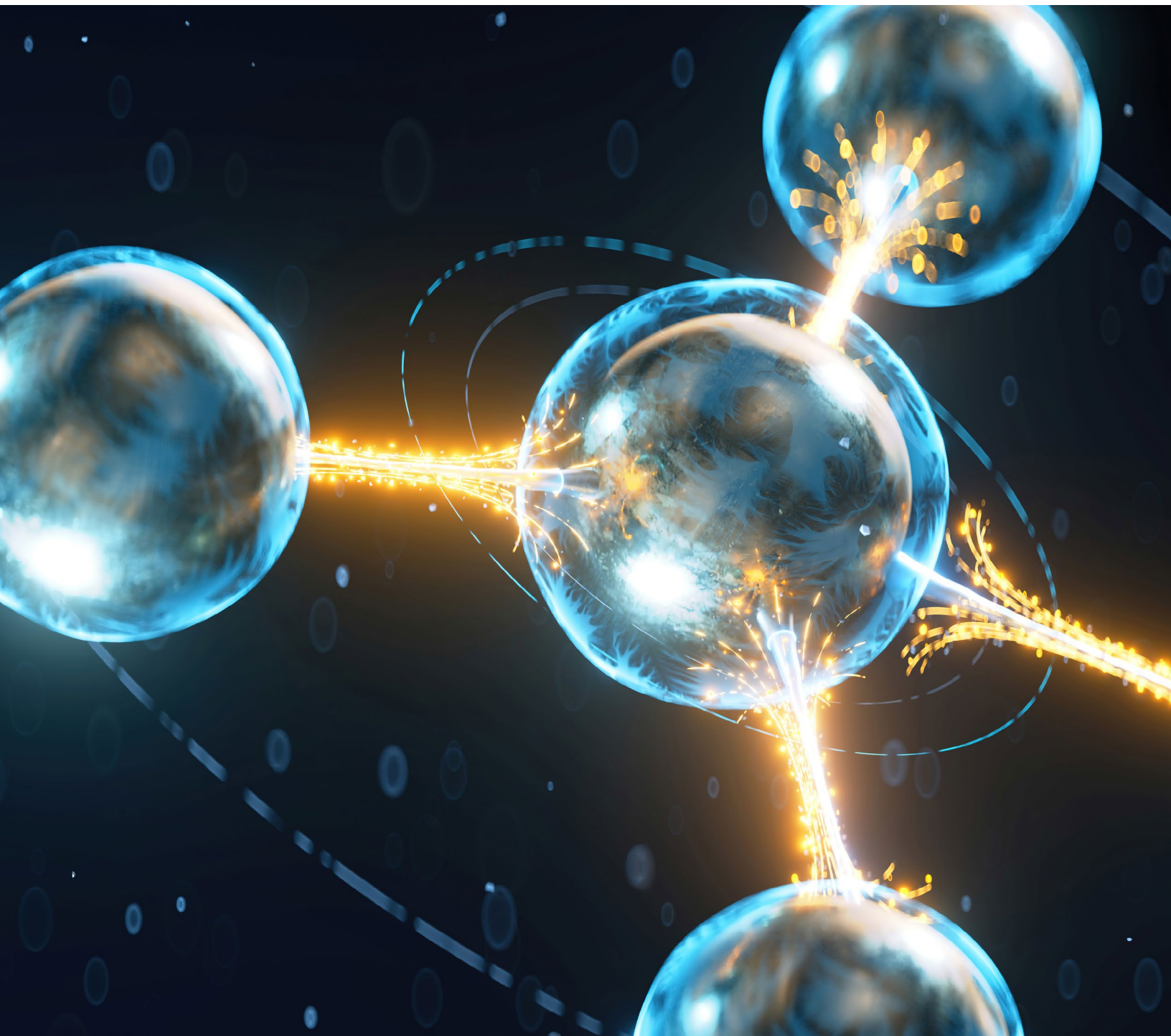


FY 2024 SUMMARY REPORT

INSTITUTES AND CENTERS AT DISCOVERY PARK DISTRICT



A MESSAGE FROM THE

VICE PRESIDENT FOR DISCOVERY PARK DISTRICT INSTITUTES

Managed by the Office of Research, the Institutes and Centers at Discovery Park District comprise an integrated family of interdisciplinary research organizations that pursue discovery, learning and the translation of innovation.

