SUMMER 2023 QUARTERLY NEWSLETTER | EDITION 2

UCONN RESEARCH

NEWSLETTER

UCONN, YALE PUSH CONNECTICUT TO QUANTUM REALITY

The state's two premiere research universities are answering NSF's call to catalyze regional economic and societal well-being through technological innovation.

HEALING BIG BROKEN BONES WITH A SMALL MOLECULE

UConn Health scientists describe a new method that can promote regrowth of long bones more affordably and with fewer side effects than other techniques.

MEET THE RESEARCHER

Leila Daneshmandi

Co-founder and COO at Encapsulate & Assistant Professor of Innovation and Entrepreneurship at University of Connecticut

THE MAKING OF A UCONN STARTUP

How "Encapsulate" co-founders went from the classroom to curing cancer in less than four years

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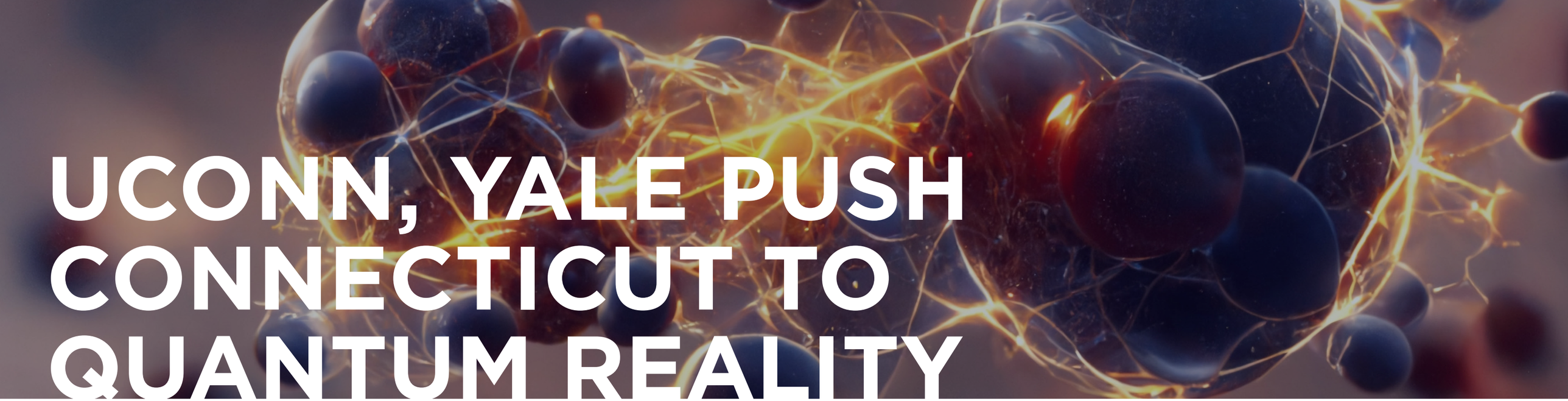


UCONN, YALE PUSH CONNECTICUT TO QUANTUM REALITY

By Matt Engelhardt

THE STATE'S TWO PREMIERE RESEARCH UNIVERSITIES ARE ANSWERING NSF'S CALL TO CATALYZE REGIONAL ECONOMIC AND SOCIETAL WELL-BEING THROUGH TECHNOLOGICAL INNOVATION

Connecticut is making progress to become the nation's leading accelerator of quantum technologies, with UConn and Yale leading the way.

The state's two premiere research universities are heading a massive coalition seeking funds to help establish the state as a quantum leader. In May, the project entitled "Quantum-CT" took an important step towards its goal with a $1 million National Science Foundation (NSF) Engines Development award.

The award funds a two-year development effort that will help Connecticut compete for a further NSF Engines award of up to $160 million over 10 years. NSF Regional Innovations Engines awarded more than 40 of the prestigious, first-ever awards to collaborations formed to create economic, societal, and technological opportunities for their regions.

Quantum technologies -- tech developed using the principles that govern the atomic and subatomic world -- are poised to influence hundreds of applications, including smartphones, navigation systems, advanced computers, and hundreds of other applications impacting many of Connecticut's key manufacturing, energy, and infrastructure industries.

"Quantum science and technologies hold so many keys to the future of Connecticut and the nation," said Pamir Alpay, UConn's interim vice president for research, innovation, and entrepreneurship, who is one of the lead investigators on the project. "Bringing together the expertise and research excellence of UConn, Yale, and many partners, Quantum-CT has the potential to be transformative for science, our economy, and workforce. This program extends opportunities to communities and sectors left behind by recent economic downturn and promotes equitability across the state."

