

WHY IMMUNOLOGY RESEARCH MATTERS

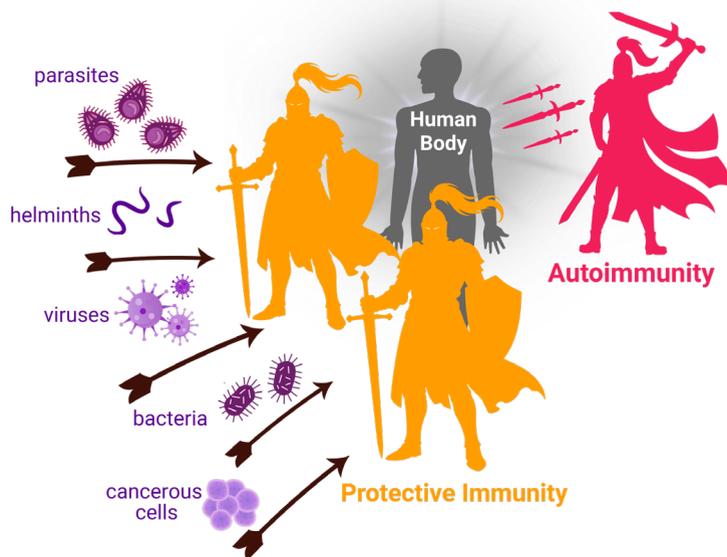


The Importance of Immunology Research

The immune system is the body's primary defense against viruses, bacteria, parasites, and other pathogens that cause disease in millions of people every year. In addition, the immune system helps the body resist the development of cancer and other illnesses. When things go wrong with the immune system, it can contribute to chronic diseases such as allergy, asthma, inflammatory bowel disease, lupus, multiple sclerosis, psoriasis, rheumatoid arthritis, type 1 diabetes, and other autoimmune conditions.

The immune system intersects with almost every aspect of human health and disease. Its functions, both when things are going well and when things go wrong, are immensely complicated.

This is why immunology research is vital. Scientists and clinicians need to better understand the complex network of cells, tissues, and organs that work to protect you from infectious diseases and other threats, or that contribute to autoimmune diseases. And they need to use that knowledge to develop better ways to prevent and treat disease.



 American
Association of
Immunologists™



Learn More
aai.org

Major Immunological Advances in Preventing and Treating Infectious Diseases

Vaccines

Vaccination is one of the greatest public health achievements in history, having prevented hundreds of millions of deaths, averted trillions of dollars in healthcare costs, transformed global health, and drastically increased life expectancy.¹ For example, NIH-funded research led to the development of vaccines against human papilloma virus (HPV), which has led to an 80% decrease in cervical cancer, and respiratory syncytial virus (RSV), which has dramatically reduced the rate of hospitalization and intensive care unit admission for infants.

The power of vaccines extends beyond infectious diseases. The shingles vaccine has been shown to reduce the risk of dementia, and vaccines also have potential to treat and/or prevent autoimmune diseases, cardiovascular disease, allergies, and even addiction.

Declining trends in vaccine coverage, however, threaten the health and wellbeing of Americans. In 2025, the U.S. experienced the highest number of confirmed measles cases, and three confirmed deaths, since it was deemed eliminated from the U.S. in 2000, with 93-94% of cases occurring in unvaccinated children.² The 2024-2025 flu season was exceptionally severe with the highest number of U.S. cases since tracking began in 2004 and a record number of pediatric deaths, 90% of whom were unvaccinated.³ As vaccination rates decline, outbreaks of preventable diseases will inevitably lead to increased rates of illness, long-term complications, and death.

mRNA Vaccines

The first FDA-approved mRNA vaccines, which protect against SARS-CoV-2, continue to reduce severe disease, hospitalization, and death from COVID-19. A recent cohort study of 22.7 million individuals vaccinated with COVID-19 mRNA vaccines and 5.9 million unvaccinated individuals found a 74% lower risk of death from severe COVID-19 among vaccinated individuals, with no increase in all-cause mortality over four years. Research is underway at NIH to develop a universal coronavirus vaccine and to better diagnose and treat Long COVID, an often debilitating post-infection condition.