During the first full year under the leadership of Purdue President Mung Chiang, Executive Vice President for Research Karen Plaut, and myself, our efforts have focused intently on Purdue's strategic initiatives: Purdue Computes, Purdue in Indianapolis and One Health. At the same time, new program development, research, and education and training innovations have continued in our ongoing strategic thrusts that include national security and defense, sustainability, and health and life sciences.

This document summarizes the progress made in fiscal year 2024 (July 2023 – June 2024) in categories that we consider "return" on the investments we received both from the University and our external sponsors, including: research productivity, alignment with Purdue strategic priorities and those of its colleges, scholarly works, education and workforce development and commercialization/translation. In all of these categories we see our primary role as an essential partner with colleges and their departments across the Purdue research enterprise, and with the Purdue Applied Research Institute (PARI).

Leading the Institutes and Centers at the Discovery Park District is a true honor for me. I am inspired by the vision and dedication of past leaders as well as the innovative people who make our current organization Purdue's gem of interdisciplinary research.

Dan DeLaurentis

Vice President for Discovery Park District Institutes
Purdue University

LEADERSHIP
AND STAFF

Dan DeLaurentis

Vice President for
Discovery Park
District Institutes and
Bruce Reese Professor of
Aeronautics and
Astronautics

Kaethe Beck

Assistant Vice President
for Strategic Impact
in Life Sciences

Mary Ann Bobillo

Operations Manager

Lisa Muncy

Executive Assistant

OVERVIEW

INSTITUTES AND CENTERS AT DISCOVERY PARK DISTRICT

The Institutes and Centers at Discovery Park District bring together researchers from across disciplines and colleges to advance large-scale research, foster breakthroughs and drive innovations aimed at solving the world's most critical problems. These interdisciplinary institutes and centers are managed by Purdue's Office of Research.

Institutes and Centers at Discovery Park District

- Birck Nanotechnology Center
- Purdue Center for Global Food Security
- Center for Education and Research in Information Assurance and Security (CERIAS)
- Institute for a Sustainable Future
- Network for Computational Nanotechnology
- Purdue Policy Research Institute
- Purdue Quantum Science and Engineering Institute
- Bindley Bioscience Center
- Purdue Institute for Cancer Research
- Purdue Institute of Inflammation, Immunology and Infectious Disease
- Purdue Institute for Integrative Neuroscience
- Purdue Institute for Drug Discovery
- William D. and Sherry L. Young Institute for the Advanced Manufacturing of Pharmaceuticals
- Eli Lilly and Company and Purdue University Research Alliance Center

Affiliated Organizations

Based within the Institutes and Centers at Discovery Park District facilities, these organizations are managed by a specific college but are integral to the activities and partnerships of the institutes and centers.

- Center on AI for Digital, Autonomous, and Augmented Aviation (AIDA)
- Center for Innovative and Strategic Transformation of Alkane Resources (CISTAR)
- Center for Secure Microelectronics Ecosystem (CSME)
- Emergent Mechanisms in Biology of Robustness Integration and Organization Institute (EMBRIO)
- Joint Transportation Research Program (JTRP)
- Natural Hazards Engineering Research Infrastructure (NHERI-NCO)
- Scalable Asymmetric Lifecycle Engagement (SCALE)
- Women's Global Health Institute (WGHI)

