.[12] Advances have also been made in efforts to protect against the Dengue virus: a vaccine candidate developed by NIH researchers has shown protection against infection and is now being tested in a multi-center Phase 3 clinical trial.[13]

NIH's Essential Role in the Biomedical Research Enterprise

As the nation's main funding agency for biomedical research, NIH supports the work of "more than 300,000 members of the research workforce" located at universities, medical schools, and other research institutions in all 50 states, the District of Columbia, and several U.S. territories.[14] More than 80% of its budget supports the work of these scientists through about 50,000 grants; about 10% of its budget supports roughly 6,000 researchers and clinicians who work at NIH facilities in Maryland, Arizona, Massachusetts, Michigan, Montana and North Carolina.[15] NIH funding strengthens the economies of the states where these researchers live and work; in 2015, it supported more than 350,000 jobs across the United States.[16] NIH also provides invaluable scientific leadership. Through congressional testimony and frank dialogue, NIH advises our nation's elected and appointed leaders on scientific advancements, needs, and threats. This open exchange is essential to ensuring that urgent and long-term scientific needs are addressed, and that taxpayer funds directed to NIH are well-spent. In addition, as the leader of our nation's biomedical research enterprise and the steward of more than $32 billion in taxpayer dollars, NIH governs the conduct of scientific research and fosters collaborations between government and academia; between U.S.-based scientists and their international colleagues, who are invaluable to our nation's research enterprise; and between government and industry, which depends on the innovative and sometimes high-risk basic research supported by NIH to fuel their own advances in drug and medical device development.[17] These NIH leadership responsibilities, which include consultation with, and notice to, a broad and diverse stakeholder community, require skilled personnel. Therefore, AAI urges that NIH scientific and administrative personnel be exempted from any government hiring freeze.

Recent Funding Increases Have Eased, Not Eliminated, Erosion of NIH Purchasing Power

Recent NIH funding increases, including $2 billion in FY 2016 and $352 million in FY 2017 (through the 21st Century Cures Act) have helped restore some of the purchasing power that NIH lost from years of inadequate budgets that were eroded further by biomedical research inflation.[18] Although AAI is extremely grateful to Congress for these funding increases (and for the Cures Act's FY 2018 authorization of $496 million to supplement regular NIH appropriations), AAI remains concerned that NIH's purchasing power is still (to date, before approval of FY 2017 appropriations) more than 19% below what it was in FY 2003.[19] In addition to limiting ongoing and promising new research and delaying discoveries that might lead to new treatments or cures, these funding constraints have a deleterious impact in other ways, forcing some productive researchers to lay off staff, close their labs, or move overseas, where support for biomedical research continues to grow.[20] Perhaps most importantly, inadequate or uncertain funding is deterring many promising young people from pursuing careers in biomedical research, threatening the viability of the next generation of researchers, doctors, professors, and inventors. Regular, predictable, and robust funding increases for NIH, through the timely passage of annual appropriations bills, would strengthen and stabilize NIH and the biomedical research enterprise.

Conclusion

AAI greatly appreciates the subcommittee's continued strong bipartisan support for NIH and biomedical research through annual appropriations and the 21st Century Cures Act, urges ongoing frank dialogue with NIH leaders and stakeholders, and recommends an appropriation of *at least $35 billion* for NIH in FY 2018.

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[2] See https://www.cancer.gov/about-cancer/treatment/drugs for list of drug approvals

[3] https://www.fda.gov/Drugs/InformationOnDrugs/ApprovedDrugs/ucm526430.htm

[4] https://clinicaltrials.gov/ (NCT01218867, NCT02107963, NCT00924326, NCT02153580); Johnson, L.A., *et al*. 2017. Driving gene-engineered T cell immunotherapy of cancer. *Cell Research* 27: 38-58.

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[11] http://www.who.int/csr/disease/ebola/en/

[12] Corti, D., *et al*. 2016. Protective monotherapy against lethal Ebola virus infection by a potently neutralizing antibody. *Science* 351: 1339-1342.

[13] Kirkpatrick, B.D., *et al.* 2016. The live attenuated dengue vaccine TV003 elicits complete protection against dengue in a human challenge model. *Sci. Transl. Med.* 8: 330-336.; https://www.niaid.nih.gov/news-events/dengue-vaccine-enters-phase-3-trial-brazil

[14] http://www.nih.gov/sites/default/files/about-nih/strategic-plan-fy2016-2020-508.pdf;
http://www.nih.gov/about-nih/what-we-do/budget;
https://report.nih.gov/award/index.cfm?ot=&fy=2016&state=&ic=&fm=&orgid=&distr=&rfa=&om=n&pid=#tab1

[15] See footnote 14; https://www.training.nih.gov/resources/intro_nih/other_locations

[16] Ehrlich, Everett. NIH's Role in Sustaining the U.S. Economy. *United for Medical Research,* http://www.unitedformedicalresearch.com/advocacy_reports/nihs-role-in-sustaining-the-us-economy-2/

[17] http://www.help.senate.gov/imo/media/Innovation_for_Healthier_Americans.pdf;
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