National Science Foundation

Sample Projects Evaluated by PEER

PREM Center for Quantum Material Innovations and Educational Excellence (CQ-MIEE) ($4,200,000, 2024-2030 est)

This UCF-UW partnership envisions collaborative training of under-represented minority (URM) students in cutting edge research topics to make rapid discoveries related to materials synthesis, investigation and manipulation of new physical phenomena, and theory-guided pursuit of novel quantum materials and catalysts, closely aligned to the MGI. It involves three interdisciplinary research groups (IRGs). In the first IRG, Electronic Structure and Light Matter Interaction in Layered Quantum Materials will unravel ultrafast processes that happen in one-billionth of a nanosecond (one femtosecond). In the second IRG, new catalysts that speed up the rate of chemical reactions will be developed. The third IRG will potentially impact future technologies by representing key scientific thrust areas, including energy-efficient communications and computing, production of novel chemicals, and screening and discovering new medicines. CQ-MIEE is sponsored through the NSF Partnership for Research and Education in Materials (PREM) Program.

- Principal Investigator: Dr. Saiful Khondaker, UCF NanoScience Technology Center

CAREER: Control of NOD2-dependent Lipid Mediator Production ($1,062,170, 2024-2029 est)

This project aims to advance the understanding of the production of NOD2-dependent lipid mediators, which play a key role in inflammation, body temperature regulation, and detecting pain in the body. With the overarching goal of developing therapies to resolve inflammation, this project will contribute to valuable research while also providing enriching experiences for undergraduate and graduate students. This project has 3 key objectives: (1) Investigate whether natural activation of NOD2 leads to changes in an enzyme named 5-lipoxygenase (5LO) through a protein called RIP2. (2) Identify the specific parts of RIP2 that are important for activating 5LO and producing lipid mediators. (3) Create a hands-on research course (GEAR) that allows undergraduate students to gain valuable experience in lipid mediator research.

- Principal Investigator: Dr. Justine Tigno-Aranjuez, UCF Burnett School of Biomedical Sciences

Scholarships, Academic, and Social Supports to Provide Low-Income Transfers Students Opportunities for Nurtured Growth in AI ($2,490,530, 2024-2029 est)

This 5-year project will fund scholarships to 50 full-time University of Central Florida students who are pursuing a Bachelor of Science or a Master of Science degree in the artificial intelligence (AI) fields of Computer Science, Computer Vision, Computer Engineering, Data Analytics, and Statistics & Data Science. Each program participant is provided with a faculty mentor and a peer mentor to serve as personal guides for the student. By supporting students with a scholarship, a mentor, and surrounding them with like-minded peers, this reduces the obstacles that students face, allowing them to focus and remain interested in their field of study and motivate them to excel academically. Through this support, this NSF project aims to increase STEM degree completion of low-income, high-achieving students with

demonstrated financial need and ultimately contribute to the national need for well-educated scientists, mathematicians, engineers, and technicians.

- Principal Investigator: Dr. Mubarak Shah, UCF College of Engineering and Computer Science

CyberTraining: Implementation: Small: Using Problem-Based Learning for Vocational Training in Cyberinfrastructure Security at Community Colleges ($125,000, 2024-2025 est)
This project aims to provide vocational training in cyberinfrastructure security to community college students. The cybersecurity workforce helps benefit many sectors including research, military, civil law enforcement, corporate, and private sector communities. CyberTraining recognizes that the demand for cybersecurity professionals far exceeds the number of students in the field and seeks to address this by bringing community college students into the field. Using problem-based learning, innovative teaching approaches, and vocational training modules, this project will educate students on advanced cybersecurity skills and ultimately benefit the wellbeing of society by protecting the nation's cyberinfrastructure.

- Principal Investigator: Dr. Irfan Ahmed, Virginia Commonwealth University

CyberTraining: Implementation: Small: Using Problem-Based Learning for Vocational Training in Cyberinfrastructure Security at Community Colleges ($124,516, 2020-2025 est)
This project aims to provide vocational training in cyberinfrastructure security to community college students. The cybersecurity workforce helps benefit many sectors including research, military, civil law enforcement, corporate, and private sector communities. CyberTraining recognizes that the demand for cybersecurity professionals far exceeds the number of students in the field and seeks to address this by bringing community college students into the field. Using problem-based learning, innovative teaching approaches, and vocational training modules, this project will educate students on advanced cybersecurity skills and ultimately benefit the wellbeing of society by protecting the nation's cyberinfrastructure.

- Principal Investigator: Dr. Sajal Bhatia, Sacred Heart University

REU Site: Nanomanufacturing of Emerging 2D Materials and Devices ($405,000, 2023–2026 est)
This REU Site is hosted by Pennsylvania State University - University Park. The project provides students with a 10-week summer research experience to address problems relevant to the semiconductor industry, a growing sector in the United States where trained employees are expected to be in high demand. In small research teams, students work alongside faculty advisors and graduate student mentors towards a technologically relevant development goal. REU students have the opportunity to conduct research on 2-dimensional semiconductors and topological semimetals, which supports the goal of motivating and preparing them to pursue graduate studies in fields involving nanofabrication. They also receive training in research conduct and laboratory safety and help contribute to research and manufacturing infrastructure for semiconductor chips and emerging electronic and photonic devices.