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ENGAGED FACULTY

\$3.1M

RESEARCH FUNDING FOR GRADUATE AND UNDERGRADUATE STUDENTS

\$205M

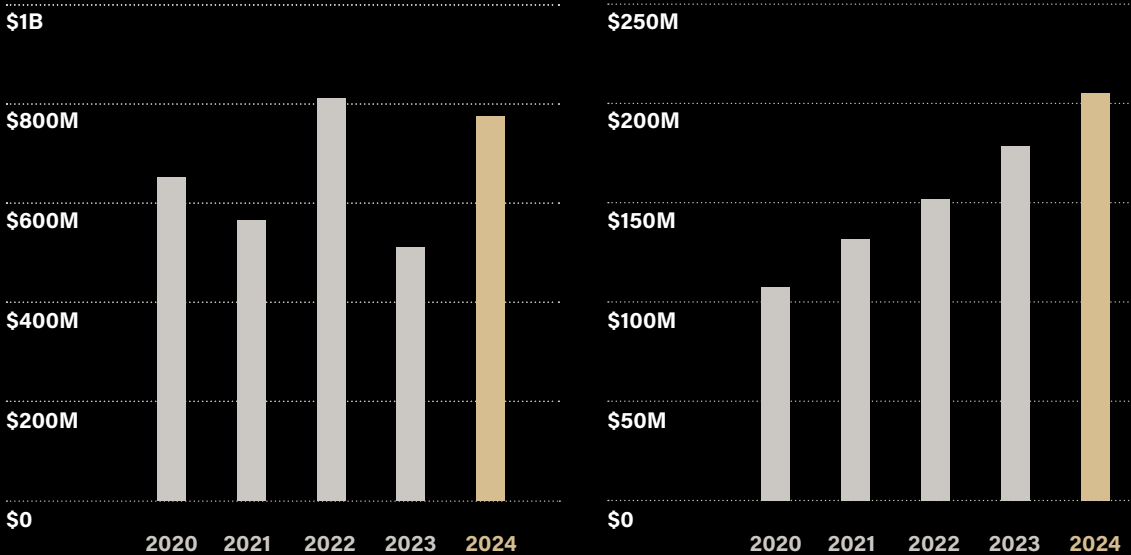
COLLABORATIVE RESEARCH EXPENDITURES



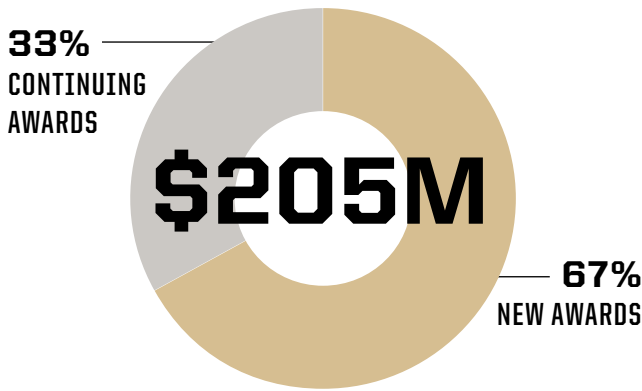
FY 2024

SPONSORED RESEARCH PROPOSALS AND AWARDS

The Institutes and Centers at Discovery Park District submit research proposals and secure awards from nearly all federal agencies, as well as many of Purdue's key industry and foundation partners. Fiscal year 2024 was a record year for research awards both for the institutes and centers and for Purdue as a whole. The institutes and centers played a significant role in several of Purdue's largest awards.



RESEARCH FUNDING



30%
OF PURDUE'S TOTAL FUNDED RESEARCH AWARDS involve the Institutes and Centers at Discovery Park District

FY 2024

SIGNIFICANT SPONSORED PROGRAM AWARDS

The Institutes and Centers at Discovery Park District tackle large-scale problems, pursuing and winning significant, high-impact funding that highlights the world-class scholarship, discovery and reputation of Purdue researchers and students. A small sample of our significant awards is included below.

Principal Investigator	Institute/Center and Academic Department	Sponsor	Project	Award amount
Alejandro Strachan, others	Birck Nanotechnology and NCN, materials science and engineering	Applied Research Institute/U.S. Army	Workforce Development in Microelectronics through nanoHUB	\$1,000,000
Zhihong Chen	Birck Nanotechnology, electrical and computer engineering	Applied Research Institute/U.S. Department of Defense	University Network to Accelerate Lab-to-Fab	\$4,569,800
Dongyan Xu	CERIAS, computer science	Air Force Research Laboratory	FIREFLY: A Cyber-Physical Framework for Scalable CPS Modeling and Simulation	\$6,500,090
Andrea Kasinski	Purdue Institute for Cancer Research, biological sciences	NIH-National Cancer Institute	Vehicle-Free-Delivery of miRNA Therapeutics and Ligand Mediation	\$3,860,108
Daniel DeLaurentis	Institutes and Centers administration, aeronautics and astronautics	U.S. Department of Defense/ Stevens Institute of Technology/ Systems Engineering Research Center	Defense Civilian Training Corps (DCTC) Program Development, Piloting, and Instrumentation	\$4,455,594
Linda Lee	Institute for a Sustainable Future, agronomy	National Science Foundation Regional Innovation Engine	Great Lakes Regional Innovation Engine (ReNEW)	Variable over project duration, but greater than \$2,000,000 for Purdue

