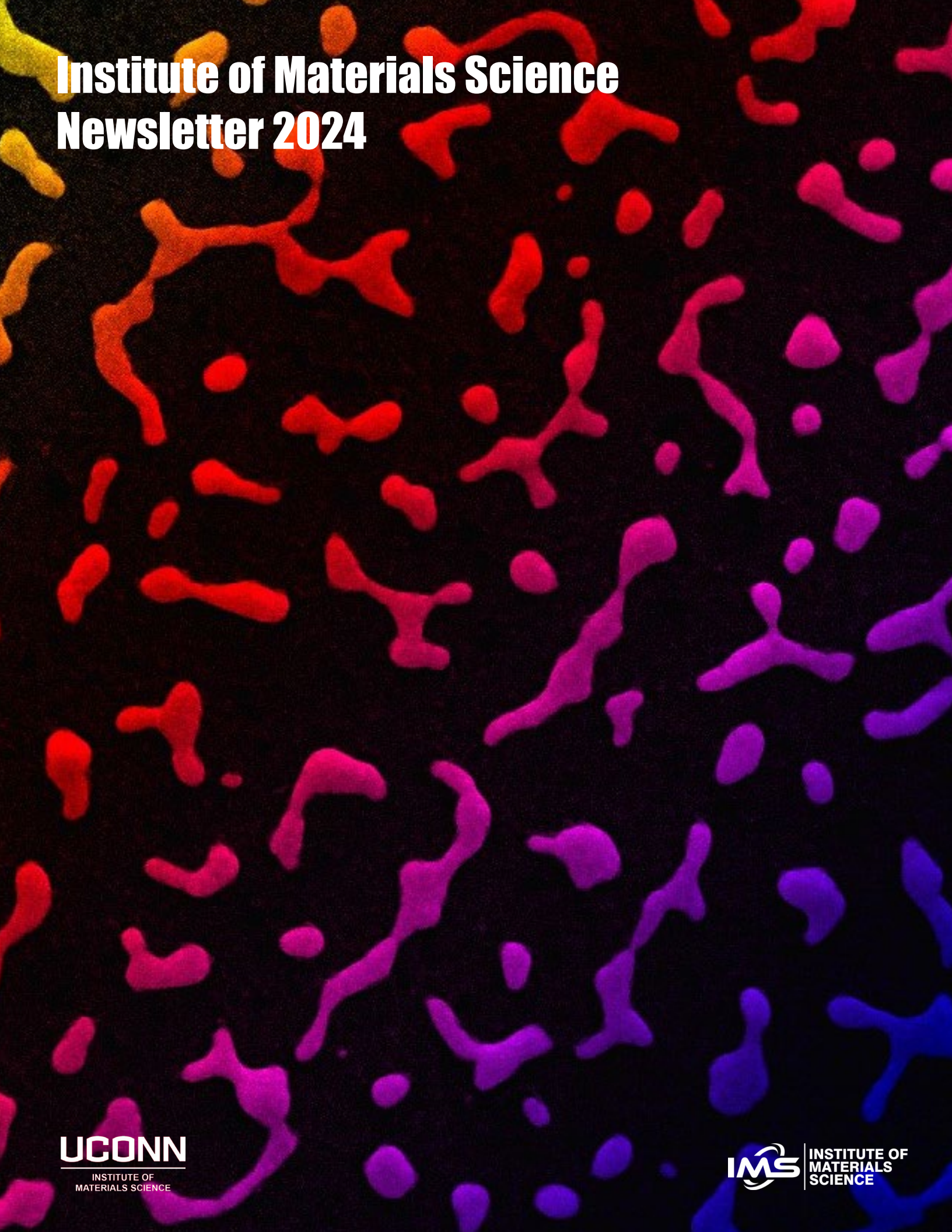
Institute of Materials Science Newsletter 2024



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Institute of Materials Science

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Department Head
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On the Cover:

"Maze"
SEM Image by Paul Elliot
From the Collection of Dr. Challa V. Kumar

Medium
A thin layer of gold was deposited onto a silicon wafer by a sputter coater (a thin film coating technique). The gold was heated in a tube furnace, causing the gold layer to coarsen into blobs. Ostwalt ripening, the process through which this occurred, is a phenomenon in solid or liquid solutions in which small crystals or solution particles dissolve and redeposit onto larger crystals or solution particles.

Dr. Challa V. Kumar donated his collection of photomicrographic art to the Institute of Materials Science. We honor him upon his retirement with our cover image from that collection. Read how the scientific community honored his legacy on page 13.

"Maze" from the collection of Dr. Challa V. Kumar

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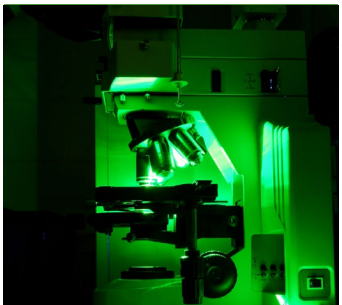
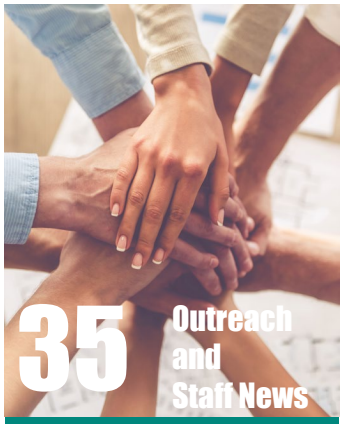




Message from the Director

Hello again!


Dr. Steven L. Suib, Director of IMS

A little over a year ago IMS moved into our new home, the Science 1 Research Center. We have had many visitors during this time, and we welcome you to visit at any time. The research labs, meeting rooms, offices, core labs, and other facilities are all spectacular and we are very appreciative of this great new space.

The views from our large meeting rooms are impressive and have been experienced by several groups from a variety of UConn entities, visitors from the Connecticut legislature, industry partners, and other universities. The Nanobyte Café serves many customers each day, and the large parking area outside the building is often fully occupied.

A unique facility new to IMS is our spacious Clean Room. This facility has enhanced our ability to generate and characterize new materials important in many areas such as semiconductors, catalysts, ceramics, thin films, and quantum devices. Another novel addition is the Active Learning Classroom, which features tables for groups of six students, incredible audiovisual aids, excellent acoustics, and a setting that captures the attention of students. This educational space facilitates collaboration within the learning environment. The Undergraduate Teaching Laboratories for students in the Materials Science and Engineering Department now also reside within the IMS building.

IMS recently received two major donations. The Harry and Honey Birkenruth Fellowships will support graduate students in materials science, and a donation from RTX (formerly Raytheon) was made in support of the new Clean Room.

In this issue we feature new faculty and staff members. We also highlight the numerous grants and contracts secured by our faculty members as well as the awards and honors they have received for their efforts in teaching, research, and outreach. Our students continue to impress as they make inroads into their research and are rewarded with fellowships and publications that encourage continued growth in their particular pursuits. We are extremely proud of our recent graduates as they embark on their careers.

We are pleased to announce the recent appointment of Dr. Yang Cao as the new Assistant Director for IMS. In this role, Dr. Cao will actively pursue targeted research opportunities.

Our Polymer Program, Materials Science Program, and the Materials Science and Engineering Department all continue to expand with new students, increased enrollment, and continual growth in financial support of the research efforts of both faculty and students. The Industrial Affiliates Program remains vital to our industry partners who rely on the program's expertise to resolve materials challenges and assist them in bringing improved products to market for their customers.

We invite you to read about the many accomplishments of our staff, faculty, and students in this interactive issue of IMS News.

As always, we wish the best to you and your families.

Steven L. Suib

Promotions
Appointments
Honors

Pamir Alpay Appointed Vice President for Research, Innovation, and Entrepreneurship

From UConn Today

Dr. Pamir Alpay, the new Vice President for Research, Innovation, and Entrepreneurship (Sean Flynn/UConn Photo)

In a letter to the UConn community, President Radenka Maric announced the appointment of S. Pamir Alpay as Vice President for Research, Innovation, and Entrepreneurship:

"Pamir has very successfully served in this role on an interim basis since February 2022, overseeing the University's $320 million research enterprise at Storrs, UConn Health, the School of Law, and our regional campuses.

He previously served as executive director of the Innovation Partnership Building at UConn Tech Park beginning in 2017, where he was the university's chief advocate for industry-informed research and primary liaison between the research community and government partners.

Those of us who have been fortunate enough to work closely with Pamir have been continually impressed by his visionary nature, tenacity, and exceptional effectiveness as a leader and researcher. Among his greatest strengths is his ability to successfully build highly productive relationships not only with colleagues but also numerous critical partners who are external to UConn.

Pamir arrived at UConn in 2001 as an assistant professor of materials science and engineering and physics and rose through the ranks, ultimately being named Board of Trustees Distinguished Professor in 2020. He served as head of the Department of Materials Science and Engineering from 2013-17 and as associate dean for research and industrial partnerships for the UConn School of Engineering from 2019 to 2022.

Pamir's research is at the intersection of materials science, condensed matter physics, and surface chemistry. He has over 200 peer-reviewed journal publications and conference proceedings, five invited book chapters, and a book on the physics of functionally graded smart materials. On the strength of his scholarship and service, he was elected fellow of the American Physical Society, ASM International, and the American Ceramic Society. He is also an elected member of the Connecticut Academy of Science & Engineering (CASE).

He has raised more than $30 million for research and development from federal and state agencies and industry. He is the PI of an $18 million interdisciplinary Air Force Research Lab (AFRL) contract dedicated to optimization of high value-added manufacturing technologies for aerospace components. Working with Yale University, he recently led a statewide coalition to secure an NSF Regional Innovations Engine Development Award, "Advancing Quantum Technologies (CT)," allowing Connecticut to participate in NSF's new flagship program promoting equitable economic development through technology innovation.

As executive director of the UConn Tech Park, Pamir established partnerships with industry, state government, and federal agencies and built several interdisciplinary research teams that successfully competed for large-scale funding. Since 2017, industry partners have invested more than $285 million for applied research at the Tech Park, corresponding to over $50 million per year in research and development funding. Pamir also established partnerships with small to medium-sized regional businesses as part of core outreach efforts, critical to UConn's mission of supporting economic growth in the state.

He earned his B.S. and M.S. from Middle East Technical University in Ankara, Turkey, and his Ph.D. from the University of Maryland."

Faculty Promotions

IMS congratulates faculty members promoted in the past year. These faculty members are among 96 promotions announced by the Office of the Provost.

Avinash Dongare
Professor
Materials Science & Engineering
College of Engineering

George Lykotrafitis
Professor
Mechanical Engineering
College of Engineering

Syam Nukavarapu
Professor
Biomedical Engineering
College of Engineering

David Pierce
Professor
Mechanical Engineering
College of Engineering

Leslie Shor
Professor
Chemical & Biomolecular Engr.
College of Engineering

Menka Jain
Professor
Physics
College of Liberal Arts
and Sciences

Jasna Jankovic
Associate Professor w/Tenure
Materials Science & Engineering
College of Engineering

Tomoyasu Mani
Associate Professor w/Tenure
Chemistry
College of Liberal Arts
and Sciences

MSE Welcomes Alexander Dupuy to the Department

From the Department of Materials Science and Engineering

Dr. Alexander Dupuy has joined the Department of Materials Science and Engineering

The department of Materials Science and Engineering welcomed their newest faculty member, Alexander Dupuy, who joined the department as an assistant professor in the Fall 2024 semester with an appointment in IMS.

Having received his Ph.D. in mechanical engineering from the University of California, Riverside in 2016, Dupuy went on to work for the University of California, Irvine as a postdoctoral scholar and then as assistant project scientist before joining us here at UConn.

With 16 years of research experience in ceramic processing and synthesis, particularly using Spark Plasma Sintering (SPS), Dupuy makes for an exciting addition to the department. His research interests include materials related to electrifications (such as energy generation, storage/batteries, delivery, and conversion), materials for high temperature and extreme environments, and the processing, properties, and behavior of high entropy ceramics.

Dupuy previously authored 23 scientific publications. He also has significant mentorship experience, guiding 7 Ph.D. students, 11 undergraduate researchers, and 5 senior design students in their work over the past 13 years.

"I am thrilled to become a Husky," Dupuy said. "The MSE department, School of Engineering, and Institute of Materials Science have made UConn a world-renowned institution for materials science scholarship and innovation. I am so pleased to be joining UConn and contributing to its important teaching and research missions."

Dean of Engineering to Transition from Administration to Research, Teaching

From UConn Today

During Dr. Kazem Kazerounian's tenure as dean, enrollment in the College of Engineering has more than doubled, research expenditures have quadrupled, and industry partners offer 46 student full scholarships. (UConn Photo)

After 12 years leading the direction of UConn's College of Engineering (CoE), Dean Kazem Kazerounian is heeding advice from one of his favorite musicians, Kenny Rogers.

"At some point, you have to know when to fold," he says. "There's a time to hold 'em and a time to fold 'em. This is my time for change."

