PennState

2019

Annual Report of Research Activity

OFFICE OF THE SENIOR VICE PRESIDENT FOR RESEARCH

Research expenditures again reach record high

Wow! We've had another awesome year! Penn State's research expenditures reached a **record high for the third year in a row** in fiscal year 2018-2019. The total figure of $968 million represents a **$47 million increase** over last year's figure, and it includes a record **$593 million** in federal funding, as well as **$375 million** from a combination of private funders, the Commonwealth of Pennsylvania, and University sources.

Our federal funding increased from **$562 million to $593 million**. Research funding from the Commonwealth of Pennsylvania increased from **$68 million to $73 million**, while funding from industry, foundations, and other sponsors held steady at **$101 million**.

A major factor in achieving the record was a **13 percent increase** in the Applied Research Laboratory's research expenditures, a gratifying vote of confidence from the Department of Defense. We deeply value the **partnership** we have built over the years and are exceedingly proud of Penn State's role in national security.

LORA G. WEISS
Senior Vice President
for Research

Nearly 21 percent of total expenditures, **$202 million**, is from the University's own investment in research for the public good. This is an integral part of our land grant mission and includes investments in **facilities, infrastructure, and staffing** that allow our investigators to excel in their research and to attract highly competitive federal grants.

It is exciting for me, as a former Penn State researcher, to return to Penn State and be a part of the continued growth and vigor of our research enterprise. It is a testament to my predecessor, Neil Sharkey, and to the world-class talent within our university. **Our faculty, staff, and students are truly exceptional!**

A CULTURE OF INTERDISCIPLINARY RESEARCH

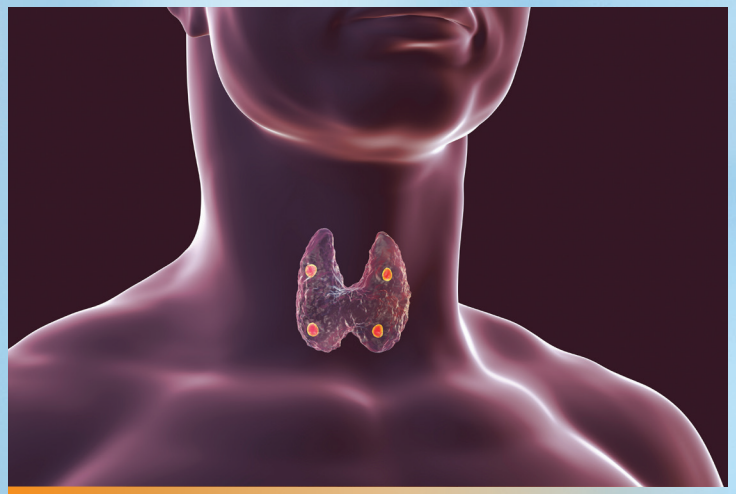
Penn State's longstanding investment in its interdisciplinary research institutes has created a culture of collaboration that differentiates the University's research enterprise from its peers. By encouraging research that cuts across colleges and disciplines, and by having done so for decades, the institutes have moved knowledge across traditional silos to foster new ideas that address our world's most difficult challenges. We are creating teams that seek expanded collaborations and thrive on tackling these challenges.

From the establishment of the Applied Research Laboratory in 1945 and the Materials Research Laboratory (now Institute) in 1973, we have grown seven successful interdisciplinary research institutes. Each is dedicated to driving impact in critical spheres of influence, to creating impressive and meaningful breakthroughs, and to reinforcing our commitment to fostering innovation through partnerships and teamwork.

The following pages offer snapshots of these institutes and provide a glimpse into the breadth and depth of unmatched expertise residing at Penn State. Increasingly our institutes have been collaborating among each other, tackling research challenges that not only cross disciplines, but also scales, from micro to macro, cellular to society.

As Penn State develops advances for the future, our institutes are leading the way.

WE ARE CREATING TEAMS THAT SEEK EXPANDED COLLABORATIONS AND THRIVE ON TACKLING DIFFICULT CHALLENGES.