IMPACTING PURDUE PRIORITIES

The Institutes and Centers at Discovery Park District have embedded Purdue President Mung Chiang's priorities in their vision, goals and strategic pursuits. The following pages illustrate some of these successes.

PURDUE COMPUTES

Many of the Institutes and Centers at Discovery Park District support this key initiative, which includes four pillars: Computing, Physical AI, Semiconductors and Quantum.

CERIAS has eight ongoing funded interdisciplinary research projects from the Defense Advanced Research Projects Agency (DARPA), the National Science Foundation (NSF), The Department of Energy, the Air Force Research Laboratory, Sandia National Laboratories and with various members of industry. All are addressing challenges within computing, AI and semiconductor fields, aspects of the Purdue Computes initiative.

Purdue's **Network for Computational Nanotechnology** boasts ChipsHUB, which is using nanoHUB infrastructure to power semiconductor education, workforce development and research and development efforts.

A Purdue researcher works in the 25,000-square-foot Scifres Nanofabrication Laboratory clean room located in the Birck Nanotechnology Center. (Charles Jischke)



A physics graduate research assistant explores light-atom interactions to develop practical quantum optical systems for applications in secure communication and precision sensing. (Charles Jischke)

The **Purdue Quantum Science and Engineering Institute (PQSEI)** is the university's central hub and catalyst for all facets of quantum research and leads major funded programs across agencies. Housed in the Birck Nanotechnology Center, PQSEI also drives increasingly tighter innovation cycles in quantum computing and its relationship to semiconductors and advanced microelectronics.

The **Birck Nanotechnology Center's** \$45 million renovation and expansion project will be complete in fiscal year 2025. Birck continues to lead the way in semiconductor innovation as home to several awards from the Silicon Crossroads Department of Defense Microelectronics Commons Hub, the imec partnership, and many of Purdue's core research centers in this area.

ONE HEALTH

One Health focuses on innovation and interaction among human, plant and animal health. Helping lead the One Health charge is the **William D. and Sherry L. Young Institute for the Advanced Manufacturing of Pharmaceuticals**, which is Purdue's leading organization for the recently awarded Tech Hub "Heartland BioWorks," supported by the U.S. Department of Commerce Economic Development Administration. The Young Institute will provide hands-on training in advanced manufacturing technologies as part of BioTrain, a workforce initiative within Heartland BioWorks.

Purdue also is instrumental in the **new NSF Regional Innovation Engine** called Great Lakes Water Innovation Engine (ReNEW) — ReNEW aims to discover, develop and deploy novel technologies to clean the Great Lakes while also attracting water-intensive manufacturers, and new jobs, to the Midwest. Purdue will contribute to the project at every stage, helping define and advance

A Purdue University trainee prepares a sample of vials for characterization in a lyophilization facility at Discovery Park District at Purdue. (Purdue University photo)

strategies that eliminate toxic so-called "forever chemicals," while also extracting valuable, reusable minerals from wastewater. Linda Lee, Distinguished Professor of Agronomy and professor of environmental and ecological engineering, is Purdue's principal investigator and part of the ReNew leadership team.

PURDUE UNIVERSITY IN INDIANAPOLIS

The Purdue Institute for Integrative Neuroscience (PIIN) taps into access for clinical cohorts, human brain specimens, and stem cell resources.

Stemming from the fall 2023 Life and Health Sciences Summit, a multidisciplinary team led by Michael Heinz, professor of speech, language and hearing sciences and biomedical engineering, as well as a member of PIIN, works closely with Purdue researchers on the Indianapolis campus. They are collaborating on a data-driven, cross-species project titled "Accessible Precision Audiology to Reduce the Burden of Untreated Hearing Loss."



