Rowan University

2024 HIGHLIGHTS

HENRY M. ROWAN COLLEGE OF ENGINEERING

2024 HIGHLIGHTS

Cover: DEHub Ph.D. student **Jai Rathore** and undergraduate student **Sam Menaker** are performing reverse engineering on a drone to inspect its dimensional accuracy after assembling the parts, which were fabricated using digital design and advanced manufacturing methods.

DEAR FRIENDS,

2024 was a year of remarkable growth for our college, with enrollment surpassing 1,790 students and 492 engineers graduating. Two undergraduate students earned the prestigious Goldwater Fellowship as our 26 degree programs remain at the forefront of engineering education, emphasizing minds-on, hands-on learning, interdisciplinary collaboration, and real-world impact.

Driven by the research and innovation of our faculty and students, we achieved a record $15.6 million in externally funded research expenditures. Three of our faculty members received the NSF CAREER award, and our Advanced Materials & Manufacturing Institute (AMMI) received a $36 million cooperative agreement from the Army Research Laboratory that focuses on convergent manufacturing and advanced materials. We are also proud of our achievements in health, robotics, and artificial intelligence, such as Dr. Rachel Riley's work on nanoparticle therapies for preeclampsia and Dr. Mohammad Abedin-Nasab's NIH-backed robotic surgery system.

Experiential learning remains at the heart of our mission. From the Engineering Clinic Program, which engaged over 569 students in 135 real-world projects, to our growing co-op programs, which provide invaluable industry experience, our students are graduating as career-ready problem-solvers. International collaborations, like our study-abroad initiatives in Germany, Greece, and Japan, continue to expand students' global perspectives and engineering expertise.

Entrepreneurship is more than launching companies—it is a mindset. Our curriculum challenges students to think beyond conventional solutions, engaging them in entrepreneurial clinic projects, business competitions, and cross-disciplinary collaborations. Students can also major in Engineering Entrepreneurship. This culture of entrepreneurship ensures that our graduates are not only technically skilled but also adaptable, innovative, and ready to lead in a rapidly evolving global landscape.

With over 5,000 alumni shaping industries and communities, events such as the Alumni Circle of Distinction and our expanding professional network highlight the lasting impact of a Rowan Engineering education.

Looking ahead, we are committed to fostering a dynamic learning environment, advancing impactful research, and strengthening industry and the community. Your support is vital to our success, and we are grateful for your role in our journey.

Thank you for being part of the Rowan Engineering family. Together, we will continue to innovate, inspire, and lead.

Giuseppe R. Palmese, Ph.D.
Dean, Henry M. Rowan
College of Engineering

"Experiential learning remains at the heart of our mission. From the Engineering Clinic Program, which engaged over 569 students in 135 real-world projects, to our growing co-op programs, which provide invaluable industry experience, our students are graduating as career-ready problem-solvers."

— Giuseppe R. Palmese, Ph.D.

The 2024 academic year saw continued growth within the Henry M. Rowan College of Engineering. More than **1,790** undergraduate, master's and doctoral students were enrolled in the college. The academic year closed with **492** new graduates from across all departments and degree levels.

ENROLLMENT BY DEGREE

UNDERGRADUATE	1492
Biomedical Engineering	127
Chemical Engineering	121
Civil Engineering	298
Construction Management	185
Electrical & Computer Engineering	325
Electrical Engineering Technology	9
Engineering Entrepreneurship	48
Surveying Engineering Technology	12
Mechanical Engineering	360
Mechanical Engineering Technology	7

MASTER'S	240
Biomedical Engineering	7
Chemical Engineering	22
Civil Engineering	68
Electrical & Computer Engineering	56
Engineering Management	35
Mechanical Engineering	52

DOCTORAL	117
Biomedical Engineering	28
Chemical Engineering	12
Civil & Environmental Engineering	12
Electrical & Computer Engineering	21
Engineering Education	14
Materials Science & Engineering	4
Mechanical Engineering	16

YEAR IN REVIEW
BY THE NUMBERS:

492
DEGREES AWARDED

1799
STUDENTS ENROLLED

26
DEGREE PROGRAMS

DEPARTMENTS & DEGREES

	BS	MS	PhD	PhD/MD	PhD/DO
Biomedical Engineering (BME)					
Biomedical Engineering	✓	✓	✓	✓	✓
Civil & Environmental Engineering (CEE)					
Civil & Environmental Engineering	✓	✓	✓		
Chemical Engineering (ChE)					
Chemical Engineering	✓	✓	✓		
Electrical & Computer Engineering (ECE)					
Electrical & Computer Engineering	✓	✓	✓		
Experiential Education (ExEEd)					
Engineering Entrepreneurship	✓				
Engineering		✓			
Engineering Education			✓		
Mechanical Engineering (ME)					
Mechanical Engineering	✓	✓	✓		

DIVISIONS & DEGREES

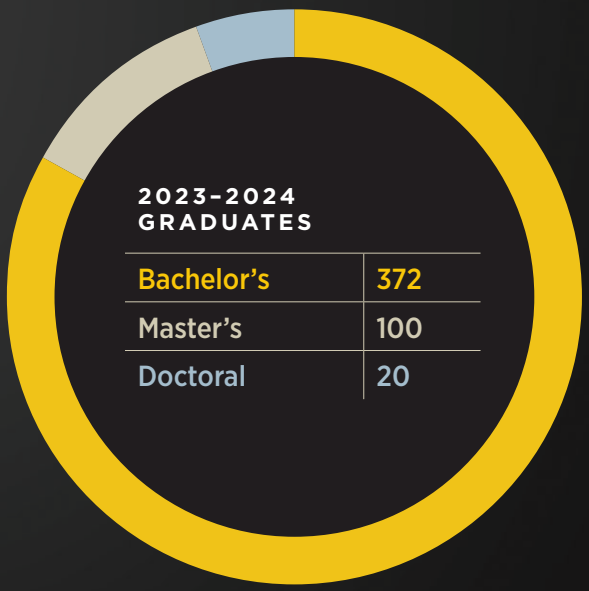
	BA	Master's
Construction & Engineering Management		
Construction Management	✓	
Master of Engineering Management		✓
Engineering Technology	**BS**	
Electrical Engineering Technology	✓	
Mechanical Engineering Technology	✓	
Surveying Engineering Technology	✓	

FACULTY BY THE NUMBERS:

22
TEACHING FACULTY

59
TENURE TRACK

22:1
UNDERGRADUATE STUDENT-FACULTY RATIO



NANOPARTICLES OFFER NEW HOPE FOR PREECLAMPSIA TREATMENT

Rachel Riley, Ph.D., assistant professor in the Department of Biomedical Engineering and the director of the Innovative NanoMedicines for Prenatal and Cancer Therapy (IMPACT) Lab.

Women comprise over half of the population, yet their health has been disproportionately underfunded and understudied. Historically, the majority of clinical trials have not included women, and even fewer studies have included pregnant women. This lack of research has left critical gaps in the basic understanding and treatment options for conditions that primarily affect women, particularly those surrounding pregnancy. Researchers at Rowan University aim to change that narrative by developing innovative approaches to improve maternal-fetal health outcomes.

A study published in Bioactive Materials in 2024 highlights research directed by **Rachel Riley, Ph.D.**, an assistant professor in the Department of Biomedical Engineering and the director of the Innovative NanoMedicines for Prenatal and Cancer Therapy (IMPACT) Lab. The project was led by Rachel Young, a Ph.D. candidate in Riley's lab, with contributions from other lab members, as well as collaborations with the University of Delaware, University of Pennsylvania, and Dr. Charalampos Papachristou from the Department of Statistics at Rowan University. The paper showcases the development of nanoparticles, ultrasmall particles designed to deliver therapeutic payloads to specific tissues in the body, as a new treatment approach for diseases of pregnancy.

The research addresses the critical need for new therapies in maternal-fetal health and in particular for preeclampsia. Preeclampsia affects 5-8% of pregnancies and is the leading cause of maternal mortality worldwide. The main symptoms include new onset hypertension and proteinuria, and severe disease leads to seizures, end-organ damage and it can affect fetal growth and development. However, current treatments for preeclampsia focus on symptom management and the only curative treatment for severe disease is to induce preterm birth, which can have detrimental impacts on the infant depending on the stage of gestation.

In this work, Riley and Young used an advanced statistical approach to engineer a lipid nanoparticle platform (LNP) that preferentially delivers the nucleic acids to the placenta as a potential treatment for preeclampsia. Preclinical studies in cells and mice demonstrated these LNPs deliver nucleic acids as the therapeutic drug to the placenta with high safety profiles. By delivering therapeutic RNA directly to the placenta, this approach offers the potential to extend pregnancy duration, reduce complications and improve outcomes for both mother and baby.

The LNPs developed by Riley and her team are structurally similar to the nanoparticles used in the Moderna and Pfizer-BioNTech SARS-CoV-2 vaccines, making this approach translational to humans with further research. This publication is part of Riley's broader research program aimed at developing innovative drug delivery platforms for diseases of pregnancy and pediatric cancer to provide new and safe treatment options for these patients. This study, and Riley's ongoing efforts, aim to address long-standing inequities in women's health research and the lack of treatment options for these patient populations, leading to improved outcomes.

FEATURED FACULTY PUBLICATIONS (Peer-Reviewed)

BME

Paone, L. S.; Szkolnicki, M.; DeOre, B. J.; Tran, K. A.; Goldman, N.; Andrews, A. M.; Ramirez, S. H.; Galie, P. A. Effects of Drag-Reducing Polymers on Hemodynamics and Whole Blood–Endothelial Interactions in 3D-Printed Vascular Topologies. *ACS Applied Materials & Interfaces* 2024, 16 (12), 14457–14466.
DOI:10.1021/acsami.3c17099

CEE

Farhoud, H.; Islam Mantawy. Metal Additive Manufacturing of Damage-Controlled Elements for Structural Protection of Steel Members. *Materials & Design* 2024, 113428–113428.
DOI:10.1016/j.matdes.2024.113428

CHE

McLaughlin, J. A.; Emre Kinaci; Palmese, G. R. Biobased Acetal Vinyl Ester Thermosets for Recovery of Fiber Reinforcements in Composite Materials. *ACS Applied Polymer Materials* 2024.
DOI:0.1021/acsapm.4c01658

ECE

Umer, M.; Polikar, R. Adversary Aware Continual Learning. *IEEE Access* 2024, 12, 126108–126121.
DOI:10.1109/access.2024.3455090

EXEED

Bravo, F. A.; Cruz-Bohorquez, J. M. Engineering Education in the Age of AI: Analysis of the Impact of Chatbots on Learning in Engineering. *Education Sciences* 2024, 14 (5), 484.
DOI:10.3390/educsci14050484

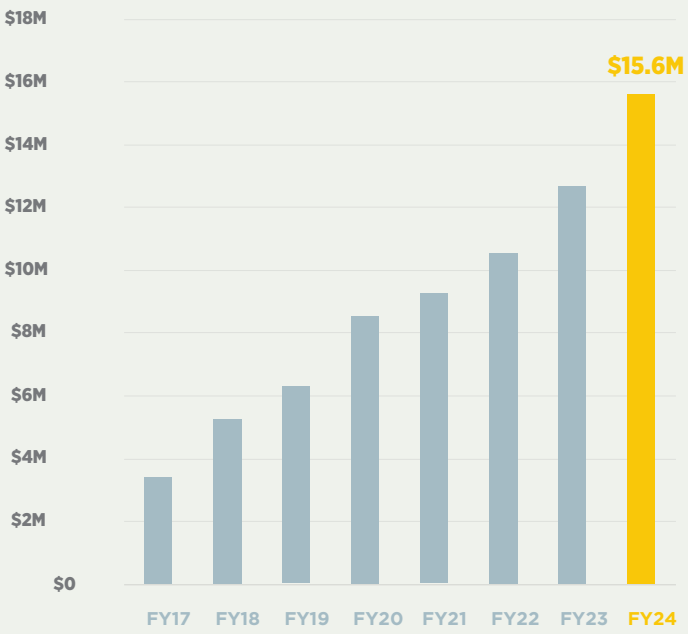
ME

Chadi Ellouzi; Farhood Aghdasi; Zabihi, A.; Miri, A. K.; Shen, C. Versatile Standing Wave Generation between Arbitrarily Oriented Surfaces Using Acoustic Metasurface Deflectors and Retroreflectors. *Advanced Intelligent Systems* 2024.
DOI:10.1002/aisy.202400474

RESEARCH EXPENDITURES

$15.6M

Research Expenditures: Growth Snapshot



AMIN NOZARI (NOZARIASBMARZ)

assistant professor,
Ph.D., North Carolina State University

Dr. Amin Nozari is an assistant professor in the Department of Mechanical Engineering at Rowan University. He earned his bachelor's and master's degrees in materials science and engineering (MSE) from Sharif University of Technology and the University of Tehran, respectively. Dr. Nozari completed his Ph.D. in electrical engineering (nanoelectronics) with a minor in MSE at North Carolina State University in 2017. He then pursued a two-and-a-half-year postdoctoral fellowship at The Pennsylvania State University (Penn State). Before joining Rowan, Dr. Nozari served as an assistant research professor in the Department of Materials Science and Engineering at Penn State from 2020 to 2024. His research interests include innovative materials, processing and devices for renewable energy, self-powered wearables, thermal management, thermoelectrics and high-entropy systems.