With its versatility and potential to change lives for the better, quantum technology research and development has generated dozens of partners for the Quantum-CT initiative. Collaborators on the grant include the Governor's office, the cities of Hartford, New Haven, Stamford, and Waterbury, the Connecticut State Colleges and Universities (CSCU), the Connecticut Conference of Independent Colleges, and the CT Business and Industry Association, among others. Innovation and venture partners, including Connecticut Innovations, CT Next, Advance CT, Yale Ventures, and UConn's Technology Innovation Program, will work to together ensure that emerging quantum technologies are quickly transferred to real-world applications.

"Quantum technology represents the future of computers and science, and through a partnership fused between UConn and Yale, Connecticut is ready, determined, and eager to become the nationwide hub and central force of this technological revolution," Governor Ned Lamont said. "Our workforce in Connecticut is the best educated and most talented in the nation, trained with the modern skills needed to make the United States an international leader in the research and development of the emerging field of quantum technology. Our workforce, our businesses, our schools, our research institutions, and our state government are aligned in the effort to create the pipeline needed to grow this field."

NSF Director Sethuraman Panchanathan, who visited UConn in 2022 and announced the Engines program, said, "These awardees are part of the fabric of NSF's vision to create opportunities everywhere and enable innovation anywhere. They will build robust regional partnerships rooted in scientific and technological innovation in every part of our nation. Through these planning awards, NSF is seeding the future for in-place innovation in communities and to grow their regional economies through research and partnerships. This will unleash ideas, talent, pathways and resources to create vibrant innovation ecosystems all across our nation."

The Quantum-CT planning initiative is complex, with far-reaching benefits. In addition to state offices and the network of universities, technology adopters in the pharmaceutical, defense, financial services, and computing sectors all stand to benefit.

"Yale has a stellar reputation in quantum science and a blossoming start-up community in quantum technologies," said Michael Crair, Yale's vice provost for research and co-principal investigator for the NSF grant. "This will be a multi-billion-dollar industry, and we'd love for Yale and UConn, with partners around the state, to nucleate a national quantum corridor in Connecticut."

UConn's involvement includes more than a dozen researchers spanning several schools, colleges, and services. Quantum technology is applicable to many of UConn's research priorities, including sensing, cryptography, artificial intelligence, infrastructure optimization, drug and therapy development, software, and cybersecurity.

"Connecticut is a microcosm of the challenges and opportunities facing our nation," said UConn President Radenka Maric.

"Our proud industrial base has stayed strong in the face of international competition, offshore manufacturing, and the mass retirement of skilled workers. Likewise, our cities and towns have persevered through tremendous adversity. UConn is honored to join Yale as leaders in the effort to make Connecticut America's accelerator by transforming a diverse, compact region into an economic development powerhouse using quantum tech."

HEALING BIG BROKEN BONES WITH A SMALL MOLECULE

By Kim Krieger

UCONN HEALTH SCIENTISTS DESCRIBE A NEW METHOD THAT CAN PROMOTE REGROWTH OF LONG BONES MORE AFFORDABLY AND WITH FEWER SIDE EFFECTS THAN OTHER TECHNIQUES

Repairing severely damaged bones is a challenge—especially the long bones of the arms and legs. Now, UConn Health scientists describe a new method in the 22 May issue of PNAS that can promote regrowth of long bones more affordably and with fewer side effects than other techniques. Orthopedic surgeons have recently begun treating difficult breaks with specific human proteins that encourage bone growth, both alone and paired with grafts or scaffolds. But the proteins, known more specifically as recombinant human bone morphogenetic proteins (rhBMPs), have limitations. First is that large molecules such as rhBMPs can be expensive to manufacture and store. Another is that the immune system has a tendency to treat them as invaders to be neutralized, limiting their usefulness. And rhBMP treatments have been known to induce bone growth in undesirable locations in addition to the site of the bone fracture.

University Professor Dr. Cato T. Laurencin and colleagues at UConn School of Medicine pioneered slightly different technique -- using forskolin, a small molecule that encourages the same bone growth response as rhBMPs do. And, guessing that some of the undesirable effects from rhBMPs were related to long-term use, they engineered a biodegradable scaffold to release the forskolin onto a bone almost entirely within a 24-hour period.

