Citizen-Centric Report 2021

NIH › National Institute of General Medical Sciences

Who We Are and What We Do

The National Institute of General Medical Sciences (NIGMS) supports research in basic science, sometimes called "fundamental" science, that helps researchers understand living systems and various life processes. Whether it be through better diagnostic technologies, vaccines, or targeted therapeutics, this knowledge leads to better ways to predict, prevent, diagnose, treat, and ultimately cure disease.

> *"The overarching goal for all of NIH is to advance medical science and improve human health. My hope is that, through our support of fundamental scientific research, effective training programs, and new technologies, NIGMS will play an important role in reaching that goal."*
>
> *Dr. Jon R. Lorsch, NIGMS Institute Director*

Strategic Priorities

- Fund research that drives important scientific discoveries and advances our understanding of human health and disease.
- Support the development of a highly skilled, creative, and diverse national biomedical research workforce.
- Ensure researchers have access to essential research tools, technologies, capabilities, and other resources.
- Spend tax dollars wisely by continually measuring, improving upon, and communicating returns on investment (ROI).
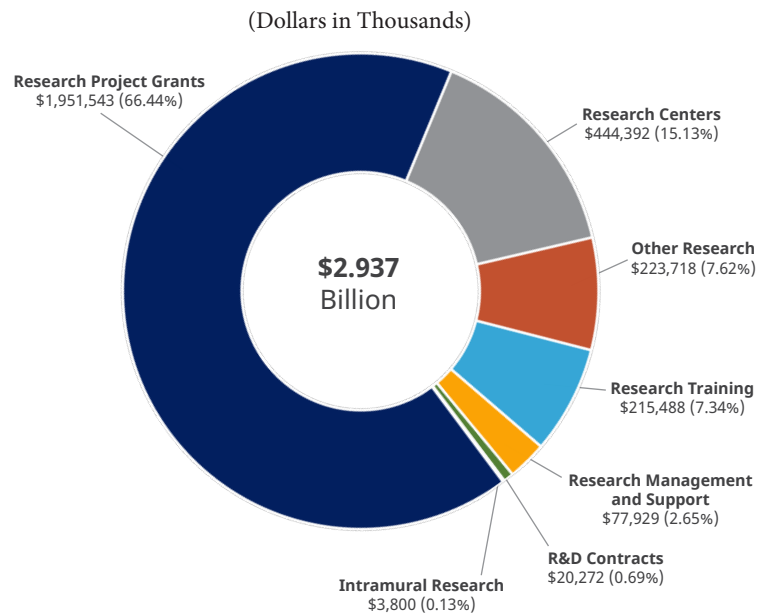
Areas of Research

- Biophysics, Biomedical Technology, and Computational Biosciences
- Genetics and Molecular, Cellular, and Developmental Biology
- Pharmacology, Physiology, and Biological Chemistry
- State and Institutional Research Capacity Building
- Training, Workforce Development, and Diversity

See the **2021 – 2025 NIGMS Strategic Plan**

Budget Allocation: Fiscal Year 2020

Most of the NIGMS budget goes into local economies through grants to scientists at universities, medical schools, hospitals, and other research institutions throughout the United States.

(Dollars in Thousands)

- Research Project Grants $1,951,543 (66.44%)
- Research Centers $444,392 (15.13%)
- Other Research $223,718 (7.62%)
- Research Training $215,488 (7.34%)
- Research Management and Support $77,929 (2.65%)
- R&D Contracts $20,272 (0.69%)
- Intramural Research $3,800 (0.13%)

Center: $2.937 Billion

NIGMS by the Numbers

1962	90	>3,000	$2.937 Billion	>5,000
Year Established	Noble Prize Winners 47 Chemistry 43 in Physiology or Medicine	Supported Scientists	FY20 Budget	Funded Research Grants

Why Invest in Basic Science?

Understanding Basic Science Results in Clinical Advances

- Determining how a **protein's shape affects its function** allows researchers to design drugs that better target and alter a specific protein's structure and activity in order to treat a condition or disease (e.g., statin drugs and cholesterol).
- **Understanding the mechanisms of wound care and infection control** can lead to better treatments for traumatic injuries and improve health outcomes (e.g., recovery from traumatic brain injury).
- **Developing new methods of looking inside cells** to see how cell growth is controlled and regulated can be used to understand and prevent multiple diseases and conditions (e.g., cancer).
- **Understanding the molecular biology of RNA** has led to promising new approaches for treating or preventing certain diseases (e.g., COVID-19 vaccines).

New Technologies Enable and Expedite Important Scientific Advances

- **Cryo Electron Microscopy** (cryo-EM) is a technique that simplifies and improves the imaging of various biomolecules. Specimens remain in their native state without the need for dyes or fixatives, allowing cellular structures, viruses, and protein complexes to be seen at molecular resolution. Advances toward a possible HIV vaccine depend on information from cryo-EM studies about how antibodies recognize the virus.
- The **CRISPR System** is a gene editing technology that shows promise in targeting and correcting gene sequences that contribute to chronic and genetic diseases such as cancer.
- Understanding and **modeling infectious disease outbreaks** through computer simulations provide valuable information for researchers and policy officials to increase and enhance preparation and response.