ADITYA DILIP LELE

assistant professor,
Ph.D., The Pennsylvania State University

Dr. Aditya Dilip Lele is an assistant professor in the Department of Mechanical Engineering at Rowan University. He completed his Bachelor of Technology in mechanical engineering at VIT Pune, India, in 2015, followed by a Master of Science in Mechanical Engineering from the Indian Institute of Technology Madras in 2018. Dr. Lele earned his Ph.D. in mechanical engineering with a minor in computational materials from Penn State in 2021. Prior to joining Rowan in Fall 2024, he was a postdoctoral researcher at Princeton University. His research focuses on machine learning-assisted multi-scale simulations to explore novel processes critical to sustainability, including plastic recycling, biofuel combustion and materials synthesis. Dr. Lele is also a member of the American Chemical Society (ACS).

TEACHING FACULTY SPOTLIGHT **MELANIE AMADORO**

Professor Amadoro is an associate teaching professor in the Department of Mechanical Engineering who strives to incorporate innovative learning strategies based on her industry and academic experience. She also focuses on the students' well-being as the undergraduate chair.

She joined Rowan University's College of Engineering in 2016. Her diverse background includes biomechanics and gait analysis at a children's hospital, applications engineering for an international bearing company and shipboard design and applications for Navy vessels.

Amadoro strives to incorporate real-world applications and hands-on learning in the classroom. She is passionate about creating a teaching environment where students are engaged in the learning process and gain the skills to apply their knowledge in unique ways.

Amadoro has been active in the **KEEN Engineering Network** and the **American Society for Engineering Education (ASEE)** with a focus on increasing female participation in engineering and innovation in the teaching of traditional engineering courses. She was recently named Rowan University's KEEN Campus Rising Star due to her focus on incorporating entrepreneurial minded learning.

Amadoro values teaching and interaction with her students and plans to continue her personal growth through working with KEEN and ASEE. She desires to keep evolving the engineering education paradigm so that students leave the undergraduate program with adaptable skills as they head into their careers or graduate studies.

> "My goal is to engage students in the learning process and get them excited about problem-solving in the real world."
>
> — Melanie Amadoro

THREE NSF CAREER AWARDS

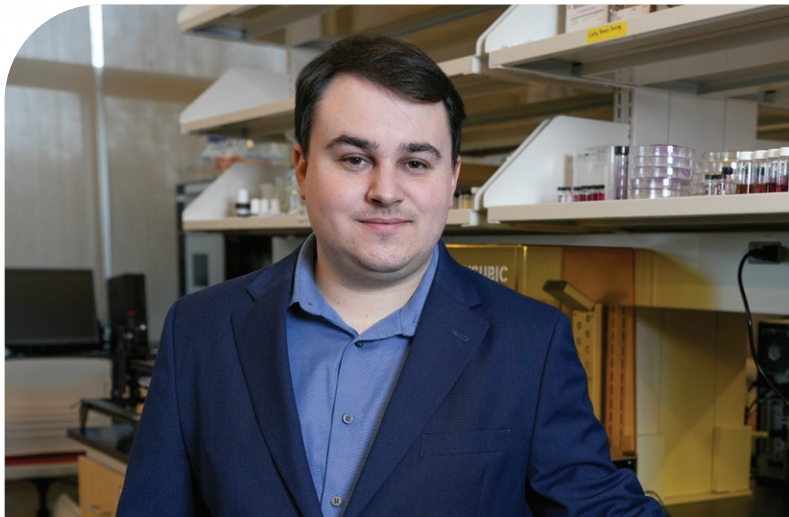
NATIONAL AWARD TO STUDY CRYSTAL FORMATION

Gerard Capellades, Ph.D., an assistant professor of chemical engineering in the Henry M. Rowan College of Engineering, received a five-year, $574,000 National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award to investigate the mechanisms by which impurities incorporate in growing crystals.

Industrial crystallization is a widespread process that plays a critical role in the production of bulk and fine chemicals, food products, pharmaceuticals and several materials. The manufacturing process for those products often involves multiple chemical reactions, generating unwanted impurities that can incorporate into the final product, leading to a change in its properties or to adverse health effects. Crystallization is often employed as a purification process to separate the main product from those impurities; however, while this is a highly effective unit operation, some impurities still manage to incorporate in the growing crystals.

Understanding how impurities are retained in a product during the crystallization process could point the way toward better production methods for novel materials. In pharmaceuticals, the work could lead to improved medications and potentially fewer side effects for patients.

To closely study the crystallization process in the lab, Capellades will use readily available compounds, such as acetaminophen (the active ingredient in Tylenol) and salicylic acid (a precursor to aspirin), as model pharmaceutical systems. Capellades will use dyes as model impurities to test the research methods and then validate their findings with relevant systems from industrial collaborators in the pharmaceutical sector.



RESEARCH GRANT TO DEVELOP MORE FUNCTIONAL ELECTRICAL SENSORS

Chen Shen, Ph.D., an assistant professor of mechanical engineering in the Henry M. Rowan College of Engineering, received support for the $500,000, five-year project with the National Science Foundation's Faculty Early Career Development Program (CAREER) Award. Shen will study methods of manipulating interactions with high-frequency vibrations known as surface acoustic waves (SAWs) in electronic devices to broaden their functionality.

SAWs travel on the surface of solids or materials and they can transmit electrical signals using devices called SAW filters, which are widely found in smartphones and tablets. They can also be used in sensors, as SAWs are sensitive to foreign material and environmental conditions, such as humidity. When these sound waves travel over certain piezoelectric materials, they generate an electrical charge.

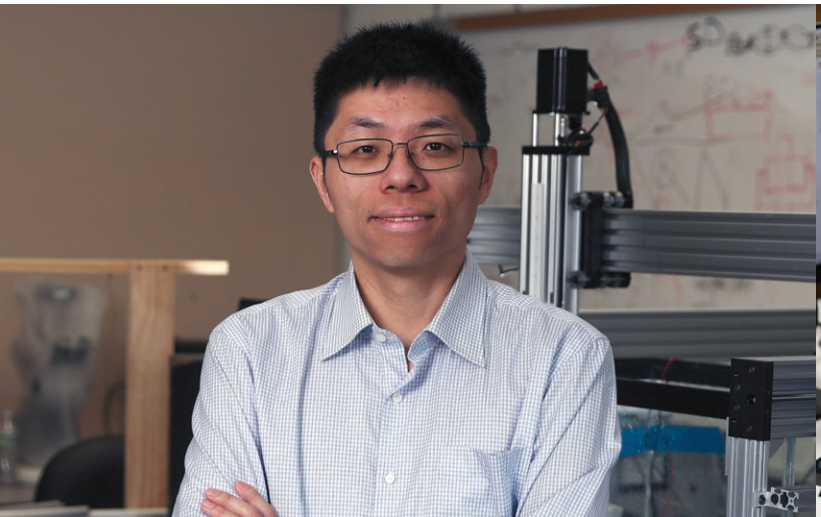
Chen and his team will utilize the method of electrical tuning in which a small electrical voltage is applied to control the propagation of SAWs. This allows SAW sensors to be integrated with other sensors or electrical components. Preliminary results showed that small amounts of electrical voltage can control the propagation of SAWs. Now, Shen hopes to design more integrated devices.

FUNDING TO IMPROVE PROCESS SYNTHESIS AND DESIGN OF WASTEWATER TREATMENT SYSTEMS

Much of Kirti Yenkie's research aims to help reduce trial and error in design and decisions related to environmental sustainability. **Kirti Yenkie, Ph.D.**, an associate professor in the Henry M. Rowan College of Engineering's Department of Chemical Engineering, has received funding to improve process synthesis and design of complex systems such as wastewater treatment networks. These improved processes will be cost-effective, environmentally friendly and robust, meaning these systems can withstand effects from extreme weather events, for example. Yenkie will complete the work over five years with $505,676 in funding from the National Science Foundation's Faculty Early Career Development Program (CAREER) Award.

Using mathematical concepts from graph theory, Yenkie and her team will identify a ranked list of possible designs for a wastewater treatment plant. Then, machine learning algorithms will be employed to inform these possible designs and make them more resilient. The goal is to predict when certain pieces of aging infrastructure or technologies might fail or if extreme weather could disrupt the plant operations.

Ultimately, Yenkie expects this methodology will lead to creative, cost-effective and greener solutions for designing new wastewater treatment facilities or retrofitting existing facilities. This approach could also be extended to other complex systems such as plastics recycling or solvent recovery.



Mohammad Abedin-Nasab (bottom left) and Provost Anthony Lowman (top right)

HONORING ROWAN INNOVATORS

Rowan University Provost and Senior Vice President for Academic Affairs **Anthony Lowman** and the inventor of a surgical robot, **Mohammad Abedin-Nasab**, were among the New Jersey innovators recognized by the Research & Development Council of New Jersey (R&D Council) during the 2024 Edison Patent Awards, the highest recognition of innovation in the state.

Lowman received the 2024 Educator of the Year Award for his role in transforming Rowan University into the third fastest-growing public research institution in the United States. Abedin-Nasab, Ph.D., was recognized with an Edison Patent Award in the Medical Technology category for a surgical robotic system named Robossis.

SPARKING INNOVATION IN ENGINEERING EDUCATION: LEGO-BASED WORKSHOP AT KEEN CONFERENCE

How can instructors spark creativity and innovation in engineering education? That was the topic of a talk given by two Rowan faculty at a national conference. **Melanie Amadoro**, an associate teaching professor, and **Smitesh Bakrania**, **Ph.D.**, an associate professor, hosted a workshop, titled "Play as a Platform to Spark EML Conversations", at the KEEN (Kern Entrepreneurial Engineering Network) National Conference in Austin, Texas in February 2024.

The talk focused on strategies for encouraging students to think outside the box and emphasized the three Cs of entrepreneurial engineering: value creation, making connections and fostering curiosity. Attendees took part in collaborative hands-on challenges where teams used LEGO sets to create a new "animal," market it and vote for a winner.

The presentation was so successful that Amadoro and Bakrania were invited to give it again at the IISE National Conference in Montreal in May 2024.

Ying (Gina) Tang, Ph.D.

DR. TANG HONORED WITH IEEE SMCS OUTSTANDING CONTRIBUTION AWARD

In October 2024, **Dr. Ying (Gina) Tang**, professor in the Department of Electrical & Computer Engineering, was honored with the IEEE Systems, Man & Cybernetics Society (SMCS) Outstanding Contribution Award at the society's annual conference in Malaysia, attended by over 900 participants. This prestigious award recognizes individuals who have made significant contributions to the field of human-centered engineering. Tang was specifically recognized for her exceptional service as Vice President of Finance for SMCS from 2021 to 2024.

During her tenure, Tang played a pivotal role in doubling the society's financial reserves, a major achievement that ensured the organization's stability and long-term growth. She also led efforts to resolve journal backlogs, automate project management processes, and collaborate with technical committees to develop educational resources. Her leadership was particularly invaluable during the COVID-19 pandemic, when she helped strengthen the society's financial foundation, enabling it to navigate the challenges of the global crisis.

With nearly 5,000 members worldwide, SMCS continues to advance integrative engineering solutions. Tang's contributions have had a lasting impact on the society, shaping its future direction and ensuring its continued growth and success.

The Henry M. Rowan College of Engineering is committed to advancing research that drives meaningful change. Engineers across all disciplines are engaged in pioneering studies and innovations in four critical areas: **Health**, **Sustainability**, **Connectivity** and **Education**. Inspired by Henry M. Rowan's dedication to transformative projects, our research has the power to improve lives, revolutionize industries through enhanced connectivity, promote sustainable development and foster equitable educational opportunities. Through these efforts, we aim to make a lasting impact on both individuals and communities.

SUSTAINABLE MATERIALS & PROCESSES

Joseph Stanzione III, Ph.D., professor of chemical engineering and founding director of Rowan University's Advanced Materials & Manufacturing Institute (AMMI), examines a new polymer synthesis process in the lab.

PARTNERSHIP WITH U.S. ARMY IN CONVERGENT MANUFACTURING AND ADVANCED MATERIALS

A Rowan University-led team will collaborate with the U.S. Army Combat Capabilities Development Command Army Research Laboratory and government partners on a five-year project with funding up to $36 million to develop new "super" materials and find ways to blend traditional and novel manufacturing processes using a single manufacturing platform.

Led by **Joseph Stanzione III, Ph.D.**, professor of chemical engineering and founding director of Rowan University's Advanced Materials & Manufacturing Institute (AMMI), the project includes researchers at Drexel University and PPG, a global supplier of paints, coatings and specialty materials.

Using advanced engineering optimization techniques, the project aims to revolutionize composite materials and their manufacturing processes used by the U.S. Army and its industrial base. The team will work to create useful, lightweight and durable parts that can be rapidly produced. The project will involve combinations of unconventional, yet domestically sourced raw materials, convergent manufacturing methodologies and the advancement of fundamental materials science and engineering.

Researchers will team up with the Army's subject matter experts for high-impact research. The Army's team of experts will help guide the focus of the studies and ensure they are relevant and make the greatest impact.

AMMI includes experts in materials, sustainable chemistry and engineering, geosciences and advanced manufacturing strategies from the Henry M. Rowan College of Engineering and the College of Science & Mathematics. The project will involve dedicated faculty, staff, research scientists, graduate and undergraduate students, paid interns and postdoctoral fellows to develop the next generation of highly-skilled, technical employees.