The researchers found that the high dose forskolin-impregnated scaffold and the rhBMP-impregnated scaffolds did equally well at encouraging new bone growth. The short, 24-hour duration of the drug release also seemed to prevent the unwanted side effects often seen in rhBMP treatment.

"I am delighted to see the outstanding progress of the field of regenerative engineering leveraging cutting-edge technology to apply to broad fields. The potential of polymeric chemistry and novel biological materials in combination offer new potential to tackle complex societal problems in tissue regeneration. The work presented here is an important example," says Laurencin, the Albert and Wilda Van Dusen Distinguished Endowed Professor of Orthopaedic Surgery at UConn and CEO of The Cato T. Laurencin Institute for Regenerative Engineering at UConn.

The Cato T. Laurencin Institute for Regenerative Engineering continues its breakthrough work dedicated to achieving limb regeneration by the year 2030 within its Hartford Engineering a Limb Project (HEAL).

LEILA DANESHMANDI

Co-founder and COO at Encapsulate & Assistant Professor of Innovation and Entrepreneurship at University of Connecticut

Leila Daneshmandi received her Ph.D. in Biomedical Engineering from UConn in 2020, and decided to return for a Master of Engineering in Global Entrepreneurship while she launched her startup Encapsulate (featured on page 5 of this newsletter). Her work at UConn focused on tissue regeneration under Dr. Cato T. Laurencin (whose work is highlighted on page 3). Her entrepreneurship trajectory encouraged her to pursue conversations with the people who would be using the products she helped engineer – in her case, this meant speaking with cancer patients about what would make their lives easier. Along with her cofounders Armin Tahmasbi Rad '19 Ph.D., '20 MA and Reza Amin '18 Ph.D., '20 MA, she launched Encapsulate on a mission to change the future of precision cancer medicine. Her company's signature biochips can grow patients' cancer cells outside the body and allow doctors to test a wide variety of potential treatments quickly. Daneshmandi is now an Assistant Professor of Innovation and Entrepreneurship at UConn, where she uses her expertise to help other Huskies chase big dreams and transform lives.

REMOVING HUMAN ERROR FROM BREAST CANCER DETECTION

By Loretta Waldman

THE FEATURE FUSION SIAMESE NETWORK SYSTEM USES ARTIFICIAL INTELLIGENCE TO COMPARE TWO SETS OF FILMS TAKEN AT TWO DIFFERENT TIME POINTS FOR DIAGNOSIS, ELIMINATING THE NEED FOR MANUAL COMPARISON, SAVING TIME, AND REDUCING THE POTENTIAL FOR MISTAKES

An estimated 37 million mammograms are performed in the United States each year. The prevalence of false positives is an ongoing challenge for radiologists, which increases costs and causes needless anxiety for patients.

Two UConn researchers have developed a new, artificial intelligence (AI)-enabled deep-learning approach to breast cancer detection that takes aim at that problem. The Feature Fusion Siamese Network for Breast Cancer Detection, developed by Dr. Clifford Yang, an Associate Professor of Radiology at UConn School of Medicine, and Sheida Nabavi, an Associate Professor at UConn's Department of Computer Science and Engineering, analyzes mammograms using a new algorithm that reduces false positives.

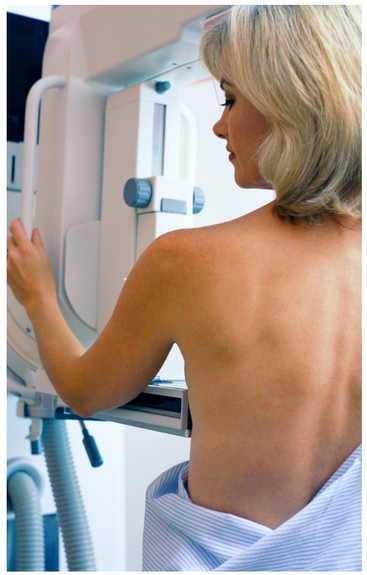
The Feature Fusion Siamese Network system uses AI to compare two sets of films taken at two different time points for diagnosis, eliminating the need for manual comparison, saving time, and reducing the potential for human error.

"I wanted to have a program that had the same input as a radiologist," Yang says. "Our hope is that this system would function like a radiologist and would leverage the ability of the radiologist to read many more mammograms."

Yang and Nabavi published their findings in 2022 and are working with Technology Commercialization Services (TCS) at UConn Research to begin testing the patent-pending technology and bring it to market.

Michael Invernale, a senior licensing manager at TCS, characterizes the technology as a game-changer.

