



American Rescue Plan & COVID-19 Response Update

Updated May 9, 2022

FACTS

\$463,325,573

**ARP Research Recovery
Funds Mobilized**

1,472 Awards Funded

OVERVIEW



As part of the national effort to recover from the COVID-19 pandemic, the National Science Foundation (NSF) continues to fund important research as well as recovery efforts to help the United States science, engineering and STEM education communities rebound. From equipment delays and reagent shortages to lost training time and missed field research, the pandemic has strained research projects in unique ways. With the continued support from Congress and the Administration, including the \$600 million provided in the American Rescue Plan, NSF is able to support groups of individuals and institutions most strongly affected by the pandemic as well as those at vulnerable transition points in their research careers.

The funds are being invested consistent with the below guiding principles:



MOST STRONGLY AFFECTED GROUPS. The pandemic has exacerbated existing disparities and has had disproportionate impacts on specific groups of individuals. These strongly affected groups include:

- Women researchers, who have disproportionately taken on the duties associated with increased child-care and other family-related responsibilities.
- Underrepresented groups. Programs that support these students and researchers have been subject to disruption due to the pandemic.
- Early-career faculty. The early part of a research career represents a critical time for research productivity, building and funding a research program, and preparing for potential tenure and promotion.



INDIVIDUALS AT VULNERABLE CAREER TRANSITION POINTS. It is well established that attrition from STEM or higher education altogether frequently occurs at certain educational and career transition points, and the pandemic has intensified this threat. These individuals/transition points include:

- Undergraduates preparing to finish their degrees and attend graduate school.
- Graduate students, particularly those nearing the end of their research careers.
- Postdoctoral fellows, research trainees, and graduate fellows.
- Early career faculty.
- Mid-career faculty, who are often called upon to do greater service in light of pandemic impacts.