The mRNA vaccine platform is now driving significant innovation in cancer (and in many other chronic and infectious diseases), offering new therapeutic and preventative possibilities for previously hard-to-treat cancers like pancreatic cancer and other solid tumors.^{4, 5}

HIV and AIDS

HIV is a virus that attacks the immune system and, if untreated, can lead to AIDS. Due in large part to NIH-funded research, HIV/AIDS is a highly manageable condition, with daily medicines allowing most people with access to treatment to keep the virus under control and live long, healthy lives. New long-acting treatments, such as lenacapavir, which is given by injection just 1-2 times a year and is almost 100% effective at preventing HIV transmission, and broadly neutralizing antibodies that suppress the virus, are being studied as longer-lasting options for treatment and prevention, offering hope for simpler care in the future.^{6, 7}

Influenza

Influenza (flu) is a respiratory virus that can cause serious illness, particularly in infants and the elderly, leading to the hospitalization and/or death of hundreds of thousands of people in the U.S. each year. Influenza mutates rapidly, leading to multiple strains that may spread in any given year. Newly emerging strains, like the recent H5N1 “bird flu” that has been circulating globally in birds, poultry, and mammals, have the potential to spill over into humans. Such strains can be more contagious and deadly, due to a lack of prior immunity, and have the potential to cause a pandemic. NIH-funded influenza research has driven several recent advances in vaccines, including testing needle-free, intranasal candidates, an investigational mRNA flu vaccine, and vaccines that are designed to provide universal protection against many different strains of influenza.

Malaria and Tuberculosis

Malaria and tuberculosis (TB) are leading global causes of death. An estimated 13 million Americans are infected with TB, and locally acquired cases of malaria were recently reported in the U.S. for the first time since 2003. NIH-funded research has led to several recent breakthroughs, including the distribution of the first licensed and World Health Organization (WHO)-recommended malaria vaccine; WHO endorsement of a second malaria vaccine, R21/Matrix-M; clinical trials which demonstrate protection against malaria by a monoclonal antibody; and a new vaccination method (intravenous) that provides the most effective protection ever achieved against TB.

¹ Shattock, A.J., Johnson, H.C., Sim, S., et al. 2024. “Contribution of Vaccination to Improved Survival and Health: Modelling 50 Years of the Expanded Programme on Immunization.” *The Lancet*. [https://doi.org/10.1016/S0140-6736\(24\)00850-X](https://doi.org/10.1016/S0140-6736(24)00850-X)

² <https://www.cdc.gov/measles/data-research/index.html>

³ <https://www.cdc.gov/mmwr/volumes/74/wr/mm7436a2.htm>

⁴ Sayour, E.J., Boczkowski, D., Mitchell, D.A., et al. 2024. “Cancer mRNA vaccines: clinical advances and future opportunities.” *Nature Reviews Clinical Oncology* 21(7):489-500. <https://doi.org/10.1038/s41571-024-00902-1>

⁵ Sethna, Z., Guasp, P., Reiche, C. et al. 2025. “mRNA neoantigen vaccines prime long-lived CD8+ T cells in pancreatic cancer.” *Nature* 639, 1042–1051. <https://doi.org/10.1038/s41586-024-08508-4>

⁶ <https://www.nih.gov/news-events/nih-research-matters/key-long-term-hiv-control>

⁷ <https://www.qilead.com/news/news-details/2025/yeztuqo-lenacapavir-is-now-the-first-and-only-fda-approved-hiv-prevention-option-offering-6-months-of-protection>

Immunological Advances that Have Changed the Course of Cancer, Autoimmune Diseases, and More

Cancer

Cancer research continues to focus on understanding the complex interactions between tumor cells and healthy cells, including immune cells. Scientists are also utilizing vast genetic and metabolic data to advance our understanding, diagnosis, and treatment of cancer.

Numerous advancements have been made in the field of cancer immunotherapy, in which the patient's own immune system is stimulated or suppressed to fight cancer. These include CAR-T cell therapy (engineered immune cells that can identify and eliminate tumor cells); cancer vaccine research; and better understanding of the microbiome's influence on tumor growth. Immunotherapies and targeted cancer therapies have resulted in long-term remission for some patients, including those who previously had limited options for successful treatment.