Creating Opportunity and a Bright Future for Biomedical Research

Programs Across the Educational Spectrum

Training the next generation of biomedical research scientists is fundamental to the NIGMS mission. In 2018, NIGMS made a series of strategic changes to its programs designed to **enhance the diversity in the biomedical research workforce and catalyze the modernization of biomedical undergraduate and graduate education**. These programs span community college, undergraduate, graduate, postdoctoral, and faculty levels, and apply to both research-intensive (≥ $7.5 M in research program grants [RPGs]) and research-active institutions (<7.5 M in RPGs). A complete list of NIGMS Training and Workforce Development programs can be found here.

NIGMS Supports:

- ~1000 Research Training & Diversity Enhancing Awards...
- Investing ~$340 Million per year
- Across ~300 Institutions in the U.S....

Promoting Science in Pre-K Through Grade 12 Levels

Pathways, a collaboration between NIGMS and Scholastic, Inc., provides free educational resources on basic biomedical science and research careers (grades 6 - 12). Educators can also access free, evidence-based STEM classroom materials, created through NIGMS's Science Education Partnership Awards.

nigms.nih.gov/science-education
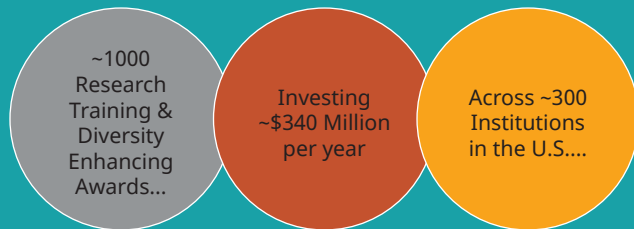
Resources for the Training Community

In addition to funding training programs, NIGMS has created and supported resources specifically for career training in the biomedical sciences:

- Webinars on scientific and career development topics.
- Clearinghouse for Training Modules to Enhance Data Reproducibility.
- Laboratory Safety Training and Guidelines.
- Video interviews with NIGMS-funded scientists on their research, career paths, and related topics.

nigms.nih.gov/Training-Resources

The MIRA Award: Investing in People vs. Projects

In 2015, NIGMS pioneered a novel mechanism of funding scientific research called the Maximizing Investigators' Research Award (MIRA). Rather than supporting a series of projects, this mechanism cohesively supports the total program of research in an individual scientific investigator's laboratory.

The goals of the MIRA are to:

- Promote creative and ambitious research by giving investigators the flexibility to follow new scientific leads and insights.
- Improve the distribution and stability of funding by expanding involvement of early-stage investigators (ESIs) and supporting their research for an additional year.
- Allow scientific investigators to focus on their research by reducing administrative burdens such as the amount of time spent repeatedly writing grant applications.

Progress

MIRA, now in its sixth year of operation, has funded 628 Early-Stage Investigators (ESIs) and 721 Established Investigators (EIs) as of FY 2020. NIGMS plans to continue to support and expand the MIRA mechanism while simultaneously promoting scientific collaboration through its Collaborative Program Grants for Multidisciplinary Teams (RM1).

Building Research Capacity Across the Nation

The Institutional Development Award (IDeA) Program

- Established by congressional mandate in 1993 to broaden both the equity and geographic distribution of NIH funding, particularly to institutions in states and territories (known as IDeA states) having historically low levels of NIH support.

- Provides funding to recruit, retain, and train faculty as well as develop overall infrastructure in at least 24 states and territories.

Addressing Disparities and Strengthening Rural Health

Most IDeA states include rural and historically underserved populations. Programs to improve health in these communities include:

- IDeA-Clinical and Translational Research (CTR) programs focus on statewide or multi-state infrastructures that target and address health-related challenges and disparities often experienced by specific communities in IDeA states, e.g., the opioid epidemic.

- Centers of Biomedical Research Excellence (COBRE) programs focus on addressing specific rural health challenges (e.g, maternal health) by engaging primary care physicians in Practice-Based research networks.

Catalyzing Public-Private Partnerships for Better Technologies

As part of the continuing evolution of the IDeA program, NIGMS has established Regional Technology Transfer Accelerator Hubs for IDeA states in each of the four IDeA regions (central, northeast, southeast, and west). These awards support the **development, maturation, and dissemination of important clinical and translational research technologies** through entrepreneurship, innovation, and technology transfer activities.
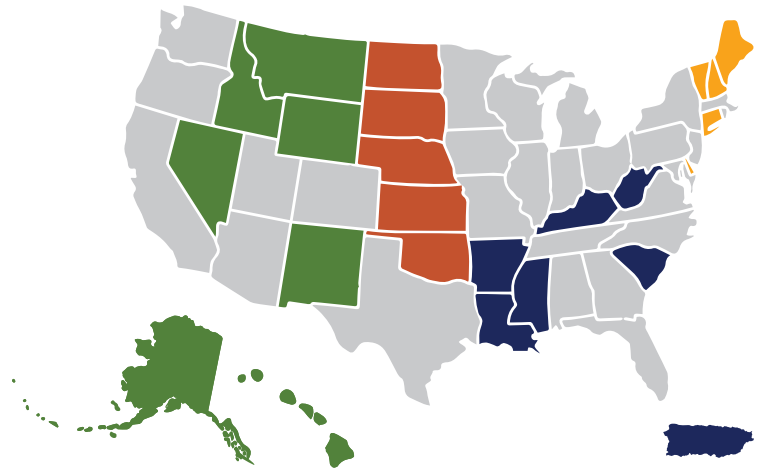
Four IDeA Region Accelerator Hubs: Central (red), Northeast (yellow), Southeast (blue), and Western regions (green)

