

2022

ANNUAL REPORT

Discovery and Innovation with a Purpose



\$47.7M

Awards

\$40.8M

Expenditures

421

**Proposals
Submitted**

Introduction

We have ended a successful year of activities for our research enterprise. The cross-cutting research groups have continued the discussions on defining the short and long-term research goals, based on our internal strengths and external research relationships, and on the need to solve the great global challenges. In addition, in collaboration with the Advancement Division we have had productive meetings with faculty members to discuss potential moonshot projects, that helped develop a vision in five different areas, and meetings with our government consultants to align our funding requests to the federal priority areas. These on-going efforts are meant to define and continuously adjust our research strategy.

FY22 was the second highest year in the value of award installments received: through the Office of Sponsored Programs, we were awarded \$47.7 million in government, corporate, and private funding. FY22 also marked the third highest in number of proposals submitted and total value of proposals, 421 proposals for a total value of almost \$326M. Research expenditures had a 10% increase to an all-time high of \$40.8M, the first time above the \$40M mark. Expenditures are the best indicator for actual research activities on campus, and this increase of expenditures/activities is even more impressive given that FY22 was still impacted by the effects of COVID. The externally recovered indirect costs, returned to the operating budget, were at an all-time high of \$8.1M. The new awards, contracts and cooperative agreements received in FY22 have reached a record projected value of \$71M for the life of the awards.

In addition, 11 new patents were issued and 7 licenses executed, three of them with startup companies, and the first gas cans having the flame arrestor designed at WPI, were put on the market by Scepter.

For the first time, our top funder was the Department of Defense (35%), followed by the National Science Foundation (32%), the National Institutes of Health (15%), the Department of Energy (10%), the USDA (4%), and the U.S. Department of Education (2%).

I would like to thank our faculty, students and staff who made this happen and our colleagues in the Offices of Sponsored Programs (OSP), Sponsored Programs Accounting (SPA), Office of Technology Commercialization (OTC), the Research Solutions Institute (RSI), and our new Office for Research Integrity and Compliance (ORIC), as well as our technical staff, for providing crucial support to WPI's researchers.

It is too early to tell what FY23 will look like. With close to \$15 million in new awards and award increments in the first 3 months of this fiscal year, we are off to a great start!



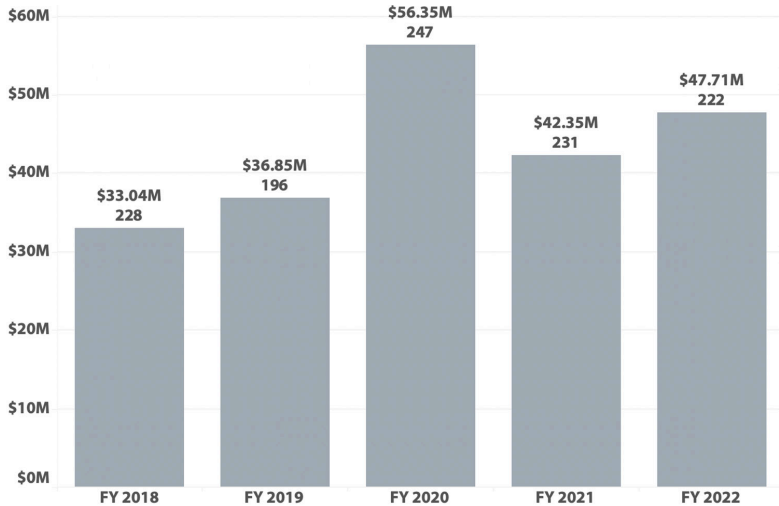
*Bogdan M. Vernescu,
Vice Provost for Research*



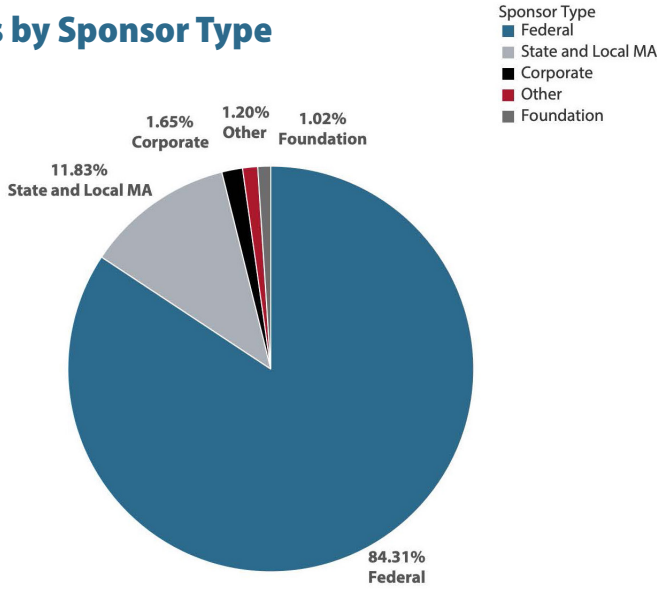
Awards

WPI received \$47.71M in awards in FY22. Awards are funds which have been fully obligated and released by the sponsor. In cases where a grant is funded in yearly increments, only those increments received by WPI are counted as awards.