PURDUE@DC

The **Purdue Institute for a Sustainable Future (ISF)** hosted a four-day workshop called “Unraveling the Cyber-Physical Infrastructure Climate Change Nexus” in Washington, D.C.

ISF partnered with the NATO Science for Peace and Security Programme (SPS) and the U.S. Department of Homeland Security (DHS) Science and Technology Directorate, as well as the Center for Education and Research in Information Assurance and Security (CERIAS) and Purdue’s Policy Research Institute (PPRI), to address the critical convergence of climate change, cybersecurity and essential infrastructure, which includes social-economic-political institutions. The workshop strengthened organizational ties among Sandia National Laboratories, DHS and the NATO SPS program, and identified key areas in which Purdue has strong research and leaders to collaborate and compete for future funding. Areas of particular interest include development of strategies for collecting and securing climate data; creation and defense of resilient critical infrastructures; advancement of an integrated approach to food, energy, water and information security; integration of heat-related threats into strategic defense planning.



NATIONAL SECURITY AND TECHNOLOGY INITIATIVE

Purdue Policy Research Institute (PPRI) serves as the liaison for Purdue University with the U.S. Department of State Diplomacy Lab initiative.

In collaboration with the U.S. Space Force and the National Reconnaissance Office, PPRI will host Purdue’s inaugural Space Policy Symposium, an action-oriented event that brings together leaders in military, government, industry and academia to inform policy development shaping norms of behavior in space for a stable, prosperous and secure future.

PPRI is providing seed funding to an interdisciplinary team focused on research that will inform policies intended to build on the PACT Act and the Foreign Claims Act.



Speakers present at the NATO Science for Peace and Security Programme, a workshop hosted by the Purdue Institute for a Sustainable Future in Washington, D.C. (Purdue University photo)

WORKFORCE DEVELOPMENT

Transferring knowledge and skills to Purdue students is an important aspect of the work done by the Institutes and Centers at Discovery Park District. Our Institutes and Centers connect faculty from various Purdue disciplines on collaborative projects, offering graduate students valuable training and hands-on experiential learning.

LILLY PURDUE RESEARCH ALLIANCE CENTER

The Eli Lilly and Company and Purdue University Research Alliance Center (LPRC) is building a critical pipeline of talent in research and development. In FY24, 65 graduate level students and 115 undergraduate students were engaged in the program, supporting research and working on professional development in key strategic areas at Eli Lilly and Company. Students engaged in the program experience an unusually high level of scientific collaboration through the alliance — working with more than 50 Purdue investigators and Lilly scientists.



A researcher at Eli Lilly and Company. (Photo provided by Lilly)

SCALE

The nationwide, Purdue-led Scalable Asymmetric Lifecycle Engagement (SCALE) program is the preeminent U.S. program for semiconductor workforce development in the defense sector. Nearly 1,000 students have participated in SCALE since its 2020 inception. SCALE is affiliated with the Institutes and Centers at Discovery Park District.

DEFENSE CIVILIAN TRAINING CORPS (DCTC)

The new DCTC program helps students build civilian careers in the Department of Defense relating to acquisition, digital technologies, critical technologies, science, engineering, and finance and more. DCTC is a scholarship-for-civilian-service award. As one of four universities selected to pilot and advance the program, Purdue now has 44 scholars in the program on our campus with a new cohort to be selected in 2025.

SCALE Co-director Peter Bermel works with a Purdue undergraduate engineer to perform infrared measurements on microelectronics to measure their durability. (Charles Jischke)





The College of Engineering's Semiconductors@Birck VIP program provides students with experiential learning, preparing them for careers in the U.S. semiconductor workforce. (Purdue University photo)

SEMICONDUCTORS@BIRCK VIP

The Birck Nanotechnology Center is home to the semiconductors track of the College of Engineering's innovative Vertically Integrated Projects (VIP) program, a growing experiential learning opportunity for undergraduates. Sophomores, juniors and seniors work in vertically integrated teams with faculty, staff and graduate-researcher mentors during multiple semesters. The students learn nanofabrication skills, receive Lean Six Sigma and project management training, and tackle real-world research and engineering challenges. Sixty-seven Purdue students participated in the program during the 2023-24 academic year, with many on the waiting list.