IMPACTFUL EDUCATION

Justin C. Major, Ph.D.,
assistant professor of experiential engineering education

ASSESSING STUDENTS' WELL-BEING IN ENGINEERING'S 'CULTURE OF HARDSHIP'

A culture of difficulty among engineering majors often pushes out students who question whether they have the resources to succeed, especially those from marginalized backgrounds. But **Justin C. Major, Ph.D.**, an assistant professor of experiential engineering education at Rowan University, suggests steps can be taken to create a culture of thriving instead.

With a five-year grant from the National Science Foundation's EDU Core Research program, Major will explore students' well-being and career perceptions in the context of engineering culture. Supported with a combined $1.25 million in NSF funding for their work, Major and collaborator Karin Jensen, Ph.D., assistant professor of biomedical engineering at the University of Michigan, will interview engineering students at all levels of undergraduate study at both institutions to better understand students' conceptualizations of mental health at different points in their education. The researchers will gain longitudinal insights by following a group of first-year students throughout their undergraduate education and into their first careers in the field.

The researchers plan to implement interventions in their own classrooms to get students thinking more about their mental health and engineering careers in tandem.

NSF-FUNDED POSTDOCTORAL FELLOWSHIP WILL PREPARE ENGINEERING SCHOLARS TO THRIVE

Scholars fresh out of an engineering doctoral program have spent years developing research skills, but they're often unprepared for other aspects of an academic career.

Researchers **Kaitlin Mallouk, Ph.D.**, associate professor in the Department of Experiential Engineering Education (ExEEd), Cassandra Jamison, Ph.D., ExEEd assistant professor, and Jill Perry, Ph.D., associate professor of content area teacher education in Rowan's College of Education, are leading a project that aims to fill these gaps. Funded by a $1.2 million grant from the National Science Foundation, the Training Holistic Research Innovators Via Education Postdoctoral Fellowships in STEM (THRIVE-STEM) program will provide explicit training in teaching and service for ExEEd's first three postdoctoral fellows.

During the first year of the three-year project, Mallouk, Jamison and Perry will develop workshops and forge partnerships with faculty mentors across campus. When the postdoctoral scholars begin the fellowship in September 2025, they will benefit from holistic, intentional training for their academic careers.

In their first year, the scholars will shadow experienced instructors and contribute to established faculty members' research. During their second year, they will teach independently, work on their own research and mentor graduate students. Fellowship training will also leverage programming from the National Center for Faculty Diversity and Development. At the end of the project, the researchers hope the postdoctoral scholars will have the skills to thrive in their careers.

Kaitlin Mallouk, Ph.D.,
associate professor of experiential engineering education

EQUIPPING STUDENTS **FOR SUCCESS**

BIOMEDICAL | NATIONAL GRANT FOR ROBOTIC-SURGERY SYSTEM

A Rowan University researcher is developing the first robotic-surgery system designed to align fractured long bones, such as the femur, or thigh bone. These bones often don't heal properly due to misalignment—causing pain, difficulty walking and other long-term problems.

Mohammad Abedin-Nasab, Ph.D., and his research team have won a $1.8 million grant from the National Institutes of Health (NIH) to further develop the system—named Robossis—and bring it to market. Abedin-Nasab has been working on Robossis for 10 years.

Robossis could make femur realignment surgery less invasive. The robot makes only small incisions, which can limit blood loss, post-surgical pain and scarring. Robossis also requires fewer X-rays than traditional surgery, reducing radiation exposure for patients and health care providers.

The R01 grant, the NIH's original and most prestigious funding program, will be used to create and test a clinical-grade version of Robossis, based on the current prototype. The new system will include enhancements to meet the Food and Drug Administration's stringent safety and efficacy requirements. The research team will then conduct five new studies, evaluating the system's performance on cadavers before presenting results to the FDA.

Robossis consists of three components: the robot, the haptic controller (a controller that provides physical feedback) and a navigation system that automatically aligns the bone.

Using X-ray images from two angles and cameras to track the fractured pieces, Robossis creates a 3D computer model of the surgical site and recommends a path to precisely realign the broken bone. The surgeon can then manipulate both the robot and the patient's leg using the haptic controller while viewing the animated model through a virtual reality headset. A surgical assistant would no longer need to stabilize and align the leg manually.

Robossis is among Rowan's first NIH-backed, translational research projects with a combined investigator team that includes Virtua Health—a result of Rowan's academic health partnership with southern New Jersey's largest health system.

Mohammad Abedin-Nasab, Ph.D.,
Robossis founder and associate professor
of biomedical engineering

IMPACTFUL
HEALTH

Andrea Vernengo, Ph.D., project director for Rowan REACTS and associate professor of chemical engineering

IMPACTFUL SUSTAINABILITY

SUSTAINABLE MATERIALS & PROCESSES | TRAINING ENGINEERS IN SUSTAINABILITY RESEARCH

To address the growing demand for professionals in the sustainability sector, the Henry M. Rowan College of Engineering has received a federal grant to support doctoral education. Rowan University's Department of Chemical Engineering and the Experiential Engineering Education Department (ExEEd) have been awarded a $1.7 million grant from the Department of Education's Graduate Assistance in Areas of National Need (GAANN) Ph.D. fellowship program.

The funds will support 10 doctoral fellows as they advance their careers in sustainability research and education through Rowan's Shaping the Next Generation of Researchers, Educators and Leaders in Chemical Technologies for Sustainability (REACTS) program.

The effort is led by **Andrea Vernengo**, **Ph.D.**, the project director for Rowan REACTS and a chemical engineering professor. Fellows will work closely with a faculty advisor and engage in research across areas such as sustainable pharmaceuticals, regenerative medicine, clean hydrogen energy and water treatment. Two fellows will focus on engineering education, and all research will emphasize sustainability.

The GAANN program supports graduate fellowships in fields critical to national needs, including education, engineering and psychology. Rowan REACTS aligns with these priorities, focusing on advancing both chemical engineering and sustainability.

In addition to research opportunities, fellows will receive training in teaching through Rowan's STEM Teaching Efficacy and Practice for Situated Learning Skills (STEPS) program, supported by ExEEd. They will also gain experience in mentorship and leadership by participating in Rowan's K-12 outreach and undergraduate engineering clinic programs. By the end of the program, fellows will have the opportunity to teach their own course in sustainability. The three-year fellowship provides full tuition coverage, fees, living expenses, a health insurance subsidy, travel support and a stipend based on financial need.

IMPACTFUL **CONNECTIVITY**

Mohammad Jalayer, Ph.D.,
associate professor of civil and environmental engineering

INFRASTRUCTURE & TRANSPORTATION
RIGHTING WRONG-WAY CRASHES IN NEW JERSEY

Wrong-way driving crashes—where a motorist who is driving on the wrong side of traffic collides with another vehicle—are among the deadliest types of auto crashes. New Jersey ranks among the top 15 states with the highest number of wrong-way fatalities.

In order to reduce these crashes, the U.S. Department Of Transportation awarded a $2 million Strengthening Mobility and Revolutionizing Transportation (SMART) grant to the New Jersey Department of Transportation (NJDOT) to study wrong-way driving incidents and prototype wrong-way driving systems in New Jersey. Rowan University is part of the research team led by AtkinsRéalis USA, Inc.

Under the direction of **Mohammad Jalayer, Ph.D.**, an associate professor in the Department of Civil & Environmental Engineering, Rowan's team will use data analytics tools to evaluate and verify the effectiveness of at least two wrong-way driving Intelligent Transportation Systems (ITS) systems installed in New Jersey.

RESEARCH SPOTLIGHT:
JIE LI

Millions of people rely on energy systems for the delivery of electricity to their homes to power their heating, cooling, lights and devices. **Jie Li, Ph.D.**, an associate professor of electrical and computer engineering in the Henry M. Rowan College of Engineering researches how machine learning algorithms could manage the consumption of this energy in addition to the cyber-physical security of these power systems.

Energy service interruptions are a rare but inconvenient part of life in the 21st century. Li and her team investigate machine learning solutions to manage the consumption of energy. How can AI benefit energy systems operations? Can AI allow for a more efficient and effective delivery of service, as well as equitable energy market access?

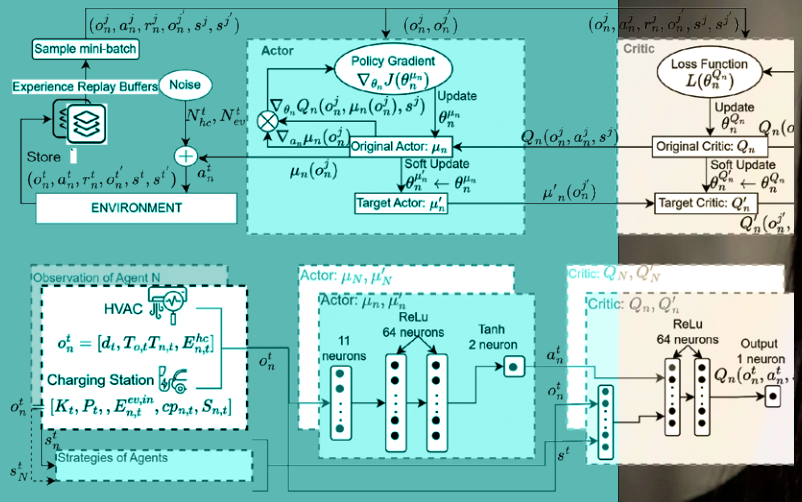
"We expect our solution to enable communities with different distributed resources so they can better manage their energy consumption behaviors and minimize demand peaks to alleviate the burden to the electric grid," Li said. "This saves the community in energy costs, and contributes to the system stability and reliability."

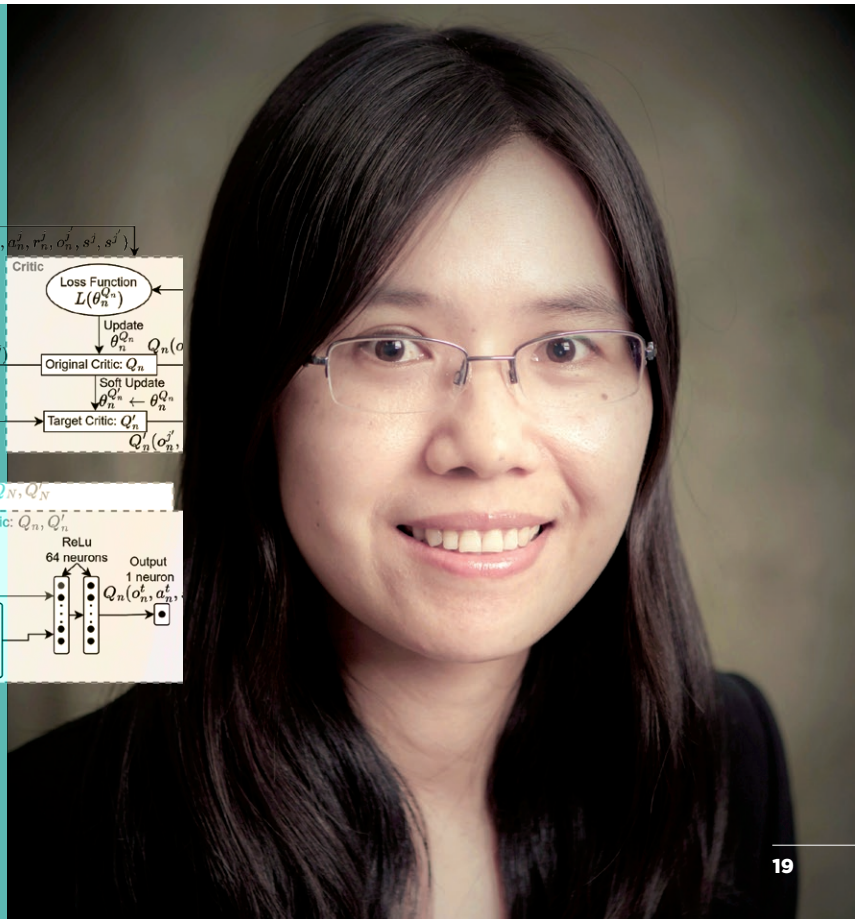
Another thread of Li's research deals with energy security. As the country adopts diversified energy resources—for example, the move to photovoltaic, wind, and transition to electric vehicles—with greater digital technology integration, Li's research addresses the security challenges of these new systems. The goal is to collect data to monitor the performance of increasingly interdependent energy systems that could create a detection system for anomalies and provides correctives under the emerging deep uncertainties. Li and her team recently completed a project in conjunction with the state of New Jersey's board of public utilities, and the state electricity, natural gas and petroleum providers to develop a state energy security plan.

"When we talk about resilience, that means response to natural events," Li said, "but this also includes response to cyber-attacks as well as physical attacks and human misoperation. The system needs to be ready to respond.

Jie Li, Ph.D.,
associate professor of electrical
and computer engineering

Figure: Deep reinforcement learning for smart community energy management





ROWAN ENGINEERING CLINICS: REAL-WORLD LEARNING

Rowan engineering students enjoy a unique educational experience through the Henry M. Rowan College of Engineering's clinic program, which provides real-world, hands-on learning opportunities from the first semester. The program integrates classroom concepts with practical applications, allowing students to collaborate on laboratory and design projects alongside classmates, faculty and graduate students. Since its inception in 1996, clinics have been central to Rowan's engineering curriculum, placing students in professional environments where they work on projects with real clients, including government agencies, businesses and hospitals.