"Being able to do this sort of comparison quickly and effectively and without a margin of human error is hugely important," Invernale says. "It's an added level of confidence and a better more reliable technology with the potential to detect cancer early and save lives."



THE MAKING OF A UCONN STARTUP

By Mac Murray

HOW "ENCAPSULATE" CO-FOUNDERS WENT FROM THE CLASSROOM TO CURING CANCER IN LESS THAN FOUR YEARS

Like the company they created together, Leila Daneshmandi '20 Ph.D., '21 MA and Armin Tahmasbi Rad '19 Ph.D., '20 MA got their starts at UConn. During their PhDs, Daneshmandi focused on tissue regeneration, while Rad specialized in nanotechnology and cancer medicine. The stars aligned for the creation of their biotech startup when they both enrolled in a class on technology, innovation, and entrepreneurship led by Profs. Hadi Bozorgmanesh and David Noble.

"That's where we came together and we learned about the process of user-driven innovation and entrepreneurship," says Daneshmandi. The pair began to speculate about what they could accomplish by combining their respective expertise. Four years later, their startup, Encapsulate, is on a mission to change the future of precision cancer treatment.

Growing (and Treating) Tumors on a Chip

Before they met, Rad had been working with Prof. Mu-Ping Nieh in the Institute of Materials Science to create a nanoscale universal drug delivery system for fighting cancer. The resulting product could "encapsulate" any type of cancer drug for targeted delivery into tumors. During the development process, Rad worked with cutting-edge ex vivo research techniques, which allow scientists to test the efficacy of different treatments on patient cell samples that are cultured outside the body.

Drug developers have had a few decades to appreciate ex vivo research since the technique's development, around the close of the last century. But clinicians and patients typically don't have access to the same technology for their own use. Together, Daneshmandi and Rad began envisioning a way to bridge that gap: an automated system that would allow cancer patients to receive personalized, precision medicine based on tests from their own tumor biopsies.

Rad, Daneshmandi, and their co-founder, Reza Amin '18 Ph.D., '20 MA, wanted to create a technology that would allow clinicians to test multiple drugs at once and quickly determine the best course of action for each patient.

While they faced many hurdles and detractors, the Encapsulate team persevered. They worked closely with Dr. Bret Schipper, the chief of surgical oncology at Hartford Hospital, and took feedback and advice from industry stakeholders. Their background research also involved conversations with patients in various stages of cancer treatment, a sobering reminder of the urgency of their work, Daneshmandi says.

"When you sit down and have a conversation with a patient who would eventually be using your technology, and you hear their stories … That's when you realize you have the potential to change the life of someone who's experiencing pain, unnecessary pain," she says. "Those were difficult conversations."

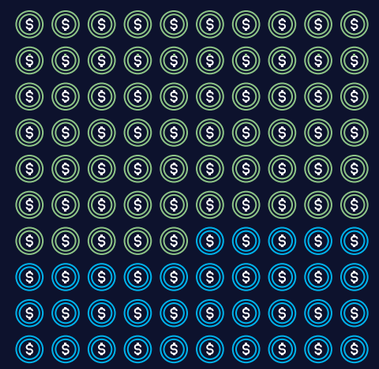
The talks galvanized them to bring their technology to market, and quickly. From conception to clinical studies, Encapsulate's development process took about three years, according to Rad. The startup's signature product is nCapsule, a biochip that is "able to very quickly, very precisely mimic the body," according to Rad. It can grow bona fide microtumors using the cells from patients' tumors. Encapsulate's other staple technology, nCapsulizer, processes the biochips and tackles treatment analysis.