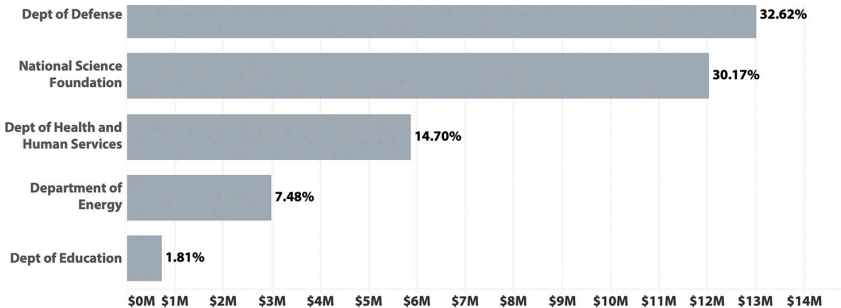
Awards Overview



Awards by Sponsor Type



Awards by Top Federal Sponsors





AWARDS BY SCHOOL

\$14.1M

Arts & Sciences

\$30.5M

Engineering

\$991K

Business

\$281K

Global

\$1.8M

Other

Awards

Awards by School

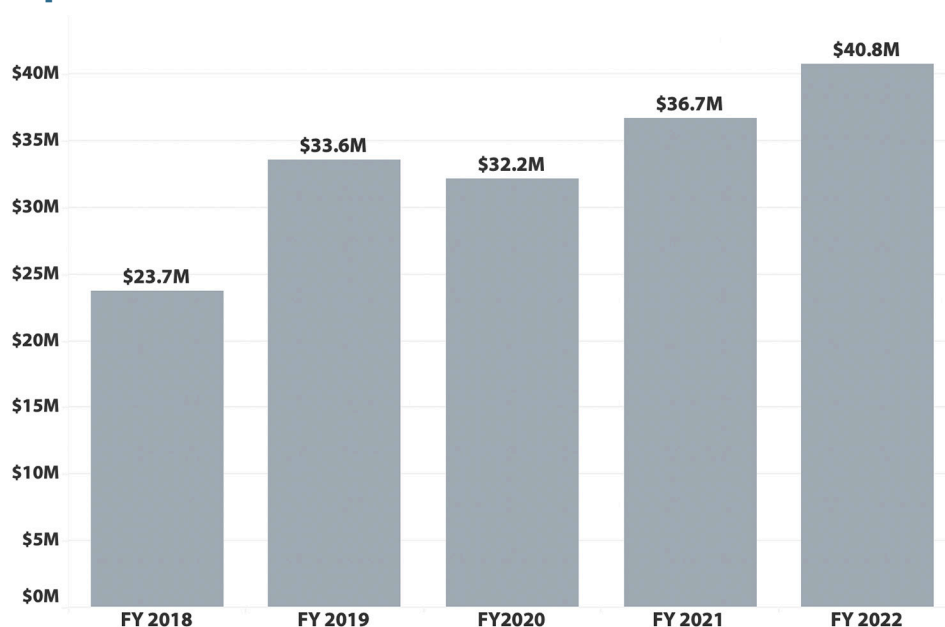
	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Arts & Sciences	\$16,964,998	\$16,002,966	\$23,401,978	\$19,071,651	\$14,060,218
Business	\$219,895	\$659,530	\$672,457	\$1,985,492	\$991,195
Engineering	\$14,140,673	\$18,783,250	\$30,566,966	\$19,555,376	\$30,544,454
Global	\$68,448	\$75,175	\$259,245	\$25,232	\$281,479
Others	\$1,641,047	\$1,331,251	\$1,450,569	\$1,716,266	\$1,835,235
Grand Total	\$33,035,061	\$36,852,172	\$56,351,216	\$42,354,016	\$47,712,580

Expenditures

Expenditures are actual costs for research and educational activities paid from WPI’s external funding in a given year. These costs are recorded in real-time as the research is taking place, unlike awards which are recorded as a lump sum. As such, expenditures provide the most consistent year-over-year measure of funded research activity at WPI and partner institutions.

The next two charts show the research and education expenditures funded by grants in FY22.

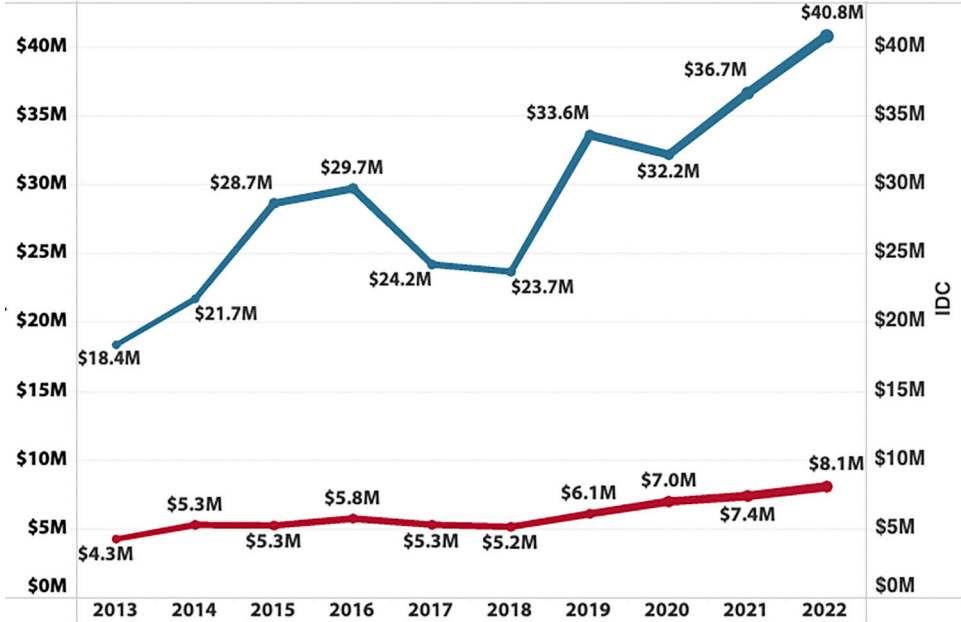
Expenditures Overview





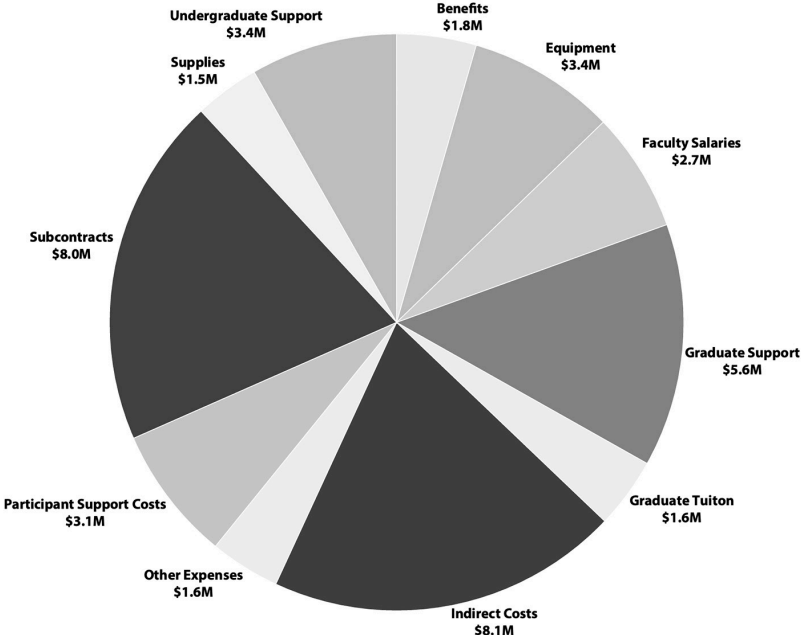
Expenditures

Expenditures and IDC



The third pie chart shows the categories these expenditures were in: \$1.6M in graduate tuition, and \$3.4M in undergraduate and \$5.6 in graduate support (that includes funding for 189 undergraduate and 300 graduate students), \$2.7M in faculty salaries (which also includes funding for 43 post-docs and non-faculty researchers), \$3.4M worth of scientific instrumentation, \$8.1M in indirect costs returned to the operating budget, \$3.1M in support for workforce development activities, and others.

Expenditures Breakdown



Funding Spotlight: GLOBAL INITIATIVES and LOCAL COMMUNITIES



Michael Elmes, The Business School, has been awarded a grant from the U.S. Department of Education for a project that is designed to prepare New England Students, Faculty, and Business Professionals for Climate Resilience Enterprise Opportunities (CREO) in New Zealand and the Oceania Region. The project provides an international focus to a growth area of business (climate resilience) and builds on local interest and expertise in innovative business approaches to climate change adaptation and mitigation.

Katherine Foo and Sarah Stanlick, Integrative and Global Studies, have received a grant from the National Science Foundation for a project that engages with BIPOC experiences and perspectives to render visible BIPOC ecological knowledge and sustainability policy networks to broader publics. The project's goal is to produce an urban metabolic model for urban and regional food systems, which repairs historical grievances, and is rooted in relational place identities.