- Principal Investigator: Dr. Suzanne E. Mohney, Penn State University

REU Site: Research Experience for Undergraduates in Applied and Computational Mathematics ($393,363, 2023–2026 est)
This project provides the opportunity for undergraduate students to conduct research projects on applied and computational mathematics issues. Recruiting students from underrepresented minority groups and those with limited access to other research opportunities is given special effort. Alongside faculty members, students work on projects related to medical imaging, financial engineering, and mathematical biology. Opportunities during the program include mini-courses, developmental seminars, career and graduate school preparation workshops, social and recreational activities, and an REU symposium. The goal of this project is to train students in research-based theory and applications of computational mathematics concepts and ultimately prepare them for careers that require a rigorous mathematical foundation.

- Principal Investigator: Dr. Katiuscia Teixeira, University of Central Florida

CAREER: A Decentralized Optimization Framework for Next-gen Transportation and Power Systems with Large-scale Transportation Electrification ($525,781, 2023–2028 est)
This Faculty Early Career Development project aims to challenge and change traditional transportation and power systems (TPSs) infrastructure with the goal of increasing sustainability. This project promotes the use of electric vehicles and grid integration of intermittent clean energy in an effort to mitigate the environmental impacts from both the transportation and power sectors. Integrating research and education activities, this project improves the knowledge of professionals and public audiences, including K-12 and college students from underrepresented groups, utility companies, and transportation planning agencies. By advancing the understanding of the mechanism design of decentralized TPSs and creating a unified methodological framework for sustainable development of decentralized TPSs, this project aims to create a more sustainable future for transportation and power systems.

- Principal Investigator: Dr. Zhaomaio Guo, University of Central Florida

REU Site: Advanced Technologies for Hypersonic, Propulsive, Energetic, and Reusable Platforms (HYPER) ($405,000, 2023–2026 est)
With the overall goal of preparing students for PhD-level research and research-oriented employment, HYPER exposes students to advanced structures and systems with application to hypersonics, space, propulsion, and energy. HYPER aims to engage a diverse pool of undergraduate students in hands-on research training where they work with leading faculty and graduate students at UCF to advance the fundamental knowledge and overcome technical and systematic barriers that limit the speed and reach of advanced transportation systems, such as launch systems and hypersonic flight. REU students also benefit from research-oriented seminars, professional development workshops, software training, and launch pad facility tours.

- Principal Investigator: Dr. Ali Gordon, UCF College of Engineering and Computer Science

FIU-JILA Partnership for Research and Education in AMO Physics ($900,000, 2022–2025 est)

This project was funded under the NSF Partnerships for Research and Education in Physics (PREP) Program and is located at the Florida International University (FIU). The FIU-JILA project forms a strategic partnership between the Department of Physics at FIU and the JILA Physics Frontier Center (JILA PFC) to advance research in Atomic, Molecular, and Optical (AMO) physics and improve the diversity of graduate students in both institutions. AMO Physics has been a cornerstone for modern science and emerging technologies and plays a fundamental role in the field of quantum information science and technology. This partnership addresses several scientific challenges in AMO physics along with challenges in recruiting and training undergraduate and graduate students from underrepresented groups. To achieve the project's research goals, students explore two main research thrusts: ultra-cold atomic physics and single-molecule biophysics.

- Principal Investigator: Dr. Heben Li, Florida International University

IRES Track 1: Low-Dimensional Materials for Transducers ($299,891, 2022–2025 est)
The COVID-19 pandemic created disruptions in a global supply chain, one of which being the shortage of semiconductor chips. Chip manufacturing is essential for processing data and enabling autonomous operations of various consumer products. This NSF International Research Experiences for Students (IRES) Program site aims to engage six undergraduate/graduate students each year for three years in an international summer research experience in Korea. Faculty from four different universities work with participating students to innovate transducer technologies by utilizing newly developed nanoscale materials. Each cohort of students participates in research in different cultural environments to stimulate their professional development. By providing this international research experience to students, this project aims to directly impact the workforce development in chip manufacturing, which is currently one of the weakest links in US industries.

- Principal Investigator: Dr. Hyoung Jin Cho, University of Central Florida

Collaborative Research: HSI Implementation and Evaluation Project: Enhancing Student Success in Engineering Curriculum through Active e-Learning and High Impact Teaching Practices (ESSEnCe)
($500,000, 2022–2025 est)
This Track 2 NSF Improving Undergraduate STEM Education: Hispanic-Serving Institutions (HSI) Program sponsored project, located at UCF, aims to support the implementation of evidence-based unit, department, or multi-department level innovative teaching/learning practices that enhance the quality of undergraduate STEM education to increase Hispanic/Latino transfer student success. UCF holds admission articulated agreements with six community colleges in the Central Florida area to guarantee access to high-quality bachelor's degree programs to transfer students, which is an attractive conduit for many Hispanic/Latino students. The goal of this project is to achieve a significant gain in Hispanic/Latino transfer students' retention through active learning and high-impact teaching practices in engineering foundation courses along with coordinated curriculum alignment efforts with partner community colleges.