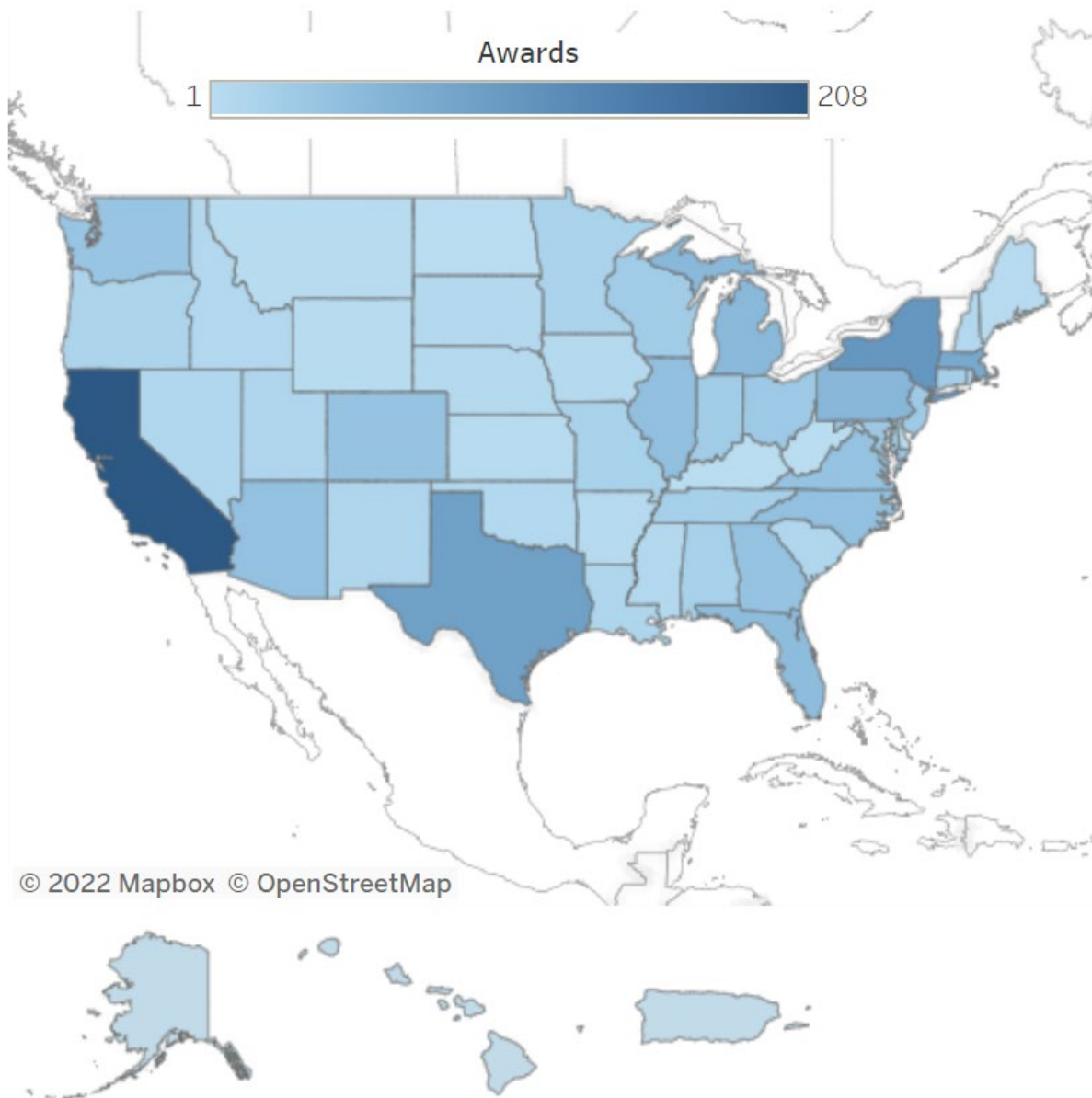


BROAD DISTRIBUTION. To ensure a broad distribution of funding and in further pursuit of the funds reaching those most impacted by the pandemic, NSF is using these funds towards an expansive research portfolio that prioritizes disproportionately affected persons at every institution as well as all persons at disproportionately affected institutions, such as:

- Minority-serving and less-affluent institutions, which may lack strong research administration infrastructure or the financial resources to support STEM students and faculty.
- Institutions in EPSCoR jurisdictions, which have not benefited from robust federal funding yet support a significant number of STEM students and faculty across the nation.

AWARDS

	American Rescue Plan funds	Research Recovery (FY21 + FY22)	COVID-19 Research (CARES Act + FY20 + FY21 + FY22)
Number of Awards	1,472	2,872	1,316
Funding Deployed	\$463,325,573	\$645,973,063	\$249,668,974



ARP awards by state

NSF Support

This update spotlights recent awards funded by the American Rescue Plan and research programs stood up by NSF to support the scientific research community. It is a snapshot of the essential research and support NSF is able to invest in thanks to the support from Congress and the Administration.

NSF PROGRAM FEATURE

Directorate for Technology, Innovation and Partnerships

America's Seed Fund, Small Business Innovation Research/Small Business Technology Transfer program

Small businesses and startups have been key players in delivering innovative solutions during the COVID-19 pandemic. The U.S. National Science Foundation has supported small businesses for more than 40 years. [America's Seed Fund](#), NSF's Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program, supports startups and small businesses through opportunities to move fundamental science and engineering out of the lab and into the market. SBIR/STTR focuses on funding entrepreneurs at the earliest stages of technology and company development -- transforming scientific and engineering discoveries into products and services with economic and societal impact.

American Rescue Plan funding has helped continue the agency's support of startups during the COVID-19 pandemic, providing \$18.1M for 20 NSF SBIR/STTR phase I and II projects. Early in the pandemic, NSF solicited proposals for the development of new technologies, products, and services to address the COVID-19 crisis. Startups nationwide rallied to respond with innovative technology solutions mobilizing to develop technologies ranging from rapid diagnostics to point-of-care sterilization of personal protective equipment to AI-based products that empowered distance learning. Please visit our website for a [full list of awards to small businesses working to address the COVID-19 crisis](#).