Autoimmunity

Autoimmune diseases are chronic illnesses in which a person's own immune system attacks their body. There are more than 100 autoimmune diseases that afflict over 50 million people in the U.S., 80 percent of whom are women. Autoimmunity can affect any region of the body, including the gastrointestinal system (e.g., inflammatory bowel disease), the musculoskeletal system (e.g., rheumatoid arthritis), the brain (e.g., multiple sclerosis), the metabolic systems (e.g., type 1 diabetes), and multiple organ systems at once (e.g., systemic lupus erythematosus).

NIH-supported research has identified the immune cells and molecules that cause some of these diseases, enabling the development of therapeutics. These medicines, including immunotherapies, have been used with some success to treat rheumatoid arthritis, multiple sclerosis, and inflammatory bowel disease. However, more research is needed to better understand and treat these and other autoimmune diseases, including allergies and asthma.

Inflammation of the Heart and Brain

Inflammation is the immune system's normal response to injury and infection. Excessive or chronic inflammation, however, can cause or exacerbate disease. For example, inflammation in the cardiovascular system can lead to heart attacks and strokes. New research has shown that age-associated mutations in immune cells can cause inflammation that is correlated with damage to heart tissue.

NIH-funded research has recently revealed a link between brain inflammation and memory deficits, including Alzheimer's disease (AD). Scientists are testing the efficacy of several vaccines and treatments, including a way to teach the immune system to clear out harmful plaques in the brain, to combat AD. NIH research on the role of a harmful plaque called amyloid led to the development and recent FDA approval of two anti-amyloid medications for the treatment of AD, and other innovative monoclonal antibodies are progressing through clinical trials.

Organ Transplantation

Organ, tissue, and bone marrow transplantation have been utilized successfully as therapeutic options for patients suffering from kidney, liver, lung, and heart failure; for certain cancers and genetic diseases; and after significant injury. Scientists are optimizing ways to prevent the immune system from rejecting the transplant without compromising its ability to fight infections. Research has greatly improved rates of survival and the quality of life of transplant patients, particularly by better matching patients and donors to prevent transplant rejection and graft versus host disease. Scientists have recently made significant strides in xenotransplantation (using organs from other species) and 3D tissue printing [including through the PRINT Initiative at the Advanced Research Projects Agency for Health (ARPA-H)], both of which could help overcome the major hurdle of insufficient organ availability.

(continued)



Economic Benefits of Biomedical Research

High Quality Jobs

Discoveries funded by the NIH make possible a vibrant and innovative U.S. life sciences industry which directly supported 2.3 million high-quality scientific jobs at 150,000 business establishments with an average annual salary of more than \$132,000 in 2023-2024.¹ These jobs are the economic engine for many communities around the nation.

In fiscal year (FY) 2024, NIH funding directly or indirectly supported 407,782² jobs at more than 2,500 academic and research institutions across the U.S.³

Return on Investment

Every \$1 of NIH funding produces \$2.56 in economic output.⁴ Investment in NIH contributed \$94.58 billion to the U.S. Gross Domestic Product in 2024.⁵

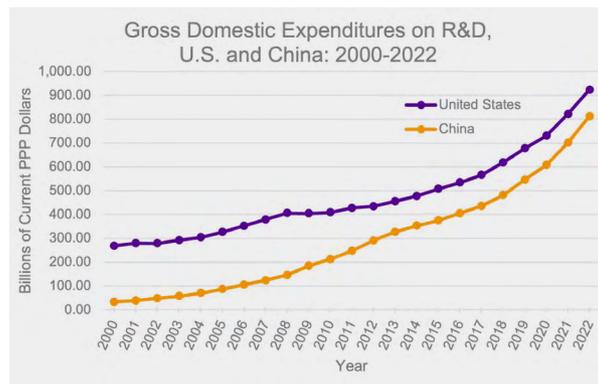
Impact on Industry

The basic research discoveries made by NIH-supported researchers are crucial to industry success in developing new products, including vaccines and other drugs, to prevent and treat disease. According to a bipartisan Senate Health, Education, Labor, and Pensions Committee report, “early stage research is high-risk—prone to high failure rates—making it less attractive to industry investment or undertaking, but these basic research findings form the foundation of the biomedical research continuum. NIH plays a vital role in its support of basic research. ...”⁶

A 2023 study, published in *JAMA Health Forum*, found that NIH funding contributed to 354 of the 356 drugs (99.4%) approved by the U.S. Food and Drug Administration from 2010 to 2019.⁷ This builds on previous evidence demonstrating that basic research funded by NIH is an essential and irreplaceable part of the biomedical research pipeline that leads to lifesaving and life-changing new drugs.