- Principal Investigator: Dr. Hyoung Jin Cho, University of Central Florida

FIU-2D Crystal Consortium Partnership for Research and Education in Materials ($3,780,000, 2021–2027 est)
This NSF Partnership for Research and Education in Materials (PREM) Program sponsored project, includes a partnership between Florida International University (FIU) and the 2D Crystal Consortium Materials Innovation Platform (2DCC MIP) at the Pennsylvania State University which aims to increase diversity in materials research by promoting the recruitment of minority students and women into the workforce. Over the life of the project, FIU-2DCC PREM aims to support over 30 Ph.D., 20 M.S., and 40 B.S. students

belonging primarily to underrepresented minority groups in STEM and women. This research partnership aims to increase understanding of fundamental and practical aspects of new 2D materials and processes with potential to deliver significant societal progress. Students receive dual mentoring by faculty from both institutions, access to experts and instrumentation, and career skills training for a research-intensive educational experience.

- Principal Investigator: Dr. Daniela Radu, Florida International University

PREM Center for Ultrafast Dynamics and Catalysis in Emerging Materials (C-UDCEM) ($800,000, 2021–2024 est)

This UCF-UW partnership envisions collaborative training of under-represented minority (URM) students in cutting edge research topics to make rapid discoveries related to materials synthesis, investigation and manipulation of new physical phenomena, and theory-guided pursuit of novel quantum materials and catalysts, closely aligned to the MGI. It involves two interdisciplinary research groups (IRGs). In the first IRG, time and angle resolved photoelectron spectroscopy will unravel ultrafast processes in new quantum materials including two-dimensional (2D) van der Waals solids and 2D magnets. Intended outcomes for this effort aim to reveal important dynamic processes in the femtosecond time scale and map this behavior across many different 2D materials. In the second IRG, various defects including point defects (e.g., oxygen vacancies) will be systematically introduced in catalyst materials to enable single site catalysts for low temperature CO/hydrocarbon oxidation and CO2 reduction. U-UDCEM is sponsored through the NSF Partnership for Research and Education in Materials (PREM) Program.

- Principal Investigator: Dr. Saiful Khondaker, UCF College of Sciences

Developing Reliable Educational Avenues to STEM Careers ($1,917,670, 2019–2025 est)

With support from the NSF Undergraduate STEM Education: Hispanic-Serving Institutions (HSI) program, this Track 1 project aims to build institutional capacity in STEM, particularly marine science and technology. To achieve this goal, the project seeks to improve student perceptions of STEM and to increase the number of students who enter STEM programs and pursue STEM careers. Project activities include implementation of innovative teaching strategies, use of and research about the effectiveness of technologies such as virtual reality, and development of effective pathways to STEM careers. By developing a STEM Ambassador program, the project will provide opportunities for undergraduates to participate in STEM outreach to K-12 students. The undergraduate STEM Ambassadors share their experiences and provide real-life examples about what makes STEM interesting and how to be successful in STEM. The project also engages students in undergraduate research and professional internships to help them develop skills needed in the workplace. The project team is investigating the effectiveness of innovative technologies, such as virtual reality, to actively engage students and elevate their interest in STEM and STEM careers. Expected outcomes of the project include increased recruitment and retention of students in STEM programs, thus contributing to increasing the diversity of the STEM workforce.

- Principal Investigator: Dr. Patrick Rice, College of the Florida Keys

CyberCorps Scholarship for Service: Workforce Training and Preparation in Cybersecurity and Privacy ($2,885,353, 2021–2026 est)

With more smart devices being connected to the Internet, the risk and cost of cyber-attacks to national assets and infrastructure continues to increase. There is a great need for universities to train students to become highly qualified cybersecurity professionals and address the shortage of cybersecurity talent, particularly in the government sector. To address this need, this CyberCorps® Scholarship for Service (SFS)

project at UCF recruits, supports, and guides undergraduate and graduate students in three cyber-related disciplines: Computer Science, Information Technology, and Computer Engineering. This project is sponsored by the CyberCorps® Scholarship for Service (SFS) program, which supports establishing or continuing scholarship programs in cybersecurity and aligns with the U.S. National Cyber Strategy to develop a superior cybersecurity workforce. Following graduation, scholarship recipients are required to work in cybersecurity for a federal, state, local, or tribal Government organization for the same duration as their scholarship support.

- Principal Investigator: Dr. Cliff Zou, UCF College of Engineering and Computer Science

CAREER: Experimental Investigation of Shape Morphing Hydrofoils Encountering Unsteady Flows (2021–2025 est)

The principal aim of this project is to provide a deep understanding of the unsteady hydrodynamics of adaptive lifting surfaces. This project also promotes advanced education of marine hydrodynamics and underwater robotics amongst students at all level, including outreach activities at the Orlando Science Center and the Orange County Public Library.