AWARD HIGHLIGHTS

DIVISION OF INFORMATION AND INTELLIGENT SYSTEMS American Rescue Plan \$174,716



Title [CRII: SCH: Developing a new hybrid interactive machine learning software tool for cancer researchers\)](#)

Institution Marshall University; Huntington, WV

Research & Recovery Recent advances in technology enable cancer researchers to detect the disease more effectively. Digital slide scanners produce very high-resolution images of tissue samples and specialized artificial intelligence software tools help medical and scientific experts in interpreting the tissue area. However, existing software tools detecting cancer areas have a limited capability to conduct integrated prediction of the cancer and the prediction has been performed based on either hand-crafted features or deep learning generated features. This project will develop an open-source hybrid interactive machine learning software tool that will enable pathologists to interactively detect cancer areas promptly and with high accuracy in whole slide images. This will be done by fusing hand-crafted features identified by clinical researchers and deep learning generated features so that cancer researchers can easily define the regions within which they can extract features of interest. The proposed hybrid interactive machine learning software tool will benefit regions such as Appalachia, which have a lack of pathologists. The software tool developed will eventually reduce the cost of cancer diagnosis and treatment. Moreover, the successful accomplishment of the proposed research work can affect the enhancement of other research areas needed for heterogeneous data analysis extending to meteorology and ecology in the interpretation of intensity variation. The accomplished results of this project will also promote the interest in cancer research in K-12, undergraduate, and graduate locally and nationally, through synergistic research and education activities.

DIVISION OF ELECTRICAL, COMMUNICATIONS AND CYBER SYSTEMS

American Rescue Plan \$199,296



Title [ERI: Efficient and Power-Dense Modular Power Electronic Architecture for Utility-Scale DC-AC Conversion](#)

Institution Portland State University; Portland, OR

Research & Recovery

As a society striving towards a clean energy future, integration of renewable energy sources is increasingly essential. Battery energy storage systems are one of the fastest growing energy storage technologies due to their high energy densities, efficiency, and low self-discharge. To interconnect the DC batteries with the AC utility grid, power electronic converters are necessary. Current commercial implementations feature a two/three-level converter with a transformer for voltage step-up function. Transformers are bulky, lossy, and costly. In contrast, modular electronic converters have improved scalability, fault-tolerance, and reliability. This project focuses on a transformative design of a fundamental building block to create an innovative, efficient, and power-dense DC-AC modular topology suitable for a battery energy storage system. The innovative feature of the proposed module is the three-phase integrated design, which enables high-density and efficient power conversion. The project also facilitates the involvement of undergraduate and high-school students through the deployment of learning tools and summer programs in power conversion to engage students from underrepresented communities.

The Engineering Research Initiation (ERI) program supports new investigators as they begin their careers as researchers, educators, and innovators, which can be a difficult transition point. The ERI program also broadens the base of investigators involved in engineering research by focusing on those who are not affiliated with “very high research activity” R1 institutions (per Carnegie Classification <https://carnegieclassifications.iu.edu/>). This award supports research by an early-career woman investigator, who is part of a group most strongly affected by the pandemic.

DIVISION OF ENVIRONMENTAL BIOLOGY
American Rescue Plan \$249,994



Title [Quantifying Plant Mediation of Ecosystem Multifunction in Response to Fire and Warming](#)

Institution Northern Arizona University; Flagstaff, AZ

Research & Recovery

Wildfire and warm temperatures affect how ecosystems function, but their impacts can be mediated by the plant communities that are part of those ecosystems. For example, wildfire and warming may speed up decomposition rates in the soil, but this trend can be slowed if the plant community produces leaves that are thicker and tougher to decompose. Ecosystems are shaped by disturbances like fire, and when these disturbances change, some species may be unable to survive thus impacting the presence of species that can mitigate the effects of fire and warming. This project examines how fire severity and experimental warming interact to shape plant traits, plant communities, and multiple ecosystem functions such as decomposition and plant productivity. The

project studies ponderosa pine forest understory communities in Arizona. This work is of critical importance as the climate warms and increasingly severe fires occur over large areas of the western United States. Results from the study provide valuable information about biodiversity, ecosystem function, and ecosystem stability in the future. In addition, the project educates students about ecosystem science and wildland fires.