Seth Tuler, Department of Integrative and Global Studies, has received an award from the National Science Foundation to expand existing partnerships and lay the foundation for a Massachusetts Integrated Landscape and Land Use Research for Sustainability Network through co-learning activities, relationship building, and development of resources to support integrated land use planning and management in the Commonwealth. The project advances sustainability and climate resilience goals in Massachusetts, and it broadly advances collaborative governance by initiating partnerships and research among sectors where communication and coordination about land uses are weak.

Joseph Sarkis, The Business School, has received a grant from the Mass Tech Collaborative for a collaboration with Worcester State University and WorcLab to create the Worcester Smart City Technology Lab. The goal of this Project is to lay the groundwork for combining current Worcester and Central Massachusetts resources from academia, government, and the private sector to research and develop solutions for easily applying blockchain and AI to industry for social good and inclusiveness.



Funding Spotlight: MatR: Materials Reimagined



Nima Rahbar, Civil and Environmental Engineering, and **Suzanne Scarlata**, Chemistry and Biochemistry, received an award from the NSF to create a new class of inexpensive, carbon-negative, self-healing construction materials. These materials utilize a safe, ubiquitous, biological enzyme that can efficiently capture CO₂. The proposed method provides a means for the development of carbon-negative materials to ultimately replace concrete.

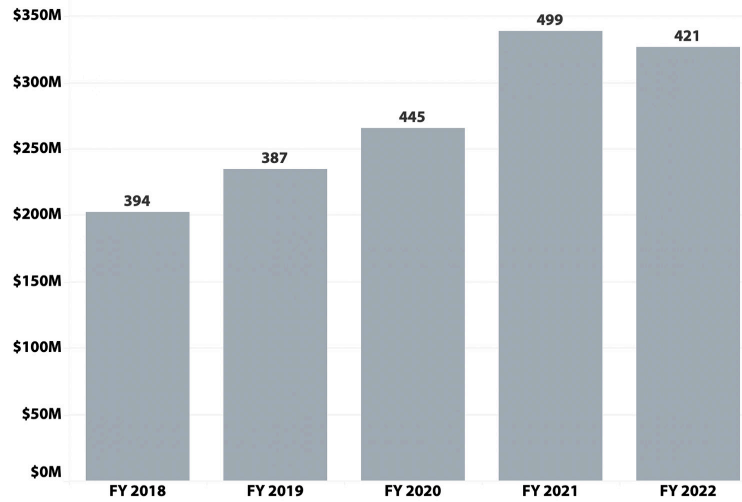
Yu Zhong, Mechanical and Materials Engineering, received an award from the Department of Energy for a collaboration with West Virginia University, which aims to design a hetero-structured oxygen electrode material for Solid Oxide Electrolysis Cells (SOECs) through a computationally guided approach, which is resistant to compositional and phase changes, and to performance degradation, in the operation conditions with the presence of chromium (Cr)-containing gas impurities.



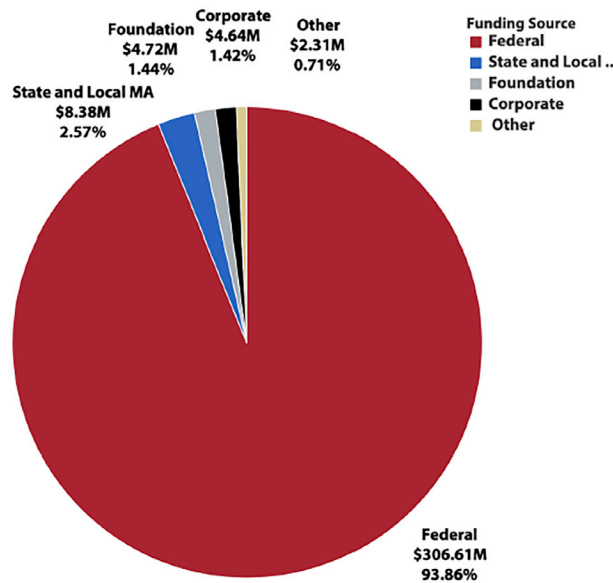


Proposals

Proposals Overview



Proposals Submitted by Sponsor Type

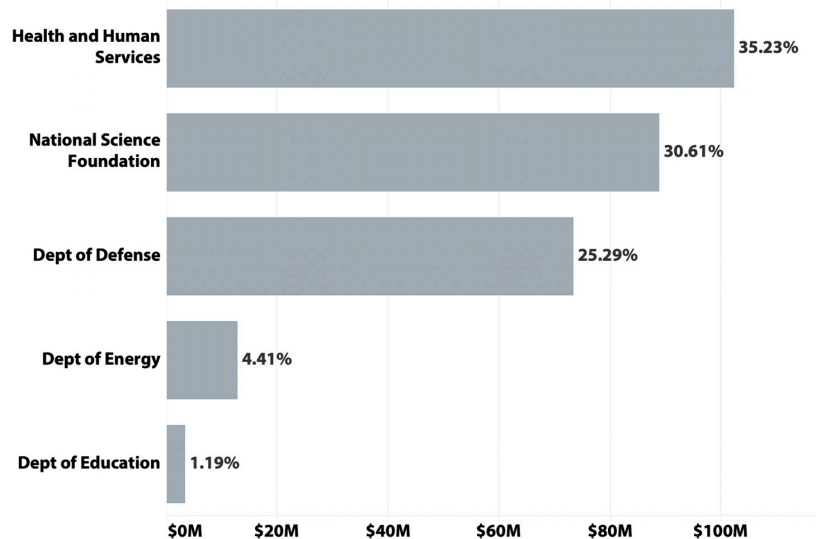


Proposals Submitted by School

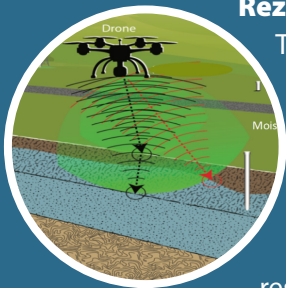
School	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Arts & Sciences	\$109,590,744	\$114,604,684	\$107,532,150	\$181,991,609	\$137,055,967
Business	\$6,415,282	\$1,404,014	\$5,050,532	\$4,138,270	\$4,923,625
Engineering	\$84,161,007	\$116,567,646	\$142,986,123	\$131,866,996	\$172,858,221
Global		\$372,371	\$918,458	\$1,065,902	\$3,815,712
Other	\$2,583,290	\$2,054,068	\$9,437,850	\$20,123,737	\$7,996,988
Grand Total	\$202,750,323	\$235,002,783	\$265,925,113	\$339,186,514	\$326,650,513

Proposals

Proposals Submitted to Top Federal Sponsors



Funding Spotlight: SMART WORLD

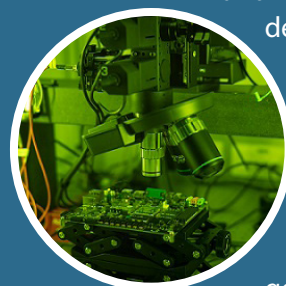


Reza Zekavat, Physics and Data Sciences, has received a USDA grant for a collaboration with Michigan Technological University to develop a technology that facilitates efficient megafarm irrigation. Its goal is to redesign a radar, integrate it with drones, and equip it with Artificial Intelligent (AI) for soil root-zone moisture characterization.