This August, Professor Kazerounian—or simply "Kazem" as he's fondly known in the CoE's Deanery—will step down from his role as dean and return to research and teaching. He's already developing new courses including one on the intersection of advanced technologies and humanity, as well as advance his research on computational kinematics in the School of Mechanical, Aerospace and Manufacturing Engineering.

"While Kazem has made an extraordinary impact to the College of Engineering as a dean, the students will really benefit by having access to his wealth of experience and knowledge, and our faculty will gain a formidable mentor," says Horea Ilies, school director and professor of mechanical engineering. "He's equally respected as an instructor and a researcher as he is as an administrator."

The Dean's Doings...

As dean, Kazerounian leads strategic initiatives focused on expanding the CoE's research enterprise, institutional advancement, educational innovation, and technology commercialization. He's consistently striving to ensure growth in all engineering programs by focusing on three pillars: developing successful students, maintaining research excellence, and contributing to the economic output and development in the state of Connecticut.

He works with the UConn Foundation to secure private and corporate donations for the college including the College of Engineering Dean's Fund, which provides resources, program support, and scholarships for engineering students. But the majority of his time is consumed by "running an enterprise" that consists of nearly 200 faculty, 152 staff members, and about 5,000 students. He oversees all academic programs, seven departments and 20 centers.

"The College of Engineering is one of the best engineering schools on the East Coast in so many ways," Kazerounian says. "I always say we are the Berkeley of the East. We offer a wonderful public engineering program that's very comprehensive, and being a land grant university, there's a lot on our shoulders," Kazerounian says. "It's critical that we produce engineers who contribute to the state's economic development so we need to keep going down that path."

Leaving a Legacy

During Kazerounian's tenure as dean, enrollment in the College of Engineering has more than doubled, research expenditures have quadrupled, and industry partners offer 46 full scholarships for students. The School of Engineering—as it was called since 1940—was elevated to a College last November, as was Kazerounian's own department; Mechanical Engineering is now the School of Mechanical, Aerospace and Manufacturing Engineering.

And, as part of UConn's Next Generation Connecticut initiative to expand research in STEM fields, Dean Kazerounian's tenure overlapped the opening of the Engineering and Science Building in 2018, the Innovation Partnership

Building in 2018, and the state-of-the-art Science 1 building in 2023, which houses the Materials Science and Engineering Department.

No small feat, but Kazerounian humbly shares the credit with his colleagues.

"Really, the blessing of being the Dean is that you're surrounded by amazing, brilliant administrators, faculty and staff who put forth the effort to improve our programs and impact students and people's lives," he says.

Among Kazerounian's staff is Kylene Perras, assistant dean of operations and strategic initiatives for the CoE. They met in 2011 when Perras worked in advancement at the UConn Foundation, and in 2015, Kazerounian hired her to work in various capacities in the CoE.

"Humility is a rare trait in leadership, but Kazem exemplifies this effortlessly, despite his impressive achievements," Perras says. "He heads the College of Engineering with his wisdom, inspiring us not only with his vision but also by rolling up his sleeves working alongside us, creating a culture of mutual respect. This, combined with his thoughtful approach to decision-making and genuine concern for our well-being individually and collectively in the College of Engineering has made him not only a great leader, but also a mentor we trusted and admire."

Claire Tremont, manager of communications and digital strategy for UConn Engineering, also admires Kazem for his humble mannerisms. "In all meetings I've had with Kazem, he thanks me for giving him some of my time. I know he does it with others, too. The value he places on relationships is noticeable."

Kazerounian "is all about relationships," says Donald Swinton, senior director of development for the College of Engineering/ University of Connecticut Foundation. "From the moment he took on the role as associate dean … he started a constant mission to find partners who could help raise up the College of Engineering. It started with companies like Pratt & Whitney and Hamilton Sundstrand (now Collins Aerospace). As dean, Kazerounian was constantly doing one visit, one plant tour, one coffee/lunch/dinner after another - building relationship after relationship with our alumni and executives."

"There's a time to hold 'em and a time to fold 'em. This is my time for change."

~Kazem Kazerounian

His knack for relationship building led to years of negotiations that birthed the United Technologies (now Pratt & Whitney) Institute of Advanced Systems Engineering with $10 million in funding; the Krenicki Institute for Arts and Engineering (in partnership with then Dean of Fine Arts Provost Anne D'Alleva), with $5 million in funding; and the National Institute for Underwater Vehicle Technology with $90 million (over 5 years) in funding. He supported growing the Eversource Energy Center to a $30 million enterprise; launched the Comcast Center of Excellence and the Altschuler Cybersecurity Laboratory, and helped enable UConn to land the modern day Thermo Fisher Scientific Center for Excellence in Microscopy and Materials Characterization, a similar partnership with Zeiss, and several others in the Innovation Partnership Building (IPB).

His work also broadly affected students.

"Acutely aware of undergrad students' unhappiness with the required engineering ethics requirement that generally fell to an introductory philosophy course," Swinton says, Kazerounian began talks with the Gladstein Family Human Rights Institute that resulted in the Engineering for Human Rights Initiative, which addresses human rights implications of the most significant challenges in engineering and technology. "Students from all parts of UConn were introduced to courses with case studies, experiential learning and content from the hard sciences, social sciences and humanities," Swinton recalls.

This radical idea firmly connected engineering to the social sciences and broadened faculty collaborations throughout UConn - now involving 60 faculty.

Of his list of accomplishments, Kazerounian is most proud of his efforts in diversity and inclusion. In 2019, Women Engineering magazine recognized UConn's College of Engineering as a "Top 20" leader in the nation for fostering diversity and inclusion among its student and faculty population. And in 2016, The Washington Post reported that UConn saw the largest five-year gain in female engineering graduates among 90 public institutions nationally.

His work with Betsy '81 (CLAS) and chemical engineering major Mark Vergnano '80 (ENG) brought Engineering's DEI efforts to a new level with the Vergnano Institute for Inclusion and the Vergnano Chair for Inclusion.

"We've really worked to close the gender gap in engineering," Kazerounian says. "We're really leading many institutions in that regard." IMS

Read the full story

IMS Welcomes Mihai "Mishu" Duduta

From the Institute of Materials Science

Dr. Mihai "Mishu" Duduta

Mihai "Mishu" Duduta has joined the Department of Mechanical Engineering with an appointment in the Institute of Materials Science (IMS). Having earned his B.S. from MIT, he completed his M.S. and Ph.D. at Harvard University. Following the completion of his Ph.D., Duduta joined the faculty of the Department of Mechanical and Industrial Engineering at the University of Toronto as an assistant professor. He is a recipient of the Banting Foundation Discovery Award for 2022 for his research on "Smart Micro-catheters Based on Electro-mechanical Artificial Muscles."

At the heart of his research "Mishu" (as Duduta prefers to be called) is focused on the science of soft robotics, novel materials, and energy storage. He seeks to "invent new ways to store energy and deliver power that bring new robotic capabilities."

IMS News reached out to Dr. Duduta to welcome him and learn more about him and his research.

We are happy to welcome you to UConn IMS. How did you become interested in UConn and how will you contribute to student success, a key priority for the University?

UConn has a great location, outstanding students, talented faculty, and fantastic infrastructure. My goal is to train students to be more capable scientists and engineers, but also to develop a strong grasp of how to communicate science effectively, as well as gain an understanding of where their work can bring societal value.

> **I have always been fascinated by energy and by materials that can act as transducers...**
>
> ~Mihai Duduta

Your research focus includes novel materials, soft robotics, and energy storage. All of these are at the cutting edge of future technology. What led you to pursue this field of science?

I have always been fascinated by energy and by materials that can act as transducers, effectively transforming one type of energy into another. For example, chemical energy stored in covalent bonds of a fuel, to thermal energy, or heat by burning said fuel. I see Robotics as the next area of innovation for energy storage, conversion and harvesting.

> **The end goal is to replicate nature, as closely as possible, in an engineered system.**
>
> ~Mihai Duduta

You have said that in order for robots to interact more closely with people they must be more compliant, or flexible. How can the combination of materials, soft robotics, and energy storage achieve this goal and what do you see as the future implications as the science advances?

As machines become smaller or softer, we'll need to invent new materials and mechanisms for actuation, sensing, and computation. The end goal is to replicate nature, as closely as possible, in an engineered system. If we have artificial muscles that can effectively replace natural ones, and run as efficiently for long periods of time, we can radically change almost all segments of the economy: from healthcare, to agriculture, manufacturing and beyond.

Jason Hancock and Tomoyasu Mani Receive IQSE Award

From the Institute of Materials Science

Dr. Jason Hancock

Dr. Tomoyasu Mani

Jason Hancock and Tomoyasu Mani have been awarded funding from the Innovations in Quantum STEM Education program. The program, offered as a companion program to the Quantum-CT Regional Innovation Engine project, led by UConn and Yale University, seeks to inspire and seed research into quantum-ready STEM education and workforce training that will enable our communities to rise to meet the new employment opportunities that quantum technologies will bring.

Regenerative Engineering Pioneer, Cato T. Laurencin, Named 2023 Inventor of the Year

From UConn Today

Dr. Cato T. Laurencin

The Intellectual Property Owners Education Foundation (IPOEF) awarded the prestigious Inventor of the Year award to Dr. Cato T. Laurencin for his groundbreaking innovation in regenerative engineering. Dr. Laurencin's work has led to clinical systems for bone, cartilage, ligament, and tendon healing and regeneration. At the same time, his technologies have had profound implications for the treatment of cancer, and degenerative conditions such as osteoarthritis. Dr. Laurencin currently serves as one of two University Professors at the University of Connecticut and is the Chief Executive Officer of The Cato T. Laurencin Institute for Regenerative Engineering at UConn.

The Inventor of the Year is the annual award presented to the world's most outstanding recent inventors. Previous award winners have included the inventors of CRISPR-Cas9 technologies and the inventors of mRNA technologies for COVID-19 vaccine development.

Professor Laurencin's innovations in regenerative engineering and his impact on the fields of biomaterials, nanotechnology, and stem cell science have had an immeasurable impact. As the leading international figure in polymeric biomaterials chemistry and engineering, he has made extraordinary scientific contributions while at the same time, he has had profound contributions to improving human health through the technologies and products he has invented.

Dr. Laurencin is the first surgeon elected to the four major national academies in the United States (the National Academy of Sciences, the National Academy of Engineering, the National Academy of Medicine, and the National Academy of Inventors). He received the National Medal of Technology and Innovation, America's highest honor for technological achievement, in ceremonies at the White House in 2016.

Internationally his work has been recognized with election to academies throughout the world including the Royal Academy of Engineering, the Chinese Academy of Engineering, the Indian Academy of Engineering and Academies of Science in Europe, Africa, and Asia.

Dr. Laurencin was presented the 2023 IPO Education Foundation Inventor of the Year award at the 2023 IPOEF Awards Celebration on December 6, 2023, in Washington, DC.

Syam Nukavarapu and Arash Zaghi Elected to CASE

From the Institute of Materials Science

Dr. Syam Nukavarapu

Dr. Arash Zaghi

The Connecticut Academy of Science and Engineering (CASE) announced the election of 35 of Connecticut's leading experts in science, technology, engineering, mathematics, and medicine to membership in the Academy. The new members were introduced at the Academy's 48th Annual Meeting and Dinner which was held on May 24, 2023.

Professor of Biomedical Engineering and Orthopaedic Surgery Syam Nukavarapu, UConn School of Engineering; and Professor of Civil and Environmental Engineering, Arash E. Zaghi, UConn College of Engineering, both IMS affiliate members, were among those honored.

MSE Department Head, Bryan Huey, Elected Chair of University Materials Council

From the Department of Materials Science and Engineering

Dr. Bryan Huey, Department Head, Materials Science and Engineering

Materials Science and Engineering (MSE) Department Head Bryan Huey was elected as the 2022-2023 chair of the University Materials Council (UMC), a nationwide association of MSE department heads.

The council meets bi-annually to share best practices. Professor Huey and 5 other UMC officers are responsible for organizing the biannual meetings. In the spring of 2023, 45 department heads met in San Diego alongside The Minerals, Metals & Materials Society (TMS) conference. In addition to an update on student recruiting, discussions on how to leverage artificial intelligence in materials education, and ideas about department culture and inclusivity were explored.