Global Competitiveness

Despite recent increases in federal biomedical research funding, the growth rate for U.S. research and development (R&D) spending remains relatively low, especially in comparison with some of our economic competitors. For example, from 2010-2022, China’s R&D spending increased by 12% annually, compared to an average annual increase of 7% in the U.S.⁸ Due to China’s strong and consistent investment in R&D, it has already surpassed the U.S. in key metrics, including the number of patents granted and the total number of scientific publications each year.⁹



Increased investment in U.S. R&D will bolster innovation, strengthen our economy, and give the U.S. a competitive edge, enabling the U.S. to maintain its preeminence in biomedical research.

- <https://bio.widen.net/s/hfimb92hwx/the-us-bioscience-economy-driving-economic-growth-and-opportunities-in-states-and-regions>
- https://www.unitedformedicalresearch.org/wp-content/uploads/2025/03/UMR_NIH-Role-in-Sustaining-US-Economy-FY2024-2025-Update.pdf
- <https://www.unitedformedicalresearch.org/annual-economic-report/>
- <https://www.nih.gov/about-nih/what-we-do/budget>
- See endnote 2
- See endnote 2
- http://www.help.senate.gov/imo/media/Innovation_for_Healthier_Americans.pdf
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10148199/>
- <https://nces.nsf.gov/pubs/nsb20257/global-r-d-and-international-comparisons-2#>
- <https://nces.nsf.gov/pubs/nsb20243/translation-u-s-and-global-science-technology-and-innovation-capabilities>



The National Institutes of Health (NIH): At a Glance



Source: National Institute of Allergy and Infectious Diseases, NIH

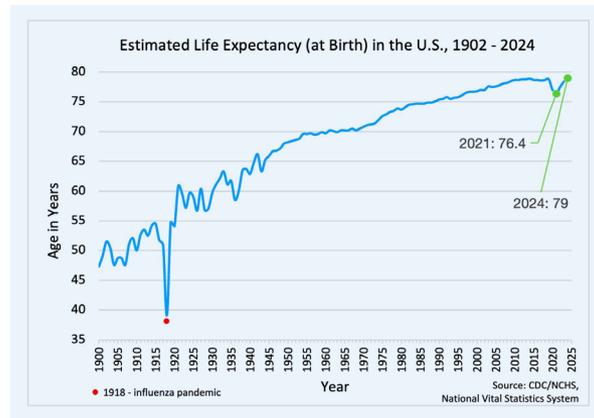
NIH's mission is “to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.”

NIH is composed of 27 Institutes and Centers, most of which fund and conduct research on diseases or body systems. While about 11% of its budget supports the research of nearly 6,000 scientists in its own laboratories, more than 82% of its budget funds the work of about 300,000 extramural scientists at 2,500 universities, medical schools, and other research institutions in every state across the nation.¹

A History of Success

174 NIH-supported researchers have received or shared the Nobel Prize and 214 NIH-supported researchers have received Lasker Awards.³

NIH-funded biomedical research has helped to dramatically lengthen—and improve—the lives of millions of Americans. In 2019, then-NIH Director Francis Collins, M.D., Ph.D., explained that “[l]ife expectancy for a baby born in the U.S. has risen from 47 years in 1900 to more than 78 years today. Among the advances that have helped to make this possible are a 70% decline in the U.S. death rate from cardiovascular disease over the past 50 years, and a drop of more than 1% annually in the cancer death rate over the past couple of decades.”⁴



Life expectancy in the U.S. has slightly declined in recent years due to several public health crises, including the COVID-19 pandemic. NIH-funded research, which has led to the development of new vaccines and treatments, is helping to reverse this trend, with estimated life expectancy surpassing pre-pandemic levels in 2024.