In their first and second years, students develop essential technical, managerial and communication skills. They engage in team-based design projects that connect their academic studies to real-world engineering challenges. Sophomore clinics emphasize communication, with students learning to write reports and present their findings, supported by writing and public-speaking courses built into the program.

By their junior and senior years, students select from over 100 clinic projects, which range from designing adaptive technologies to developing augmented reality systems for various industries. These projects are often client-based, allowing students to work in interdisciplinary teams on complex problems. This hands-on experience not only strengthens technical knowledge but also equips students with valuable skills that make them highly competitive in the workforce or graduate school.

Through these experiences, Rowan engineering students are prepared to tackle the challenges of tomorrow's industries and make a meaningful impact in their fields.

STUDENT CLINICS BY THE NUMBERS:

1200
CLINIC PROJECTS TO DATE

STUDENTS ASSIGNED TO CLINIC PROJECTS TO DATE
5000+

A TOTAL OF
569
STUDENTS PARTICIPATED IN
135
CLINIC PROJECTS IN
2024

FROM ENGINEERING STUDENT TO CLINIC INSTRUCTOR

As a mechanical engineering major, **Kyle Naddeo** worked on clinic projects that aligned with his major, like trying to perfect the tilt mechanism on a hoverbike. But it wasn't the mechanics that caught Naddeo's attention—it was machine learning. By his senior year, Naddeo dove head-first into machine learning.
"I was a mechanical engineer, and while we did code, it wasn't our main focus," Naddeo said. "The clinics opened that door to dive deeper. It was something I really liked doing."

Now, Naddeo is pursuing a doctorate in electrical and computer engineering while also leading and advising clinic projects where undergraduates are working on his innovation. In collaboration with his Ph.D. advisor, **Nidhal C. Bouaynaya**, **Ph.D.**, he learned principles of artificial intelligence and how to make data-driven predictions. At the core of all of Rowan's engineering clinics is a real-world problem and students are tasked with solving it. For Naddeo's clinic project, the central question is: 'Can I automate the act of tossing a wok without human intervention?'

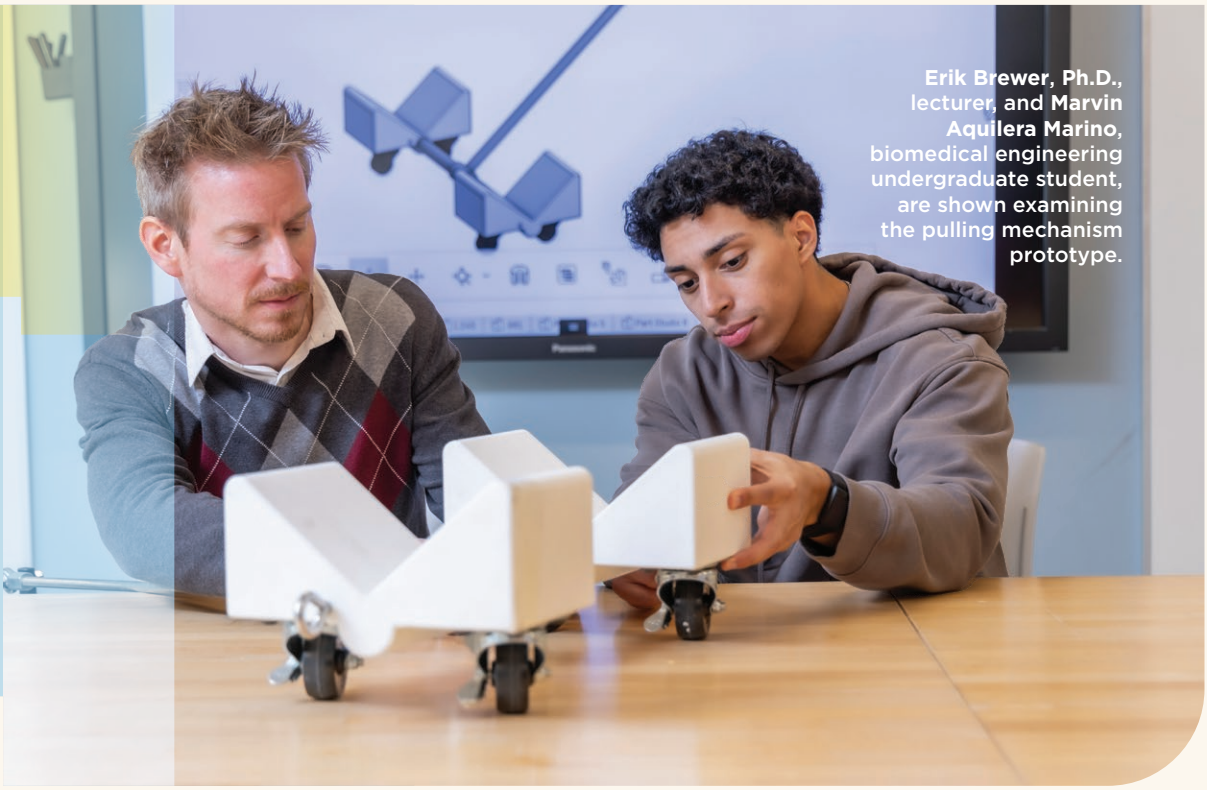
Naddeo's mechanical arm system continuously tosses a wok, freeing chefs to prepare other items or interact with customers.

Using measurements from wok burners used in restaurants today, Naddeo created a 3D simulation of the mechanical arm device that would pair with all wok sizes. Undergraduate students across disciplines worked on the innovation: mechanical engineers to build the structure, electrical and computer engineers to build the circuitry and artificial intelligence engineers to build the algorithmic code. This multidisciplinary team allowed students to learn from one another and effectively collaborate.

> **"The clinics really let you explore things that you're interested in...It makes you think about what do I actually want to do once I graduate?"**
>
> — **Kyle Naddeo, Ph.D. candidate in ECE**

Each week, students recounted what they were able to accomplish last week, what they were struggling with and what they hoped to accomplish in the future. They also learned soft skills, like cloud-based organization in a team Google Drive.

Clinic projects, Naddeo said, help students envision their careers post-graduation. "It really lets you explore things that you're interested in," he said. "It makes you think about what do I actually want to do once I graduate?"



Erik Brewer, Ph.D., lecturer, and **Marvin Aquilera Marino,** biomedical engineering undergraduate student, are shown examining the pulling mechanism prototype.

IMPROVING THE LIVES OF VETERANS

Engineers often contribute to projects with real-world impacts, but it may take years until the fruits of their labor reach the public. One group of Rowan engineering students had the rare opportunity to make a material impact on the life of a veteran through a one-year clinic project.

Students **Joshua Perry**, **Anna Sasse**, **Bailey Erikson**, **Christopher Iuliucci**, **Marvin Aguilera Moreno** and **Alexa Warren** worked under the direction of **Erik Brewer, Ph.D.**, an associate teaching professor in the Department of **Biomedical Engineering**, to create an attachment for strollers and shopping carts to help a blind veteran better maneuver these items while using his white cane.

The project is part of an ongoing collaboration with **Quality of Life Plus**, a national nonprofit that partners with universities across the country to engage engineering students in creating personalized solutions for injured veterans and first responders.

The team met with U.S. Army veteran **Mike Nelson**, who, due to injuries sustained during military service, is visually impaired. He shared his difficulties taking his children for walks in a stroller while using his visual assist cane and asked the team if they could design a pulling mechanism attachment, allowing him to guide a stroller or shopping cart behind him while using his cane in front of him.

Before the first mockups were sketched, the students needed to gather information. The first few months of the project were dedicated to interviews with disability advocates, occupational and physical therapists and content creators in the disability community to gather information that would help inform their design. Through these conversations, they learned what products were already commercially available, whether the attachment would allow Nelson to push the cart or pull it and how to make the attachment as easy to maneuver as possible.

This fact-finding mission helped prepare students for future careers, especially as entrepreneurs, where interviewing and problem-solving are crucial to understanding a client's needs. One student from the team, Joshua Perry, is following this entrepreneurial path and has founded his own company and is currently pursuing his MBA at Rowan.

Once the team determined the attachment would be a pull mechanism, then came the design phase. How would the attachment look? How to make it adaptable to different-sized strollers and shopping carts? How to make the handle the most comfortable for Nelson? Once a design was solidified, students turned to their core engineering skills to prototype and test the attachment.

After they designed and manufactured the attachment, the students presented the final product to Nelson at the end of the academic year, a rewarding experience to see the tangible impact of their work.

The team also presented their work at the Northeast Bioengineering Conference at Stevens Institute of Technology.

Joshua Perry, biomedical engineering alumnus and MBA student; **Alexa Warren**, undergraduate student; and **Marvin Aquilera Moreno**, undergraduate student, are examining the pulling mechanism prototype.

> **Participating in this project was an incredibly rewarding experience. It provided a unique opportunity to apply engineering principles in a practical setting while collaborating closely with my team and outside experts... This experience not only highlighted the importance of teamwork and interdisciplinary collaboration but also reinforced how engineering creates meaningful real-world impact.**
>
> — **Joshua Perry**, biomedical engineering alumnus and MBA student at Rowan University

MORE SUSTAINABLE PROCESSES

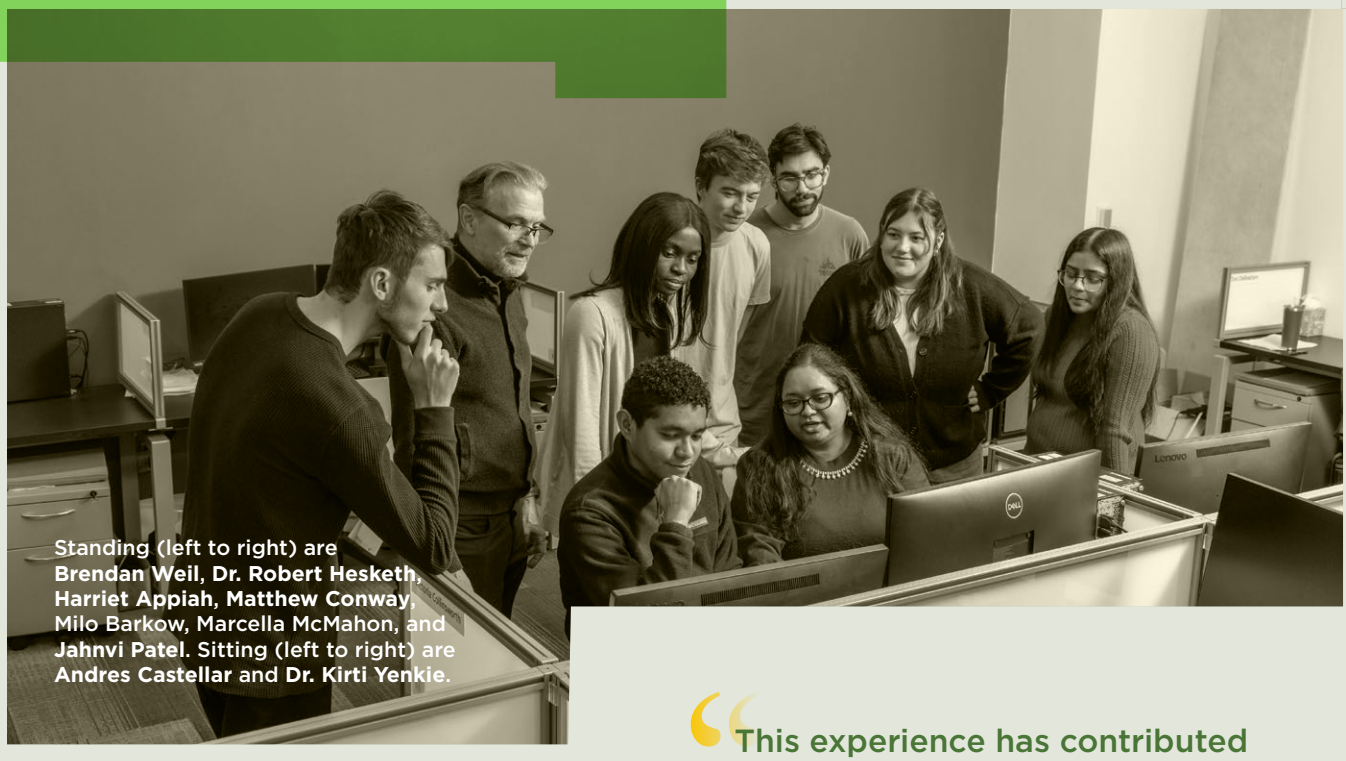
ENGINEERING CLINIC PROJECT TACKLES SUSTAINABILITY IN CHEMICAL ENGINEERING

In a world of perpetual innovation, researchers are constantly developing new chemicals for pharmaceutical and other industries. But what impact do these chemicals have on the environment? An engineering clinic project at Rowan aims to create a machine learning algorithm to predict novel chemical properties, separation mechanisms, environmental impacts, sustainability metrics and its life cycle.

Undergraduates **Marcella McMahon** (left) and **Milo Barkow** (right) are collaborating with Ph.D. student **Harriet Appiah** (center).

The project, led by **Kirti M. Yenkie, Ph.D.** and **Robert Hesketh, Ph.D.**, professors in the Department of **Chemical Engineering**, is a continuation of previous work where the team examined the environmental impact of chemicals from the pharmaceutical industry that end up in waste streams. If these materials could be better understood, engineers could design more chemicals or processes that use these materials more sustainably.

