

**Testimony of David D. Chaplin, M.D., Ph.D.,
on behalf of The American Association of Immunologists (AAI),
Submitted to the Senate Appropriations Subcommittee on
Labor, Health and Human Services, Education, and Related Agencies,
Regarding the Fiscal Year 2020 Budget for the National Institutes of Health
May 28, 2019**

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) 2020 appropriations for the National Institutes of Health (NIH). **AAI recommends an appropriation of at least \$41.6 billion for FY 2020** to enable NIH to fund critically important new and ongoing immunological research, support the current – and next – generation of biomedical researchers, and ensure continued U.S. leadership in basic, translational, and clinical research.

The Recent History (with a Nobel Prize) – and the Exciting Future – of Immunology

For more than a century, the immune system had been defined by its role protecting against infectious agents, such as viruses, bacteria, and parasites, that cause disease. That understanding has evolved dramatically. Research has since demonstrated that the immune system can also be harnessed to great purpose: it can kill malignant tumors, manage autoimmune diseases, and promote healing.

In 2018, the Nobel Prize in Physiology or Medicine was awarded to two AAI members, American immunologist and NIH grantee James Allison, Ph.D., and Japanese immunologist Tasuku Honjo, M.D., Ph.D., for their groundbreaking discovery that the immune system's natural brakes, which prevent excessive harm to the body's own cells, can be released, allowing immune cells to attack and kill tumor cells. This key finding has led to the development of immunotherapy agents known as checkpoint inhibitors, which have now been approved by the Food and Drug Administration (FDA) for the treatment of several solid tumors and blood cancers.¹ According to the Nobel Committee, this "entirely new principle for cancer therapy"... "constitute[s] a landmark in our fight against cancer."² These Nobel Laureates, and many other AAI members and scientists, have built on this discovery to help develop drugs and therapies that are not only transforming how we prevent, treat, and potentially cure several types of cancer, but are also showing similar promise for many other diseases, including rheumatoid arthritis, type 1 diabetes, and inflammatory bowel disease.³

The immune system, once thought to be a discrete system, has been shown to be a complex network of cells and organs that has an impact on virtually every other organ of the body and plays a significant role in preventing, contracting, and fighting innumerable infectious, autoimmune, and chronic diseases, including Alzheimer's disease, cardiovascular disease, HIV/AIDS, influenza, measles, tuberculosis, Ebola, and other public health threats. This progress has led to a greater understanding of the immune system, and the recognition that immune system-driven inflammation can not only promote healing, but if overexuberant, can also exacerbate human disease.

Recently, significant developments in immunology research include:

- *Immunotherapy*: Although immense progress has been made to use the immune system to kill cancer cells, much research is still needed to improve on existing, and develop new, immunotherapies. For

example, not all tumors appear susceptible to immune cell killing, and NIH-funded research continues to investigate how to address this challenge.⁴ In addition, because not all patients benefit from immunotherapy, there is significant effort underway to understand why and when this treatment is effective.⁵ Finally, because certain tumors appear to become resistant to some immunotherapy treatments, research to discover next generation approaches is necessary.⁶

- *Universal influenza vaccine*: Despite the existence of a seasonal influenza virus (flu) vaccine, flu remains a major cause of disease, with an estimated 9.3 to 49 million illnesses and 12,000 to 79,000 deaths annually in the United States.⁷ Although vaccination is still the best way to protect against getting sick, the current flu vaccine is suboptimal in part because it must be re-administered annually and does not induce broad cross-protection that would provide immunity against newly emerging flu strains that have pandemic potential. NIH is supporting the development of a universal flu vaccine, which has the potential to provide broad protection for all age groups against many flu strains.⁸ NIH-sponsored clinical trials of universal flu vaccine candidates have been launched in 2018 and 2019.⁹
- *Discovery of immune cell infiltration into the brain*: Historically the brain has been described as an immunologically privileged site, in part because of the apparent lack of classical lymphatic vessels throughout the body that allow immune cells to circulate. However, meningeal lymphatic vessels were discovered in 2015, earning a “Breakthrough of the Year” nomination by *Science* magazine.¹⁰ This discovery confirmed a connection between the immune and nervous systems which had not been previously recognized. A 2018 NIH-funded study then showed microscopic “tunnels” or vessels used to transport immune cells directly to sites of brain injury, providing ways for immune cells to contribute to healing from the injury. Further research is needed to determine whether these newly discovered vessels may be useful for drug delivery in the future for stroke, Alzheimer’s, and other brain diseases, or whether they could be harmful by contributing to immune damage to the brain.¹¹

As described in part in the examples above, immunologists have made extraordinary progress, but there is still much to do. The next series of breakthroughs will be achieved only with strong federal support.