RESEARCH BY THE NUMBERS

THIRD QUARTER FIGURES FOR FY23

NEW AWARDS BY CAMPUS

Each $ Is Equivalent To 1%



STORRS/REGIONAL

$000,000,000

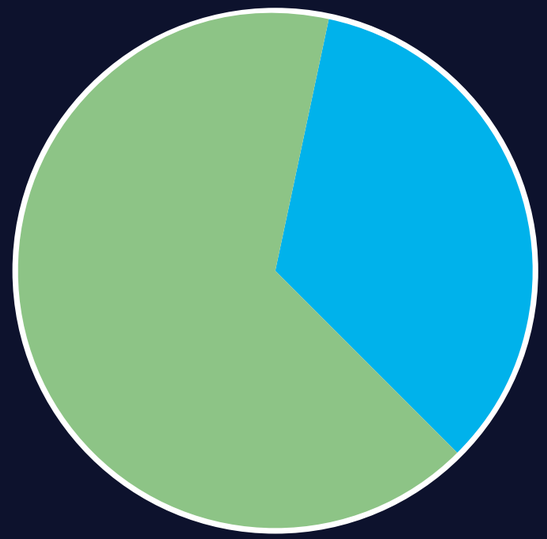
UCONN HEALTH

$00,000,000

TOTAL OF NEW AWARDS

$000,000,000

EXPENDITURES BY CAMPUS



STORRS/REGIONAL

$000,000,000

UCONN HEALTH

$00,000,000

TOTAL EXPENDITURES

$00,000,000

HEAT IS THE TOP CAUSE OF EXERTION-RELATED INJURIES AND FATALITIES FOR LABORERS

By Anna Zarra Aldrich, College of Agriculture, Health and Natural Resources

THIS STUDY IS ONE OF THE FIRST OF ITS KIND TO EVALUATE EXERTION-RELATED INJURIES AND FATALITIES FROM WORK-RELATED ACTIVITIES

Dangers like working high above the ground or with heavy machinery are common hazards for laborers in industries like construction or excavation. But there's another near-universal hazard for laborers – heat.

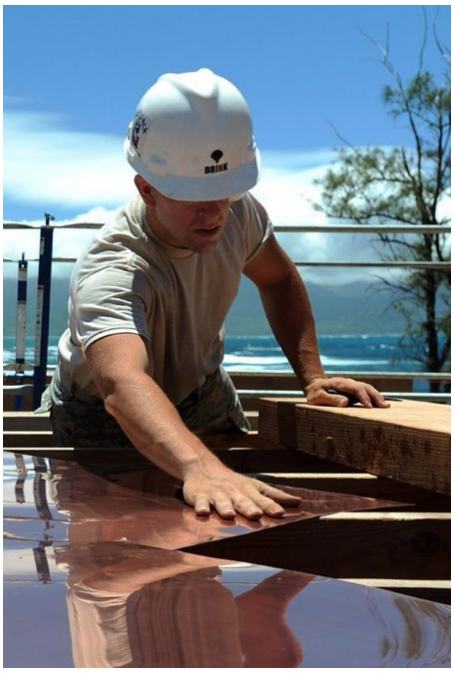
Margaret Morrissey, a postdoctoral fellow within UConn's College of Agriculture, Health and Natural Resources and president of occupational safety for the Korey Stringer Institute, led a recently published study that found heat is the number one cause of exertion-related injuries and fatalities on U.S. work sites.

This work was recently published in the International Journal of Environmental Research and Public Health. Using data reported to OSHA (Occupational Safety and Health Administration), the team found that of all injuries and fatalities, about 3% were exertion related. Of that 3%, a staggering 89% were related to heat stress. This study shows that heat is a significant danger for laborers in industries like construction, excavation, farming, and assembly line workers. Morrissey says she hopes this study can help improve health and safety measures to protect workers.

"We want people to recognize heat is a problem and it might not be one people automatically think of," Morrissey says.

Morrissey emphasizes that heat-related injuries and fatalities are preventable. There are simple, low-cost measures employers can take to protect workers in hot conditions, like hydration, body cooling, environmental monitoring, and educational training. Employers can also engage workers in heat acclimatization, which gradually exposes workers to hot conditions, allowing them to adapt to better tolerate heat and decrease their risk of injury.

The Korey Stringer Institute has been working to promote the health and safety of athletes since its founding in 2010. It has since expanded its work to include other populations that are especially vulnerable to heat illness, like soldiers and laborers.



Recent Awardees

Honorees at the March Vice President for Research, Innovation, and Entrepreneurship/Provost Award Luncheon

PI: Eleni Rodis
Co-PI: Kathryn Parr
$803,712
State Opioid Response – Department of Mental Health and Addiction Services and Research

PI: Joseph Ercolano
$1,384,984
Small Business Development Center, FY23

PI: Emily Wilson
Co-PIs: Anita Morzillo and Qian Lei-Parent
$304,661
Trails and Active Living Program, Department of Energy and Environmental Protection (DEEP)

Land Cover Comparison, EPA/CT DEEP

PI: Yi Li
$749,965
Cas9-mediated Development of Dwarf, Super-root, and Early Germination Perennial Ryegrass and Tall Fescue

PI: Yuanyuan Zhu
$596,736
NSF CAREER: Mechanistic Understanding and Strategies to Improve the Regeneration of Supported Nickel Catalysts for Methane Conversion

UCONN RESEARCH

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