Erin Ottmar, SSPS and Learning Sciences and Technologies, received an NSF CAREER award this year. Her project aims to change math instruction by providing teachers with rich information about their students' math strategies, behaviors, and learning in real-time. Its results will advance foundational knowledge in math cognition, embodied cognition, computer science, and STEM learning that will contribute to a deeper theoretical and empirical understanding of developmental, cognitive, and perceptual mechanisms underlying mathematical thinking and problem solving.



A faculty team in Electrical and Computer Engineering received two major equipment awards in FY22, funding cutting-edge microscopes and creating the basis of a collaborative research and development center to advance secure manufacturing of semiconductor chips. **Saba**



Ganji received an NSF Major Research Instrumentation award for the acquisition of a High-Resolution Photon Emission/Laser Fault Injection Microscope, which is designed to be used for failure analysis and security assessment of electronic systems. **Shahin Tajik** received a grant from the Massachusetts Technology Collaborative for the purchase of a complementary semiconductor failure analysis system, which will be used in a collaboration with universities, companies and non-profit research labs to create new capability for security testing of semiconductors and for training a next generation workforce for hardware security.



HIGHLIGHTS RSI

70

Number of
Proposals
Supported

\$15.M

Amount of
Awards
Supported

8

Education
& Training
Events
Hosted

16

Seed
Grants
Awarded

Research Solutions Institute (RSI)

Purpose-Driven Education and Research

As part of WPI's Strategic Plan: *Lead with a Purpose*, RSI has focused its research development resources to enhance the institutional strategic area of Purpose Driven Education and Research.

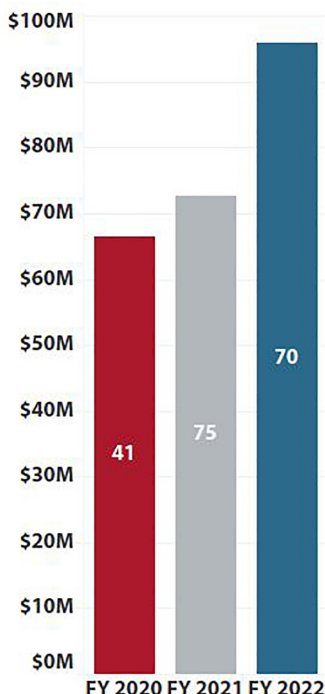
With that focus in mind, the RSI team has further developed services in FY22 geared towards increasing resources for the research community.

- **Proposal Development:** Addition of graphics development support and defining proposal levels of service: Basic, Intermediate, Advanced, and Intensive to assist with faculty proposals
- **Education and Training:** Hosting of additional Workshops, Brown Bags Lunches, Training Sessions, and other events geared towards enhancing collaboration
- **Internal Funding Opportunities:** Addition of seed grants provided to faculty to aid in collaborative research

Proposal Development

While the number of proposals supported has dropped slightly in FY22, the total value of the proposals submitted has increased. To help manage faculty expectations and work effectively, the team has defined proposal development services into Basic, Intermediate, Advanced, and Intensive levels. Of the 70 proposals developed, 36% proposals received Advanced services and 29% proposals received graphics services.

Our goals for FY23 are to increase proposals submitted in the larger amount range, to increase the number of proposals for which graphics development services are provided, and to increase the number of proposals receiving Intermediate level services to strengthen the quality of proposals submitted.



Internal Funding Opportunities: Seed Grants

Our TRIAD interdisciplinary projects concluded, and we had a symposium showcasing results in late March. We are collaborating again with several UMass campuses on seed grants. In December, UMMS CTSA awarded funds to three such collaborative projects, and more recently we awarded five such seed grants with UMass Lowell. Most recently, we had an internal planning grant competition focused on research/scholarship in the diversity, equity, inclusion, and justice (DEIJ) space. We awarded eight projects from this **DEIJ Planning Grant** initiative.

For FY23 RSI has invested in an additional resource InfoReady that is designed to streamline the internal grant and limited submission process. We anticipate this streamlined process will help faculty, the Research Development Council, and the RSI team work more proactively and efficiently in identifying and communicating funding op-



RSI

opportunities in a timely manner that will lead into quality proposals submitted.

Manufacturing USA Institutes

WPI has an active portfolio of research and education initiatives in advanced manufacturing through WPI's memberships in twelve federally sponsored Manufacturing USA Institutes (MIIs). Several synergies among and beyond the MIIs continue to take shape leading to additional funding avenues, cross-team interactions, and expanded impact of MII investment.

NextFlex awards, e.g., have allowed us to receive follow-on funding from the Army Research Lab for **Pratap Rao's** work to develop a manufacturable, washable, soft robotic haptic glove prototype. The Massachusetts Manufacturing Innovation Initiative (M2I2) has provided equipment funding in support of this project to add screen-printing and chip bonding capabilities to the printed electronics lab at LEAP and a testbed for human-robot interaction.

Another Institute, **BioMADE**, has provided funding for a regional workforce development partnership led by Eric Young to prepare high school students for transition to programs at Qunsigamond Community College and WPI in Biomanufacturing. Furthermore, **REMADE**, is funding **Brajendra Mishra** and **Adam Powell's** collaboration with Phinix to develop, validate and commercialize processes to selectively remove Fe, Cu, Si, Mn, and Zn from molten scrap-based secondary aluminum melts.

RAPID, another MII, is a partner on a large grant that **Mike Timko**, Chemical Engineering, was awarded by the Department of Energy's Advanced Manufacturing Office. This project sets out to demonstrate a new efficient process for converting sewage sludge waste into natural gas, thus potentially making wastewater treatment a net zero process.

Instrumentation and Facilities

WPI opened its first service centers, LEAP and PracticePoint, a few years ago. Last year, we added three more centers, the Cell Engineering Research Equipment Suite - CERES, the lab facilities in the Materials Processing Institute and the Materials Characterization Lab. We are furthermore working on a searchable database of all scientific equipment at WPI and have just concluded the project's first phase.

Office of Technology Commercialization (OTC)

The Office of Technology Commercialization (OTC) has received 48 invention disclosures in FY22. 11 new patents have been issued and 7 licenses have been executed, three of them with startup companies. Three new Startup companies have formed.

Yan Wang, Mechanical Engineering, has started his second company, **AM Batteries**, as a follow up to his highly successful Ascend Elements. AM Batteries is based on joint intellectual property with Missouri Science and Technology. AM Batteries is working on a new, unique way of producing lithium batteries. The company has completed a seed round of financing and has already hired a WPI graduate as its first employee. It is closing on a major round of financing in the fall of 2022 to accelerate the commercialization of the idea.

The work of **Suzanne Scarlata**, Chemistry and Biochemistry, and **Nima Rahbar**, Civil and Environmental Engineering, in the area of self-healing and repair of concrete has been licensed to a new startup, **Enzymatic, Inc.** Enzymatic is headed by WPI alumnus, Charlie Maddox, who is working on contracts to validate the technology on a large scale. The timing for commercialization is excellent as the government has put an emphasis on infrastructure repair. We are looking forward to the growth of Enzymatic and the application of WPI's technology.