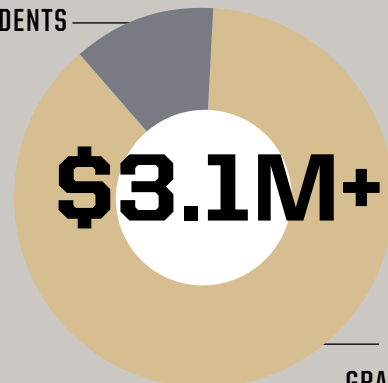
QUANTUM SUMMER SCHOOL

The Purdue Quantum Science and Engineering Institute annually hosts the Quantum Science Center's annual U.S. Quantum Information Science Summer School, which includes talks from industry, academia and government experts, as well as hands-on and applied exercises. Participants, primarily graduate

and postdoctoral students, broaden and develop personal and business networks that will shape their careers and the future of the quantum workforce. There were 115 students and 38 faculty and industry representatives from around the nation who participated in the 2024 summer school at Purdue's West Lafayette campus.

RESEARCH FUNDING FOR GRADUATE AND UNDERGRADUATE STUDENTS

22
UNDERGRADUATE
STUDENTS



155
GRADUATE
STUDENTS

COMMERCIALIZATION TO TRANSLATION

1200

DISCLOSURES

50

PATENT APPLICATIONS

15

LICENSES

2

START-UPS

Redoubling our commitment to drive discoveries beyond the dissertation or scientific article to societal impact is central to the mission of the Institutes and Centers at Discovery Park District. Being co-located with Purdue Innovates, which provides support and resources for technology commercialization, and a growing cadre of resident companies and government laboratory satellite offices, expedites translation. As we forge new translation paths within and well beyond the district, we work continuously to increase awareness of and efficiencies within commercialization pathways and knock down barriers — and even myths — when we find them.

Fiscal year 2024 has brought notable successes. Perhaps most prominent was the entry into clinical use of PLUVICTO®, developed by Philip Low, Purdue's Presidential Scholar for Drug Discovery and the Ralph C. Corley Distinguished Professor of Chemistry in the College of Science, in collaboration within the Purdue Institute for Cancer Research (PICR).

An example of an accelerating success story is embodied in the growth in research partnership with SAAB Inc. in the Discovery Park District. While their decision to locate near Purdue University to build the center fuselage for the USAF/Boeing T-7 Red Hawk Trainer was multidimensional, the opportunity for joint pursuit of federally sponsored research with Purdue was key. Together, Purdue and SAAB Inc. have won several major research awards over the past three years.



Philip Low, Purdue's Presidential Scholar for Drug Discovery and the Ralph C. Corley Distinguished Professor of Chemistry in the College of Science, in his lab. Low is also a member of the Purdue Institute for Cancer Research and the Purdue Institute for Drug Discovery. (Purdue University photo)

SELECT NOTABLE PUBLICATIONS

Purdue Institute for Cancer Research member and biomedical engineering associate professor Fang Huang published in [Nature Communications](#). The findings provide a theoretical approach to quantitatively account for the impact of noise on a microscope's resolution, an important factor for precise microscopic cancer research.

Purdue Quantum Science & Engineering Institute advances toward the next giant leap in quantum electronics by combining twistrionics with spintrionics. See Yong Chen's contributions in June 2024's [Nature Electronics](#).

In April 2024, a Purdue Institute for Drug Discovery team published in [Nature Communications](#) about novel delivery of a tumor-responsive chemo-immunotherapy drug for Glioblastoma, one of the most aggressive and lethal tumors in humans.

Herman Sintim of the Purdue Institute for Cancer Research leads a team that engineered a compound to treat drug-resistant acute myeloid leukemia. The work was published in the June 2024 [Journal of Clinical Investigation](#).

1000+
PEER-REVIEWED
FACULTY PUBLICATIONS