This award supports research by individuals and at institutions disproportionately affected by the COVID-19 pandemic.

DIVISION OF BIOLOGICAL INFRASTRUCTURE
American Rescue Plan \$347,015



Title [IQ-Bio-REU: Interdisciplinary and Quantitative Biology Research Experience for Undergraduates](#)

Institution University of Puerto Rico – Río Piedras; San Juan, PR

Research & Recovery This REU Site award to the University of Puerto Rico, Río Piedras will support the training of 10 students for 9 weeks during the summers of 2022-2024. It is anticipated that a total of 30 students, primarily from schools with limited research opportunities, will be trained in the program. Participants will be immersed in a mentored research project that allows for the exploration of biology using computational and quantitative tools, such as: the application of statistics to the life sciences, the integration of quantitative analyses towards understanding molecular changes, and the use of big data and machine learning approaches to document the effects of climate change on biological systems. Through skills development workshops and hackathons, students will receive training and practice for fluency in research techniques related to data analysis and visualization, computing, and bioinformatics. Career development workshops will offer guidance in the process of applying to graduate school, obtaining funds for research, and exposure to concepts and theories that will help participants navigate career transitions in science.

This award supports participation in STEM by, and training and education of, individuals disproportionately affected by the COVID-19 pandemic.

DIVISION OF COLLABORATIVE EDUCATION AND RESEARCH

American Rescue Plan **\$307,462**



Title	<u>GP-UP: Kansas City Explores Earth and the Environment (KC E3) – A program to support early college URM student success through mentoring and community-focused inquiry</u>
Institution	University of Missouri – Kansas City; Kansas City, MO
Research & Recovery	Urban environmental hazards such as flooding and “heat island” effects (pockets of extreme temperatures) disproportionately affect communities of color. However, the geoscience workforce tackling these challenges lacks the respective diversity to represent these communities. The “Kansas City Explores Earth and Environment” (KC E3) project is a ten-month experience for early college students from historically excluded communities. The program aims to increase participation and persistence of these students in the geosciences, as well as preparing a more diverse workforce to address urban environmental hazards, and the communities impacted by them. The KC E3 cohort of 2yr and 4yr college students will work together to develop a research project for a local summer high school community program – the “Kansas City Teen Summit” - to investigate environmental hazards and their impact on urban landscapes. The shared challenge of developing and leading the high school summer program will motivate KC E3 participants to support each other, and apply their subject matter expertise to real world challenges, in a supportive environment for participants who are transitioning into college. It is planned to use KC E3 as a model for programs in other, similar urban locations. This project provides support for individuals from historically excluded groups who were disproportionately impacted by the pandemic.

DIVISION OF RESEARCH ON LEARNING

American Rescue Plan **\$435,679**



Title	<u>Developing Integrated Computer Science Curricula for Linguistically Diverse Classrooms in Grades 3-5</u>
Institution	University of Nevada – Las Vegas; Las Vegas, NV
Research & Recovery	This is a CS for All: Research and RPPs collaborative project among University of Nevada Las Vegas, George Mason University, University of South Carolina Upstate and Weber State University. This project seeks to develop integrated computer science (CS) curricula using affordances of educational robotics for grades 3-5 students in linguistically diverse classrooms; provide teacher professional development around classroom implementation of integrated units; and conduct educational research with regard to teacher outcomes (computer science teaching efficacy beliefs and teacher identity) and student outcomes (attainment of computer science concepts and practices, views of

