

**Testimony of Ross M. Kedl, 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 2021 Budget for the National Institutes of Health
March 20, 2020**

The American Association of Immunologists (AAI), the nation's largest professional society of research scientists and physicians who are dedicated to understanding the immune system through basic, translational, and clinical research, respectfully submits this testimony regarding fiscal year (FY) 2021 appropriations for the National Institutes of Health (NIH). **AAI recommends an appropriation of at least \$44.7 billion for FY 2021** to enable NIH to fund critically important research to prevent dangerous infectious diseases and treat debilitating chronic diseases, support meritorious scientists at all career stages, and ensure a robust biomedical research enterprise that maintains U.S. preeminence in science and innovation.

Public Health Importance of Understanding the Immune System

While recent attention to the immune system has focused on its ability, properly harnessed, to kill malignant tumors and treat other chronic diseases (immunotherapy), the coronavirus pandemic has highlighted the immune system's critical role in protecting against infectious agents – including viruses – that cause disease. The immune system plays a significant role in preventing and fighting existing and emerging infectious diseases such as HIV/AIDS, influenza, measles, tuberculosis, and Ebola. It is also central to many chronic conditions such as Alzheimer's and cardiovascular disease. Research into many of these diseases has helped scientists take on our most recent challenge: understanding the cause, prevention, and treatment of a novel coronavirus, SARS-CoV2, and its consequent disease, COVID-19. Significant recent developments in immunology research are described below.

Vaccines for SARS-CoV2/Emerging Infectious Diseases: Vaccines are the most efficient and effective method of disease prevention. Globally, vaccination against more than two dozen viral, bacterial, and fungal diseases prevents about 2.5 million deaths and reduces the severity of illness for millions of people

annually.¹ As the world's population grows and becomes more interconnected, the threat of a new emerging pathogen causing a worldwide pandemic, which has long been feared, has been realized: on March 11, 2020, the World Health Organization declared the novel coronavirus outbreak a pandemic. Although there is currently no approved vaccine for SARS-CoV2 or treatment available for COVID-19, NIH-funded research conducted on other causative pathogens in recent epidemics, including SARS (now known as SARS-CoV1) (2002) and MERS (2012), has made possible the rapid development of vaccine candidates for SARS-CoV2.² While no vaccine is likely to be approved for at least another year, a candidate vaccine developed in part by researchers at the National Institute of Allergy and Infectious Diseases' Vaccine Research Center has already moved into a clinical trial at a rate never before observed in the history of vaccine development.³ In addition, anti-viral therapeutics supported by NIH-funded research are already in, or are moving toward, clinical testing for efficacy against SARS-CoV2.⁴ AAI is optimistic that previously conducted research, together with new research now being urgently pursued, will result in new vaccines and treatments that will prevent and/or reduce the lethality of COVID-19.

With regard to other infectious diseases, NIH-funded research has allowed scientists to make significant advances in understanding and developing vaccines against many emerging infectious agents. In 2019 alone, this research helped lead to a Food and Drug Administration (FDA)-approved Ebola vaccine, a phase-I clinical trial for a Zika vaccine, and a multi-national phase-3 clinical trial for an HIV vaccine.⁵ Researchers have also begun early-stage clinical trials of a universal vaccine for influenza, a disease that results in 9 – 45 million illnesses and 12,000 – 61,000 deaths per year in the U.S.⁶ Without strong, steady support from NIH, researchers will be ill-prepared to respond to new emerging diseases threatening the safety of Americans and people around the world.

Cancer Immunotherapy: Cancer immunotherapy harnesses the immune system of the patient to fight tumors, contributing to substantial reductions in cancer mortality. These treatments include engineered tumor-specific immune cells (adoptive cell therapy), therapies that restore cellular functional capacity to

exhausted immune cells (checkpoint blockade), and vaccines to generate new immune responses against the tumor. In 2019, the FDA approved immunotherapies for several types of cancer, including breast, bladder, uterine, kidney, and esophageal.⁷

- Adoptive cell therapy: The success of chimeric antigen receptor T cells (CAR-T; T cells engineered to express novel receptors targeting specific tumor-associated molecules) in the treatment of B cell lymphomas has led to current NIH-funded clinical trials testing the efficacy of CAR-T cells in solid tumors, such as for patients with glioblastoma and pancreatic cancer.⁸
- Checkpoint blockade therapy: Recent advances in this area have provided substantial benefit in clinical trials to oncology patients with solid tumors, including melanoma, non-small-cell lung carcinoma, and glioblastoma.⁹ Additional research efforts aim to increase the efficacy of this treatment by identifying combinatorial therapies and biomarkers of successful treatment.¹⁰
- Vaccines: An existing therapeutic vaccine targets prostate cancer, with ongoing clinical trials testing novel vaccines designed to combat multiple myeloma and breast cancer.¹¹ Additionally, meta-analyses of a decade of human papilloma virus (HPV) vaccinations have provided compelling evidence of the vaccine's efficacy and safety, leading to new efforts to reduce HPV-related cervical cancer.¹²

Ongoing NIH-funded research seeks to identify new opportunities to improve the efficacy of immunotherapies for additional cancer types as well as exploring its use as a treatment for other life-threatening or debilitating conditions, including heart disease and autoimmune conditions.¹³

Vaping: Since 2007, the U.S. has seen an exponential increase in the use of e-cigarettes. In 2018, one in 20 middle school and one in five high school students was using e-cigarettes.¹⁴ This increased use has resulted in an outbreak of e-cigarette or vaping associated lung injuries (EVALI), with nearly 3,000 cases of hospitalization or death.¹⁵ Pathological analyses of lung injury patterns demonstrate extensive lung inflammation in these cases.¹⁶ While inflammation – the immune system's response to injury – is usually a

sign of healing, excessive inflammation for a prolonged period of time will cause lung damage that can be fatal. As a result, NIH is currently supporting research to investigate the pathogenesis of EVALI, including studies of especially vulnerable populations, such as those with allergies or asthma.¹⁷