The project, sponsored by **U.S. Environmental Protection Agency** and supported by **AstraZeneca**, aims to create a machine learning algorithm that can predict this sustainability information. The goal is to trace the life cycle of a chemical, from its raw materials to a manufactured product, through its use and disposal. Where did the chemical ultimately end up—in a sanitation facility or was it recycled? This machine learning algorithm will help scientists determine any potential environmental impacts a



Standing (left to right) are **Brendan Weil, Dr. Robert Hesketh, Harriet Appiah, Matthew Conway, Milo Barkow, Marcella McMahon, and Jahnvi Patel.** Sitting (left to right) are **Andres Castellar** and **Dr. Kirti Yenkie.**

> **This experience has contributed to my research experience by providing a hands-on opportunity to apply computational design in chemical engineering. Working on this project has allowed us to bridge theoretical concepts with real-world applications, particularly in developing sustainable solutions.**
>
> — **Milo Barkow,**
> chemical engineering major

chemical poses at the start of the design process, not after. Ultimately, the machine learning algorithm will be made publicly available.

The algorithm will help manufacturers make more informed decisions—and highlight the pros and cons of various synthesis processes. This project will counter the assumption that all bio-based materials are inherently more sustainable by highlighting the longevity and qualities of certain materials and weighing them against comparable chemicals.

The project began in 2022 and will continue until 2025. In 2023, undergraduate clinic students won a grant from the American Institute of Chemical Engineers for their work on this project.

Student involvement includes collecting data which will act as inputs and outputs to the algorithm as well as learning about the processes of how chemicals are created. They also learned how to program the algorithm in Python, an invaluable industry skill that goes beyond what is covered in the chemical engineering curriculum. Graduate student **Emmanuel Aboagye**, a postdoctoral researcher now at Princeton, trained the team on machine learning algorithms.

In 2024, students **Matthew Conway**, **Jared Longo**, **John Pazik** and **Milo Barkow** worked on the project. Conway, ‘25, was awarded the prestigious 2024 Goldwater Scholarship, awarded to students pursuing research careers in the natural sciences, engineering and mathematics.

Also through this project, Yenkie and Hesketh designed K-12 outreach activities designed to teach younger students about the life cycle of materials through a popcorn-making exercise. Students were shown various methods of making popcorn, what materials were used and how much energy was consumed in each method. They then discussed which option was the most energy- and taste-efficient.

MEASURING UNDER BRIDGES

While driving under bridge overpasses in New Jersey, motorists might notice minimum vertical clearance signs. But have you ever wondered how the clearance of those bridges are measured in the first place?

One engineering clinic project, sponsored by the New Jersey Department of Transportation, focused on automating the way these clearances are measured using remote sensing. Typically, measuring vertical clearances requires inspectors to stop traffic and manually measure the space between the road and the bridge—which poses a potential risk to the inspector. Rowan engineers are developing a safer method using cutting-edge technology where an inspector would simply drive under the bridge and remote sensors on the vehicle will measure the clearance.

Not only will this technology prevent road closures and ensure the safety of the inspector, but it will also enable engineers to access clearance information for bridges. This will allow large tractor-trailers to easily avoid routes with bridges they cannot clear, thereby preventing collisions.

Michael Waldron, civil engineering undergraduate student; **Adriana Trias Blanco, Ph.D.**, assistant professor; and John Vrabel, Ph.D. candidate, are viewing the point cloud of a bridge.

> Bridge vertical clearance signage is critical to alert drivers to prevent unwanted and avoidable accidents. Utilizing this proposed new technology, experts in the field can accurately and successfully capture the bridge's vertical clearance, while being safely secured in the vehicle.
>
> — **John Vrabel**, civil and environmental engineering Ph.D. candidate

John Vradel, Ph.D. candidate, is pictured holding a LiDAR scanner.

The project was led by **Adriana Trias Blanco, Ph.D.**, an assistant professor in the Department of **Civil & Environmental Engineering**, alongside students **Juliana DiVentura**, **Richard Russo**, **Keegan Roche**, **Robert Ruhl**, **Andrew Mazurek**, **Thuy Nguyen**, **Michael Waldron** and **Mason Kennedy**. The team collaborated with researchers from Rutgers University who worked to build an automated tool where the user can point and click at the space under a bridge and see the dimensions under the bridge.

The Rowan team's contribution was to collect and analyze data to build computational models. First, the team visited 12 bridges along Routes 70 and 73 in southern New Jersey and drove under the bridge with a mobile LiDAR sensor to capture the entire geometry of the structure without needing to stop. The bridges the team analyzed were fairly old and the road beneath had been recently paved so the new clearance was unknown.

Then, each student was assigned a bridge whose data they processed and analyzed manually. Students created cross-sections and different views of the area beneath their assigned bridge to measure the dimensions.

If the clearance was below 14 ft. 6 in. for county roads and 14 ft. 9 in. for state roads, the bridge needed to post signage indicating as much. A handful of the bridges students analyzed did fall under the required dimensions.

Students had the opportunity to work directly with this cutting-edge technology to collect data, providing unique insight into a slightly lesser-known aspect of civil engineering: bridge engineering. Their work will be summarized and disclosed back to the NJDOT in a final project report.

The hope is future teams of student engineers can analyze more bridges in the state.

PREVENTING FALLS WITH ENGINEERING

Falls pose serious health threats for people of all ages and abilities. A postal service worker in wintertime might skid as they navigate icy sidewalks. An elderly person might lose their balance while grocery shopping. A dish washer in a kitchen runs the risk of slipping on soapy dishwater.

Vaibhavsingh Varma, Ph.D. candidate; **Zachary Roberts**, undergraduate student; and **Mitja Trkov**, Ph.D., assistant professor, are testing a wearable exoskeleton device.

> Working with Dr. Trkov on this project has profoundly influenced not only my academic and professional career but also my life... connecting me with some of the most talented and inspiring people I know. One of the most rewarding aspects has been getting to work as part of a team, to collaborate with incredible individuals and to see all of us grow together.

— **Zachary Roberts,**
mechanical engineering major

Rowan engineers are designing a device that would prevent these falls. For a clinic project, **Mitja Trkov**, **Ph.D.**, an assistant professor in the Department of **Mechanical Engineering**, led student researchers in the design and testing of a wearable exoskeleton device meant to assist with lower-limb placement and thus prevent falls.

The multi-disciplinary team included undergraduate students **Zachary Roberts**, **Sarah Smith**, **Luca Franco**, **Preston Haddon**, **Nathan Mains** and **Fawaz Mallick**. Mechanical, electrical and biomedical engineering majors were represented in the project. Biomechanical engineers focused on the user perspective, while mechanical engineers experimented with joint range of motion and other device requirements. Electrical engineers developed the electrical aspects of the exoskeleton.

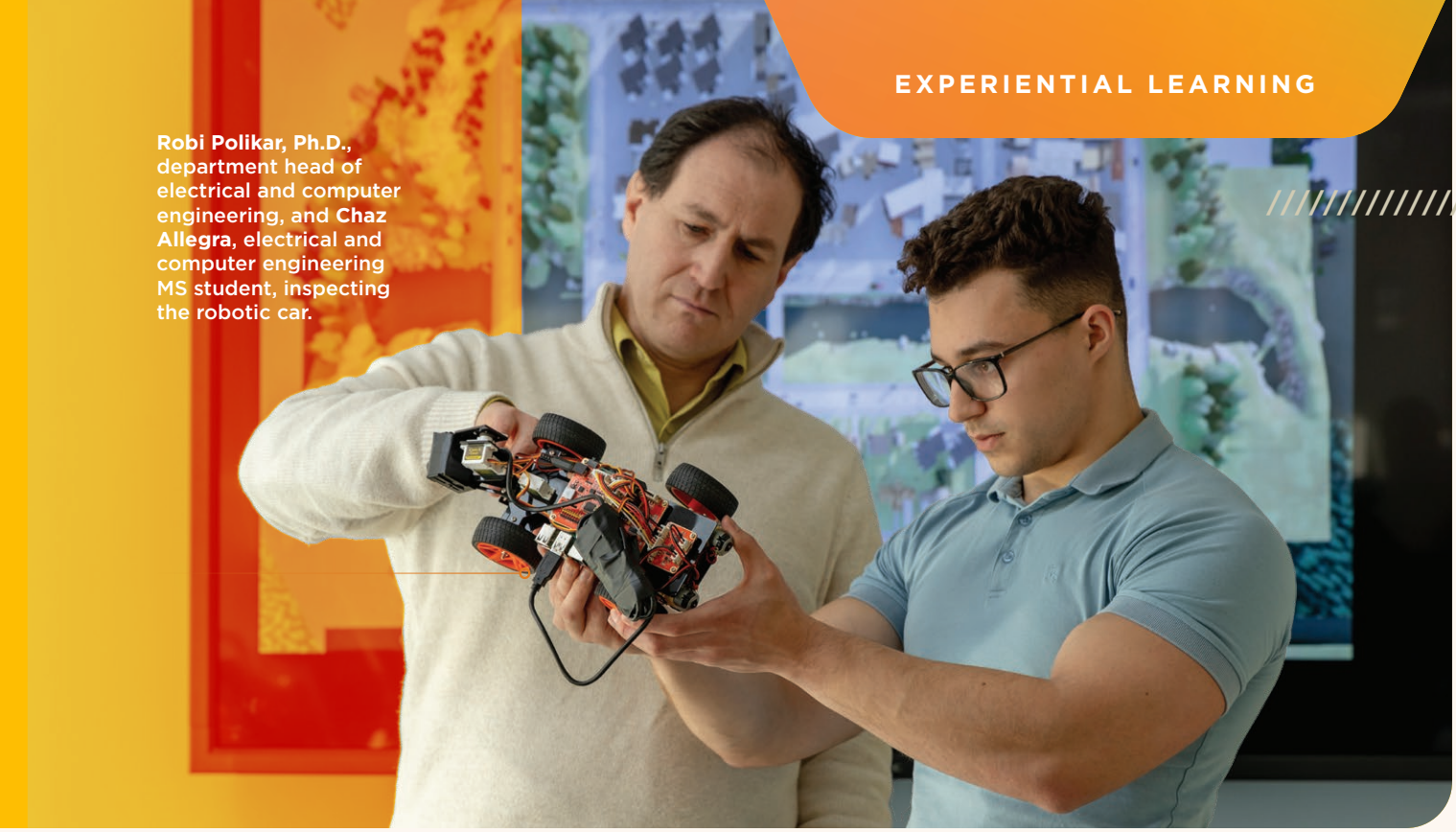
The clinic project was part of ongoing multi-year research, sponsored by the **National Science Foundation**. In 2021, students working on this project won a clinic award for best research in mechanical engineering.

Many existing exoskeletons are designed for rehabilitation or long-term assistance, offering support for repetitive walking movements. Trkov's exoskeleton can be worn by anyone who might be at risk of slipping. The device then offers corrective external assistance, physically manipulating the body to stop the wearer from falling. To do so, compressed air cylinders that have been installed along the back will release the compressed air into air cylinders that pull the cable-driven mechanism on the back leg when a slip occurs. The device will encourage the wearer to ground their back foot.

During clinic, students improved the prototype of the device by making it more ergonomic and comfortable for the wearer and to have better control. Student researchers also integrated air cylinders and electronics in a backpack and improved hip and knee actuation mechanisms. They then tested the device in the lab without human subjects.

Due to the interdisciplinary nature of the project, students practiced collaboration in a real-world research environment. Because the exoskeleton will ultimately be used by humans, they had the additional challenge of developing a safe, comfortable device. Trkov hopes to test the device on human subjects in 2025.

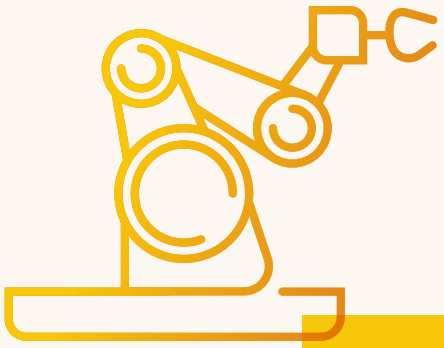
Students eventually went on to co-author conference publications and secure internships and job offers based on their contributions.



Robi Polikar, Ph.D., department head of electrical and computer engineering, and **Chaz Allegra,** electrical and computer engineering MS student, inspecting the robotic car.

TEACHING ROBOTS TO ACT

Somewhere in a future not too far from now, humans may open their homes to robots who can carry groceries or wash dishes on demand. Such technology isn't yet available, but one engineering clinic project is laying the groundwork to make this sci-fi vision a reality.



Robi Polikar, Ph.D., a department head and professor in the Department of **Electrical and Computer Engineering**, and student **Chaz Allegra** worked to train language models, like ChatGPT, to make a physical action on command. In this research, Allegra and Polikar were able to verbally instruct robot cars to make specific movements, like turning left or driving straight.

To do so, they developed a method called Action Question Answering (AQA). Since the language model already has a grasp of English but does not know the meaning of the words, researchers were able to assign specific movements to corresponding phrases—essentially, translating words into physical movements. Before the robot can even complete actions, it must be taught what those actions mean. Allegra and Polikar taught the language model 45,000 action-description pairs.

Then, the robotic cars could be trained to perform those actions on command. Every time the robot hears an instruction like "stop" or "turn right," it will react in kind. The process works in reverse, too: Researchers can present the language model with an action and ask it "What am I doing?" and it will respond with the correct action.