- Principal Investigator: Dr. Samik Bhattacharya, UCF College of Engineering and Computer Science

REU Site: Research Experience for Undergraduates in Computer Vision ($407,181 est, 2021–2024) estimated; $363,997 2018–2021; $517,241, 2015–2018; and $359,770, 2012–2015)

The NSF has designated the Computer Vision Lab, Department of Electrical Engineering and Computer Science, at UCF, as a site for Research Experiences for Undergraduates (REU) in the area of Computer Vision. This project is a continuation of a REU site in Computer Vision that has operated successfully at UCF for over 30 years. For the current cycle, each year, 10 UG students participate in a 10-week full-time summer program, where they learn fundamentals of computer vision, which plays an important role in many areas, including, security, healthcare, defense, and manufacturing. This project provides opportunities to a diverse group of undergraduates, most from predominantly undergraduate institutions, to spend a summer with a highly successful research group. The model includes earlier project planning, round-the-clock mentoring by the research team, a streamlined 7-day short course that lets participants start their research projects sooner, and daily meetings with mentors to plan activities throughout the day. Participants take the short course, match themselves to a project topic that they most desire, and spend sufficient time in focused research. They then can opt to continue through the year by working with the professors to write research papers on their project, to prepare for the GREs and to apply to graduate programs.

- Principal Investigator: Dr. Mubarak Shah, UCF College of Engineering and Computer Science

REU Site: Engineering and Nanoscience of Materials and Device Applications in Biotechnology and Medicine ($373,887, 2021–2025 est)

This REU site brings together engineering, computer science, photonics research, chemistry and biochemistry, and nanoscience and technology fields in multidisciplinary teams focused around these areas. Experiences for the REU participants include research projects in topics such as remote monitoring of physiological parameters using implantable sensors, as early as possible disease detection using biomarkers, and smart therapeutic tools. This project provides students with enrichment activities that build participants skill sets relevant to research and to professional life. Social activities facilitate developing bonds and networking at the REU site, industry site visits, and a research showcase.

- Principal Investigators: Dr. Sudupti Seal (Y3) and Dr. Andre Gesquiere (Y1-2), UCF College of Engineering and Computer Science

CAREER: Elucidation of the Physical Principles the Govern Endothelial Structure and Function (2021–2026 est)

This project will utilize principles from cell biology and mechanics to establish the role that biomechanical forces and fluid forces play in the structure and function of the endothelium. Endothelial cells line the inside of all blood and lymphatic vessels within the body. Their ability to regulate structure and function is essential to proper functioning of every major organ within the body. The goal is to (a) develop an endothelial biomechanical force model, (b) define the role of fluid shear stress and cell-derived mechanical forces on endothelial permeability; and (c) investigate the influence of fluid pressure and fluid frequency on endothelial permeability.

- Principal Investigator: Dr. Robert Steward, UCF College of Engineering and Computer Science

IRES Track 1: Advancing Materials and Combustion Technologies for Next Generation Propulsion and Power Generation Systems at the German Aerospace Center (DLR) ($300,000, 2020–2023 est)

Worldwide efforts to meet next generation propulsion capabilities for hypersonic suborbital and reusable space vehicles rely on interdisciplinary and transformational technologies. This IRES project provided focused opportunities of new and disruptive research in advanced materials and combustion that culminate in a 2-month experience for U.S. students, both at the graduate and undergraduate levels, every year for 3 years at the German Aerospace Center (DLR). The project had widespread societal benefits in creating next generation energy, propulsion and transportation technologies. The educational broader impact of the international research was achieved through i) opportunities for a diverse group of students to experience collaborative research in highly advanced facilities with mentoring from world-known scientists and peers; ii) training of the next generation of interdisciplinary global scientists to support advanced gas turbine and hypersonic initiatives; iii) outreach through activities with local high school and middle school students, interactive blogs and podcasts, as well as through a new initiative of interactive Skype sessions that connect German scientists to U.S. classrooms.

- Principal Investigator: Dr. Seetha Raghavan, UCF College of Engineering and Computer Science

CAREER: Actin Cytoskeleton Biomechanics and Mechanobiology in Complex Cellular Environments (2020–2025 est):

The actin cytoskeleton is an essential structural component of a living cell and exists in a complex environment. The PI and research team will use protein biophysics and nanoscale tools to measure how the mechanical and structural properties of the actin cytoskeleton change with crowding. The knowledge gained will impact a broad range of applications in multiple scientific fields including cell physiology and aging. Integration of the research findings to a uniquely designed biophysics pedagogy will benefit undergraduate and graduate students. The goal of this CAREER project is to identify molecular mechanisms by which varying intracellular environments modulate the conformations, mechanics, and mechanosensing of actin cytoskeleton.

- Principal Investigator: Dr. Ellen Kang, UCF College of Sciences

CAREER: The Mechanics of Tunable Exoskeleton Structures: Interactions of Rigid Scales with Deformable Substrates (2020–2025 est)

Breakthroughs in the understanding of behavior and design of exoskeletons are needed to fulfill the growing industrial needs of human-integrated robotics, inspection of aging infrastructure, and injury rehabilitation. This research project aims to understand the structure-property interplay with the help of analytical techniques, multi-scale computational modeling, and experimental validation. The objective of Dr. Gosh's research is to quantify the structure-property relationships operative in a representative class of exoskeletal structures and discover universal and emergent extreme behavior.