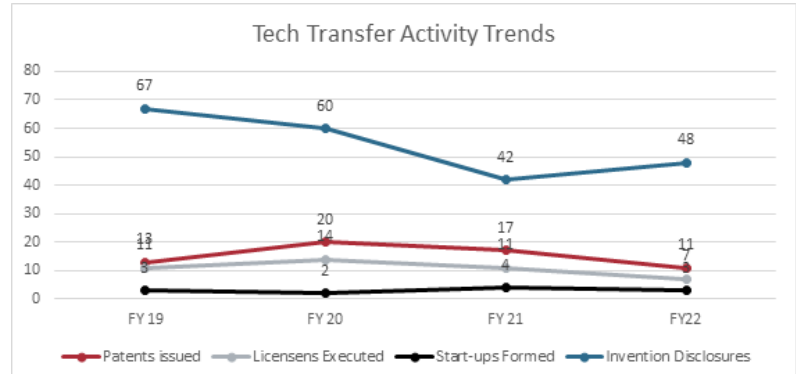
HIGHLIGHTS
OTC
48
**New
Invention
Disclosures**
11
**Issued
Patents**
7
**Licenses
Executed**
3
**New Startup
Companies**
240
**Jobs
Created**
\$220M
**Raised by
Startups**
OTC

Ali Rangwala and his team in Fire Protection Engineering came up with the concept of a special adapter to be added to the common household gas can to prevent it from potentially blowing up. This adapter technology was licensed to Scepter in 2021, one of the largest gas can manufacturers in North America. The first gas cans were produced and began

selling in March of 2022. It takes a long time to navigate the commercial pathway as the original patent was filed in March of 2014. It is exciting to see an idea coming from the lab to be translated into something that will add to the safety of a common product.

Another important contribution from OTC was finding and connecting the Innovation Studio to WPI's Seaport location. The Innovation Studio operates District Hall, a community space that supports the entrepreneurial community at the Seaport and which is a short walk from WPI's location. The Innovation Studio/District Hall has entered a partnership with WPI to support the entrepreneur ecosystem at the Seaport and connecting it to Worcester.

OTC finished the winter I-Corps cohort with 7 new teams graduating. OTC also runs the WPI Commercialization Fund, with currently 9 companies with active investments. In the case of WPI's most successful start-up, the initial investment of \$25,000 from this fund is now worth over \$800,000. This company won the Association of University Technology Managers (AUTM) Better World Award, which celebrates the exemplary process of moving technology from basic research into the marketplace. Sixty-five applicants from 7 countries applied and WPI was voted top choice.


Office of Research Integrity and Compliance (ORIC)

With the recent growth in WPI's research funding, it has become increasingly important that we focus on managing the risks associated with research. For this reason we have established a new department within the OVPR organization: the Office of Research Integrity and Compliance (ORIC). ORIC is responsible for regulatory compliance, risk management, and ethical oversight related to WPI's research activities. ORIC is currently focused on the following areas:

- **Conflict of interest:** ORIC administers the annual COI disclosure and review process. In coordination with the Conflict Management Committee, ORIC administers conflict management plans for approximately 20 faculty members.
- **Human Subjects:** ORIC oversees WPI's human research protection program and IRB. The IRB reviews approximately 550 proposals per year and currently provides oversight for 64 grant-funded projects.
- **Export Control:** ORIC advises faculty on export control concerns, reviews research propos-

ORIC

als and contracts for export concerns, and develops internal controls for managing export risks. We also provide training for faculty working on export-controlled research.

- **International engagements:** ORIC provides risk assessment and management related to international research funding, visiting scholars, and other engagements in countries of regulatory concern.

ORIC also coordinates with other compliance bodies on campus, such as the IACUC, Institutional Biosafety Committee, Environmental Health & Safety, and others, to better manage risks and promote a culture of safe and ethical research at WPI.

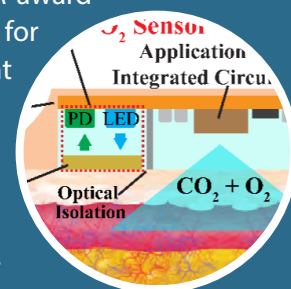
Funding Spotlight: BIOPPOINT

Four faculty affiliated with BioPoint received NSF CAREER awards this year.



Amity Manning, Biology and Biotechnology, won her CAREER for a project to determine the factors influencing a critical piece of cellular machinery during normal cell division. The five-year project will focus specifically on histone modifications in a dividing cell and how they recruit proteins to help with the process of cell division. More broadly, the project will answer questions about a fundamental cellular process that impacts how organisms grow, mature, and maintain life.

Ulkuhan Guler, Electrical and Computer Engineering, received her CAREER award for a project that will create a first-of-its-kind multimodal blood gas monitor for managing the home care of at-risk patients continuously in real-time to prevent acute respiratory failures. This technology will address a critical unmet need by providing remote relevant and accurate data alerting a caregiver to an acute health risk and informing the course of treatment outside of a clinical setting. This need would be satisfied by a wearable device for the noninvasive, continuous monitoring of blood gases (oxygen and carbon dioxide) at home, which would revolutionize the monitoring and treatment of numerous respiratory diseases.



Min Wu, Mathematical Sciences, received a CAREER award for a project that sets out to expand our current understanding of filamentous cell wall growth by developing mathematical models and methods to probe how the secretion of new cell wall materials and cell wall mechanics regulate cell wall extension and morphologies. There is a great need for a mechanistic understanding of the process of filamentous tip growth, such as that of root hairs and pollen tubes in seed plants and hyphal growth in fungus, to unleash its full potential in revolutionizing both agriculture and public health.

Natalie Farny, Biology and Biotechnology, received an award from the Environmental Protection Agency for a study whose goal it is to understand, predict, and control the relationships between soil microbial communities (SMCs) and genetically engineered microbes (GEMs). Farny hypothesizes that changes in dominant SMC species affect the survival and persistence of GEMs, and that understanding these relationships will permit us to manipulate SMCs to control GEMs.