"I'm especially pleased that broad support emerged across the UMC membership for a few nationwide efforts that should benefit materials professionals," Huey notes. "For one, we're going to kick off communities of practice for those supporting our teaching labs. This will make it easier for us to share popular lab modules, or to identify the most suitable equipment for an undergraduate lab." IMS

Read the full MSE story

IMS Faculty Mentor 2023 SURF Awardees

Megan Lemay '24
(Chemistry, CLAS)
Project Title: *Synthesis of the Siderophore Aerobactin and Fluoroform Labeled Aerobactin*
Faculty Mentor: Dr. Alfredo Angeles-Boza, Chemistry

Lisa Liang '25
(Chemistry, CLAS)
Project Title: *A Vehicle for Combatting Genetic Disorders: Design and Synthesis of Nucleus Targeting Nanocarriers for the Delivery of Therapeutic DNA*
Faculty Mentor: Dr. Jessica Rouge, Chemistry

Neo Lin '25
(Chemistry, CLAS)
Project Title: *Toward Realization of Optically Addressable Radical Pairs in Donor-Bridge-Acceptor Triad Systems*
Faculty Mentor: Dr. Tomoyasu Mani, Chemistry

Katrina Schneider '24
(Biological Sciences, CLAS)
Project Title: *Standardizing Visualization and Quantification of Mammalian Neuronal Synapses by Employing Ultrathin Imaging and Fluorescent Immunohistochemistry*
Faculty Mentor: Dr. Linnaea Ostroff, Physiology and Neurobiology

Lyla White '24
(Pharmacy Studies, PHARM)
Project Title: *Effect of Freezing and Thawing and Freezing and Heating on Aspirin Tablet Stability*
Faculty Mentor: Dr. Bodhi Chaudhuri, Pharmaceutical Sciences

Diane Burgess Honored for Mentorship and Advancement of Women in Pharmaceutical Sciences

From UConn Today

Dr. Diane Burgess

Diane Burgess, Board of Trustees Distinguished Professor of Pharmaceutics, Pfizer Distinguished Endowed Chair in Pharmaceutical Technology, has been honored with the Alice E. Till Advancement of Women in Pharmaceutical Sciences Recognition. This award recognizes a pharmaceutical professional who has contributed significantly to the mentorship and advancement of women in the pharmaceutical sciences. The recipient of this award makes a positive impact in the promotion of women's professional development, success, and recognition in pharmaceutical sciences.

Burgess has served as a researcher, educator, and mentor throughout her 30 years at the school. Burgess works closely with student researchers in her four labs and has also helped establish the School of Pharmacy's Traditional Chinese Medicine Study Abroad Program which provides students with an opportunity to learn about traditional eastern medicine. Burgess has been recognized for commitment to her students, having received the UConn's Outstanding Teacher of the Year award in 1992 and 2005. In 2014, the AAPS honored her with their Research Achievement Award in Formulation Design and Development, as well as the AAPS Outstanding Educator Award. Burgess was the 2002 AAPS President. Burgess's work demonstrates her dedication, mentorship, and support for her students.

"It is my distinct honor to receive this recognition from AAPS," says Burgess. "Mentoring has always been a great passion of mine to empower junior scientists and foster their success. I have a keen interest to increase diversity and inclusivity, and in particular to help women succeed and create opportunities to compete on a level playing field".

Xueju "Sophie" Wang Receives 2024 ONR Young Investigator Award

From the Institute of Materials Science

Dr. Xueju "Sophie" Wang

Xueju "Sophie" Wang has been awarded an Office of Naval Research (ONR) 2024 Young Investigator Award in the category Ocean Battlespace Sensing. The Ocean Battlespace Sensing Department of ONR explores science and technology in the areas of oceanographic and meteorological observations, modeling, and prediction in the battlespace environment; submarine detection and classification (anti-submarine warfare); and mine warfare applications for detecting and neutralizing mines in both the ocean and littoral environment.

Dr. Wang's research, entitled *A Soft Intelligent Robot for Self-digging, Multi-modal Sensing, and In Situ Marine Sediment Analysis*, was recognized by the Littoral Geosciences and subcategory. The Littoral Geosciences and Optics program supports basic and applied research for expeditionary warfare, naval special warfare, mine warfare and antisubmarine warfare in shelf, near-shore, estuarine, riverine, and riparian environments, with a particular emphasis on robust 4D prediction of environmental characteristics in denied, distant or remote environments.

Wang earned a Ph.D. from Georgia Institute of Technology in 2016. She joined the faculty of the Materials Science and Engineering Department (MSE) in 2020 with an appointment in the Institute of Materials Science (IMS). Since then, she has earned extensive recognition for her research including the National Science Foundation (NSF) CAREER award in 2022; the National Institutes of Health (NIH) Trailblazer Award, also in 2022; and the American Society of Mechanical Engineers (ASME) Orr Early Career Award in 2021 among others.

2023-24 REP Award Recipients

Seven IMS Faculty members have received the Research Excellence Program (REP) award sponsored by the Office of the Vice President for Research (OVPR). The goal of the award is to provide seed funding to fuel innovative research, scholarship, and creative endeavors with strong potential for significant extramural funding from federal and state sponsors, corporations, industry partners, and foundations; and achievements consistent with the highest standards of accomplishment in the discipline. IMS Congratulates the recipients.

Lesley Frame
Oxidation Rate Control on Ferritic Stainless Steel through Mechanical and Thermal Treatments

José Gascón
Discovery of binding sites and mechanism of action of azoboronate photoswitches in CRAC channels

Jeongho Kim
Finding Net-Zero-Thermal-Expansion Titanium and Components Design for Space Technologies: An Inter-Disciplinary Approach

Sangamesh Kumbar
Polymeric Implants for Soft-Tissue Wound Healing

Hugo Posada-Quintero
Design and validation of a multimodal device for the collection of electrocardiography and electrodermal activity in horses

Gregory Sotzing
PolyCannabinoids, nonphenolic antioxidant and naturally biodegradable coatings for corrosion protection

Wei Zhang
Lightweight, Scalable and Dynamic Load Balancer for Edge Computing

Montgomery Shaw Honored by Society of Plastics Engineers

From the Institute of Materials Science

Dr. Montgomery Shaw

The Society of Plastics Engineers (SPE) Applied Rheology Division has honored IMS resident faculty member, Dr. Montgomery Shaw, with a symposium in his name. Shaw, an emeritus professor of chemical and biomolecular engineering, and a pioneer and influential researcher in the fields of rheology and polymer processing, has made significant contributions to the understanding of polymer melt rheology, viscoelasticity, polymer blends, and polymer processing.

In honor of Dr. Shaw's career and contributions, the SPE Applied Rheology Division hosted the full-day Shaw Symposium for Polymer Processing, Rheology, and Characterization during their 2023 Annual Technical Conference and Exhibition (ANTEC) in March 2023. The event brought together renowned colleagues who presented their work in rheology and polymer processing. The symposium also featured a keynote speech by Dr. Shaw himself, who shared his insights and perspectives on the past, present, and future of rheology and polymer processing.

Dr. Luyi Sun, IMS resident faculty member and professor in the Department of Chemical and Biomolecular Engineering, was a co-organizer of the symposium and presented his research in coatings to create smart materials.

"This project started out seven years ago as a collaboration with Dr. Shaw, who helped figure out some of the fundamentals," says Sun who, as a student, learned from Shaw's books and was pleased to then collaborate with him at UConn. "It is a tremendous honor to participate in this symposium to celebrate his contributions to polymer science and engineering," Sun said.

The Shaw Symposium presented an excellent opportunity to honor the career of Dr. Shaw, to showcase his excellence in materials science and engineering, and included presentations from members of academia, industry, and government organizations.

Dr. Robert Weiss, UConn Emeritus Board of Trustees Distinguished Professor and the United Technologies Corp. Professor of Advanced Materials and Processing, who served 10 years as Director of the IMS Polymer Program and 6 years as the Associate Director of the Institute of Materials Science, joined Dr. Sun, Dr. Anson Ma, UConn Associate Professor of Chemical Engineering and IMS Polymer Program faculty member, and 10 others in presenting research during the symposium.

Barrett Wells Named CLAS Associate Dean for Life and Physical Sciences

Excerpted from UConn Today

Dr. Barrett Wells

When Barrett Wells became head of the Department of Physics in 2018, he says his opinion of the department changed.

"It was such an interesting thing, to learn more about what all my colleagues were doing," the condensed matter physicist says. "I always felt we had a good department but as I learned more details [on colleagues' research], I thought, 'Wow, we're better than I thought we were.'"

Now as Wells, who goes by Barry, joins the College of Liberal Arts and Sciences as the new Associate Dean for Life and Physical Sciences, he expects he'll experience that all over again.

"Of course, this will be different – broader, and much larger," he notes. "But I'm looking forward to learning more broadly about all our science departments."

Wells joined UConn in 1998, following positions at Boeing and Brookhaven National Laboratory. He became department head in 2018, where he met and worked with department heads across the CLAS Division of Life and Physical Sciences.

Wells will oversee the Division of Life and Physical Sciences, which comprises the Departments of Chemistry; Earth Sciences; Ecology and Evolutionary Biology; Geography; Marine Sciences; Molecular and Cell Biology; Mathematics; Physics; Physiology and Neurobiology; Psychological Sciences; Speech, Language, and Hearing Sciences; and Statistics.

"Barry is a thoughtful and experienced scientist and leader, and I'm very happy to have him," says Ofer Harel, interim dean of the College. "His track record shows that he asks the right questions and really advocates for his faculty and staff."

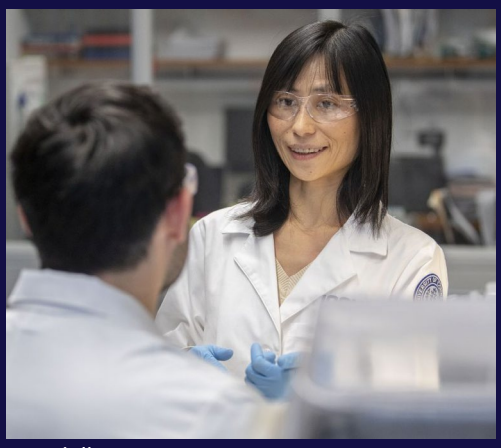
Among the unique challenges of the position, Wells says, is ensuring adequate space for laboratory research. He will work closely on these and other issues with Associate Dean for Research and Graduate Affairs Andrew Moiseff, who previously served in Wells' role.

"Andy is a major part of the reason I decided to apply for this role," says Wells. "He's been wonderful to work with. It's a little scary to try to live up to him."

Wells says he wants to ensure people have access to resources for both interdisciplinary and disciplinary research. Research and teaching in the disciplines needs to be strong, he says, for interdisciplinary research to be successful.

Xiuling Lu Announced as AAPS Fellow

Excerpted from UConn Today



Dr. Xiuling Lu

Xiuling Lu has attained the esteemed title of AAPS Fellow, a recognition of her steadfast commitment to pioneering research, marked by its unwavering excellence and innovation, and the transformative effects it has had on patients grappling with unmet medical needs.

An AAPS Fellow is an AAPS member who is recognized as a leader in the pharmaceutical field. Peers recognize Fellows for facing challenges head-on with creative solutions in the discovery, development or regulation of pharmaceuticals and biologics.

The status of Fellow denotes professional excellence and a sustained, positive impact to global health and to the AAPS Community. AAPS Fellows are encouraged to continue to actively contribute to their fields and to AAPS throughout their tenure.

Lu stands as a distinguished luminary in the realm of nanoparticle-based therapeutics and their corresponding product advancement. At UConn, her lab has successfully devised inventive image-guided therapeutic nanoparticle systems, surmounting considerable obstacles within the realm of cancer treatment. Lu's contributions extend further to a profound comprehension of the challenges associated with designing therapeutic agents, enhancing the bedrock understanding of delivery and treatment barriers.

A Career Worth Celebrating: Dr. Challa V. Kumar

From the Institute of Materials Science

Colleagues, collaborators, family, friends, and former students gathered to celebrate the career of Dr. Challa V. Kumar

By the time registration closed for the *Symposium Celebrating the Research and Education Legacy of Professor Challa V. Kumar*, more than 60 delegates from around the world had registered. The event, which also celebrated Dr. Kumar's retirement as well as his 70th birthday, brought together colleagues, collaborators, friends, and former students of Professor Kumar eager to pay homage to him and to present research on the topic for the day, *Chemical Approaches to Biological Materials and Beyond*.

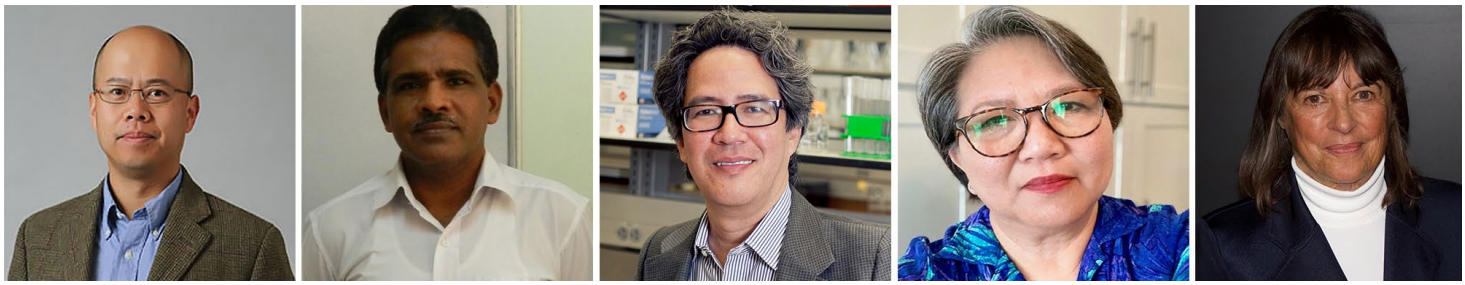
The full-day event opened on September 9, 2023, with continental breakfast and a welcome message from Dr. Yao Lin, professor of chemistry and Institute of Materials Science (IMS) resident faculty member. Lin also served as chair for the morning session. IMS Director Dr. Steven L. Suib opened the symposium with remarks that set the tone for the day's events.