- Principal Investigator: Dr. Ranajay Ghosh, UCF College of Sciences

CAREER: mechanics of Learning for Mastery System that Creates a Student-centered STEM Learning Environment (2019–2025 est)

This NSF Faculty Early Career Development (CAREER) program prestigious award supports Dr. Zhongzhou's activities addressing three major challenges facing STEM higher education in the US today: educating an increasingly diverse and non-traditional student population, producing at least 1 million additional STEM graduates, and reducing the cost of higher education. The goal of the project is to create a student-centered online learning system that has the potential to allow every student to select and engage with learning resources that best suit their own backgrounds and learning needs

- Principal Investigator: Dr. Zhongzhou Chen, UCF College of Sciences

SaTC EDU: Collaborative: Building a Low-cost and State-of-the-art IoT Security Hands-on Laboratory ($340,175, 2019–2023)

The Internet of Things (IoT) interconnects everything including physical and virtual objects together through communication protocols. This project seeked to improve IoT and privacy education through the development of laboratory module materials. The improvements included the development of an IoT platform with an industrial grade microcontroller (MCU) equipped with a crypto co-processor that is significantly lower cost than existing platforms. The platform allowed for the development of a full-fledged IoT laboratory with hardware security modules at a cost that will make it affordable for students and institutions. This project was the first to use an industrial grade microcontroller and a crypto coprocessor to systematically develop teaching materials including hands-on labs and case studies on IoT security and privacy.

- Principal Investigator: Dr. Cliff Zou, UCF College of Engineering and Computer Science

REU Site: Advanced Technologies for HYpersonic, Propulsive, Energetic, and Reusable Platforms (HYPER) ($382,371, 2019–2023)

This NSF Research for Experiences for Undergraduates (REU) program funded REU Site addressed challenges in next-generation modes of transportation and energy generation. Realizing planned platforms for advanced space travel and energy production can only be achieved through multidisciplinary research, the REU site actively recruited and partnered a diverse group of approximately 33 students over 3 years with leading UCF faculty and graduate students. Together, these teams advanced the fundamental knowledge needed to overcome technical barriers limiting hypersonic flight. Candidate REU students were matched with individual research projects based on their interests and skills. With most of their time engaged in cutting-edge research, REU students also benefitted from research-oriented seminars, professional development workshops, software training, and launch pad facility tours. HYPER had several goals, most importantly, to prepare students for Ph.D. level research and research-oriented employment.

- Principal Investigator: Dr. Ali Gordon, UCF College of Engineering and Computer Science

STEM Transfer Students Opportunity for Nurtured Growth (STRONG) ($999,994, 2018–2023)

With funding from the NSF Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) program, the STEM Transfer Students Opportunity for Nurtured Growth (STRONG) project provided support to low-income students with demonstrated financial need and academic promise to succeed in STEM disciplines at the UCF. This S-STEM Track 2 project funded up to 36 scholarships over 5 years for transfer students who are pursuing bachelor's degrees in STEM. Compared to first time in college (FTIC) students who begin their academic careers at a four-year institution, transfer students generally find the path to obtaining a bachelor's degree more challenging, and they are significantly less likely to graduate than their FTIC counterparts. Finding ways to improve the educational experiences of these students is an urgent national priority. The aim of UCF's STRONG project was to substantially increase retention, graduation rates, and career success of STEM transfer students. This goal was achieved in part by giving each student a role in various STEM activities within a community of high-achieving scholars, who are majoring in similar fields. Providing financial support, mentorship, and opportunities for academic engagement outside the classroom promises to reduce the obstacles students face, keep them interested in their field of study, and motivate them to excel academically. A thorough study of how the program affects its participants maximized the impact of the intervention and informs future efforts to improve the educational experiences of STEM transfer students.

- Principal Investigator: Dr. Mubarak Shah, UCF College of Engineering and Computer Science

Valencia College Engineering Technology Supply Chain Automation ATE Project ($224,999, 2018–2021)

To best serve the growing national and global supply chain workforce environment, new talent must be engaged in programmatic opportunities to address the skills-gap in emerging technician occupations. The Valencia College Engineering Technology Supply Chain Automation ATE project located in Central Florida advanced research on effective practices in engineering technology (ET) workforce education through a new curriculum framework and innovative approaches to teaching supply chain automation (SCA). The new SCA-specialization provided a model for community colleges across the country, contributing to a growing movement for businesses and industries to become more efficient in distribution and supply chain automation practices. The project was designed to demonstrate that the SCA-specialization within the ET associate degree (A.S.) program is a viable two-year degree option that will serve the community through partnerships with industry, leading to high wage employment opportunities in high-demand occupations, and generating new knowledge on the skills and competencies identified by industry to meet the workforce needs in SCA. Following a rigorous evaluation, Valencia shared best practices, curriculum and insight with other ATE centers and projects and collaborators that added knowledge to benefit the whole.