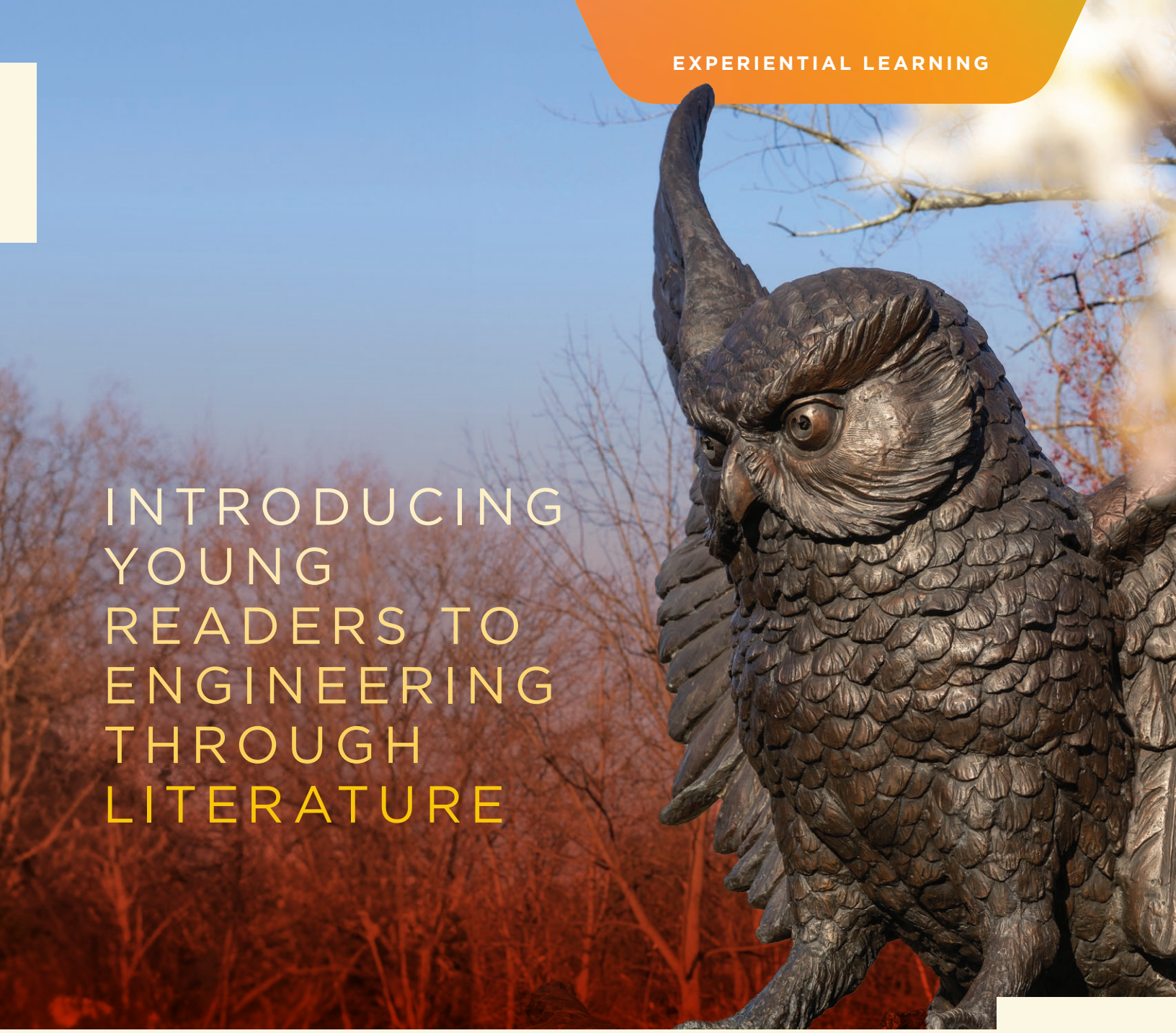
In a simulation scenario, the robotic car would listen to step-by-step driving instructions from a navigation system: turning right when the navigation says so, and so on.

This process can be applied to any robotics application in order to make these devices as universally useful as possible. Currently, robots have been programmed to perform one specific function. Through AQA programming, robots would not have to be programmed for every task and instead will learn over time how to perform and how to associate that task with a particular phrase. Think of it as if an Alexa-enabled device had a body and could perform physical actions.

Moving forward, Allegra is moving away from driving-based functions to more generalized robotic actions: home chores and tasks.

Allegra is now pursuing his master's at Rowan and is in the process of writing papers for submission to academic journals on this topic and others.

> "The great thing about language models is we can communicate with them. You don't need to be an expert to talk to language models. In most robotics, you need to build it for a certain use case and then you'll need an expert technician who's been trained to use that robot to be able to have it do anything useful... This is essentially the start of looking in that direction of robotics."
>
> — **Chaz Allegra**, machine learning researcher and MS student at Rowan University



INTRODUCING YOUNG READERS TO ENGINEERING THROUGH LITERATURE

Engineering and book publishing might seem like they have little overlap, but as this clinic project shows, there's more than meets the eye. In order to spark preschool and elementary students' interest in engineering, students wrote and illustrated a children's book, "Owen The Owl and the Trash Attack," about the subject of water treatment.

The project was in collaboration with the **Gearing Towards Engineering Foundation**, a charitable organization specializing in book readings, career days, STEM events—and even commissioning the writing of books—in order to introduce STEM concepts to young students.

Faculty project manager **Danielle Farrell, P.E.**, an instructor in the Department of **Experiential Engineering Education (ExEEd)**, led the team of students, including **Adam Amaefuna**, **Zeynep Bartek**, **Megan Downey**, **Katlynn Hewitt-Ezekiel**, **Stephen Kehoe**, **Mary Kunz** and **Adriana Zawojski** through the entire process.

> Writing — and drawing — a kids' book was an exciting opportunity. My interest in drawing led to my being connected with the illustrators working with the Gearing Towards Engineering Foundation... What initially started as a way to take a creative break turned into an opportunity to help reach and teach a community of young minds.
>
> — **Adriana Zawojski,** civil and environmental engineering major

Given Farrell's experience in the water industry, the theme of the book would focus on water treatment. To help inform their work—and discover the interdisciplinary nature of water treatment—students visited a water treatment facility in Maple Shade to observe how water was pulled from the ground and treated.

Students then conceptualized a main character—Owen the Owl—and developed a plot. Using their newfound water treatment knowledge, the authors were able to present educational information on water treatment while entertaining young readers.

The team had a special focus group of "Little Owls"—students enrolled in Rowan's on-campus Early Childhood Demonstration Center Preschool—as well as the center's director to help workshop ideas. Based on test readings, the authors learned what concepts resonated with children, what language to use and aspects of the story that might be confusing to young readers.

The Gearing Towards Engineering Foundation provided the team with a professional editor who also offered feedback.

One student, Adriana Zawojski, took on the responsibility of illustrating the entire book. She's since been hired as an in-house illustrator at the Gearing Towards Engineering Foundation. Mary Kunz was hired by Gearing Towards Engineering Foundation to work as a liaison between the organization and universities.

In addition to penning a book, students developed elementary school-friendly experiments to accompany it. Experiments included watching how dyed water moved throughout a rose and how a carbon filter could remove the coloring from dyed water.

The students also presented a poster about their work at a water industry conference, focusing on their efforts to present STEM concepts to young students through language and hands-on activities.

"Owen the Owl and the Trash Attack" is slated to hit bookstores nationwide in 2025.

ECE

BRIDGING CLASSROOM & INDUSTRY: THE ECE CO-OP

To meet the ever-changing needs of employers, Rowan University's **Electrical & Computer Engineering (ECE)** co-op program connects students with leading industry partners for real-world experience. The program integrates hands-on training with a customized curriculum, ensuring students are "day-one ready" for their careers.

Many companies require new hires to undergo extensive training to fully integrate into their roles. This program reduces that ramp-up time by offering students on-the-job experience and industry-specific coursework. As a result, students gain both technical expertise and practical skills while earning certificates in specialized fields like power systems engineering and cybersecurity engineering.

Donovan Brown, a 2024 ECE alumnus who worked in substation engineering at Atlantic City Electric, applied classroom concepts to his job. "The best part of the program was taking what I learned in classes, like power systems engineering and energy storage systems, and applying it to my everyday work," he said. "Taking these classes during the co-op made my work easier and the course material more easier to understand."

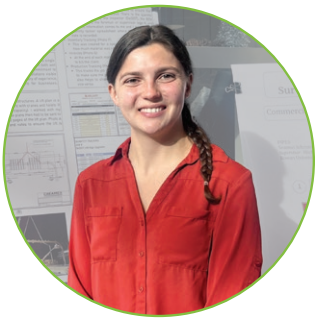
The co-op experience runs from the summer between students' junior and senior years through the fall semester, allowing them to earn up to six credits and complete a specialized certificate. Students may also participate in internships with the same companies before their formal co-op begins.

Students gain insight into company culture and industry dynamics, while employers assess technical skills and essential soft skills. Feedback from both students and industry partners helps refine the curriculum to keep pace with industry needs.

Over the last few years, the ECE co-op program has reached more than 100 participants, with over 95% receiving full-time job offers from the companies where they completed their co-ops. The program continues to grow, with 20-25 new students expected to join in the 2025 cycle.

Rowan's ECE co-op program boasts strong partnerships with industry leaders, including Atlantic City Electric (Atlantic City, New Jersey), Lockheed Martin (Moorestown, New Jersey), and NAVSEA (Philadelphia, Pennsylvania). A new partnership with NAWCAD (Lakehurst, New Jersey) will begin in 2025. These partnerships provide valuable opportunities for students to work with top companies, strengthen ties with alumni and industry leaders and open avenues for collaboration on research and development projects.

> "During my co-op program, I worked for Atlantic City Electric in substation engineering. The best part of the co-op program was taking what I learned in classes, like power systems engineering and energy storage systems, and applying it to my everyday work. Taking these classes during the co-op helped make my work less difficult and the course material easier to understand."
>
> — **Donovan Brown,**
> electrical and computer engineering alumnus



> My internship at J. Fletcher Creamer & Son was a valuable learning experience, offering industry connections and the chance to apply classroom knowledge in a real-world setting. The PIPES program helped me grow both professionally and personally and I highly recommend it to all students.
>
> — **Julia Fiorentino**, civil and environmental engineering major

PIPES CO-OP PROGRAM: CONNECTING CLASSROOM TO CAREER

In 2023, the inaugural cohort of three civil and environmental engineering students participated in the **Professional Industrial Partnership Engagement for Students (PIPES)** co-op program. Designed to offer students industry experience while still in school, the students worked with private, city, government and municipal organizations on projects ranging from graphic engineering to environmental solutions. Students enrolled in PIPES receive credit for their junior and senior engineering clinic courses.

By 2024, the program expanded to include 19 students who completed industry-related projects and formally presented their work in a poster session along with the submission of a technical report. Seventeen students extended their internships through fall 2024 and 28 students are enrolled in PIPES for the spring 2025 semester, allowing for continuous professional growth.

This expansion includes several new industry partners, such as Borrelli Steel Fabricators/Borrelli Metal Buildings, Roux Inc., Southern New Jersey Steel, Kennedy General Contractors, TRC, AECOM and KMA Engineering. Additionally, companies like Earle Asphalt and Remmington Vernick have each recruited two interns each.

Julia Fiorentino, a civil and environmental engineering major, recommends the program to all students. “My internship at J. Fletcher Creamer & Son was a valuable learning experience, offering industry connections and the chance to apply classroom knowledge in a real-world setting,” she said. “The PIPES program helped me grow both professionally and personally.”

Co-op participants work six hours per week while earning additional pay for their contributions beyond their clinic hours. Seniors can work more hours, helping them build valuable experience in the field. The program emphasizes collaboration, with students working in teams on projects that are approved by the CEE department. The PIPES program not only strengthens students’ resumes but also connects them with industry professionals, preparing them for specific project needs and providing a platform for future job opportunities. Many partners have recruited students from the PIPES program for full-time employment.

Industry partners also provide feedback to Rowan faculty regarding students’ preparedness for the needs of the job market. The ability to train future employees for as long as two years ensures graduates are ready to hit the ground running.

The PIPES program aims to expand to include federal, state and local agency partners and to include summer internships.

STUDY ABROAD PROGRAMS IN GREECE, GERMANY & JAPAN

Rowan engineering students explored global innovation through immersive study abroad programs in Greece, Germany and Japan. In Germany, students delved into advanced manufacturing techniques, visiting cutting-edge facilities and historical landmarks to understand the intersection of technology, culture and history. Greece offered hands-on experience in digital design and manufacturing through a summer program focused on modern methodologies, culminating in presentations and awards. In Japan, students gained insights into how culture shapes engineering, with visits to tech hubs and schools showcasing Japan's innovative approaches to societal challenges. These programs prepare students for global engineering careers.

DIGITAL ENGINEERING GOES ABROAD

For five days last July, **Antonios Kontsos**, the director of DEHub and professor in the Department of Mechanical Engineering, led the first-ever Digital Design & Advanced Manufacturing Summer School (DDAM) in collaboration with the Department of Mechanical Engineering at the University of Thessaly in Volos, Greece.