computer scientists, and computer scientist identity). This project will assist elementary school teachers in culturally, linguistically, and economically diverse communities of Clark County, Nevada, and Spartanburg, South Carolina, and the less culturally and linguistically diverse community of Davis County, Utah to successfully integrate CS into their classroom teaching. This project reflects the stance that CS should be meaningfully integrated with math, science, and rich literacy connections by considering English learners' (EL) funds of knowledge and English language proficiency (ELP) levels to extend all elementary school students', including ELs, exposure to CS before middle school. This approach would provide all students with equitable learning opportunities to access CS education and eventually cultivate their interest in computing fields. The RPP will provide information to the field on the successes and challenges of engaging in this work and a program that is evidence-based through rigorous efficacy research.

ARP funds were used for this project because it supports English language learners to learn introductory computer science. English language learners are an underrepresented group in computer science generally.

INNOVATION AND TECHNOLOGY ECOSYSTEMS

American Rescue Plan \$2,000,000



Title [CIC-E: COVID Information Commons Extension for Pandemic Recovery](#)

Institution Columbia University; New York, NY

Research & Recovery The initial COVID Information Commons (CIC) effort demonstrated the benefits of creating an interactive tool and platform containing information about all the diverse COVID-related awards made by NSF. Broader impact is central to the idea of the CIC, which pulls together publicly available information along with voluntary self-reported information on NSF-funded COVID-related research projects to enable search and discovery of information and collaborations among efforts. In particular, this tool and platform enabled researchers from all disciplines and a breadth of academic and research institutions to efficiently search for information and discover linkages among highly varied, yet often complementary efforts. By extending the CIC effort to the pandemic recovery phase, the CIC Extension is reaching an even larger and more diverse community of COVID researchers.

By summer 2022, the CIC platform will also include all COVID-related awards made by NIH with plans to add COVID-related awards made by other domestic and international funders in the future, dramatically expanding networking and discovery among researchers engaged in COVID-related

research. The CIC is providing a critically important and engaging collaboration platform and events for the diverse COVID research community, bringing together thousands of NSF- and NIH-funded researchers and students, in a virtual format during the travel-restrictive COVID environment, to accelerate research that will contribute to recovery and relief from the COVID pandemic. Leveraging advanced technology tools such as machine-learning maps of COVID research, easily searchable research information, and monthly researcher lightning talks and collaboration meetings, the CIC continues to create a strong and cohesive community of researchers, students and practitioners to identify, develop, and advance best practices for pandemic recovery and relief.

DIVISION OF MATERIALS RESEARCH

American Rescue Plan \$800,000



Title [University of Hawaii - University of Washington PREM: Materials Research and Education Consortium \(MRE-C\)](#)

Institution University of Hawaii; Honolulu, HI

Research & Recovery The University of Hawaii at Manoa (UH), located on the island of Oahu, Hawaii, has a diverse student population that includes Native Hawaiians and other Pacific Islanders (NHPI, 18.9 %), and women (61.8 %). With this Partnership for Research and Education in Materials (PREM) Seed award, the University of Hawaii and the University of Washington's (UW) NSF-funded Materials Research Science and Engineering Center (MRSEC) aim to utilize this diversity in UH's student population to create a pathway to recruit, retain, and ensure degree attainment by over 10 student STEM participants, mostly from underrepresented minority groups. The PREM Seed implements a multifaceted and integrated approach to recruitment of student participants, using on/off-campus diversity resources and a new PREM website. The UH-UW synergistic partnership emphasizes student mentoring, unique on/off campus outreach, materials science education in general, along with energy and space materials research. In addition, the PREM Seed's outreach effort to K-12 schools drives sustainable long-term growth for underrepresented groups participation in STEM, and it enhances visibility and public appreciation of materials science.

The disproportionate hardship imposed by the pandemic on underrepresented minority students, especially those from socioeconomically disadvantaged backgrounds, is well-established. This PREM Seed award, funded under the American Rescue Plan Act of 2021, will develop a pathway to recruit, train and retain a diverse population of students, including Native Hawaiians and other Pacific Islanders, at University of Hawaii at Manoa (UH), located on the island of Oahu, Hawaii, to help create a world-class, next-generation workforce to tackle challenges related to the discovery, design, and

development of materials for a variety of technological applications, particularly with relevance for energy and space industries.