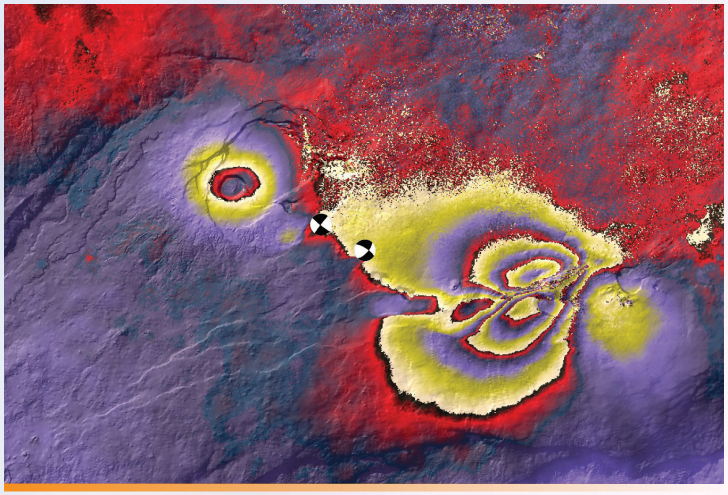


PENN STATE CANCER INSTITUTE

Based at the Penn State Health Milton S. Hershey Medical Center in Hershey, Pa., with research presences there and in University Park, Penn State Cancer Institute is committed to fighting cancer on every front: through education and prevention, early detection and diagnosis, effective treatment, and survivorship programs. The Cancer Institute has three research programs, focused on the themes of Population Health and Cancer Control, Mechanisms of Carcinogenesis, and Experimental Therapeutics. Additionally, pediatric cancer research led by faculty at Penn State Children's Hospital and Penn State College of Medicine is a highly visible part of the Institute and greatly benefits from the Four Diamonds Foundation, and from THON, Penn State's student-run philanthropy.

PENN STATE CLINICAL AND TRANSLATIONAL SCIENCE INSTITUTE

Penn State Clinical and Translational Science Institute accelerates discoveries to benefit human health. It is a bridge between basic scientists and clinical researchers and promotes collaboration to discover new treatments, medical procedures, and ways to diagnose disease. Its mission is to help move health research more efficiently out of the laboratory and into use by the people who need it. The Institute was established in 2007 and was a member of the National Institutes of Health Clinical and Translational Science Award Network. It focuses on the health needs of the rural communities that surround Penn State and its academic health system, Penn State Health.

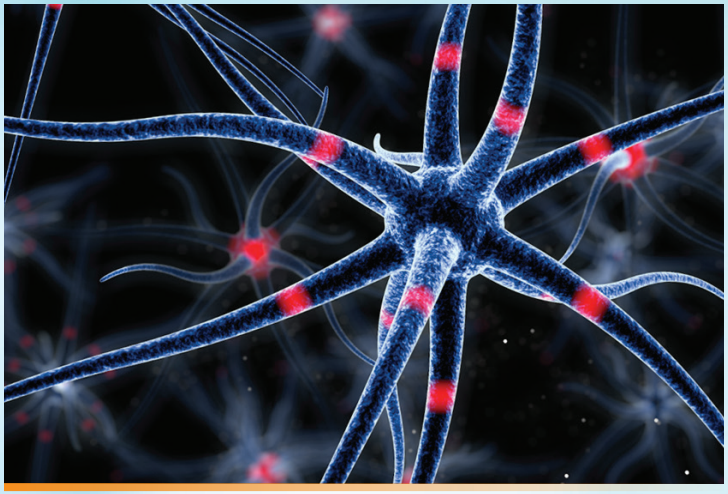


INSTITUTE FOR COMPUTATIONAL AND DATA SCIENCES

The Institute for Computational and Data Sciences was established in 2012 as the Institute for CyberScience, to bring researchers together to develop and apply innovative, high performance computation methods. Since its inception, the Institute has coordinated a co-hiring initiative, awarded more than $1.3 million in seed grants in yearly competitions, and funded several research centers. In 2014, as part of efforts to ensure that Penn State can deliver the broad spectrum of computing and data services required for advanced research, the Institute developed an Advanced Cyber Infrastructure. Today, more than 4,000 researchers and students use the Infastructure to boost their productivity and accelerate their research.