- Principal Investigator: Dr. Nasser Hedayat, Valencia College

An Educational Network to Gain STEM Graduates and Enhance STEM Education (ENGAGE)
($1,109,550, 2017–2021)

The Louis Stokes Alliances for Minority Participation (LSAMP) program assisted universities and colleges in diversifying the STEM workforce through their efforts at significantly increasing the numbers of students from historically underrepresented minority (URM) populations to successfully complete degree programs in science, technology, engineering and mathematics (STEM) disciplines. The LSAMP Bridge to the Baccalaureate (B2B) funding opportunity provided support for URM STEM students who begin their instruction at a community college with the intent to transfer into 4-year STEM degree programs, in addition to other infrastructure support such as STEM faculty professional development. ENGAGE aimed to broaden participation of URM students and enhance diversity in STEM. Valencia College, on behalf of

the Central Florida STEM Alliance (CFSA), sought to significantly increase the number of URM STEM students transferring from CFSA 2-year colleges, Valencia College, Lake-Sumter State College and Polk State College, to STEM baccalaureate degree programs at regional university partners, the Florida Institute of Technology, Florida Polytechnic University, UCF, University of Florida and University of South Florida.

- Principal Investigator: Dr. Kathleen Plinske, Valencia College

SaTC: EDU: Online Digital Forensics Courses and Labs for Students and Professionals ($314,955, 2017–2019)

Information leakage and data breaches have become increasingly damaging to businesses, the government, and people's lives. While the existing cybersecurity curricula focus on defensive solutions, this proposed online program from the UCF investigators provided both defensive and post-attack digital forensics curriculum for dedicated digital forensics students and professionals. This NSF Secure and Trustworthy Cyberspace program funded project enriched the future cybersecurity workforce with both preventative and post-attack digital forensics skills to effectively counter the cause and effect of cyber-attacks. This program also helped alleviate shortages of qualified digital forensic researchers and practitioners in cybersecurity areas.

- Principal Investigator: Dr. Yier Jin, Department of Electrical and Computer Engineering, University of Florida

RET Site: Collaborative Multidisciplinary Engineering Design Experiences for Teachers (CoMET) ($595,702, 2016–2020)

The objective of this NSF Research Experiences for Teachers (RET) Site program funded project was to provide K–12 teachers with a hands-on engineering design experience covering all aspects of the Internet of Things, from the manufacturing of a sensor to the hardware and software that allows it to connect to the Internet. In order to support the STEM educational services for teachers and students in K–12, the RET site program aimed at creating competent teacher trainers who will ensure quality pre-service and in-service teacher education, by providing multidisciplinary experiences that are relevant to the current technical development. Teachers developed teaching modules to deploy in the classroom in the form of lecture notes, demonstration kits, and prototypes. Thirty teachers in STEM education from Seminole, Orange, and Brevard County public school districts were targeted for the eight-week summer research and one- week train-the-trainer experience in the following summer. The participants rotated to four different laboratories, where they learned about the practice of engineering in various disciplines such as Materials Science and Engineering, Civil and Environmental Engineering, Mechanical Engineering, Computer and Electrical Engineering and Computer Science on the UCF campus under the guidance of faculty mentors.

- Principal Investigator: Dr. Hyoung Jin Cho, UCF College of Engineering and Computer Science, Department of Mechanical and Aerospace Engineering

RET Site: Research Experiences for Teachers in Computer Vision and Bio-Medical Imaging ($600,000, 2016–2019)

The goal of this NSF Research Experiences for Teachers (RET) Site program funded project at UCF was to generate high school students who are inspired by knowledge of technological innovation, and to address the more immediate need for generating a pool of teachers familiar with the processes and workings of innovation in our technologically sophisticated and demanding society. The RET site proposed to use Computer Vision and Bio-Medical Imaging to immerse teachers in research methods; involve them in UCF

faculty's research projects; and assist and mentor them in transitioning, transferring and communicating their experiences to their classrooms. This RET site encouraged teachers to build and sustain longer term relationships with UCF's research programs and open pathways for high school students to consider research careers and select academic paths that lead to pursuing graduate studies. Teachers were embedded within a successful, active research group and exposed to the intellectual excitement involved in research activity, and this helped them observe how researchers develop the skills necessary to work on research projects. At the end of their year-long RET engagement, they participated in a dissemination workshop, where they will foster discussions with other STEM teachers, about their training experiences and their classroom outcomes.

- Principal Investigator: Dr. Mubarak Shah, UCF College of Engineering and Computer Science

Developing a 21st Century Training Program in the Florida Keys for Renewable Alternative Energy Technology: Wind, Solar and Tidal Power ($894,321, 2016–2022)
A NSF Advanced Technological Education (ATE) program funded project at the College of the Florida Keys (CFK) Community College aimed at the development of an Associate in Science (AS) degree for Engineering Technology that focused on training alternative energy technicians and conducting research to foster wind, solar and tidal energy technologies locally, regionally, nationally and internationally. With increasing demands for "solar and wind" jobs, the training needed to create the workforce necessary to sustain the rapid expansion and transition to these new energy production technologies is also needed. CFK is ideally located in one of the sunniest, windiest and tidal energy rich cities in the United States. As CFK continued to train the 21st Century workforce for green energy, conducts research to harness the surrounding renewable energy resources, and develops a global network devoted to fostering the renewable energy industry, the Engineering Technology Alternative Energy Technicians (ET-AET) program was at the epicenter.