The morning session commenced with Dr. Kumar's introduction of his longtime friend, Professor and Chief Editor of Science magazine Holden Thorp. Dr. Thorp emphasized the importance of scientists getting involved in the discussion of societal issues and policies through evidence-based facts. The discussion included science outreach to children, an important topic for all attendees.

Each presentation was preceded by a short introduction from Dr. Kumar, to which he brought a personal connection between himself and each of the presenters. Speakers for the morning session included Professor D. Ramaiah from Birla Institute of Technology, Hyderabad, India. Dr. Kumar and Dr. Ramaiah overlapped at the Indian Institute of Technology Kanpur before Dr. Kumar left for the United States.

Professor Michael Purugganan from New York University described his collaboration with Professor Kumar on DNA-mediated electron transfer at Columbia University. He presented research on the ways in which rice genes have co-evolved with humans over thousands of years, with 13,000 varieties identified so far.

Professor Leah Croucher from the National Institutes of Health (NIH), a former Ph.D. student of Professor Kumar, described her path from the Kumar lab to NIH in



Morning session presenters (l to r) Drs. Yao Lin (session chair), D. Ramaiah, Michael Purugganan, Leah Croucher, and J.K. Barton

Afternoon Session Speakers (l to r) Drs. Steven L. Suib, James Rusling, Ashis Basu, Rajeswari Kasi, Akhilesh Bhambhani, Ajith Pattammattel, and Anna Pyle

reverse chronological order, sharing highlights of her days at UConn along the way.

The last speaker of the morning session was Professor J.K. Barton of California Institute of Technology. Dr. Barton, a recipient of the prestigious Priestly Medal, spoke on electron transfer through DNA. Dr. Barton was also a postdoctoral mentor to Professor Kumar. Her talk led to interesting discussions on the electron transport mechanism and how DNA-mediated electron transport plays an important role in DNA damage, repair, and cancer.

Following lunch, session chair Dr. Rajeswari Kasi, professor of chemistry and IMS resident faculty member, commenced the afternoon session with an introduction of IMS Director and Professor of Chemistry Dr. Steven L. Suib. Professor Suib analyzed the research trajectory of Dr. Kumar over four decades and recounted how the Kumar research group switched gears and meandered through increasingly interesting research topics, building one over the other.

Professor of Chemistry James Rusling spoke of his interactions with Professor Kumar, elaborating on joint and related projects that they often chatted about. Professor of Chemistry Ashis Basu described his research projects on DNA damage, DNA-covalent adducts of carcinogens, and the mechanisms of carcinogenesis. Professor Kasi described some of her most recent work on protein-conjugated cellulose nanocrystals, demonstrating how her work was inspired by her collaborations with Dr. Kumar.

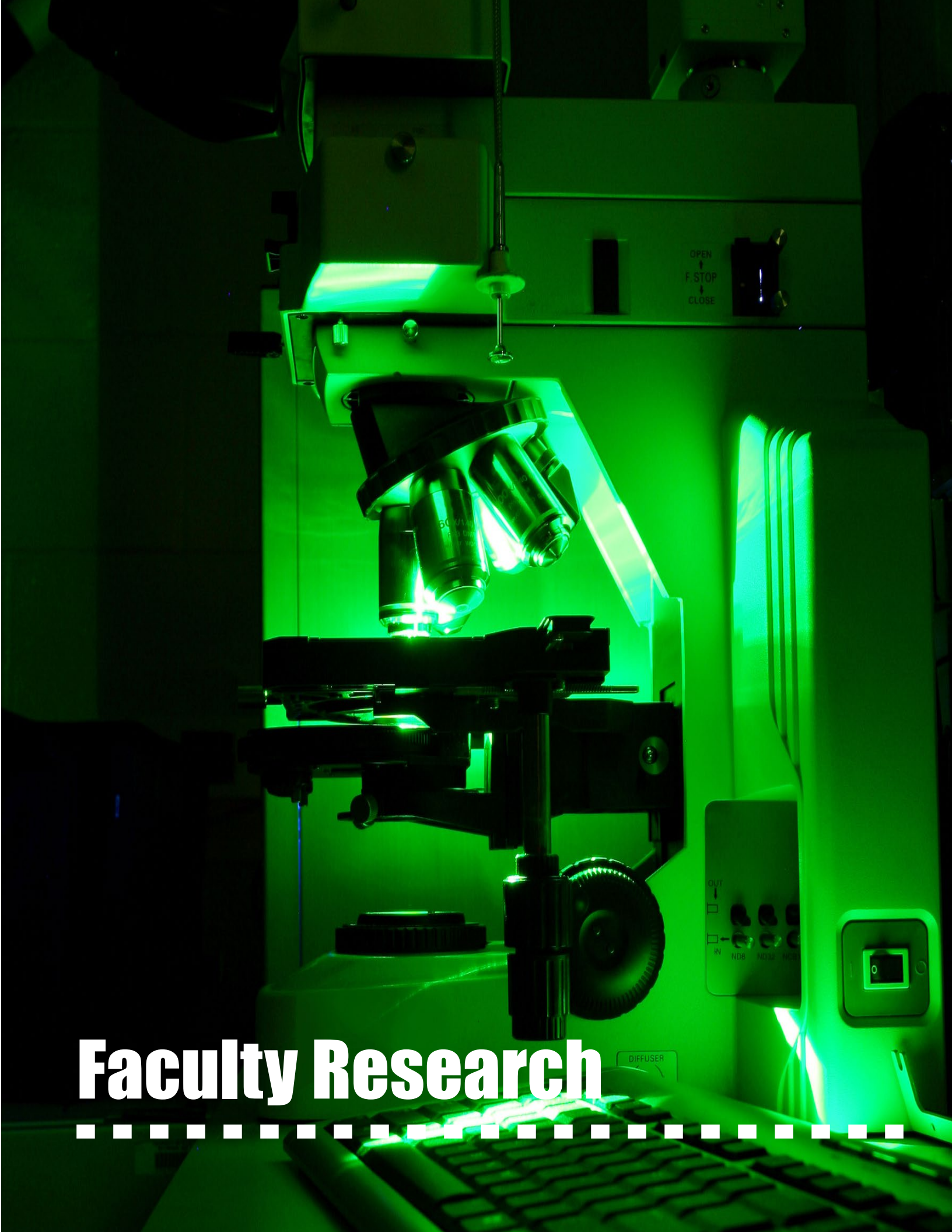
Dr. Challa Kumar was surrounded by family for the event. (l to r) Dr. Kumar's wife Anupam, Dr. Kumar, his brother Srinivas, sister-in-law Manjula, nephew Sriram, and his wife Keerti

Professor Akhilesh Bhambhani, a former Ph.D. student of Dr. Kumar, outlined the key factors for successful design, manufacturing, and deployment of biologics with humorous comparison of Dr. Kumar to the Bodha tree, which gave enlightenment to those who rested beneath it. Dr. Ajith Pattammattel, another former Ph.D. student of Dr. Kumar, elaborated on his research at the Brookhaven National Laboratory. He invited students and faculty to visit the lab to conduct collaborative advanced scattering experiments with a personal story of the instrumental role Dr. Kumar played in his success.

The penultimate talk of the symposium was given by Professor Anna Pyle, a contemporary of Dr. Kumar during her days as a graduate student at Columbia University. Dr. Pyle described how her group is deciphering the exquisite structures of multiple states of RNA using Cryoelectron microscopy.

With the last word, Professor Kumar began his plenary talk by thanking his mentors, hosts, and graduate students. He elaborated on the tortuous path taken by his research group, and lessons learned, along the same lines as Professor Suib's analysis at the beginning of the afternoon session.

The symposium concluded with a standing ovation from the audience, after Dr. Kumar explained how he came to the United States with only $21 and a Ph.D., with no friends or relatives here, and succeeded in achieving his American dream. Truly a career worth celebrating!



Faculty Research

Science 1 Hailed as a Game Changer for UConn

From UConn Today

State leaders and industry partners joined the UConn community to formally celebrate the opening of the state-of-the-art Science 1 facility in Storrs on Thursday, June 15.

"Science 1 is transforming the way we educate," UConn President Radenka Maric said at a ribbon-cutting ceremony held at the brand-new facility on King Hill Road. "This new building will support our efforts for federal funding and support our industry in the state. We want to be at the top of innovation in Connecticut. I always tell people Connecticut is a state of innovation, we are just too humble to tell people how innovative we are."

Science 1 , the new home of the Institute of Materials Science, is one of the largest projects in the Next Generation Connecticut initiative, which was announced in 2013 to significantly expand UConn's educational and research work in STEM (science, technology, engineering and math) fields.

The building is one of UConn's largest and most technologically advanced facilities, with some 198,000 square feet dedicated to research, teaching, and core laboratories; a new 240-seat active-learning room designed to engage students more dynamically than traditional lecture halls; and faculty offices, public spaces, administrative support offices, and informal gathering places.

It also includes a "clean room," which is a space designed to support specialized scientific research in a tightly controlled environment where contamination is minimized to protect the work by filtering airborne particles from within the room.

"We know that if children have the opportunity to become familiar with STEM fields that are growing, expanding, and evolving, it is great for Connecticut," Lieutenant Gov. Susan Bysiecwiz said at the ceremony. "It's equally important that we have state-of-the-art facilities to get our higher education students excited about studying STEM, and I know they are going to have the opportunity to do that in this beautiful building. The governor and I are very passionate about STEM education and STEM careers, because many of the thousands of jobs that are open right now in the state are in STEM fields, and are among the highest paying jobs."

Continued on next page

(l-r) Rep. Kathy Kennedy; Rep. Tim Ackert and his grandson, Jameson; Mansfield Town Manager Ryan Aylesworth; Mansfield Mayor Toni Moran; President Radenka Maric; Sen. MD Rahman; Rep. Gregg Haddad; Sen. Cathy Osten; Rep. Holly Cheeseman; Lt. Gov. Susan Bysiewicz; Sen. Mae Flexer; Provost Anne D'Alleva; Trustee Philip Rubin; Student Trustee Aanya Mehta; and Institute for Materials Science Director Steven Suib join together at the dedication of the Science One Research Center on June 15, 2023. (Peter Morenus/UConn Photo)

Continued from previous page

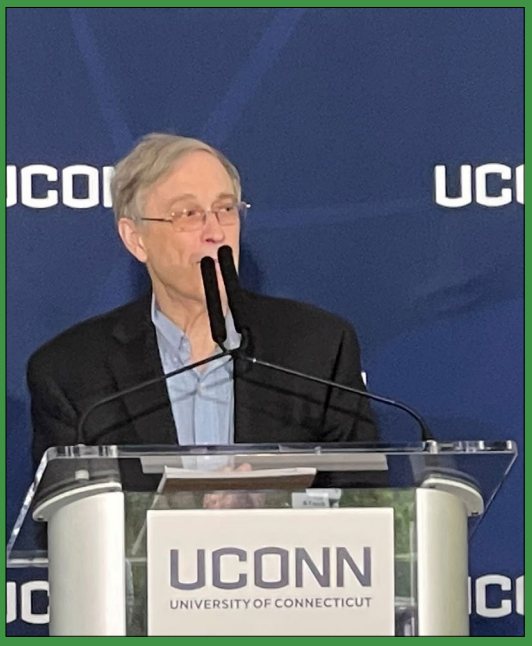
In addition to its cutting-edge research and teaching applications, Science 1 was also designed to incorporate best practices in sustainability and energy efficiency, as part of UConn's effort to achieve carbon neutrality by 2030.

The sustainability features of the facility will reduce energy usage, improve thermal comfort, optimize energy performance, and incorporate on-site renewable energy systems.

"Science 1 is designed for best practices in sustainability, and I am very passionate about incorporating climate change into how we act and think," Maric said.

The facility is also intended as a crucial step forward in Connecticut's investment in UConn as an engine for innovation and economic development. It further enhances a key priority of the University's, which is to boost entrepreneurship and research funding.

"This building expresses our mission in every dimension as a public, flagship, land grant institution," UConn Provost Anne D'Alleva said. "This building is for everyone in the state, and we couldn't be prouder to create it and share it with everyone in our state. It truly represents the dedication of our state leaders, our industry partners, and our entire Connecticut community in advancing learning, research, and economic development."