NIH’s Essential Role in the Nation’s – and the World’s – Biomedical Research Enterprise

As the nation’s major funding agency for biomedical research, NIH distributes approximately 80% of its budget to more than 300,000 researchers at about 2,500 universities, medical schools, and other research institutions in all 50 states, the District of Columbia, several U.S. territories, and internationally.¹² NIH also devotes about 10% of its budget to supporting approximately 6,000 additional researchers and clinicians who work at NIH facilities located in Maryland, Arizona, Montana, and North Carolina.¹³ By supporting researchers and laboratories across the nation, NIH funding not only draws on the ideas of the best scientists in the country, but also strengthens state and local economies; in 2018, NIH funding supported more than 433,000 jobs across the U.S.¹⁴

The research generated by NIH funding is also critically important to the nation’s highly successful pharmaceutical industry: according to a 2018 report published in the *Proceedings of the National Academies of Sciences*, NIH-funded research contributed to all 210 of the new drugs approved by the FDA from 2010-2016.¹⁵ This may be the strongest evidence to date that NIH-funded basic research is an essential and irreplaceable part of the biomedical research pipeline, leading to lifesaving and life-changing new drugs.

NIH also serves as an indispensable scientific leader both in the U.S. and internationally. The steward of more than \$39 billion in federal funds, NIH keeps our nation's leaders apprised of scientific advancements, research priorities, and emerging threats, and works to ensure that taxpayer dollars are properly and prudently spent. It oversees and establishes standards for the conduct of scientific research at academic institutions in the U.S. NIH also develops and sustains collaborations between the U.S. and other nations to work toward common goals, and between the federal government and the private sector, including the pharmaceutical, biotechnology, and medical device industries, which rely on NIH-supported basic research to provide a foundation of new knowledge upon which they can build.

Funding Increases Have Restored Some, But Not All, of NIH's Purchasing Power

Through generous, needed increases of \$3 billion in FY 2018 and \$2 billion each in FY 2016, FY 2017, and FY 2019 (including supplemental funding to support initiatives authorized by the 21st Century Cures Act), this subcommittee and the full Congress have helped restore some of the lost purchasing power that NIH experienced following years of insufficient budgets and erosion from biomedical research inflation; once ~25% below its peak funding level (2003), the gap has eased to ~9%. Robust funding increases will continue to be needed to close this gap and allow the research enterprise to grow to meet current opportunities. As the baby boom generation continues to retire, it is even more urgent that we ensure a dynamic research environment that will allow for the training, development, and support of our next generation of researchers, doctors, professors, and inventors. Timely, robust funding increases for NIH and other science agencies would bolster confidence among current and emerging American researchers who are unsure about the future of academic science.

Conclusion

AAI greatly appreciates the subcommittee's strong, continuous bipartisan support for NIH and urges an appropriation of at least \$41.6 billion for FY 2020. Such a robust increase in regular appropriations, combined with funding the 21st Century Cures Act initiatives to their fully-authorized FY 2020 levels, will continue to strengthen NIH's ability to fund research that advances our fundamental knowledge of biology, support talented scientists and trainees pursuing research careers in the United States, and provide hope to all who are impacted by disease or disability.

¹ <https://www.fda.gov/drugs/informationondrugs/approveddrugs/ucm279174.htm>

² <https://www.nobelprize.org/prizes/medicine/2018/press-release/>

³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4896612/>;
<https://www.ncbi.nlm.nih.gov/pubmed/28260183>;
<https://www.ncbi.nlm.nih.gov/pubmed/29624476>

⁴ <https://www.ncbi.nlm.nih.gov/pubmed/28159861>

⁵ <https://jamanetwork.com/journals/jama/fullarticle/2719519>

⁶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5391692/>

⁷ <https://www.cdc.gov/flu/about/disease/burden.htm>

⁸ <https://www.niaid.nih.gov/news-events/niaid-unveils-strategic-plan-developing-universal-influenza-vaccine>

⁹ <https://www.niaid.nih.gov/news-events/niaid-sponsored-trial-universal-influenza-vaccine-begins>; <https://www.nih.gov/news-events/news-releases/nih-begins-first-human-trial-universal-influenza-vaccine-candidate>

¹⁰ <https://www.nih.gov/news-events/nih-research-matters/lymphatic-vessels-discovered-central-nervous-system>; <http://science.sciencemag.org/content/350/6267/1458>

¹¹ <https://www.ninds.nih.gov/News-Events/News-and-Press-Releases/Press-Releases/Researchers-unearth-secret-tunnels-between-skull>

¹² <https://www.nih.gov/about-nih/what-we-do/budget>; <https://report.nih.gov/award/index.cfm>

¹³ <https://irp.nih.gov/about-us/research-campus-locations>

¹⁴ http://www.unitedformedicalresearch.com/advocacy_reports/nih-role-in-sustaining-the-us-economy-2019-update/

¹⁵ <https://directorsblog.nih.gov/2018/02/27/basic-research-building-a-firm-foundation-for-biomedicine/>