- Principal Investigator: Dr. Patrick Rice, College of the Florida Keys, Marine Sciences

REU Site: Engineering and Nanoscience of Materials and Device Applications in Biotechnology and Medicine ($391,867, 2016–2019)
This NSF Research Experiences for Undergraduates (REU) Site program hosted by the NanoScience Technology Center (NSTC) at UCF will engage a diverse cohort of students, recruited from underrepresented groups, in the development of materials and technologies for application in biotechnology and medicine. During the 10-week summer experience involving a multidisciplinary team of faculty and students, the participants will gain hands-on research training in topics such as adoptive cancer immunotherapy and targeted nanoparticle cancer therapy, engineering of Micro-Electro-Mechanical systems (MEMS) devices and body-on-a-chip systems for proteomics research, develop nanofibers for tissue engineering, engineer smart wound healing patches, and nanomanufacturing of tunable plasmonic sensors. The program strengthens bridges to community colleges in Central Florida and minority institutions with limited research capabilities by promoting the benefits of undergraduate research. This REU experience will inspire students to pursue careers that produce high quality researchers and personnel, which will help address the growing need for trained professionals capable of developing and deploying biotechnology and the next generation of medicine in the field.

- Principal Investigator: Dr. Andre Gesquiere, UCF Nanoscience Technology Center and Department of Chemistry

NUE: Collaborative Networked Virtual Experiences for Nanotechnology Education ($200,000, 2014–2018)

The purpose of this Nanotechnology Undergraduate Education (NUE) Engineering project funded by NSF was to promote student engagement and interactive learning in nanotechnology education. The development of virtual experiments and concept demonstrations through online modules can enhance student understanding of the subject. The project aimed to provide opportunities for students to utilize interactive media of microscopic images of both natural and artificial objects and virtually operate nanoscale devices and instruments to which they would otherwise have limited hands-on exposure. Student collaboration is addressed through shared virtual experiences and modules which will be made accessible on mobile devices and portable technology.

- Principal Investigator: Dr. Jayan Thomas, UCF College of Optics and Photonics

LSAMP Bridges to the Baccalaureate: Building Pathways through Connection and Direction for URM Students in STEM ($1,500,000, 2014–2017)

This NSF, LSAMP Bridges to the Baccalaureate (B2B) funded effort increased the number of underrepresented minority (URM) Science, Technology, Engineering, and Math (STEM) students who transferred to university STEM majors from three Central Florida colleges that comprise the Central Florida STEM Alliance (CFSA). Valencia College, Lake-Sumter State College, and Seminole State College of Florida partnered to achieve the objective of having at least 642 URM students from the CFSA transfer into bachelors' STEM majors by 2017. The project addressed multiple areas and barriers by integrating student centered, faculty centered, and department centered activities. The student-centered components included pre-college student outreach, dedicated STEM academic advising, summer academic enrichment, URM STEM student learning support, career awareness and experiences, and URM student financial support. Faculty centered activities included focus on learning strategies, diversity and inclusion, faculty research program, and curriculum alignment, whereas department centered activities focus on targeted STEM pathways and STEM online academic support. The evaluation plan examined changes in strategic indicators such as the number of URM students declaring a STEM major, persistence rate for URM, URM associate degree graduation rate, URM GPA, and more.

- Principal Investigator: Dr. Kathleen Plinske, Valencia College Osceola and Lake Nona Campus

Collaborative Research: RET in Engineering and Computer Science Site: Research Experiences for Teachers focused on Applications of ImagEs and SiGnals In High Schools (AEGIS) ($487,500, 2012–2018)

Funded by the NSF Research Experiences for Teachers (RET) program, AEGIS partners UCF and the Florida Institute of Technology (FIT) with four nearby school districts (Brevard Public Schools, Orange County Public Schools, the School District of Osceola County, and Seminole County Public Schools) to assist mathematics and science teachers in learning about engineering research. The project's objectives included (a) recruiting a diverse, talented, high school teacher population from counties in the vicinity of UCF and FIT; (b) actively engaging the recruited teachers in research within the field of Session Initiation Protocol (SIP); (c) developing and disseminating, to a large audience, a series of innovative and replicable secondary science teaching unit plans; (d) disseminate the AEGIS results to other interested stakeholders around the nation; and (e) establish a lasting partnership between AEGIS researchers and high school teachers in the participating Central Florida counties.