CONGRATULATIONS

to PIs and Co-PIs who received initial awards in FY2022

Departments	Principal Investigator	Sponsor Name	Project Title	Total Award
Academic Affairs	Bogdan M Vernescu	Department of the Army	TESTING & EVALUATION FOR SOLDIER-DEVICE TEAMING COMPATIBILITY, VULNERABILITY, AND DURABILITY IN EMERGENT SITUATIONS	\$5,283,619.00
Aerospace Engineering	Nikolaos A Gatsonis	National Aeronautics & Space Administration	Multiscale Computational Modeling of Dusty Plasmas near Space Surfaces	\$195,540.00
		Department of the Air Force	Cathode Modeling for 15 kW Hall Effect Thruster	\$15,000.00
		Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal Technology Division	A Machine-Learning Enabled Estimation Approach for Real-Time Plume and Source Tracking with a Network of Autonomous Underwater Vehicles	\$347,843.00
	Raghvendra V Cowlagi	National Science Foundation	Making Sense: Simultaneous Sensor Configuration and Optimal Control for Autonomous Systems	\$530,029.00
		Air Force Office of Scientific Research	TESTBED FOR MULTIMODAL SENSOR CONFIGURATION, REAL-TIME ESTIMATION, AND OPTIMAL CONTROL IN AUTONOMOUS SYSTEMS	\$334,077.00
Arts & Sciences Dean	Jean A King	Luce (Henry) Foundation, Inc.	Clare Boothe Luce Program: CBL Graduate Fellowships in Computer Science and Physics	\$276,128.00
Biology & Biotechnology	Amity L Manning	National Science Foundation	CAREER: Characterization of epigenetic factors and their regulatory roles in modulating mitotic fidelity	\$1,112,526.00
	Longkuan Xiang	Stellate Biotherapeutics, Inc.	Stellate Biotherapeutics Master Research Services Agreement	\$4,232.00
	Luis Vidali	National Science Foundation	Collaborative Research: Regulation of exocytic membrane trafficking required for cytokinesis and polarized cell expansion	\$449,996.00
	Natalie Farny	Environmental Protection Agency	Relationship of Soil Microbial Diversity to Persistence and Stability of SynBio Microbes	\$449,213.00
		National Institutes of Health/NIH/DHHS	Identification of Genetic Suppressors of Stress Granules	\$147,257.00
Biomedical Engineering	Catherine F Whittington	National Cancer Institute/NIH/DHHS	Using photopolymerizable collagen matrices to investigate how progressive stiffening alters lymphatic trafficking of cancer and immune cells in pancreatic ductal adenocarcinoma	\$147,257.00
		National Science Foundation	ERI: Reframing the Narrative of Mechano-modulation in Lymphatic Morphogenesis Using an Integrated In Vitro System	\$199,995.00
		Genentech, Inc	Integrated System to Model Microenvironmental Dynamics in Pathological Lymphangiogenesis In Vitro	\$50,000.00
	Eric M Young	Department of the Air Force	Regional Partnerships for Training the Bio-manufacturing Workforce in Worcester, MA	\$23,616.00

Departments	Principal Investigator	Sponsor Name	Project Title	Total Award
Biomedical Engineering	George D Pins	American Heart Association	Development of Composite-based Cardiac Patch with an Integrated Microvascular Network	\$154,000.00
	Jeannine M Coburn	National Science Foundation	REU Site: Integrated Bioengineering Research, Career Development, and Outreach Experiences at WPI	\$413,454.00
		The Bryon Riesch Paralysis Foundation	Injectable Hydrogel Scaffold with In Situ Aligning Fiber Architecture to Orient Cross-Lesion Axonal Regeneration in Traumatic Spinal Cord Injury (SCI)	\$43,059.00
	Karen Troy	National Institutes of Health/NIH/DHHS	Biomechanical factors affecting metatarsal fatigue and bone stress injury risk	\$557,351.00
Center For Stem Teaching	Katherine C Chen	Massachusetts Executive Office of Education	Central MA STEM Network Year 7 \$35k grant	\$35,000.00
Chemical Engineering	Anthony G Dixon	Johnson Matthey	Understanding product performance by using machine learning to enable multi-scale modeling	\$128,335.00
	Christina M. Bailey-Hytholt	Massachusetts Life Sciences Center	Placental proteoliposomes for pharmaceutical and nutrient screening	\$237,542.00
	Michael T Timko	Department of Energy	Harvesting Energy from Waste Water by Converting Sewage Sludge to Renewable Natural Gas	\$2,002,498.00
	N A Deskins	National Science Foundation	Collaborative Research: Solar CO2 Reduction by Atomically Dispersed Metal Sites on Few-Layer Carbon Nitride	\$247,080.00
	Susan C Roberts	SaponiQx Inc	Establishing Robust Plant Cell Suspension Lines to Produce Saponins	\$150,000.00
Chemistry & Biochemistry	Jose M Arguello	National Institutes of Health/NIH/DHHS	Molecular determinants of Salmonella cell-envelope homeostasis	\$2,181,492.00
	Patricia Musacchio	American Chemical Society	Direct Installation of Ketone and Cyano Functional Groups for the Rapid Upgrading of Hydrocarbons and Feedstock Chemicals	\$110,000.00
	Robert E Dempski	National Institutes of Health/NIH/DHHS	The role of ZIP12 in zinc homeostasis and associated neurodegenerative pathologies	\$416,354.00
Civil & Environmental Engineering	Nima Rahbar	National Science Foundation	A Carbon Negative Self-Healing Enzymatic Construction Material	\$692,386.00
Computer Science	Craig A Shue	Department of Defense	2021 DoD CySP Worcester Polytechnic Institute Scholarship Grant	\$94,468.07
	Dmitry Korin	National Institutes of Health/NIH/DHHS	Predicting the functional impact of alternative splicing on protein interactions using an integrated approach	\$1,291,970.00



Jeannine Coburn and Kris Billiar, Biomedical Engineering, have received an award from the NSF to integrate socially directed engineering into a bioengineering Research Experience for Undergraduates site at WPI. Research from this project will contribute to efforts in bioengineering to improve human health. The socially directed engineering design thinking will encourage students to think more globally and creatively about the potential impact of their work. The project will provide research, mentoring and professional development opportunities to prepare participants for graduate programs and careers in STEM fields.



Departments	Principal Investigator	Sponsor Name	Project Title	Total Award
Computer Science	Elke A Rundensteiner	Department of the Army	Thermoset Design for Additive Manufacturing	\$75,000.00
	Erin Solovey	National Science Foundation	RET Site: Engineering for People and the Planet: Research Experiences for Teaching Integrated STEM	\$599,980.00
	Lane T Harrison	National Science Foundation	Collaborative Research: CCR: New: reVISit: Scalable Empirical Evaluation of Interactive Visualizations	\$747,283.00
	Mark L Claypool	Google Inc.	Research Improved Playout Buffer Sizing and latency for Cloud-based Game Streaming	\$90,000.00
	Neil Heffernan	National Science Foundation	Collaborative Research: Common Error Diagnostics and Support in Short-answer Math Questions	\$239,307.00
		National Institutes of Health/NIH/DHHS	Building a mathematical problem-solving environment to prepare K-5 students for success in STEM and health careers.	\$24,308.00
		National Science Foundation	Support for U.S. Doctoral Students to Participate in the Annual Artificial Intelligence in Education (AIED) and co-located Educational Data Mining (EDM) Conferences	\$25,000.00
	Robert J Walls	National Science Foundation	Collaborative Research: SaTC: CORE: Medium: Compiler-Assisted Embedded Security	\$599,848.00
	Rodica Neamtu	AI4ALL	College Pathways	\$7,036.00
	Xiaozhong Liu	National Science Foundation	SCISIPBIO: Constructing Heterogeneous Scholarly Graphs to Examine Social Capital During Mentored K Awardees Transition to Research Independence: Explicating a Matthew Mechanism	\$249,456.00
National Science Foundation		Collaborative Research: SaTC: CORE: Medium: Audacity of Exploration: Toward Automated Discovery of Security Flaws in Networked Systems through Intelligent Documentation Analysis	\$349,276.00	
Electrical & Computer Engineering	Alexander Wyglinski	Department of Defense	Securing Future 5G Connectivity	\$345,661.00
	Andrew Clark	Air Force Office of Scientific Research	AFOSR YIP: Leios: Complex Network Resilience Through Controlled Islanding and Reconnection	\$441,228.00
	Berk Sunar	Qatar National Research Fund	Qatar Research Fund	\$155,460.00
	Edward A Clancy	National Institute on Disability & Rehabilitation Research/DHHS	Optimyo SBIR Phase 1	\$14,979.00
	Fatemeh Ganji	National Science Foundation	MRI: Acquisition of High-Resolution Photon Emission/Laser Fault Injection Microscope with High-Performance Computers for Failure Analysis and Security Assessment of Electronic Systems	\$360,608.00
		National Science Foundation	ERI: Theoretical Foundations of Deep Learning for Side-channel Analysis	\$194,726.00