IMS Director Dr. Steven L. Suib addresses guests at dedication ceremony for Science 1 Research Center

NIH Grant Will Help Unravel the Molecular Mechanisms of Atherosclerotic Vascular Disease

From the Department of Mechanical Engineering

Dr. Anna Tarakanova

Approximately 537 million people worldwide are affected by diabetes mellitus, a condition characterized by high blood sugar levels. By 2030, it is projected that this number will increase to 643 million. Among individuals with diabetes, almost half are older adults aged 65 or above who have type 2 diabetes.

As the global population ages and the number of people with diabetes continues to rise rapidly, this age-related disease poses a significant challenge in the medical and socioeconomic realms.

In people with diabetes and cardiovascular disease, the leading cause of death and disability is a condition called atherosclerotic vascular disease. This disease involves the progressive narrowing and hardening of blood vessels due to complex processes such as calcification, glycation, and crosslinking. However, identifying the specific molecules responsible for this degradation process remains a persistent challenge in the field.

On the other hand, gaining a deeper understanding of the causes of this disease can help us develop strategies to prevent, diagnose, or even reverse the loss of elasticity in arterial tissues.

The research funded by this new NIH R56 grant and carried out in Prof. Anna Tarakanova's group, aims to develop such a deeper understanding by investigating the mechanical deterioration of arterial elastic tissue at various levels, ranging from the sub-molecular to tissue scales. The research will develop a computational framework that simulates and unravels the molecular mechanisms behind the mechanical deterioration of arteries during aging and disease.

Healing Big Broken Bones With a Small Molecule

From UConn Today

(Getty Image)

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.

Cleanly broken bones often heal without problems. But bones with smashed or missing sections are much more difficult to regenerate. Grafting across the gaps using bone from elsewhere is one way to fix them, and about 500,000 bone grafts are done in the US every year. But bone grafts alone don't always work, and they're quite costly. Recently, orthopedic surgeons have begun treating difficult breaks with specific human proteins that encourage bone growth, both alone and paired with grafts or scaffolds. They are used to encourage bone regrowth in spinal fusion surgeries, for example.

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 used a slightly different approach to encourage bone growth. They wanted to release a medicine directly where new bone needed to grow, and do it in a short period of time. So they built a scaffold out of a biodegradable polymer to guide the growth of the new bone. They impregnated the scaffold with 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 longterm use, they engineered the scaffold to release the forskolin almost entirely within a 24 hour period.

They then tested two forskolin-impregnated scaffolds (one high dose, one low dose) against a scaffold impregnated with rhBMP, and a control scaffold that had no bone growth factor added. The scaffolds were applied to rabbits who had serious broken bones in their forelimbs.

The researchers found that the high dose forskolin-impregnated scaffold and the rhBMP-impregnated scaffolds did equally well at encouraging new bone growth in the rabbits' forelimbs. Both were much better than the control or the low-dose forskolin. The short, 24-hour duration of the drug release also seemed to prevent the unwanted side effects often seen in rhBMP treatment.

Although the forkolin scaffold and rhBMP scaffolds performed equally well at encouraging new bone growth and repair, forskolin has certain advantages. It's a small molecule that is more stable, easier to manufacture, lower in cost, and unlikely to incite an immune system reaction.

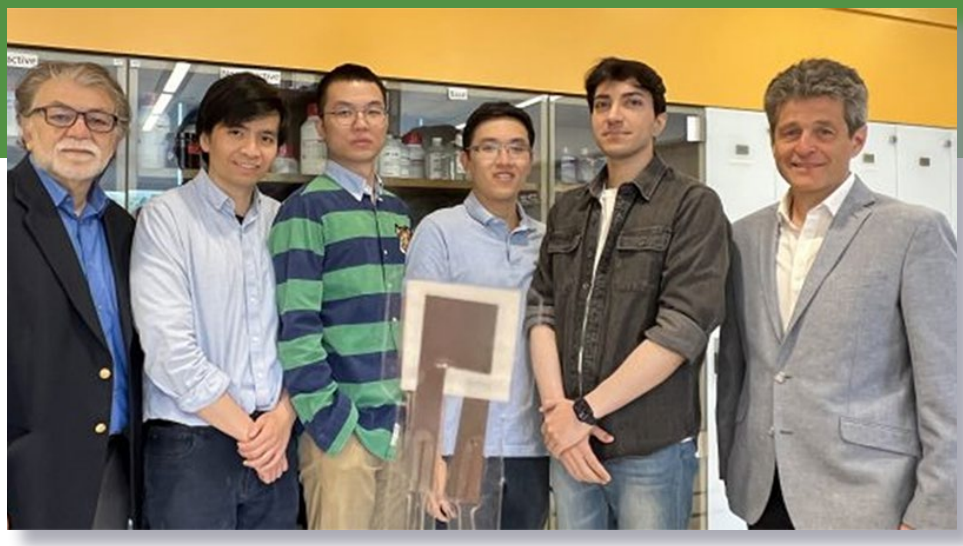
"I am delighted to see the outstanding progress of the field of regenerative engineering leveraging cutting-edge technology to apply to broad fields. The potential of polymeric chemistry and novel biological materials in combination offer new potential to tackle complex societal problems in tissue regeneration. 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.

Future studies will examine forskolin's bone growth effect in more detail, evaluating forskolin's movement and interactions in the body and how it interacts with the body's stem cells in more detail.

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).

Biodegradable Ultrasound Opens the Blood-Brain Barrier Possibly Leading to Treatments for Brain Cancer

From UConn Today



The research team. From left to right: Drs. Kazem Kazerounian, Thanh Nguyen, Feng Lin, Thinh Le, Meysam Chorsi, and Horea Ilies (contributed photo).

A new, biodegradable ultrasound far more powerful than previous devices could make brain cancers more treatable, University of Connecticut researchers report in the June 14 issue of Science Advances.

Brain cancer affects more than 24,000 people in the US every year, and more than 18,000 Americans will die of one in 2023, according to the American Cancer Society.

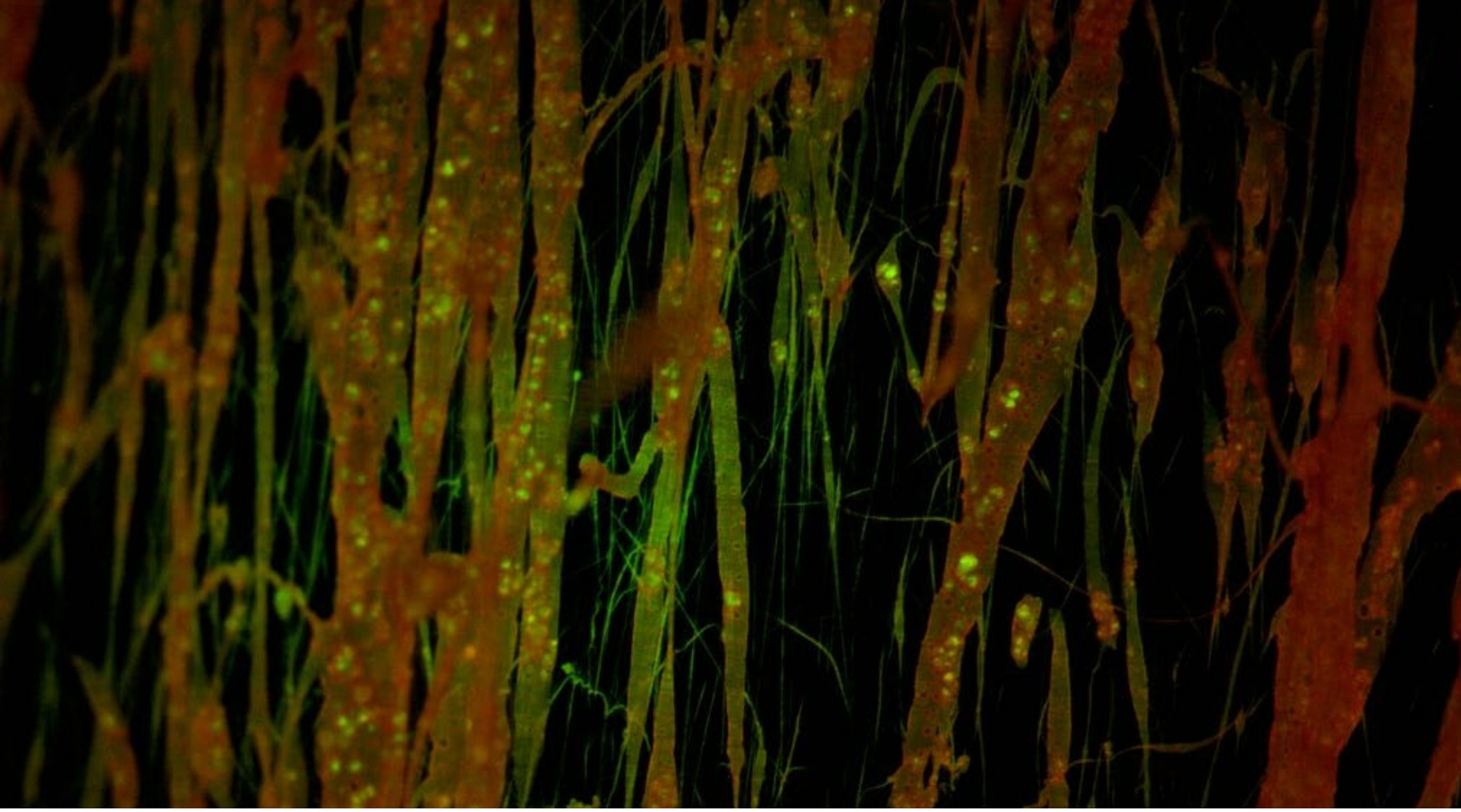
When someone is diagnosed with a cancerous brain tumor, it is usually removed surgically and then chemotherapy is used to mop up the remaining cancer cells left behind. But brain cancers are particularly resistant to chemotherapy because the lining of the blood vessels prevents large molecules that could potentially harm the brain from passing through. These also prevent useful chemo drugs and other therapeutics from killing brain cancer cells and treating other brain diseases. One safe and effective way to get past the blood-brain barrier, as it's known, is to use ultrasound to jiggle cells enough to open pores large enough to allow the medicine to pass through.

A glycine-polycaprolactone ultrasound device degrades rapidly in water, dwindling to almost nothing within minutes (contributed video).
Click image to view video

But getting ultrasound through the thick human skull is not easy. Generally, multiple powerful ultrasound devices must be strategically placed around the skull and carefully focused on the site of the tumor with an MRI machine immediately after chemotherapy is administered in the hospital. The process takes five or six hours and the powerful ultrasound can be damaging to tissue. It is rarely done more than once, even though most patients with aggressive brain cancers receive chemotherapy for months. Applying ultrasound every time the patient received chemotherapy would be much more effective. But because the MRI-ultrasound process is so cumbersome, it is rarely performed.

"We can avoid all of that by using an implanted device" within the brain itself, says biomedical engineer Thanh Nguyen. "We can repeatedly use it, allowing chemo to penetrate the brain and kill off tumor cells." There is already an implantable ultrasound device commercially available, but it is made of ceramic materials that are potentially toxic and must be surgically removed after treatment is finished.

Nguyen's lab specializes in biodegradable, piezoelectric polymers. Piezoelectric means that a material vibrates when a small electrical current runs through it. They had constructed a safe, biodegradable piezoelectric



Nanofibers of glycine spun with polycaprolactone (PCL) (contributed image).

ultrasound brain implant before, but it wasn't as powerful as the traditional piezoelectric ceramics. So the Nguyen lab with graduate students Thinh T. Le and Meysam Chorsi, who is co-advised by Engineering Professor Horea Ilies and Engineering Dean Kazem Kazerounian, along with postdoc Feng Lin, used a totally new technique to produce a biodegradable polymer ultrasound just as powerful as those made of ceramics.

The team wanted to use crystals of glycine, an amino acid that is a common protein in the body and has been recently found to be strongly piezo-electric. Glycine is safe and biodegradable, but too much so; it quickly dissolves in water. Glycine piezoelectric crystals are also brittle and easily shatter, making handling the material and fabricating it into a useful ultrasound device extremely challenging.

The researchers came up with a novel solution. They grew glycine crystals and then intentionally shattered them into pieces just a few hundred nanometers in size. They then spun them (under high voltage in a process called electrospinning) with polycaprolactone (PCL), a biodegradable polymer, to make piezoelectric films composed of nanofibers of glycine and PCL. Under a small driven voltage (~ 0.15 Vrms), the film can generate ultrasound at 334 kilo-Pascals, about the same as a ceramic ultrasound brain implant. The team coats the glycine-PCL film in other biodegradable polymers to protect it. Poly-L-Lactide (PLLA), one possible coating, takes approximately six weeks to break down.

Applying ultrasound every time the patient received chemotherapy would be much more effective. But because the MRI-ultrasound process is so cumbersome, it is rarely performed.