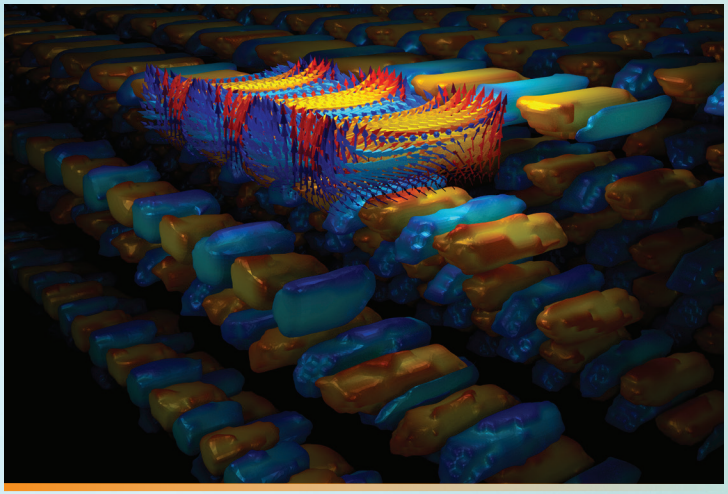
INSTITUTES OF ENERGY AND THE ENVIRONMENT

The Institutes of Energy and the Environment work to build teams of researchers from different disciplines to see how new partnerships and new ways of thinking can solve some of the world's most difficult energy and environmental challenges. The Institutes foster and facilitate interdisciplinary scholarship in collaboration with more than 500 faculty, staff, and students to advance the energy and environmental research missions of the University. As a global research leader, Penn State is uniquely equipped to address the Institutes' five major research themes: Future Energy Supply, Smart Energy Systems, Health and the Environment, Climate and Ecosystem Change, and Water and Biogeochemical Cycles.



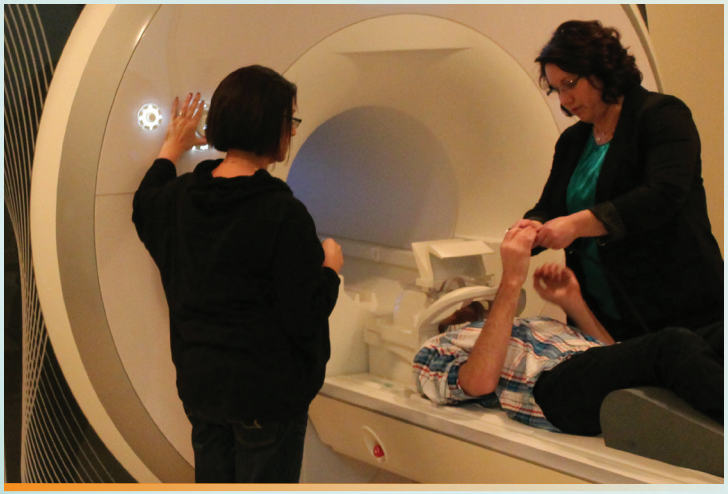
HUCK INSTITUTES OF THE LIFE SCIENCES

The Huck Institutes were established in 1996 to enhance and facilitate excellence in interdisciplinary research and training in the life sciences across Penn State. The Institutes accomplish this by investing strategically in the recruitment of outstanding faculty who then build and retain precedence in strategic areas including infectious disease, genome sciences, plant sciences, and the neurosciences. The Huck facilitates new initiatives and insights by seeding emerging fields, providing leadership in interdisciplinary graduate education, and ensuring that our faculty, staff, and students have access to state-of-the-art workspace and instrumentation. The institutes and centers that comprise the Huck work to focus the dispersed strengths across colleges, and align institutional strengths with research strategy and long-term societal needs.



MATERIALS RESEARCH INSTITUTE

The Materials Research Institute is a catalyst for multidisciplinary education and innovations in materials. Created in 1992, the Institute provides leadership both at Penn State and in the materials community worldwide, coordinating a multitude of materials-related activities, encouraging researchers to share equipment and facilities, and fostering collegial exchange of knowledge and expertise. The ultimate goal is the creation of new knowledge and the transfer of materials technology to industry and government. Today, teams of Institute faculty combine their expertise in materials science, chemistry, biology, and engineering, along with theoretical physics and advanced computation, to understand and control the properties of matter.