- Principal Investigator: Dr. Michael Georgiopoulos, UCF College of Engineering and Computer Science ($262,500, 2012–2018)
- Principal Investigator: Dr. Georgios Anagnostopoulos, Florida Institute of Technology ($225,000, 2012–2018)

South Florida Community College Bioenergy Education Program ($900,000, 2012–2016)
The purpose of this NSF Advanced Technological Education (ATE) program funded project was for South Florida Community College (SFCC) to collaborate with Vercipia Biofuels and other biofuel/biomass companies in Florida's agricultural heartland to address the technician workforce needs of the advanced biofuels industry. The goals of the project were to educate technicians to work in the advanced biofuels production industry and agriculture biomass production; develop instructional materials about advanced biofuels production; and establish a biofuels education pathway from area high schools to South Florida Community College to Florida universities.

- Principal Investigator: Erik Christensen, SFSC Applied Sciences and Technologies

Communicating Avatars: Artificial Intelligence + Computer Graphics = Innovative Science ($150,000, 2011–2014)
This NSF Communicating Research to Public Audiences (CRPA) funded project sought to build an interactive exhibit at the Orlando Science Center to showcase intelligent avatar technology for use in educating middle school students in science and engineering. The exhibit features an avatar acting as a moderator, guiding the museum visitor through an interactive exercise that educates him/her about artificial intelligence, computer graphics, and the Turing Test. The primary objectives of this project were to effectively communicate the results of NSF-funded research to the general public via a museum exhibit and to introduce the target audience (middle school students) to computer science in a way that will encourage them to consider a career as computer scientists or engineers.

- Principal Investigator: Dr. Avelino Gonzalez, UCF College of Engineering and Computer Science

Biotechnology Alliance for Suncoast Biology Educators ($187,084, 2011–2014)
This was an NSF Advanced Technological Education (ATE) funded effort to facilitate professional development for secondary school teachers leading to the design and implementation of new biotechnology laboratory activities in regional high school biology classrooms. The State College of Florida, Manatee-Sarasota (SCF) (formerly Manatee Community College) and the two school districts in the college's service area (Manatee County and Sarasota County) partnered to increase the number of students entering Science, Technology, Engineering, and Mathematics (STEM) fields by: (a) encouraging high school students to consider careers in science or in teaching science and (b) improving the overall quality of science education in local secondary schools to increase the preparedness of high school graduates to succeed in college science courses.

- Principal Investigator: Jane Pfeilsticker, State College of Florida, Manatee-Sarasota

I3: The UCF Community Embraces the Knowledge-Based Economy ($1,045,130, 2010–2016)
The goals of this NSF funded Innovation through an Institutional Integration (I3) program were to (a) provide coherence to the multiple internally and extramurally funded science, technology, engineering, and mathematics (STEM) projects at UCF and (b) integrate STEM research and education activities throughout the UCF Community. Specific expected outcomes included increased interaction and synergy among NSF funded (and similar) STEM K–12 and undergraduate educational and research programs, a more informed UCF community with greater ability to participate in a knowledge-based economy, integration of STEM research into education, increased participation of undergraduates in research, increased participation of under-represented minorities and women in STEM, and strengthened education and outreach components of future research programs.

- Principal Investigator: Dr. Marion Soileau, UCF Office of Research and Commercialization and UCF Optics, Physics, Electrical Engineering, and Computer Science; Dr. Tony Waldrop, UCF

Provost (Former Principal Investigator); Dr. Terry Hickey, retired UCF Provost (Former Principal Investigator)

Students Actualizing Talent at Education's Subsequent Stages (STATESS) ($599,973, 2010–2014):
This NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) funded project at UCF was aimed at recruiting academically talented students in STEM fields and providing financially needy students opportunities and support to focus on academics. Through STATESS, the Department of Mathematics and the Department of Electrical Engineering and Computer Science provided dozens of academically talented students, from sciences and engineering disciplines, scholarships in the range of $4,000 to $10,000, depending on financial need. Scholarship recipients received resources and participated in activities intended to ensure the student's success in completing their undergraduate or graduate degrees.

- Principal Investigator: Dr. Mubarak Shah, UCF College of Engineering and Computer Science

Integrating Sustainability into the Industrial Engineering Curriculum ($149,824, 2010–2013)
The broad goals of this NSF Course, Curriculum, and Laboratory Improvement (CCLI) funded project were to provide industrial engineering (IE) students at UCF with multiple exposures to what it means to have a sustainable mindset and to facilitate the development of both the passion and the skills to integrate industrial engineering tools and methods with sustainable practices. The expected outcomes included an increase in social responsibility, development of innovative thinking skills, and a better understanding of sustainability issues. The project aimed to enhance the ability of future engineering graduates to better contribute to a more sustainable future, preserving natural resources, and advancing technological and societal development.

- Principal Investigator: Dr. Dima Nazzal, UCF College of Engineering and Computer Science

Software Development Educational Pathway (SDEP) ($570,137, 2010–2013)
This NSF Advanced Technological Education (ATE) funded project was designed to address the shortage of well-prepared software developers by creating a new Bachelor of Applied Science track in software development that will articulate students from Associate of Science degrees in computer programming from the four partner colleges UCF, Valencia College, Eastern Florida State College, Lake-Sumter State College, and Seminole State College. Project goals included curriculum alignment, faculty development, student retention activities, and online instruction best practices.

- Principal Investigator: Dr. Craig Tidwell, UCF Regional Campus