Departments	Principal Investigator	Sponsor Name	Project Title	Total Award
Electrical & Computer Engineering	Sergey N Makaroff	National Institutes of Health/NIH/DHHS	Brain and Human Body Modeling Conference – from Fast and Accurate Computational Modeling to Clinical Practice	\$20,000.00
	Shahin Tajik	Massachusetts Technology Collaborative	Toward a Globally Competitive Electronics Workforce Endowed with Next Generation CyberSecurity Technologies	\$1,999,326.00
		National Science Foundation	Collaborative Research: SaTC: CORE: Small: ERADICATOR: Techniques for Laser Assisted Side-Channel Attack Monitor & Response	\$263,484.00
	Ulkuhan Guler	National Science Foundation	CAREER: LUCO: A Noninvasive Miniaturized Blood Gas Sensor for Respiration Monitoring	\$500,000.00
		National Science Foundation	CDS&E: Novel Computational Models for Smart Wearable Blood Gas Monitor for Infants	\$499,341.00
Fire Protection Engineering	Albert Simeoni	Kidde	Effects of Inert Gas Discharge Time on Class A Fires	\$119,764.00
		National Institute of Standards & Technology/Technology Administration/DOC	Forecasting WUI fire resilience: Quantifying firebrand generation and transport to identify communities at risk	\$399,999.00
	Ali S Rangwala	Bureau of Safety and Environmental Enforcement/Department of the Interior	Floating FR System	\$854,077.00
	James Urban	National Science Foundation	ISS: Flame Spread Response to Non-steady Airflow	\$399,095.00
		National Science Foundation	ERI: Understanding the Role of Non-steady Wind Gusts in Wildfire Spread	\$200,000.00
Humanities & Arts	Yunus Telliel	New America Foundation	From Visibility to Institutionalization: Integrating a PIT Event Series through JUST-T Collab	\$90,000.00
Global School	Katherine Foo	National Science Foundation	SRS RN: To be truly regenerative, we must be reparative: a BIPOC agenda for regional sustainable systems	\$131,606.00
	Seth Tuler	National Science Foundation	SRS-RN: Land Use in Regional Sustainability Transitions: Establishing a Network of Research and Practice to Support Governance in Linked Urban and Rural Systems of Massachusetts	\$149,873.00
Innovation & Entrepreneurship	Manuj Sharma	National Institutes of Health/NIH/DHHS	Immersive and Interactive VR Platform for Quantitative Telehealth Rehabilitation for Rare Diseases	\$40,000.00
	Timothy Loew	Massachusetts Technology Collaborative	Mass Digi	\$100,000.00



Erin Solovey, Computer Science, and Kathy Chen, STEM Education Center, have received an award from the NSF to create a Research Experience for Teachers site at WPI, which provides six-week authentic research experiences under the intellectual focus of Engineering for the People and the Planet, as inspired by the UN Sustainable Development Goals. Five in-service classroom teachers and five pre-service (WPI teacher preparation students) were paired to work in a WPI faculty lab to conduct research and to translate their research experience into a classroom activity or lesson.



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K-12 Outreach	Mia Dubosarsky	Commonwealth of Massachusetts	I am STEM – STEM I am Expanding the successful STEM Lesson Library	\$41,596.00
Library Services	Teresa Negrucci	National Library of Medicine/NIH/DHHS	Collection Equity Award	\$2,000.00
Mathematical Sciences	Adam Sales	Institute of Education Sciences/Department of Education	Direct adjustment in combination with robust or nonlinear regression: software and methods for RDDs, RCTs and matched observational studies	\$127,086.00
		Institute of Education Sciences/Department of Education	Improving the Power of Education Experiments with Auxiliary Data	\$231,188.00
	Balgobin Nandram	National Agricultural Statistics/Department of Agriculture (U.S.)	USDA IPA agreement	\$108,263.00
	Christopher J Larsen	National Science Foundation	Variational fracture with loads	\$271,932.00
	Francesca Bernardi	Mathematical Association of America	Girls Talk Math at WPI: Improving students' attitude towards challenges and self-confidence through a math and media camp	\$6,000.00
	Guanying Peng	National Science Foundation	From differential inclusions to variational problems: theory and applications	\$197,999.00
	Min Wu	National Science Foundation	CAREER: Probing multiscale growth dynamics in filamentous cell walls	\$450,000.00
	Samuel Walcott	National Institutes of Health/NIH/DHHS	Collaborative Research: A Predictive Theory of Muscle Energy Consumption	\$1,269,818.00
	Vladimir Druskin	National Science Foundation	Collaborative Research: Multiscale Simulations and Imaging of Viscoelastic Media in Reduced Order Model Framework	\$159,552.00
	Zheyang Wu	National Science Foundation	New Techniques to Combine Measures of Statistical Significance from Heterogeneous Data Sources with Application to Analysis of Genomic Data	\$200,000.00
Mechanical Engineering	Adam Powell	National Science Foundation	Rare Earth Recycling Technologies	\$50,000.00
	Brajendra Mishra	National Science Foundation	IUCRC Phase III Worcester Polytechnic Institute: Center for Resource Recovery & Recycling (CR3)	\$200,130.00
		Department of Energy	Selective Recovery of Elements from Molten Aluminum Alloys	\$200,130.00
		Department of the Army	Materials Recovery Technology for Defense Supply Resiliency [MRT-DSR]	\$25,000,000.00
	Cosme Furlong-Vazquez	National Institutes of Health/NIH/DHHS	Middle Ear Nonlinearity in High Intensity Sound: Impact on Hearing Damage and Protection	\$515,130.00
	Danielle L Cote	Department of Defense	Modeling for Penn State	\$25,000.00
		Department of the Army	Advancing High Deposition Rate Additive Manufacturing Materials and Technologies	\$431,000.00
		National Center of Manufacturing Sciences	Improved Hardware Sustainment through Solid State Additive Manufacturing Development	\$200,000.18