SOCIAL SCIENCE RESEARCH INSTITUTE

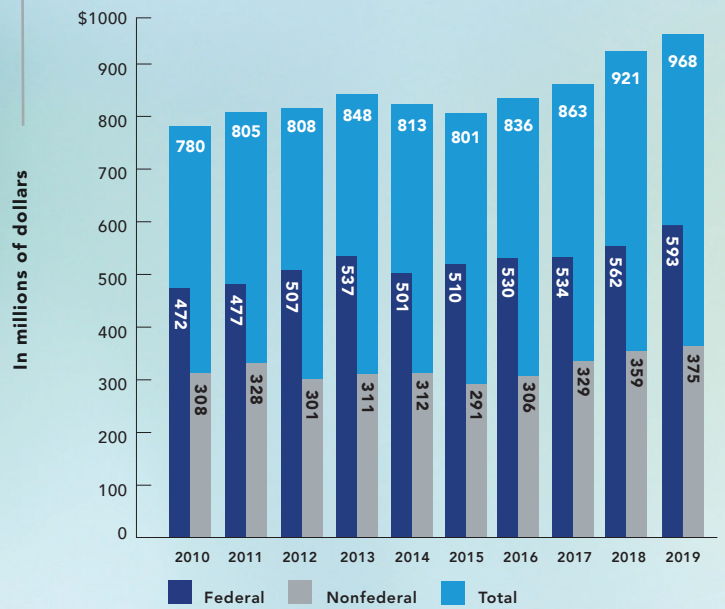
Since its inception in 2001, Penn State's Social Science Research Institute has promoted innovation and excellence in inter-disciplinary research within the social and behavioral sciences. The Institute's mission is to foster novel, interdisciplinary collaborations by investigators who aim to address critical human and social problems at the local, national, and inter-national levels and to translate and disseminate this knowledge into measurable outcomes for human behavior, health, and development. The Institute advances this mission by bringing together researchers from a range of disciplines around emerging areas of study and by providing consultation, financial support, and shared infrastructure development and services to social and behavioral scientists at Penn State.

APPLIED RESEARCH LABORATORY

The Applied Research Laboratory was established at Penn State in 1945 at the request of the U.S. Navy. Originally focused on undersea weapons technology development, the Lab now includes a broad research portfolio addressing the needs of various sponsors. The Lab supports national security, economic competitiveness, and quality of life through education, scientific discovery, technological demonstration, and successful transition to application. As a Department of Defense designat-ed University Affiliated Research Center, the Lab conducts essential research, development, and systems engineering in support of our nation's priorities free from conflict of interest or competition with industry.

TOTAL RESEARCH EXPENDITURES, 2010–2019

(Federal and Nonfederal)



SOURCES OF RESEARCH FUNDING

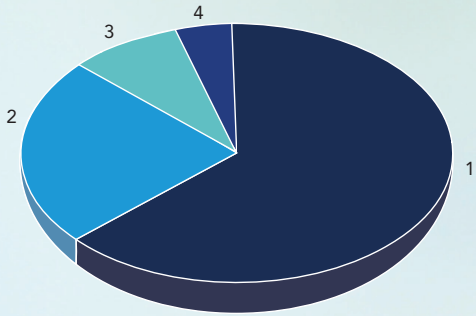
1 **Federal $593,283,000**

2 **University $201,509,000**

3 **Industry and other $100,557,000**

4 **Commonwealth of Pennsylvania $72,825,000**

Total $968,174,000



RESEARCH SPONSORED BY INDUSTRY AND OTHER SOURCES, 2010–2019

** Starting in FY15, federal flow-through dollars were removed from industry awards and allocated back to the prime federal sponsor.*

EXPENDITURES FROM FEDERAL AGENCIES

1 **Department of Defense $258,588,000**

2 **Department of Health and Human Services $132,819,000**

3 **National Science Foundation $68,120,000**

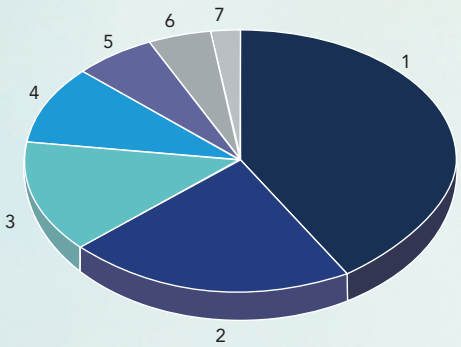
4 **Other $59,530,000**
- Commerce $2,648,000
- Education $5,384,000
- EPA $467,000
- Interior $1,515,000
- Transportation $5,209,000
- Other Federal $44,307,000