¹ <https://www.nih.gov/about-nih/organization/budget>

² <https://www.nih.gov/about-nih/nih-almanac>

³ <https://time.com/5709207/medical-science-age-of-discovery/> (2019)



(continued)

AAI Funding Recommendation for NIH

The American Association of Immunologists (AAI) recommends an appropriation of at least \$51.3 billion for the base budget of the National Institutes of Health (NIH) for fiscal year (FY) 2027.

This will enable NIH to invest robustly in the next generation of biomedical researchers while providing ample support for established investigators who lead laboratories, train and teach aspiring scientists and medical students, and bring the latest scientific discoveries to patients' bedsides. Immunologists rely heavily on NIH funding to support their research and maintain their laboratories at institutions across the country. While NIH-funded research has resulted in remarkable scientific discoveries, continued progress is contingent on strong and consistent federal support.

AAI thanks Congress for its strong bipartisan support for NIH and commitment to strengthening the biomedical research enterprise. However, the NIH budget was cut for two consecutive years prior to the \$415 million increase provided to the agency for FY 2026, which does not cover the cost of inflation and slows scientific progress. Robust, sustained, and predictable funding increases are needed to ensure adequate investment in health priorities including cancer, Alzheimer's disease, autoimmune diseases, and infectious diseases, and to ensure that the U.S. can maintain its global preeminence in science and innovation.



For more details on AAI funding priorities, please visit: <https://www.aai.org/Public-Affairs/Advocacy-Center>

(continued)

AAI Funding Recommendation for NIAID

The American Association of Immunologists (AAI) recommends an appropriation of at least \$7.15 billion for the National Institute of Allergy and Infectious Diseases (NIAID) for FY 2027.

The immune system plays a role in virtually all diseases and conditions, and therefore immunological research is funded across NIH Institutes and Centers. But the vast majority of immunology research at NIH is supported by NIAID.

NIAID funds a critical portfolio of research on infectious and chronic diseases. For example, the vaccines recently approved to prevent respiratory syncytial virus (RSV) were developed based on basic research discoveries made by NIAID-funded researchers. While RSV often results in mild symptoms, the disease burden can be significant, especially for those with high risk factors. In the 2024-2025 season, CDC estimates that RSV caused 190,000 – 370,000 hospitalizations and 11,000 – 24,000 deaths in the U.S.¹ Decades of NIAID-funded basic research also led to the FDA approval of Teplizumab, the first ever drug approved to delay the onset of Type 1 Diabetes, an autoimmune disorder that disproportionately affects children.

Much like the overall NIH budget, funding for NIAID has been roughly flat for three consecutive years. AAI strongly recommends growing the NIAID budget at the same rate as the NIH budget, 8.7%, for a total FY 2027 budget of \$7.15 billion.

¹ <https://www.cdc.gov/rsv/php/surveillance/burden-estimates.html>



About AAI

The American Association of Immunologists (AAI) is the nation's largest organization of immunologists and scientists in related disciplines. Our mission is to improve global health and well-being by advancing immunology and elevating public understanding about the immune system. AAI members, who are largely funded by the National Institutes of Health, are responsible for some of the most significant biomedical discoveries of the past century. These include understanding the transmission of infectious diseases, like COVID-19, and developing effective methods (such as vaccines) to prevent and treat them; discovering new defenses against re-emerging and drug-resistant bacterial infections; expanding our understanding of the immunological basis of cancer and developing immunotherapies; regulating debilitating autoimmune diseases; and developing treatments to prevent the rejection of transplanted organs and bone marrow. We support scientists across the field of immunology through knowledge dissemination, community building, advocacy, and public outreach.

AAI is the publisher of *The Journal of Immunology (The JI)*, which has published novel, peer-reviewed findings in all areas of experimental immunology since 1916. AAI also publishes *ImmunoHorizons*, an open access, peer-reviewed journal committed to advancing the knowledge of immunology by publishing articles that cover all areas of basic and clinical immunology.

The American Association of Immunologists

1451 Rockville Pike, Suite 650
Rockville, MD 20852
(301) 634-7178
infoaai@aai.org
www.aai.org



Learn more about our
advocacy and policy efforts.