The researchers tested the device in mice with brain cancer. They treated the mice with PTX (paclitaxel), a potent chemotherapy chemical that is effective against brain cancer but difficult to get past the blood-brain barrier. The glycine-PCL ultrasound successfully enabled PTX to bypass the blood-brain-barrier—the tumors shrank and the treatment doubled the lifetime of mice with brain cancer compared to those mice who received no treatment. The combined glycine-PCL ultrasound + PTX treatment was also much more effective for the mice than treating with PTX alone, or PTX and ultrasound from the original, less powerful version of the Nguyen lab's biodegradable ultrasound device, based on PLLA.

In addition to the aforementioned therapeutic efficacy, the team has already done a six-month safety look at the device implanted inside the brain, and found it had no adverse effects on the health of the mice. They will now begin testing safety and efficacy in large animals.

IMS Director Discusses Carbon Capture and Impact Mitigation

From the Institute of Materials Science

Click the image to view the UConn video of Dr. Suib explaining his group's research into carbon capture gel.

Dr. Steven L. Suib, Director of UConn's Institute of Materials Science (IMS), is working to mitigate the effects of greenhouse gases caused by carbon dioxide (CO2) emissions through carbon capture and conversion. His work was recently highlighted in a UConn video. IMS News reached out to Dr. Suib to discuss the impacts of his research.

How does carbon dioxide (CO2) negatively impact the environment and why is the research you are conducting critical to mitigating the impacts of CO2?

CO2 is a product of combustion from gas burning vehicles, industrial plants, and other sources. Enhanced levels of CO2 are believed to be responsible for global warming and the unusual patterns of weather throughout the world in recent years. We are trying to find ways to trap and gather carbon dioxide and also to transform this into materials that are less hazardous and with practical uses.

You state that CO2 must be trapped (or captured) in order to be converted. What methodology or methodologies are used to capture CO2 emissions?

There have been many different methods suggested to capture CO2 including physical methods of trapping in porous materials as well as chemical reactions for storage.

Discovering methods of converting CO2 to harmless but useful products requires the introduction of a catalyst to convert the gas.

You have conducted extensive and often-cited research in catalysis. How does this expertise aid in your research?

The bonds in CO2 are strong and this gas is quite stable. There are many different types of catalysts that we have made. Different reactions are often catalyzed by different catalysts. To find better catalysts they need to be synthesized. The heart of our research programs centers around synthesis of new materials. Unique new materials including catalysts may have different and beneficial properties that commercially available materials do not have.

When you use the term "harmless but useful" in describing products that can be derived from the conversion of CO2, what types of products are possible?

The objective of activating CO2 is to make products that are safe and that can be used in different applications such as new fuels, new chemical feedstocks, and others. These in turn can be used in applications involving sustainable energy, medicines and pharmaceuticals, and new conducting systems (semiconductors, superconductors, batteries, supercapacitors).

Dr. Steven L. Suib, Board of Trustees Distinguished Professor; Director, Institute of Materials Science

It seems we have reached a critical stage in the climate crisis with calls for more research and, above all, action to reduce greenhouse gases and their negative effects. How urgent is the research you and your students and colleagues are conducting to the mitigation of the climate crisis? How close is the research to producing measurable outcomes?

The field of capturing and activating CO2 is very active right now, with numerous groups around the world trying to solve problems that would allow CO2 to be eventually used in many different commercial processes. Our work involves a small set of potential materials for capture and activation of CO2. There are measurable improvements in capture and activation. The key will be to push this to the limit so practical processes can be used.

UConn AAUP Honors Diane Burgess with Edward C. Marth Mentorship Award

From UConn Today

Dr. Diane Burgess

The UConn AAUP established the Edward C. Marth Mentorship Award to recognize the leadership and dedication of Edward Marth, former Executive Director of the UConn AAUP Chapter, and to encourage and reward outstanding mentoring of graduate students by UConn graduate faculty members. Recipients of the award have had direct and significant impact and involvement with graduate students, outstanding commitment, and effectiveness as a mentor of graduate students at UConn and have demonstrated unusual effort to provide consistent mentoring of graduate students during their careers.

Recipients of the Edward C. Marth Mentorship Award are UConn graduate faculty members who have extraordinary records of excellence and effectiveness in activities such as facilitating smooth transitions for both entering and exiting graduate students; showing sensitivity to students' academic, personal, and professional goals and needs; being accessible to students; playing an active role in coaching graduate students through the graduate school experience and connecting them to appropriate intellectual and professional networks; and, guiding graduate students toward intellectual and professional independence.

"Dr. Burgess has played a pivotal role in shaping my graduate career, providing mentorship that extends far beyond the boundaries of the laboratory," says Suraj Fanse, a current graduate student in Burgess's lab. " 'If you cannot pay it back, pay it forward.' This ethos embodies not only her teachings but her way of life. Dr. Burgess' mentorship has been nothing short of transformative. The impact of her mentorship on my academic and personal development is truly immeasurable. She is an exceptional mentor, inspirational educator, a prolific leader, and an extraordinary visionary who has touched the hearts of all who have had the privilege of working under her guidance!"

"Acceptance into the Ph.D. program in Dr. Burgess Lab was a pivotal moment in my life. It opened a whole new world for me," says Yan Wang who graduated from Burgess's lab in 2013. "From the moment I joined Dr. Burgess's lab, she has been an inspiration, a role model, and a great mentor. Although it has been more than 10 years since my graduation, Dr Burgess's mentorship has continued to play a pivotal role in my professional career and personal life. She now encourages my young daughters to reach their full potential, and they look up to her and love her as I do. If I were to come up with a motto to describe her nurturing philosophy, it would be to 'work hard, work smart, and enjoy life'!"

As tradition for the recipient of the award, Burgess will address the doctoral degree recipients at the Doctoral Commencement Ceremony on May 6th, 2024.

IMS Members Awarded OVPR Internal Research Funding

Quantum Startup (QSU) Awardees:

Alexander Balatsky, Physics - $15,000
Doublet Labs

Bodhisattwa Chaudhuri, Pharmaceutical Science - $15,000
QUASIM: A groundbreaking and novel quantum computing software for manufacturing process modeling

Sanjeev Nayak, Materials Science and Engineering - $15,000
Business Model Development for Topological Quantum Materials

The Quantum Innovation Seed Grant (QISG) Awardees:

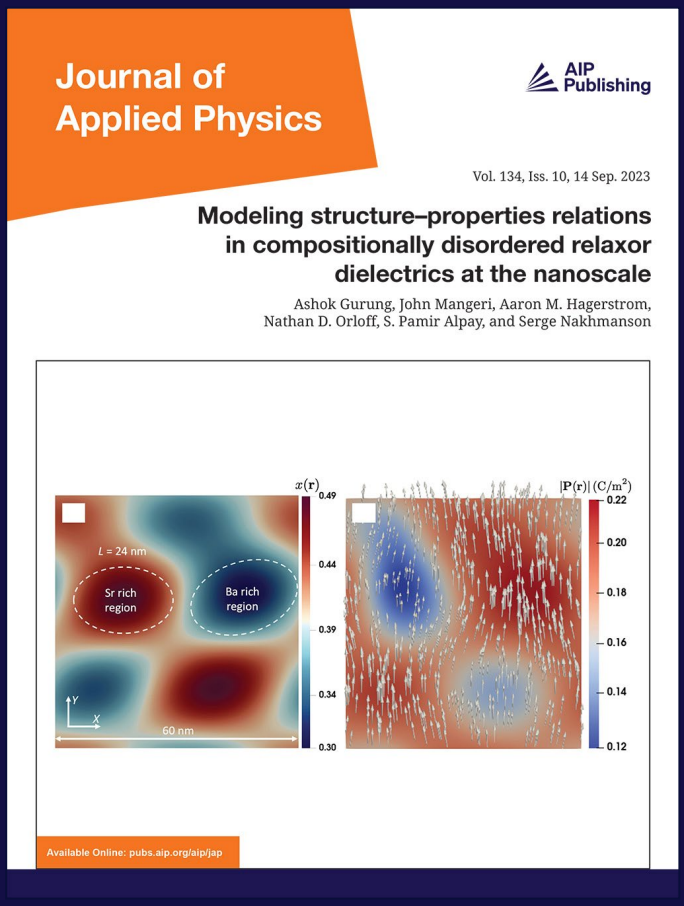
Ilya Sochnikov, Physics - $50,000
Superconducting Quantum Microwave Sensors for Topological and Magnetic Materials

The Innovations in Quantum Stem Education (IQSE) Awardees:

Jason Hancock, Physics - $50,000
The QEd project: developing quantum conceptualization in UConn's STEM curriculum

The Convergence Award for Research in Interdisciplinary Centers (CARIC) Awardee:

Baikun Li, Civil and Environmental Engineering - $150,000
Center of Quantum Technology for Carbon Sequestration



Work of MSE Professors Featured on Cover Of Journal Of Applied Physics

From the Department of Materials Science and Engineering

A research paper by Material Science and Engineering (MSE) Department professors, S. Pamir Alpay and Serge Nakhmanson, entitled "Modeling structure–properties relations in compositionally disordered relaxor dielectrics at the nanoscale," was featured on the September 2023 cover of the Journal of Applied Physics. Two other researchers involved with the research are UConn alums Ashok Gurung and John Mangeri.

Their work involves understanding the influence of microstructure and morphology in dielectric materials, such as relaxor Ba1-xSrxTiO3, on their properties and performance in a variety of technological applications. They studied the frequency-dependent dielectric response of this solid-solution system while accounting for the local fluctuations in its composition. To do this, they adopted a phase-field method combined with finite element based simulations.

S. Pamir Alpay has been a part of UConn's MSE department since 2001. He served as MSE's Department Head from 2013-2017, and was made a Board of Trustees Distinguished Professor in 2020. Currently, he serves as UConn's Vice President for Research, Innovation, and Entrepreneurship. Serge Nakhmanson has been at UConn since 2013 and is an Associate Professor in MSE and Physics departments. Currently, he serves as MSE's Director for Accreditation.

IMS FACULTY MEMBERS

Resident Faculty Members


Douglas Adamson


Mark Aindow


S. Pamir Alpay


Alexandru Asandei


Kelly Burke


Yang Cao


Avinash Dongare


Elena Dormidontova


Mihai “Mishu” Duduta


Alexander Dupuy


Lesley Frame


Pu-Xian Gao


Jason Hancock


Rainer Hebert


J. Nathan Hohman


Bryan Huey


Menka Jain


Jasna Jankovic


Rajeswari Kasi


Seok-Woo Lee


Yao Lin


Anson Ma


Vahid Morovati


Serge Nakhmanson


Mu-Ping Nieh


Volkan Ortolan


Fotios Papadimitrakopoulos


Yang Qin

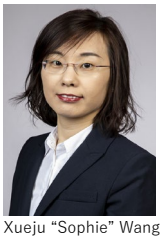

George A. Rossetti


Thomas Seery


Gregory Sotzing


Steven L. Suib


Luyi Sun


Xueju “Sophie” Wang


Yi Zhang


Yuanyuan Zhu

Full Faculty Listing

Emeritus Faculty

Student News

2023-24 Polymer Program first year students. Vishwa Suthar (left) and Hoang-Phuc Pham

Dr. Jaime A. Gómez (’89) Returns to UConn as 2023 Polymer Distinguished Alumni

From the Institute of Materials Science

2023 Polymer Program Distinguished Alumni Dr. Jaime A. Gómez (center) with Polymer Program Director Dr. Kelly Burke (left) and Dr. Luyi Sun (right)

The IMS Polymer Program honored Dr. Jaime A. Gómez as its 2023 Distinguished Alumni.