Using both classroom instruction and hands-on learning, students were introduced to modern aspects of digital design and advanced manufacturing, covering concepts such as digital product design, manufacturing methods, design optimization methodologies, additive manufacturing and quality assessment. Students also observed industry professionals at factory site visits, touring plants at Lafarge and Ilvief in Volos. The week culminated with group presentations and awards.

The summer program was so successful that Kontsos will host a second edition of DDAM next summer and is working to develop a master's level online program in digital manufacturing, which will be available to students regardless of where they live.

EXPLORING ENGINEERING IN JAPAN

The Engineering in a Global Context course at Rowan University offered students a unique opportunity to explore engineering in Japan, a country known for its technological innovation. Motivated by the chance to understand how culture influences engineering, students compared American and Japanese approaches to solving societal challenges, from robotics to transportation. In Japan's collectivist society, students saw how engineering is integrated into daily life, providing insights into how these solutions can be applied to domestic issues like urban planning and infrastructure.

Through company visits in Tokyo and Osaka, students observed Japan's focus on high-quality manufacturing and the use of technology in addressing modern problems, such as space debris and land management. Exposure to Japanese engineering schools further broadened their perspective, as they learned about research projects and student lab work, highlighting similarities and differences in global engineering education.

During the program, led by assistant teaching professor **Tiago Forin**, students were encouraged to think critically about how engineering solutions can be culturally adapted, offering them a deeper understanding of the role of engineers in global contexts. This course encourages students to think globally, fostering skills for international collaboration and inspiring them to pursue graduate opportunities abroad. By studying the sociotechnical aspects of engineering in Japan, students gain valuable insights into how engineering shapes society and industries worldwide, motivating them to apply these lessons to future careers as global engineers.

ENGINEERING INNOVATION IN GERMANY

Aside from bratwurst and beer, Germany is a country known for its innovation in automobiles and technology. Rowan engineering students spent over a week abroad exploring engineering and cultural practices while learning international manufacturing and engineering practices.

During the program, led by professor **Smitesh Bakrania**, students visited cutting-edge manufacturing facilities, including automotive manufacturing sites around Munich and Dresden. These visits offered a firsthand look at advanced manufacturing techniques, including automated assembly lines for passenger vehicles and heavy-duty trucks. The trip was designed to translate classroom theories—focused on manufacturing and measurement techniques—into real-world experiences.

Beyond technical experiences, the program emphasized the intersection of engineering, history and culture. Students visited technology museums and significant historical landmarks like the Berlin Wall and Brandenburg Gate to showcase how societal, political and economic factors shape engineering decisions.

E-SHIP

INNOVATING THROUGH ENGINEERING & BUSINESS

The fusion of engineering and entrepreneurship is a powerful catalyst for innovation and problem-solving. Rowan University's Bachelor of Science in engineering entrepreneurship (E-Ship) program exemplifies this synergy by equipping students with both technical expertise and an entrepreneurial mindset. Designed to prepare graduates for dynamic careers, the program emphasizes adaptability and cross-disciplinary collaboration. Students can choose between two specialized tracks: electrical and computer engineering and mechanical engineering.

A defining feature of the E-Ship program is its emphasis on real-world application. Graduates like **Michael Weinberg**, '22 and **Kenyon Burgess**, '23 have experienced firsthand how combining technical education with business acumen can open unexpected and rewarding career paths. Weinberg, who began his career in construction project management, found himself navigating both business operations and engineering challenges. His ability to understand financial constraints, stakeholder motivations and technical feasibility enabled him to bridge the gap between the hands-on workforce and corporate decision-makers. Similarly, Burgess, with a background in mechanical engineering, is exploring career opportunities that merge technical design with business strategy, transitioning toward roles in technical sales and business growth.

Students within the E-Ship program have the opportunity to apply for the University Innovation Fellows (UIF) initiative, a Stanford University-backed experience that challenges students to apply innovation and entrepreneurial thinking to their own campuses. Both Weinberg and Burgess participated in this prestigious program, where they learned design thinking methodologies and implemented projects addressing campus needs. These projects not only enriched the Rowan community but also provided students with invaluable hands-on experience in problem-solving, stakeholder engagement and leadership.

Collaboration is a cornerstone of the E-Ship program. Through interdisciplinary partnerships, students work alongside peers from diverse academic backgrounds—including business, psychology and the arts—to develop comprehensive solutions to complex problems. Burgess' senior engineering clinic project, which involved collaborating with the business school, demonstrated how cross-disciplinary efforts can drive innovation. Similarly, Weinberg worked with the psychology department to conduct human factors research, ensuring that technological solutions were designed with user needs in mind. These projects highlight the program's ability to merge technical knowledge with user-centered design and business principles, reinforcing the importance of understanding customer needs before developing solutions.

The core principles of curiosity, collaboration and value creation, introduced early in the program, continue to guide alumni in their careers. Whether working in engineering, construction or business development, graduates recognize that true innovation requires a broad perspective, continuous refinement of ideas and solutions tailored to real-world needs. Their ability to navigate industries where problem-solving, adaptability and stakeholder engagement are critical has been a key factor in their success.

Rowan University's E-Ship program does more than prepare students for jobs—it prepares them to think like entrepreneurs in any field. Whether launching startups, leading design teams or revolutionizing industries, graduates leave with the confidence to tackle complex challenges and drive meaningful change. Their experiences demonstrate that the entrepreneurial mindset cultivated at Rowan extends far beyond the classroom, fostering a culture of innovation and lifelong learning. This foundation empowers graduates to adapt and thrive in an ever-evolving professional landscape.

SHAPING THE NEXT GENERATION OF LEADERS AND INNOVATORS

Entrepreneurial activity runs deep in the Henry M. Rowan College of Engineering.

From a major exclusively focused on engineering entrepreneurship to clinic projects where students design and market real products in partnership with industry, engineering students of all disciplines have ample opportunity to add value with their studies and experiments.

Students engage with the "three Cs" of entrepreneurial mindset—curiosity, connections, and creating value—within their first days as engineering majors. During their first-year clinic, students participate in two design projects with an entrepreneurial focus: sustainable engineering and universal design. In both these projects, students are tasked with understanding the stakeholders involved in their design, brainstorming multiple design alternatives and selecting final designs based on the ability of the design to meet the intended users' needs.

By sophomore year, students take part in an entrepreneurial design project where they conceptualize a product and pitch it to their fellow students. After a handful of projects are selected, the class works collaboratively to create a business plan, build a prototype and discuss how they would bring the product to market.

Some of these sophomore clinic projects have transitioned into junior and senior clinic projects—and beyond. **Pete Genovese**, a mechanical engineering student from the 2018-2019 cohort, founded Protoright Productions after developing a modular fabrication system as part of his clinic project. With initial funding of $2,500 from Rowan's Venture Fund, Genovese secured additional investments and built a thriving business. His system, which allows for the quick removal and replacement of 3D print heads, laser cutters and CNC tools, has evolved into Protoright—a company that takes on customer requests and delivers custom solutions. Verge Aero, a startup that uses drones for LED light shows, was founded by three Rowan engineers. Alumnus **Brandon Graham** founded Arke Aeronautics, a startup that utilizes drones to transport first aid supplies ahead of first responders, while at Rowan. Several other students have secured patents for their innovations.

There have also been specific junior and senior clinic projects that allow students to gain a better understanding of entrepreneurial mindset. For instance, **Cheryl Bodnar**, **Ph.D.**, a professor in Experiential Engineering Education, led a clinic project where students interviewed each other to understand how they defined entrepreneurial mindset and what activities, both within Rowan classes and outside of the university, enabled them to develop these traits. This work led to both an American Society of Engineering Education (ASEE) conference publication and a peer-reviewed journal article in Entrepreneurship, Education and Pedagogy. Kaitlin Mallouk, PhD has also guided junior and senior engineering clinic students in studying entrepreneurial mindset: one team analyzed the written reflections of first-year engineering students to better understand how those students conceptualized entrepreneurial mindset. The clinic team shared their results at the ASEE MidAtlantic Section Conference.

Entrepreneurial activities proliferate throughout the college. **Andrea Vernengo**, **Ph.D.**, an associate professor of chemical and biomedical engineering, led an elective course where students designed a medical device and simulated its commercialization process. And in 2023, four Rowan students took part in the University Innovation Fellows program run by Stanford University's Hasso Plattner Institute of Design (d.school). Current seniors **Josh de Guzman**, **Resty Mercado**, **Marissa Pestritto** and alumnus **Erica Tran** participated in a six-week training program to develop a campus-wide event that celebrated diversity and unity.

These examples highlight just a few of the ways that the College of Engineering seeks to continue in the traditions set up by Henry M. Rowan to cultivate an entrepreneurial spirit in all of their engineering students.

SOARING TO NEW HEIGHTS

Rowan University's chapter of the American Institute of Aeronautics and Astronautics (AIAA) is a student organization dedicated to aerospace engineering. The club connects students with academic and professional opportunities through hands-on projects, industry clinics, and a strong alumni network. With close ties to major aerospace companies like Boeing and Lockheed Martin, AIAA offers members valuable exposure to the industry.

AIAA hosts two standout clinic projects: Rowan Rocketry and Design/Build/Fly. Rowan Rocketry made history in 2024 with the university's first successful rocket launch. These projects provide students with invaluable aerospace experience and opportunities to build skills that set them apart professionally. Alumni from these initiatives have gone on to work at SpaceX, NASA, Boeing and Lockheed Martin.

In addition to the technical side, AIAA organizes fun events like flight simulator sessions and hands-on rocket building workshops, giving students a chance to gain practical experience while bonding with peers. The club also regularly invites alumni back to share their career journeys, offering current members insight into transitioning from Rowan to the aerospace workforce.

ROWAN ENGINEERS EARN PRESTIGIOUS NATIONAL AWARD

Two engineering students received the prestigious **2024 Goldwater Scholarship**, awarded to students pursuing research careers in the natural sciences, engineering and mathematics.

Matthew Conway of Haddon Township and **Madeline "Maddy" Dunsmore** of Mantua Township, both in the Henry M. Rowan College of Engineering and the Martinson Honors College, will receive funding toward their senior years through the Goldwater Scholarship Program, among the oldest national scholarships supporting the next generation of research leaders in these fields.

Of this year's 438 scholarships, Conway and Dunsmore are two of only 64 students in engineering and materials research nationally to earn the award.

The foundation received 1,353 nominations from 446 academic institutions to compete for the 2024 scholarships. In total, 10 students from Rowan University have earned the Goldwater Scholarship since 2006.

HYGELIX: REVOLUTIONIZING NANOFIBER TECHNOLOGY FOR INDUSTRY AND BIOMEDICAL APPLICATIONS

Co-founded in 2022 by Rowan professor **Vince Beachley**, **Ph.D.**, in partnership with Early Charm Ventures, Hygelix is an innovative startup focused on advancing the production and commercialization of aligned polymer nanofibers. Supported by early-stage venture studio Early Charm Ventures—a founder and majority owner—the company is working to bring new materials to market through cutting-edge manufacturing techniques. Hygelix is also backed by collaborative research efforts, including grants from the National Science Foundation (NSF) and the I-Corps program, which helps translate academic inventions into real-world applications.

Hygelix is developing novel methods for manufacturing continuous yarns and textiles made from aligned polymer nanofibers, which are about 100 times thinner than a human hair. These nanofibers have broad potential real-world applications, particularly in filtration, smart textiles, fuel cells and regenerative medicine. The technology is especially promising in the biomedical field, where nanofibers can be used in tissue engineering. Many studies have shown that nanofiber filaments interact positively with the human body, making them ideal for use in orthopedic surgery, where they could one day be used to reconnect tendons to bone.

The company's primary goal is to produce roll-to-roll aligned nanofiber sheets for sale to industries such as biomedical research, smart textiles and manufacturing. Hygelix aims to establish itself as a custom manufacturer of these high-performance materials and eventually scale production for broader industry use.

To help grow the business, Hygelix is collaborating with students like Mohamad Keblawi and Dominique Hassinger, who participated in the I-Corps program during the fall 2024 semester. These students are actively involved in product development related to the company's NSF-funded project, which seeks to refine the technology for producing stronger, aligned nanofibers.

HYGELIX

Dr. Islam Mantawy, Director of ARC-LAB (right side), leading the research lab. Students are operating the Scare Elite Road Runner alongside the large-scale mixer and concrete pump.