5 **USDA $31,840,000**

6 **DOE $27,340,000**

7 **NASA $15,046,000**

Total $593,283,000



EXPENDITURES BY PERFORMING UNIT

1 **Agricultural Sciences $116,478,000**

2 **Defense Related Research Units $274,070,000**

3 **Earth and Mineral Sciences $70,853,000**

4 **Eberly College of Science $125,216,000**

5 **Education $9,902,000**

6 **Engineering $149,357,000**

7 **Health and Human Development $50,070,000**

8 **Information Sciences and Technology $7,823,000**

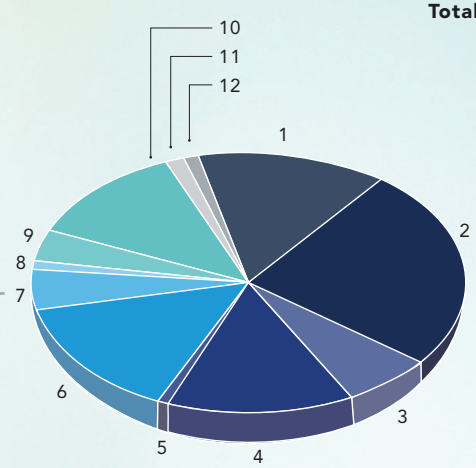
9 **Liberal Arts $40,011,000**

10 **Medicine $101,979,000**

11 **Other Campuses $12,137,000**
- Altoona College $1,072,000
- Behrend College $3,996,000
- Berks College $480,000
- Capital College $3,141,000
- Great Valley $498,000
- Other Commonwealth Campuses $2,950,000

12 **Other Colleges $10,278,000**
- Arts and Architecture $1,802,000
- Communications $442,000
- Dickinson School of Law $357,000
- International Programs $215,000
- Nursing $3,542,000
- Penn State Law $667,000
- Smeal College of Business $3,253,000

Total $968,174,000



PENN STATE TECHNOLOGY TRANSFER AT A GLANCE

Total revenue: $2.3 million

164
INVENTION DISCLOSURES **RECEIVED**

48
U.S. PATENTS ISSUED

7
START-UP COMPANIES **FORMED**

15
LICENSES AND OPTIONS EXECUTED

Technology transfer data are for the period January–December 2018.

A SAMPLING OF MAJOR AWARDS

VIRUS EVOLUTION

The National Science Foundation Growing Convergence Research program awarded $1.3M for the development of a platform to rapidly detect and identify virus strains, and predict their future evolution and impact on the human population.

SEEING MOLECULES

The National Institutes of Health awarded $560K for acquisition of a Cypher Video-Rate Scanning Atomic Force Microscope System to advance the understanding of fundamental areas of biology and disease. The instrument provides the capability to view and quantify highly dynamic biological processes at the single molecule level.

ARCTIC RESILIENCE

The National Science Foundation awarded $3M for research to aid coastal Arctic Alaskan communities in adapting to climate-related changes by investigating the connections between environmental stressors and infrastructure disruptions.

URBAN AGRICULTURE

The U.S. Department of Agriculture awarded $8.9M toward the creation of agricultural systems in urbanized landscapes that are both environmentally beneficial and economically thriving, increasing productivity, and optimizing the efficient use of water and nitrogen. The project will use the Chesapeake Bay Watershed as a case study.

SEEDBORNE BACTERIA

The U.S. Department of Agriculture awarded $3.7M for the integrated management of emerging seedborne bacterial diseases affecting cucurbits and chenopods at all stages of the production process.

SUMMARY OF RESEARCH PROPOSALS AND AWARDS

$2.72B
TOTAL AMOUNT OF PROPOSALS

$779M
TOTAL AMOUNT OF AWARDS

4,570
PROPOSALS SUBMITTED

3,227
AWARDS RECEIVED

1,948
NEW & COMPETING CONTINUATION AWARDS RECEIVED

2,071
INVESTIGATORS RECEIVING AWARDS

957
SPONSORS

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