DIVISION OF MATERIALS RESEARCH
American Rescue Plan \$1,769,806



Title [DMREF: GOALI: Salt Separation Membranes Based on Modifiable Two-Dimensional Covalent Organic Frameworks](#)

Institution University of Wyoming; Laramie, WY

Research & Recovery The global disruptions to standard operations that are occurring due to changing climate conditions, changing rainfall patterns, and increased human population will continue to stress the world's freshwater supplies. This is predicted to result in half of the population facing freshwater shortages by 2030. Because only about 3% of all water on Earth is suitable for human consumption and the oceans contain 97% of the Earth's water, energy-efficient desalinization (salt separation) technologies are crucial for maintaining society's quality of life. Reverse osmosis (RO) is currently the most employed and reliable method for water desalinization; however, improvements in process efficiency are needed to make it a more sustainable treatment option. These improvements center on the physical and chemical characteristics of the membrane materials and membrane modules to address issues related to salt selectivity, water permeability, and chemical tolerance. This project will produce new generations of membrane materials that could possibly be more stable, selective, and energy-efficient than current RO membranes. Moreover, these materials and systems have the potential to be modified for other water purification applications such as the removal of specific contaminants.

Inequalities in access to medical supplies, robust food supply chains, and clean water have been highlighted throughout the global pandemic. This ARP-funded effort aims to create materials that will enable technologies that in turn will ensure better access to basic water needs, especially as this GOALI project has an industrial partner that provides a natural means to accelerate the translation of this work into the field. In addition, the award provided the research community with funds to ensure that a research element critical to the continued advancement of the nation persisted throughout the challenges associated with pandemic.

DIVISION OF CHEMISTRY
American Rescue Plan \$249,118



Title [LEAPS-MPS: CAS:Stimuli-Responsive Biodegradable Polymeric Nanomaterials for Biomedical Applications](#)

Institution University of North Dakota; Grand Forks, ND

Research & Recovery In this project, researchers and students from the University of North Dakota will work to develop a series of stimuli-responsive, biocompatible and biodegradable polymers and polymer-based nanomaterials that can be extensively utilized in the biological and medical worlds. Biosafety and sustainability have become two critical issues of bio-oriented nanomaterials with the rapid development of nanotechnology, resulting from the fact that those materials with nanoscale sizes could not be eliminated from the body and their accumulation in the body is likely to induce chronic systemic toxicities. The new polymers will consist of biodegradable polymer chains containing bio-cleavable chemical bonds. Therefore, in biological and physiological environments, the polymers and polymer-based nanomaterials will gradually break down and eventually turn into nontoxic small molecules in the body, devoid of biosafety and sustainability concerns. Researchers will use cancer-related biomedical applications of the new materials to promote students' awareness of human health issues and to get graduate and undergraduate students as well as the underrepresented Native American students from tribal colleges in North Dakota engaged in the research.

This award supports the career development of a young faculty member and undergraduate and graduate students, all launching their careers during COVID, allowing students to obtain crucial hands-on training in scientific research, and promoting research productivity that is important for career advancement for the faculty member. The award also supports activities to help promote participation of Native American students from the local area in scientific careers, and to use hands-on activities to educate these students about COVID prevention and to provide a real-world connection to attract them to careers in scientific fields.

NSF Research News

Science Matters: [America's DataHub Consortium: seeing — and understanding — the entire elephant](#)

Science Matters: [Measuring progress \(and gaps\) in the US skilled technical workforce](#)

Science Matters: [From the lab to the coast, NSF provides critical support to prepare for hurricanes](#)

Research News: [Data researchers use health informatics and artificial intelligence in Type 1 diabetes study](#)

Research News: [Ocean water samples yield treasure trove of RNA virus data](#)