LAB SPOTLIGHT: ADVANCING THE FIELD OF ADDITIVE CONSTRUCTION

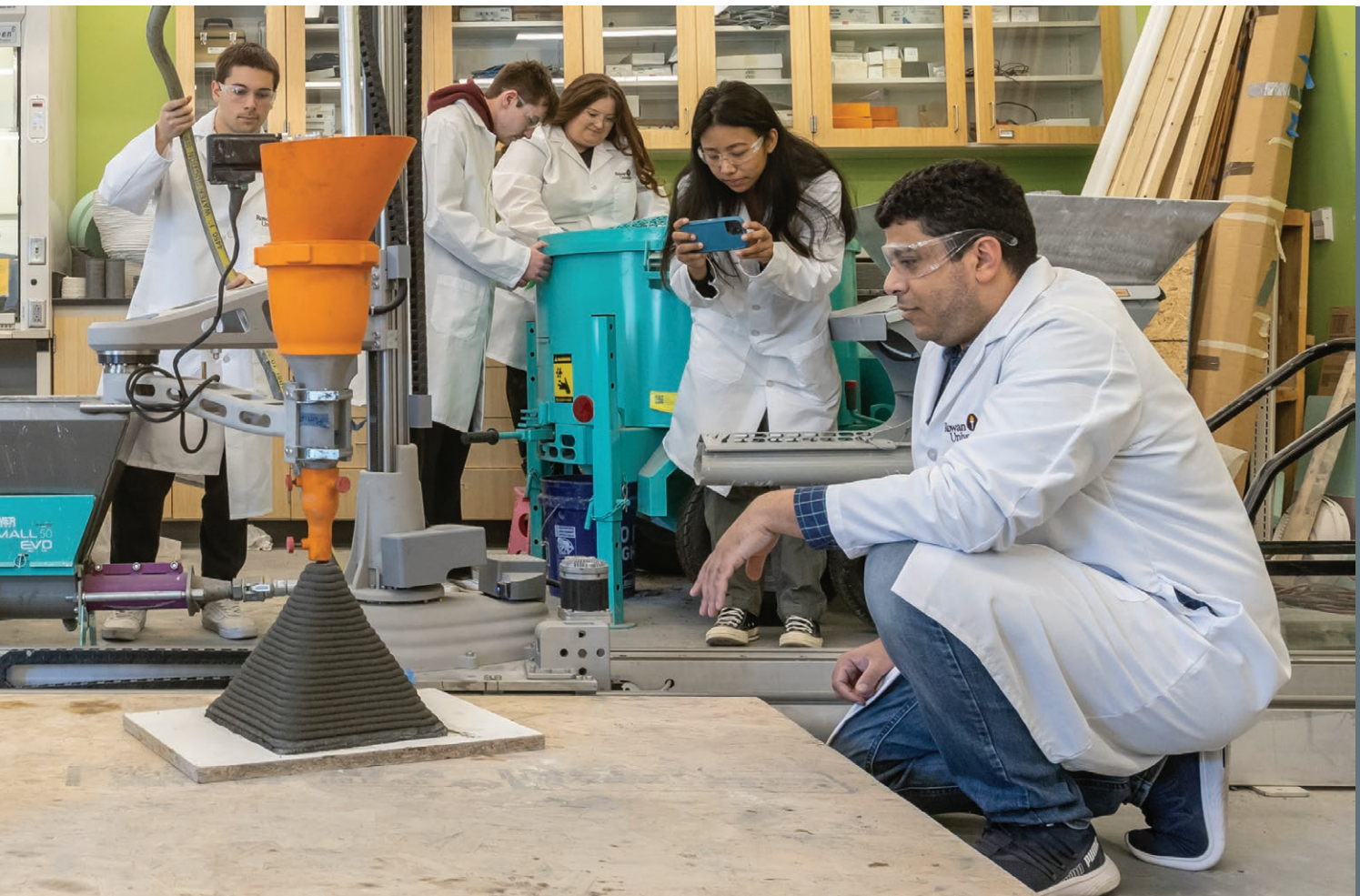
Rowan University is home to the Additive and Robotic Construction Laboratory (ARC-LAB), a cutting-edge facility dedicated to advancing the field of additive construction. Located on the first floor of Rowan Hall within the Henry M. Rowan College of Engineering, ARC-LAB features state-of-the-art technology designed to push the boundaries of both concrete and metal additive manufacturing for infrastructure and the built environment.

The centerpiece of ARC-LAB is the Scara Elite Roadrunner, a large-scale concrete 3D printer capable of constructing structures up to 20 feet long, seven feet wide and seven feet high. Along with this impressive printer, the lab houses a UR10e collaborative robotic arm, which offers six degrees of freedom and is capable of printing non-planar, complex structures in addition to supporting the large-scale printer's operations. The facility also includes a large shake table, various concrete mixers and a pumping station, enabling comprehensive research and experimentation.

At ARC-LAB, both undergraduate and graduate students actively participate in groundbreaking research projects that span fundamental, applied and use-inspired areas of construction technology. The lab focuses on two primary research themes: concrete additive construction (3D printing) and metal additive manufacturing. Within the realm of concrete additive construction, key areas of research include optimization, hazard protective systems, low-embodied carbon solutions, reinforcement techniques and the development of multi-functional structures. These initiatives aim to enhance the efficiency, sustainability and versatility of 3D-printed concrete in construction applications.

In the area of metal additive manufacturing, ARC-LAB's research focuses on optimization techniques, hazard mitigation, repair and strengthening methods and the development of advanced meta-materials to improve the structural performance and longevity under metal additive manufacturing of metal components.

Together, these research themes underscore ARC-LAB's commitment to advancing construction technologies through innovative additive manufacturing techniques that promise to revolutionize the future of building infrastructure.



STRENGTHENING ALUMNI CONNECTIONS

The Henry M. Rowan College of Engineering continues to build strong alumni connections, celebrating achievements and fostering engagement. This past year featured key initiatives and events that brought together alumni, faculty, students and industry leaders in a shared commitment to excellence.

HONORING DISTINGUISHED ALUMNI

A highlight was the Alumni Circle of Distinction event on November 2, 2024, where seven distinguished alumni were recognized for their professional accomplishments, contributions to the college and community service. Over 60 attendees, including Rowan University President Ali Houshmand and Provost Anthony Lowman, celebrated their impact.

This year's honorees included:

- **Matthew DeNafo ('06, M'07)**
  President, Atlantic County Utilities Authority
- **Dr. Nicholas Jankowski ('00, M'07)**
  Deputy Chief, RF Devices & Circuits, U.S. Army
- **Michael Muhlbaier ('04, M'06)**
  CEO, Alencon Systems
- **Keicha Muriel-Barreto ('09)**
  CEO, Integrid Project Solutions
- **Catherine "Cat" Ni ('00)**
  VP, Close Combat Systems, Lockheed Martin
- **Amol Shah ('00)**
  SVP, IT, WOW! Internet, Cable & Phone
- **Krystal Wrigley ('05)**
  Chief Basestock Engineer, ExxonMobil

These alumni exemplify Rowan's commitment to innovation and industry leadership.

STRENGTHENING THE ALUMNI COMMUNITY

With nearly 4,800 alumni, Rowan Engineering fosters engagement through networking events and reunions. The annual Engineering Happy Hour, held in May, consistently attracts over 100 alumni for casual networking.

The Nine & Dine Golf Outing, held on October 28, 2024, saw a record 62 golfers—a 20% increase from the previous year. Sponsored by PSEG Nuclear and Pennoni, the event raised funds for the Engineering Excellence Fund, supporting student programs, research and hands-on learning.

ENGINEERING NIGHT AT THE PHILLIES

A beloved tradition, Engineering Night at the Phillies each April draws over 500 attendees, uniting alumni, students, faculty and staff to celebrate their Rowan pride.

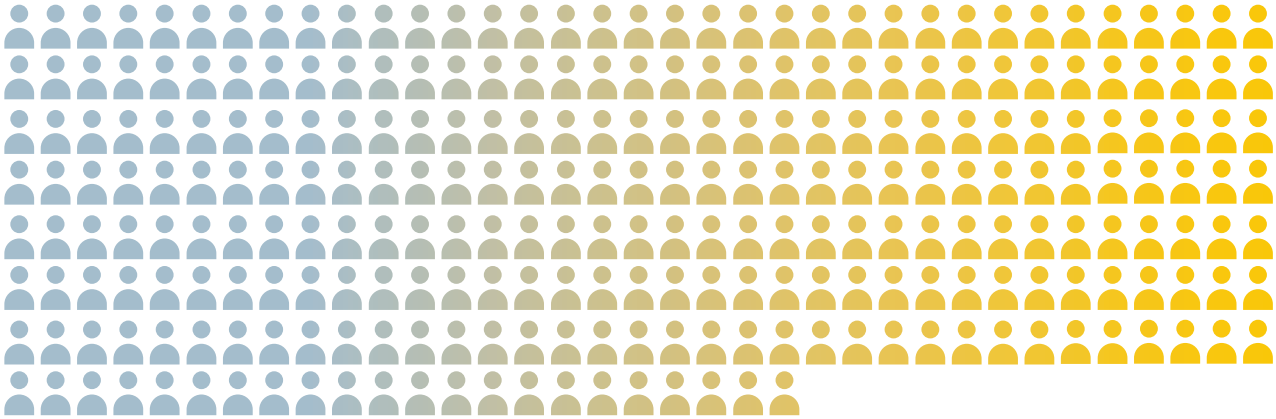
LOOKING AHEAD

The college remains committed to strengthening alumni ties through professional development, philanthropy and social events. These connections ensure that Rowan engineers continue to inspire and support the next generation of innovators.

The seven recipients of the Distinguished Alumni Award are shown at the Alumni Circle of Distinction event, pictured with Dean **Giuseppe Palmese, Ph.D.**

BUILDING A FUTURE OF INNOVATION

Since its founding in 1996, Rowan Engineering has been dedicated to providing a hands-on, forward-thinking education that shapes the next generation of engineers. Inspired by the generosity and vision of Henry M. Rowan, the college has empowered students to thrive in diverse fields, from industry and research to academia and beyond. His unwavering belief in fostering exceptional engineers remains at the heart of our mission. The unwavering support of alumni, faculty, staff, parents and friends has been essential in sustaining this vision. Their contributions help expand opportunities, enrich student experiences and shape the college's ever-evolving path forward.



FY24

267

TOTAL DONORS

DONATION BREAKDOWN	
Current, Academic Divisions	$107,018.40
Endow, Student Aid	$84,350.00
Current, Student Financial Aid	$94,500.00
Endow, Academic Divisions	$1,000,000.00
Current, Other Restricted	$1,930.00
Grand Total	**$1,287,798**

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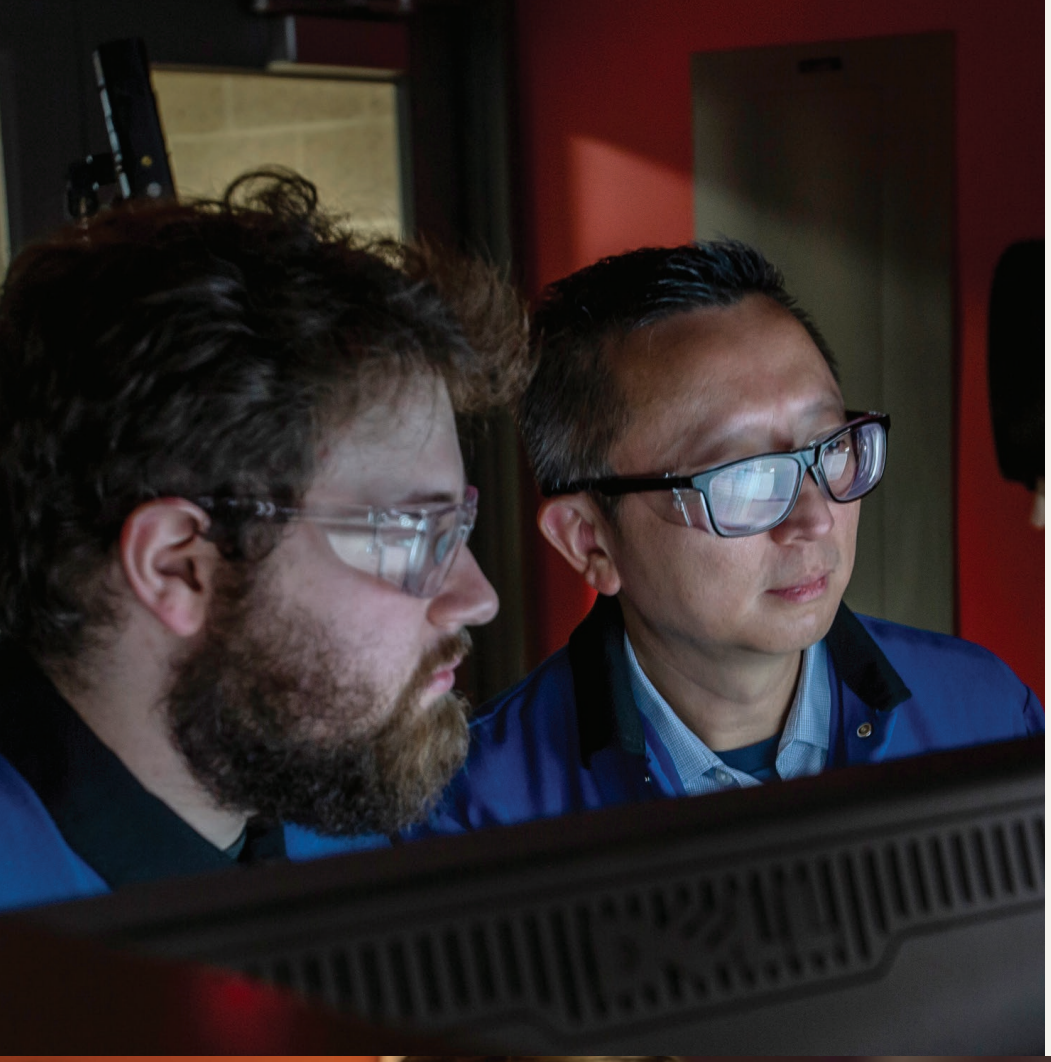

Executive Editor:
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Design:
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Photography:
Kevin Monko

Typeface:
Gotham by Hoefler & Co.

Printing:
Fort Nassau Graphics, West Deptford, NJ, on FSC-certified, (Made in USA) Cougar Super Smooth paper stock

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