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 supports more than 300,000 researchers at ~2,500 universities, medical schools, and other research institutions across the nation and internationally,¹⁸ as well as ~6,000 additional researchers and clinicians who work at NIH facilities around the country.¹⁹ By supporting these researchers and laboratories, NIH funding strengthens state and local economies; in 2019, NIH funding supported more than 476,000 jobs and accounted for \$81 billion in economic activity across the U.S.²⁰ NIH-funded basic research is also an essential and irreplaceable part of the biomedical research pipeline, leading to lifesaving and life-changing new drugs. In 2018, NIH-funded research contributed to all 210 of the new drugs approved by the FDA from 2010-2016.²¹

NIH also serves as an indispensable scientific leader both in the U.S. and internationally. The steward of nearly \$42 billion in federal funds, NIH keeps our nation's leaders apprised of scientific advancements and research priorities and works to ensure that taxpayer dollars are prudently spent. It oversees and establishes rules governing the conduct of scientific research and the research enterprise, working most recently to combat sexual harassment in science and address concerns about foreign influence in science. NIH also plays an essential role in responding to emerging threats; during the current novel coronavirus pandemic, NIH is providing vital scientific expertise to the President, Congress, and the American public while supporting urgently needed efforts to develop treatments and a vaccine.

Funding Increases Continue to Rebuild NIH Capacity

Congress, led by this subcommittee, has invested robustly in NIH in recent years, including a \$2.6 billion budget increase for FY 2020. This increase has helped restore much of the purchasing power that NIH lost after years of inadequate budgets and erosion from biomedical research inflation; once more than 22%

below its peak funding level (2003), the gap has eased to ~5.4%.²² Meaningful budget growth remains necessary to close this gap and allow NIH to make needed investments in important research priorities across all NIH Institutes and Centers. As the baby boom generation continues to retire, it is even more urgent to 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 would instill further confidence in these essential early- and mid-career researchers.

Conclusion

AAI greatly appreciates the subcommittee's strong support for NIH and urges an appropriation of at least \$44.7 billion for FY 2021. This funding level will provide needed growth across NIH, including for vital immunologic research, support meritorious scientists at all career stages, and help scientists discover ways to prevent, treat, and cure diseases that afflict people in the U.S. and around the world.

¹ https://www.who.int/immunization/global_vaccine_action_plan/GVAP_doc_2011_2020/en/

² <https://www.niaid.nih.gov/diseases-conditions/coronaviruses>

³ <https://www.nih.gov/news-events/news-releases/nih-clinical-trial-investigational-vaccine-covid-19-begins>

⁴ <https://www.nih.gov/news-events/news-releases/nih-clinical-trial-remdesivir-treat-covid-19-begins>

⁵ <https://directorsblog.nih.gov/2020/01/02/celebrating-biomedical-breakthroughs-in-2019/>; <https://www.nih.gov/news-events/news-releases/nih-begins-clinical-trial-live-attenuated-zika-vaccine>; <https://www.nih.gov/news-events/news-releases/nih-partners-launch-hiv-vaccine-efficacy-trial-americas-europe>

⁶ <https://www.cdc.gov/flu/about/burden/index.html>; <https://www.nih.gov/news-events/news-releases/nih-begins-first-human-trial-universal-influenza-vaccine-candidate>

⁷ <https://www.cancerresearch.org/immunotherapy/timeline-of-progress#>

⁸ <https://clinicaltrials.gov/> (NCT04003649, NCT02830724)

⁹ <https://www.ncbi.nlm.nih.gov/pubmed/30742122>; <https://www.ncbi.nlm.nih.gov/pubmed/30407895>

¹⁰ <https://www.ncbi.nlm.nih.gov/pubmed/31636208>; <https://www.ncbi.nlm.nih.gov/pubmed/30318169>

¹¹ <https://www.cancer.gov/about-cancer/treatment/types/immunotherapy/cancer-treatment-vaccines>;

<https://clinicaltrials.gov/> (NCT03376477, NCT00971737)

¹² <https://www.ncbi.nlm.nih.gov/pubmed/31255301>; <https://www.ncbi.nlm.nih.gov/pubmed/31990905>

¹³ <https://www.ncbi.nlm.nih.gov/pubmed/31511695>; <https://www.ncbi.nlm.nih.gov/pubmed/31957209>

¹⁴ https://www.cdc.gov/tobacco/basic_information/e-cigarettes/surgeon-general-advisory/index.html

¹⁵ https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html

¹⁶ <https://www.hindawi.com/journals/cripu/2020/6138083/>; <https://pubs.rsna.org/doi/10.1148/radiol.2020192585>

¹⁷ <https://www.niaid.nih.gov/grants-contracts/vaping-and-lung-injury>

¹⁸ <https://www.nih.gov/about-nih/what-we-do/budget>; <https://report.nih.gov/award/index.cfm>

¹⁹ <https://irp.nih.gov/about-us/research-campus-locations>

²⁰ <https://www.unitedformedicalresearch.org/wp-content/uploads/2019/04/NIHs-Role-in-Sustaining-the-US-Economy-FY19-FINAL-2.13.2020.pdf>

²¹ <https://directorsblog.nih.gov/2018/02/27/basic-research-building-a-firm-foundation-for-biomedicine/>

²² <https://crsreports.congress.gov/product/pdf/R/R43341>