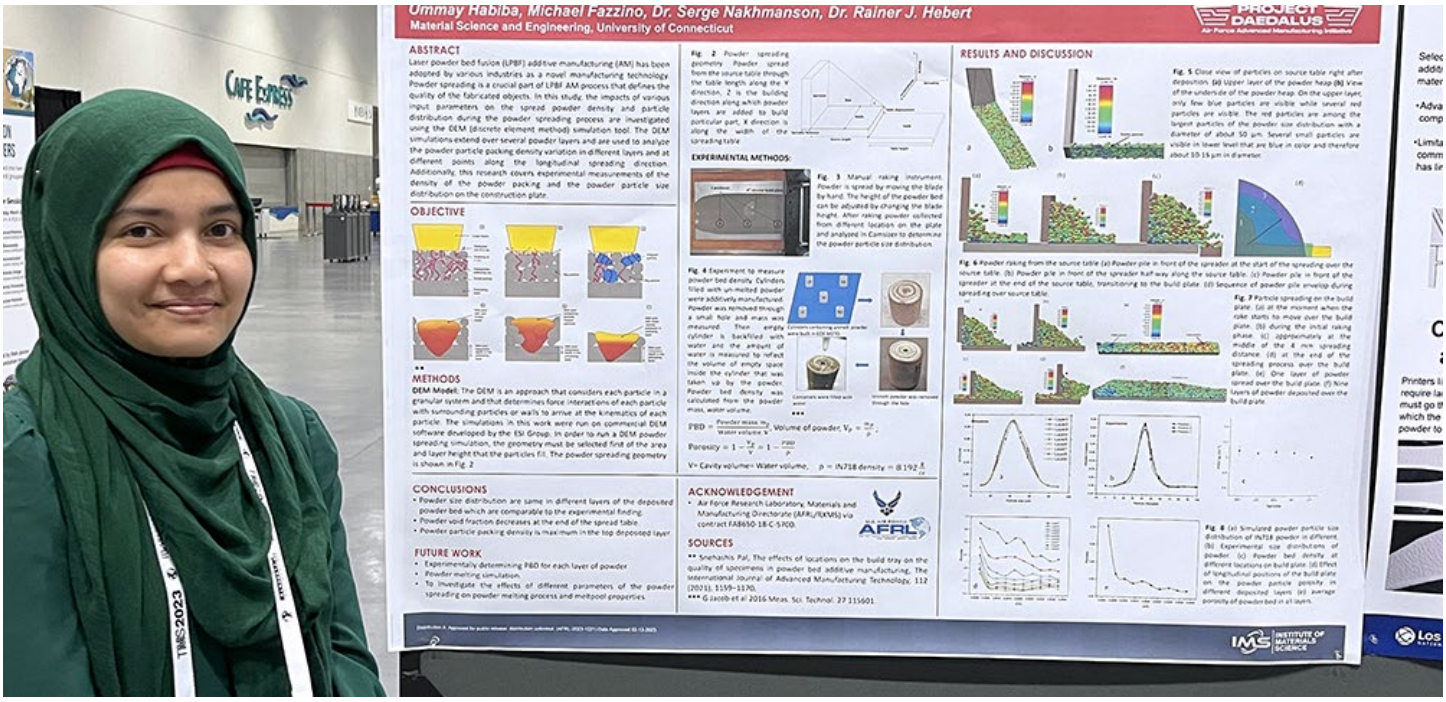
Dr. Gómez completed his Polymer Ph.D. at UConn in 1989 before beginning his career as a scientist and organizational leader. He has had a successful career including both research and leadership roles. On Friday, September 8, he opened the fall 2023 Polymer Seminar series with his talk titled, “Unexpected Challenges in the Life of a Polymer Scientist”. The talk included stories of research, product development, and exploring various real world challenges during his 30-year career as a polymer scientist. The theme of his presentation is that scientists build a foundation of knowledge and skills during their academic career, but face new and unexplored fields in the industrial setting.

Dr. Gómez received a BS in Chemical Engineering from Universidad Pontificia Bolivariana in Colombia, an MS in Organic Chemistry from Wichita State University, Kansas, and a Ph.D. in Polymer Science from the University of Connecticut. In addition to his scientific education, Dr. Gómez received an MBA from New York University (Stern School of Business) with concentration in International Business, Finance & Marketing. Dr. Gómez has 30-years of industry experience that includes plastics, specialty chemicals, and materials handling—industries where he has conducted basic and applied research, evaluation and acquisitions of technologies and companies, international business development, and corporate strategic planning. Gómez is currently President & CEO of Equitech, a company dedicated to the in-line measurement of chemical concentration, and color and film thickness for a myriad of industries.

Dr. Gómez has been an active member and leader of the Society of Plastics Engineers (SPE) for the past 35 years. He joined the Society of Plastics Engineers in 1987 while pursuing his Polymer Ph.D. here at UConn, serving as SPE’s student chapter president for two terms. He also served as a member of SPE’s Extrusion Division Board of Directors for six years and helped establish the Next Generation Advisory Board (NGAB). Dr. Gómez has been a member of SPE’s Board of Directors since 2013 and has served as SPE’s Secretary, Treasurer, VP Marketing & Communications, VP Events, and President-Elect. He received SPE’s President’s Cup in 2014 and the Excellence in Mentoring Award in 2017. He also invented and directed The Plastics Race™, an event that promotes networking and knowledge exchange between SPE members. Gómez was named President of SPE for the 2020-2021 term.

MSE Ph.D. Student Ummay Habiba Featured in MDPI Journal - Materials

From the Department of Materials Science and Engineering



Ummay Habiba, 5th year Ph.D. student in materials science and engineering (MSE).

Ummay Habiba, 5th year Ph.D. student in materials science and engineering (MSE), had two recent publications featured in the MDPI journal.

Published in April of 2023, the first article is titled "Powder Spreading Mechanism in Laser Powder Bed Fusion Additive Manufacturing: Experiments and Computational Approach Using Discrete Element Method". In Habiba's study, the impact of powder spreading in Laser Powder Bed Fusion (LPBF) additive manufacturing was investigated, with a focus on the influence of various input parameters. Utilizing the Discrete Element Method (DEM) simulation tool, the effects on powder density and particle distribution were systematically explored across multiple layers. Beyond simulation her research also covers experimental measurements to unveil variations in powder density and particle size distributions on the construction plate. This comprehensive analysis provides valuable insights into the optimization of fabricated object quality in the dynamic realm of LPBF additive manufacturing.

Another article, titled "Powder Bed Thermal Diffusivity Using Laser Flash Three Layer Analysis", was published in September of 2023. This article explores the intricate relationship between thermal diffusivity and mechanical properties in LPBF additive manufacturing. It focuses on the precise measurement of thermal diffusivity in the nickel-based super alloy Inconel718 (IN718). Additionally, comprehensive measurements at varying temperatures were conducted on a three-layered sample using laser flash three-layered analysis equipped with a dedicated powder cell. This article provides insights crucial for optimizing the LPBF process and enhancing the mechanical integrity of fabricated components.

For Habiba, her interest in research started in Bangladesh, the country where she grew up. There she realized materials science and engineering impacts every aspect of our lives and decided to pursue a career in MSE. One of her key aspirations in research is to achieve breakthroughs that contribute to advancements in the manufacturing sectors.

Under the guidance of Professor Rainer Hebert, Habiba expressed her gratitude, stating, "I am very fortunate to have the opportunity to work with a supportive and professional supervisor who has provided me with a positive work environment and strong connections to the industry. Work doesn't feel like work when you're living your passion. I count my blessings daily for the opportunity to do what I love. It's a privilege I don't take for granted."

Amy Pollock Receives Future Climate Venture Studio Fellowship

Excerpted from UConn Today

Ph.D. Materials Science student, Amy Pollock

UConn's Future Climate Venture Studio has created a fellowship program designed to provide tangible experiences for students interested in learning in start-ups, marketing, commercialization, venture development, and research around climate change. Materials Science Ph.D. student, Amy Pollock, is one of three UConn graduate students to receive the fellowship. Fellows were selected for their excellent writing skills, science, technical, or business background, interest in the entrepreneurial process, interest in addressing climate change, and their ability to work independently and handle confidential material. The program partners each student with 2 start-up companies that need advice and/or assistance within a specific discipline. This enables the companies to have access to scientist working in their field while the students gain insight regarding the many challenges of creating and maintaining a startup company. The program is one more example of UConn's support of entrepreneurship for both students as well as faculty.

Amy will be working with the following companies:

Peat (formally, "Afterlife") – [eliminating food waste]: https://www.peatfarming.com/

Homeostasis – [Carbon removal & utilization]: https://www.homeostasis.earth/

Details regarding the Future Climate Venture Studio and the fellowship can be found at: https://www.futureclimateventurestudio.com/

Polymer Program and MSE Hold Joint Poster Session

From the Institute of Materials Science

Students and industry partners interact during 2023 Polymer Program/MSE Joint Poster Session

The IMS Polymer Program, IMS Materials Science Program, and the Materials Science and Engineering Department (MSE) held their first in-person poster session since 2019 in the brand new Science 1 Research Center. The COVID pandemic put this traditional event on hold for 3 years. 42 graduate students from twenty research labs presented posters. Students welcomed the opportunity to share their research and ideas with other students, faculty, and guests from industry. The session, coordinated alongside the IMS Industrial Affiliates Program (IAP) 2023 Annual Meeting, brought over 100 industry partners to meet the students and faculty participants. The new building with its open layout added energy to the event.

Hanyi Duan Wins Samuel J. Huang Award

From the Institute of Materials Science

Polymer Program Director Dr. Kelly Burke (l) and Dr. Jie He (r) present the Samuel Huang Research Award to Hanyi Duan.

Polymer Program Ph.D. student, Hanyi Duan, was the 2023 recipient of the Samuel J. Huang Graduate Student Research Award. Hanyi was recognized for his success in research, journal articles, and strong collaborative nature in the research laboratory. As a researcher, Hanyi has taken a leading role in developing new synthetic methodology to asymmetric polymer grafted metal nanoparticles. This research was the foundation of 6 publications as lead author. Hanyi is pictured with Polymer Program Director, Dr. Kelly Burke, and his major advisor, Dr. Jie He.

Kerry Lynn Davis-Amendola Explains How EIRC Lab Mates are Like Family

From the Institute of Materials Science

"I have a challenging PhD situation. I began my PhD in 2017 part time, meaning that I was working full-time and taking classes at night. Due to this, I was not privy to the normal PhD experience in some ways. I was not exactly a first year or a second year because I was studying along at my own pace on my own time. Due to this, I did not meet fellow students in my "year" or have a connection to anyone else in the program. During my already strenuous coursework, this led to feelings of loneliness. In 2020 it was time for me to join a lab and start my thesis research. I met a professor, Dr. Yang Cao, who I automatically connected with and decided to join his group at the University of Connecticut (UConn): Electrical Insulation Research Center (EIRC). To accommodate my research, I went part time at my day job, allowing me to spend full days at the university lab. This was the best decision I have made in my PhD endeavors, and I began to unveil the absolute best part of the PhD process, my lab mates."

Kerry Lynn Davis-Amendola beautifully shares her experience as a current Ph.D. student in the Electrical Insulation Research Center (EIRC) paying special attention to the importance of her lab mates and the camaraderie that awaited her when she joined the lab. The inspiring article, The Best Part of a PhD that No One Is Talking About, appears in the "Young Professionals" section of the July/August 2023 edition of the journal IEEE.

MSE Ph.D. Student Kerry Lynn Davis-Amendola

Antigoni Konstantinou Receives 2023-2024 GE Fellowship for Excellence

From the Institute of Materials Science

Ph.D. student Antigoni Konstantinou

The College of Engineering recently announced the recipients of its General Electric Fellowship for Excellence. The award was established to recognize the excellence of current graduate students and to facilitate their completion of the Ph.D. program. Fellows are selected for their outstanding track records in research and professional service in the areas of advanced materials, manufacturing, and energy. Antigoni Konstantinou, an Institute of Materials Science (IMS) Materials Science Program Ph.D. student, has been named a recipient of this honor.

Ms. Konstantinou has exhibited academic excellence in both research and leadership. She currently serves as president of the 2023-2024 e-board for the John Lof Leadership Academy (JLLA). From this position, she empowers UConn's graduate student community by nurturing essential leadership skills, especially for women in STEM. She is also a former secretary of the UConn chapter of the Materials Research Society (MRS).

Since joining the IMS Materials Science Ph.D. program in Spring 2021, Antigoni has been working with advisor Prof. Yang Cao and his Electrical Insulation Research Center (EIRC) utilizing materials preparation and electrical engineering techniques to develop nanostructured insulation materials to protect high-voltage electric motors from high electric fields. This research bridges Materials Science with Electrical Engineering.

IMS and the EIRC congratulate Antigoni on this well-deserved honor.

Xiangyi Xi Wins Stephanie H. Shaw Scholarship

From the Institute of Materials Science

IMS Polymer Program Director, Dr. Kelly Burke, presents the Stephanie H. Shaw Scholarship award to Xiangyi Xi.

Polymer Ph.D. student, Xiangyi Xi was the 2023 recipient of the Stephanie H. Shaw Scholarship. She made some major contributions in developing biosensors for the Papadimitrakopoulos research lab. She helped implement a multi-potential step pulsing test technique which lead to increased sensitivity and reduced power consumption of implantable glucose sensors. This lead to a patent currently in application. More recently, she has helped develop an enzymatic cascade sensor. In addition to her research, Xiangyi has continued to mentor the next wave of scientists, including 10 undergraduates over the past 5 years.

Masha Aleksich Wins Top Poster Prize at ACS NERM 2023

From the Institute of Materials Science

Mariya "Masha" Aleksich won first place in the American Chemical Society's (ACS) Northeast Regional Meeting 2023 (NERM) Graduate Student Poster competition for her presentation, *Topological Engineering by Size and Steric Direction of Metal-Organic Chalcogenate (MOCha) Hybrid Assemblies*.

A graduate student in Dr. Nate Hohman's group, Masha's research concentrates on optimizing synthesis of MOCHas for comprehensive characterization.