The Impact of NIGMS and Its Grantees

Supporting Exceptional Leadership Potential

Four members of the NIGMS community are among the recipients of the prestigious Presidential Early Career Award for Scientists and Engineers (PECASE). The PECASE is the highest honor bestowed by the U.S. government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in both science and technology.

James Olzmann Ph.D.
University of California, Berkeley

Elizabeth Nance, Ph.D.
University of Washington

Sohini Ramachandran Ph.D.
Brown University

Michael Boyce Ph.D.,
Duke University School of Medicine

Preparing for and Responding To Emerging Public Health Threats

Wilbert Van Panhuis, M.D., Ph.D.

Wilbert Van Panhuis, M.D., Ph.D. is the director of the NIGMS-funded Models of Infectious Disease Agent Study (MIDAS) coordinating center, based at the University of Pittsburgh's Graduate School of Public Health. He is an infectious disease epidemiologist with training in both medicine and global disease epidemiology. His research in the fields of computational epidemiology and population health informatics aims to improve the efficient use of information for public health action. The MIDAS coordinating center provides data and resources for researchers and public health officials as well as training opportunities for the next generation of scientists. In response to the COVID-19 pandemic, the coordinating center created a central online repository for the scientific community—a clearinghouse for sharing data and data-driven discoveries about COVID-19.

Generating Societally Impactful Work

NIGMS grantee Dr. Jennifer Doudna was among those awarded the **2020 Nobel Prize in Chemistry** for the development of a genome editing technology that is contributing to new cancer therapies and may make the dream of curing inherited diseases come true. In addition, the **2018 Nobel Prize in Chemistry** went to grantees Frances H. Arnold and George P. Smith for work that integrated the fields of molecular biology, chemistry, and protein science, opening up a new frontier in drug development. Since 1962, **NIGMS grantees have won 90 Nobel Prizes, including 47 in Chemistry and 43 in Physiology or Medicine**.

Navigating Challenges and Opportunities

NIGMS will continue to invest in our core mission areas of basic science, research training, and capacity building. Challenges include continually improving institute operations using predictive financial modeling, enhancing research capacity across the nation, ensuring needed research resources are accessible to all, and clearly communicating information about NIGMS goals, activities, results, and returns on investment to stakeholders such as the American public and taxpayer.

Leveraging AI For Process Business Improvement

NIGMS has been a leader in leveraging Artificial Intelligence (AI) functions such as Machine Learning (ML) and Natural Language Processing (NLP) to automate burdensome, manually intensive business processes. Overcoming this challenge is critical to ensuring that the Institute continues to maintain a robust ability to optimally deliver on its mission to serve the scientific community and public.

In a series of demonstrative pilot projects, NIGMS has tested, scaled, and applied ML/NLP to automate business processes that were previously conducted manually. These include:

- Delineating which projects fall within and outside the scope of the NIGMS mission; and
- Determining appropriate jurisdiction of projects within the Instiute in terms of scientific division, branch, and even program official (PO).

The benefits of ML/NLP include:

- Diminished administrative burden on staff
  - Saving an average of 249 labor hours per year
  - Freeing the ability of staff to focus attention on higher-value work
- Heightened standardization of business processes without loss of either accuracy or objectivity
- Heightened administrative efficiency

NIGMS has shown that application of ML/NLP performs the above tasks as accurately as manually intensive processes and in a much shorter amount of time. This important work was published as an exemplar of organizational efficiency in the [Federal Data Strategy](#).

Evolving Our Ability to Respond to Emerging Health Threats

NIGMS stands ready to address new and emerging health threats by spurring research on Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), the opioid epidemic, and vaping, as evidenced by the issuance of the opportunities indicated below:

Notice of Special Interest (NOSI):

- Emergency Competitive Revisions for Research on SARS-CoV-2 ([NOT-RM-20-015](#))
- Acceleration of Research on the Development of Predictive Models of the spread of SARS-CoV-2 and Outcomes of Potential Public Health Interventions on COVID-19 ([NOT-GM-20-027](#))

Administrative Supplements:

- Expanding Vaping Research and Understanding EVALI ([NOT-GM-20-008](#))

Additionally, NIGMS has issued guidance on temporary arrangements to NIGMS grantees affected (through no fault of their own) by the COVID-19 outbreak ([NOT-GM-20-026](#))

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