Departments	Principal Investigator	Sponsor Name	Project Title	Total Award
Mechanical Engineering	Danielle L Cote	National Aeronautics & Space Administration	Application of Gas Dynamic Cold Spray Processing for Joining of Shape Memory Alloy	\$599,033.00
		Department of Defense	Non-Destructive Evaluation of Bonded Interface of Cold Spray Additive Repair	\$30,000.00
		Massachusetts Executive Office of Housing and Economic Development	Workforce and Technology Development Solutions to supply currently unavailable large format speciality castings via fully automated wire-to-part fabrication, treatment, and finishing	\$1,600,000.00
		Office of Naval Research	Cold Spray Development Project	\$299,952.00
	Jamal Yagoobi	National Science Foundation	IUCRC Phase II: Worcester Polytechnic Institute: Center for Advanced Research in Drying (CARD)	\$592,939.00
		Massachusetts CEC	Novel Energy-Efficient Drying Technologies for Food, Pulp and Paper, and other Energy Intensive Manufacturing Industries (DOE cost share)	\$150,000.00
		National Aeronautics & Space Administration	Electrically Driven Liquid Film Flow Boiling: A Two-Phase Heat Transport Device Driven by Electric Conduction Mechanism (Continuation)	\$549,997.00
	Pratap M Rao	Massachusetts Manufacturing Innovation Initiative (M2I2)	Manufacturing Capabilities for Soft Robotics in MA	\$844,242.00
		SI2 Technologies	Inkjet Printing Process Improvements	\$62,211.00
		Department of the Army	Soft Robotic Haptic Gloves as Intuitive Human-Machine Interfaces to Augment Human Performance	\$920,696.00
	Sarah Jane Wodin-Schwartz	National Science Foundation	Collaborative Research: Improving Engineering Students' Ability to Model and Analyze Systems Using Free Body Diagrams	\$255,883.00
	Yan Wang	National Science Foundation	SBIR Phase I: Development of Dry Manufacturing for High Energy Density and Low Cost Lithium Ion Batteries	\$15,000.00
	Yihao Zheng	National Institutes of Health/NIH/DHHS	Magnetic Rotational Exploratory Platform for Coronary Lesions	\$22,000.00
	Yu Zhong	Department of Energy	AOI 5: Heterostructured Chromium Resistant Oxygen Electrode for Solid Oxide Electrolysis Cells	\$999,973.00
Massachusetts CEC		Heterostructured Cr Resistant Oxygen Electrode for SOECs (cost share)	\$165,531.00	
Zhu Mao	National Science Foundation	Structural Dynamics Identification Using Motion Estimation and Video Magnification	\$376,410.00	
Office of Multicultural Affairs	Olufunmilayo Ayobami	National Science Foundation	Louis Stokes Renewal STEM Pathways and Research Alliance: Northeast LSAMP 2021-2026.	\$248,072.00
Office Of Undergraduate Studies	Colleen M Shaver	FIRST	First Lego - STEM Week Robotics Exposure	\$30,000.00
		Commonwealth of Massachusetts	First Lego - STEM Week Robotics Exposure	\$205,400.00
			MassFirst Robotics Grant - Expanding Access to High-Quality STEM Curriculum	\$299,669.86



Departments	Principal Investigator	Sponsor Name	Project Title	Total Award
Physics	David C Medich	Nuclear Regulatory Commission	Developing the research facilities, shielding, and licensing strategy for a next-generation university hybrid 'research and power' nuclear reactor	\$499,509.00
		Nuclear Regulatory Commission	WPI Nuclear Leadership Fellowship Program	\$399,942.00
	L. Ramdas Ram-Mohan	Air Force Research Laboratory	Extension of the k.p model to a 3-dimensional semiconductor heterostructure	\$44,532.00
	Seyed Zekavat	Department of Agriculture	Mesoscale AI-based root-zone soil moisture monitoring for efficient farm irrigation	\$1,172,896.00
Robotics Engineering	Carlo Pincioli	National Aeronautics & Space Administration	Coordination and Control of Swarms of Space Vehicles (Swarms of Space Vehicles)	\$51,019.00
	Gregory S Fischer	National Institutes of Health/NIH/DHHS	Physician Assistance Technology in Image-guided robotic intervention of prostate	\$1,172,270.00
School Of Business	Andrew C Trapp	T Rowe Price Foundation	SWAP Platform and Match Making Service	\$50,000.00
		Hispanics in Philanthropy	Refugee Inclusion: Employing Overlooked Talent	\$20,000.00
	Bengisu Tulu	National Institutes of Health/NIH/DHHS	Improving patient care in severe acute brain injury: a web/mobile/tablet-based communication and decision support tool for clinicians and families in the neuro-ICU	\$141,675.00
	Joseph Sarkis	Massachusetts Technology Collaborative	Worcester is FAB Lab for Social Good	\$125,874.00
	Michael B Elmes	Department of Education	Preparing New England Students, Faculty, and Business Professionals for Climate Resilience Enterprise Opportunities (CREO) in New Zealand and Oceania Regions	\$174,533.00
	Sara Saberi	Economic Development Administration/Department of Commerce	MERT 2.0	\$305,821.00
	Walter T Towner	Massachusetts Office of Business Development	Regional Pilot Program	\$18,420.00
Social Science & Policy Studies	Erin R Ottmar	National Science Foundation	CAREER: Grasping Understandings of Students Mathematical and Perceptual Strategies Using Real-Time Teacher Orchestration Tools	\$700,000.00
	Jeanine L Skorinko	National Science Foundation	External Review Letters in Promotion and Tenure Decision Making: Validity and Fairness	\$91,828.00
Social Science & Policy Studies	Jeanine L Skorinko	National Science Foundation	Understanding the effect of individual decision-making strategies on collective decision outcomes	\$166,891.00
	Oleg V Pavlov	Department of State	PBL Capacity Building with Kazakhstani Faculty	\$37,999.00
	Robert Krueger	Global Emergency Services Action (GESA)	GESA-WPI Perceptions of Public Safety Barometer for SSA	\$15,557.00
		USAID	Health Sanitation and Food Insecurity in Ethiopia	\$823,933.00

A special thank you to the individuals — who, through their hardwork — have contributed to the successes reported in this annual report.

Office of Vice Provost for Research (OVPR)

Antje Harnisch

Office of Sponsored Programs (OSP)

Orla Baxter, Michelle Mulkern, Kristen Bronger, Nicole Caligiuri, Allison Kunze, Courtney White, Chelsea Holland, Kristin Keane, Klelia Loloci-Silvestri, Katelyn Turnbull

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Gabriel Johnson

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Sujatha Koduvayur, Ben Nephew, Ellen Piccioli, James Eakin, Priscilla Vazquez

Sponsored Programs Accounting (SPA)

Heather Bilotta, Amanda Hickson, Colleen McShea, David Musto, Jennifer Wood

This report, published annually by the Office of the Vice Provost for Research, aims to provide a summary of key data related to WPI's extramural funding activities, including proposals submitted, awards received, and funds expended. As with prior years, this report includes only those proposals and awards administered by OSP. Gifts, internal funding, individual fellowships, and MQP/IQP project funding are not included here. We welcome your feedback on this report. Comments and suggestions can be submitted via email to Priscilla Vazquez, Research Development Specialist (pvazquez@wpi.edu).

Report layout, design, and Tableau data visualizations Priscilla Vazquez
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