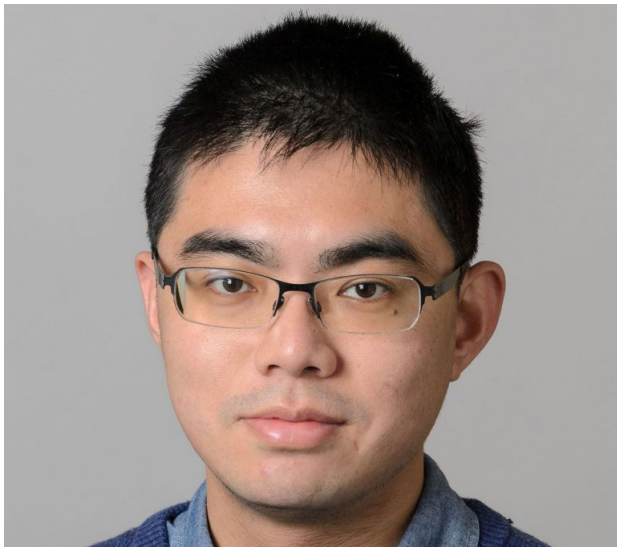
Masha holds a B.S. in chemistry from Texas A&M University (2020) where she focused on synthesis of chiral amino acid-based surfactants. She is a third-year graduate student in the Hohman Group. She also serves as vice president and treasurer of the Joint Safety Team in the Department of Chemistry.

IMS congratulates Masha on this impressive recognition.

MSE Graduate Student Masha Aleksich

Chung-Hao Liu Completes his Polymer Ph.D.

From the Institute of Materials Science



Dr. Chung-Hao Liu

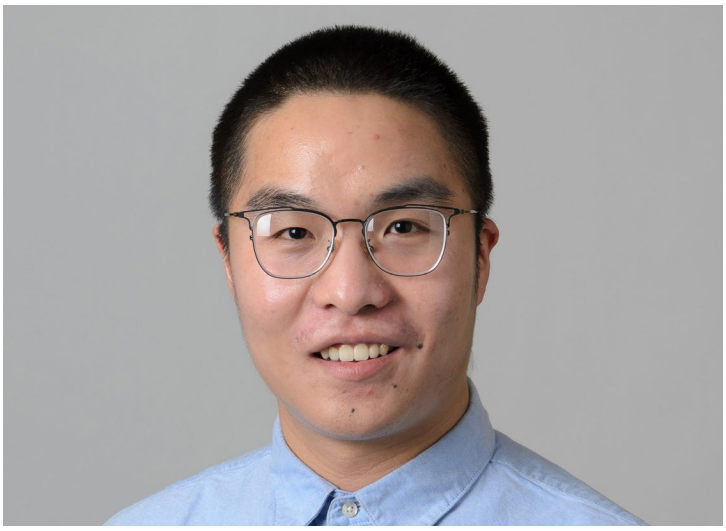
After completing his BS and MS in Taiwan, Chung-Hao Liu came to the US to join UConn's Polymer Ph.D. Program. He worked under the guidance of Prof. Mu-Ping Nieh to learn the principles of self-assembly and structural characterization using neutron, x-ray, and light scattering. Chung-Hao was a productive student in scientific output with 3 lead-author, and 14 coauthored publications in prestigious peer-reviewed journals (including Journal of American Chemical Society, Angewandte Chemie, Advanced Functional Materials, Journal of Colloid and Interface Science, Nanoscale, Macromolecules, ACS Macro Letters, etc.) and more to come.

Reflecting on his experience at UConn, Chung-Hao says he loved the collaborative nature of the Institute of Materials Science with both faculty and students. The interdisciplinary research projects allowed him to speak with chemists and engineers from various backgrounds. He also noted that faculty were always open to providing help whenever he encountered problems. Chung-Hao also enjoyed freedom in research the pursuit of research projects without being micromanaged.

Chung-Hao completed his dissertation defense, "Encapsulation and Polymerization in the Fluid Phase of a Well-Defined Bicellar Template," in spring 2023 and started his new journey in July 2023 as a postdoctoral scientist at the Oak Ridge National Laboratory.

Zaili Hou Completes his Polymer Ph.D.

From the Institute of Materials Science



Dr. Zaili Hou

After completing a bachelor's degree in chemistry at Lanzhou University in Gansu province, China, Zaili Hou became a Polymer Ph.D. student in the UConn IMS Polymer Program. With a desire to focus his research on hybrid functional materials, Zaili joined Dr. Luyi Sun's research group in 2018.

Hybrid functional materials, which consist of two or more distinct components with unique physical and chemical properties, exhibit synergistic properties, making them highly versatile and suitable for applications in various fields, including energy, healthcare, optics, and electronics. Zaili's research led him to his dissertation topic, "Hybrid Functional Materials with Multiscale Architecture Design." He successfully defended his dissertation in March 2023 and earned his doctoral degree as a result.

Reflecting on his time at UConn Zaili noted that he received excellent training and felt a strong sense of community during his time in the UConn IMS Polymer Program, which left him with a very positive overall experience. He says he appreciated access to the numerous core labs in IMS and the training available from the technical staff. He felt that direct access to the instrumentation in those labs gave him a better understanding of the science and contributed to his successful research. He also emphasized that the multi-disciplinary foundation of IMS helped create a community with multiple perspectives on the research. In addition to disciplinary diversity, Zaili also enjoyed the cultural diversity found in IMS. This helped him learn about various religions, philosophies, and cultural practices around the world.

With a desire to contribute to a better planet, Zaili began his career with World Centric, a company dedicated to sustainable products. World Centric is creating compostable and sustainable products to help reduce plastic waste that currently pollutes our planet.

"I'm very excited about making contributions to this important cause and making practical applications of polymer science to real-world issues," Zaili said.

Polymer Program Quick Facts

STUDENTS

87

M.S. - PH.D
POLYMER SCIENCE

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RECENT STUDENT AWARDS

- **AICHE WIC Award**
  Sanyukta Patil
- **Future Climate Venture Studio Fellowship**
  Amy Pollock

18 FACULTY MEMBERS

FACULTY DEPARTMENTS

Biomedical Engineering * Chemical & Biomolecular Engineering * Chemistry * Civil Engineering * Materials Science & Engineering * Physics

FACULTY EXPERTISE

- Biomedical/Biomimetic Materials
- Electronic Materials
- Materials for Energy Systems
- Smart and Responsive Materials
- Sustainable Materials

RECENT FACULTY AWARDS

- DoEd. - GAANN
- NIH - MIRA
- NIH Trailblazer
- NSF CAREER Award
- NSF - DMREF
- NSF - EFRI

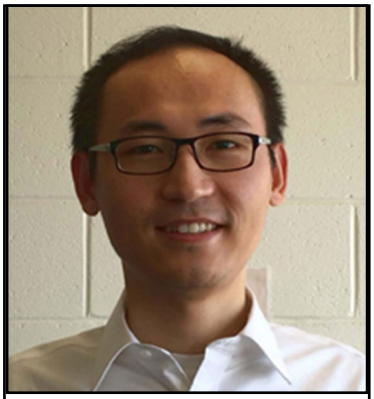
CORE FACILITIES

- Chromatography (e.g. GPC, GC, HPLC)
- Electrical Insulation Research Center
- High Field Characterization
- Spectroscopy (e.g. UV, Raman, FTIR, MS)
- Mechanical Testing and Rheology
- Microscopy (e.g. AFM, SEM, TEM)
- Nano-Measurements
- Nuclear Magnetic Resonance
- Polymer Processing
- Surface Analysis
- Thermal Analysis

CONGRATULATIONS

Ms. Kerry Lynn Davis-Amendola, M.S.

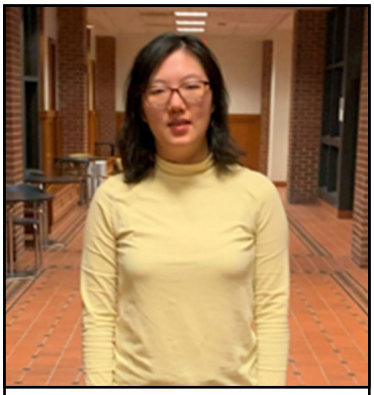
Major Advisor: Dr. George Rossetti



Dr. Guang Chen

"Polymer Brushes: from One-Dimensional Bottlebrush Polymers to Two-Dimensional Polymer Grafted Nanopores"

Major Advisor: Dr. Elena Dormidontova



Dr. Catherine Cheu

"Small Angle Scattering Modeling for Analyzing Refined Internal Structures of Lipid Nanodiscs (Bicelles)"

Major Advisor: Dr. Mu-Ping Nieh

Dr. Can Cui

"Nano-engineered Transition Metal-based Electrocatalysts for Highly-enhanced Oxygen Evolution Reaction"

Major Advisor: Dr. Pu-Xian Gao

Dr. Mohamad Reza Daeipour

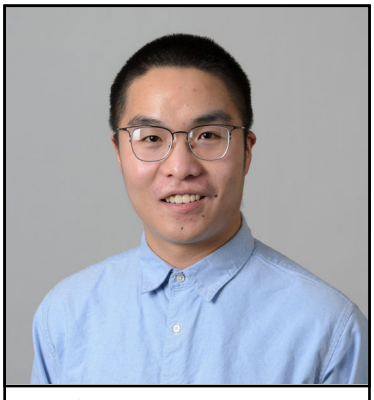
"Nano-engineered Transition MApplication of an End Chilled Benchmark Casting Process for the Development of Quantitative Quality Criteria in Novel Aerospace Aluminum Alloys"

Major Advisors: Dr. Serge Nakhmanson
Dr. Harold Brody

Mr. David Goral

Graduate Certificate in Advanced Materials Characterization

ICU Medical



Dr. Zaili Hou

"Hybrid Functional Materials with Multiscale Architecture Design"

Major Advisor: Dr. Luyi Sun

Dr. Jacob Jackson

"Evaluation of Titanium Milling Swarf Contamination and Properties for Recovery and Reuse"

Major Advisor: Dr. Lesley Frame

Dr. Janos Edwin Kanyo

"Evaluation of Strontium Zirconate Ceramics for Investment Casting of Advanced Alloys"

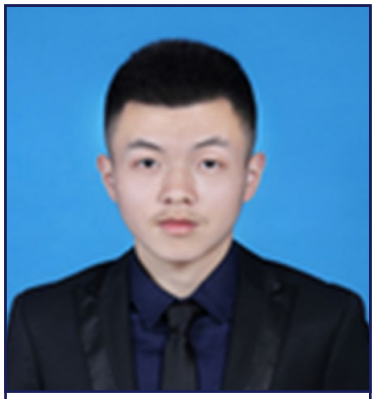
Major Advisor: Dr. Lesley Frame

GRADUATES

Dr. Donghyun Kim

"Predicting Galvanic Corrosion in Legacy Bridges: Plain Carbon Steel and Weathering Steel"

Major Advisor: Dr. Lesley Frame



Dr. Yi Li

"Reconfigurable Liquid Crystal Elastomer and Multistable Structures for Intelligent Systems"

Major Advisor: Dr. Xueju Wang

Mr. Zhongyuan Li, M.S.

Major Advisor: Dr. Seok-Woo Lee

Dr. Chung-Hao Liu

"Encapsulation and Polymerization in the Fluid Phase of a Well-defined Bicellar Template"

Major Advisor: Dr. Mu-Ping Nieh

Dr. Fangyuan Liu

"Etching-Induced Zinc Oxide Nanostructure Evolution in Aqueous Hydrochloric Acid: from in situ TEM Study to Catalytic Energy Application"

Major Advisor: Dr. Pu-Xian Gao

Dr. Shayani Parida

"Design/Discovery of Layered Anode Materials Using Density Functional Theory and Machine Learning"

Major Advisor: Dr. Avinash Dongare

Dr. Thomas K. Reid

"Quantum Materials from the Ground Up: From Methodology to Application in Density Functional Studies of Topological Insulators"

Major Advisor: Dr. S. Pamir Alpay

Mr. Aleks Rosenbaum

Graduate Certificate in Advanced Materials Characterization

Pratt & Whitney

Mr. Jay Scala, M.S.

Major Advisor: Dr. Seok-Woo Lee

Dr. Elyse Schriber

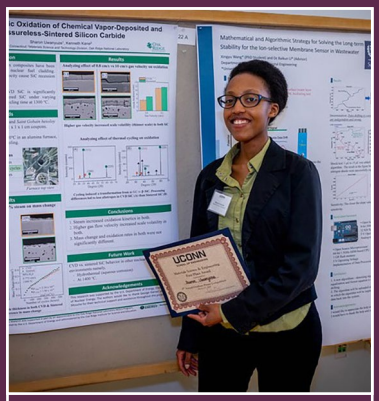
"The X-ray Gambit: Structural Characterization of Metal-Organic Chalcogenolates using Advanced X-ray Scattering and Diffraction Methods"

Major Advisor: Dr. James Hohman

Dr. Jiyu Sun

"Design and Enabling of Multifunctional ZnO Nanoarray-Based Monolithic Devices for Decarbonization"

Major Advisor: Dr. Pu-Xian Gao



Dr. R. Sharon Uwanyuze

"Investigation of strontium zirconate refractories for preventing metal-mold reactions during casting of titanium alloys"

Major Advisor: Dr. S. Pamir Alpay

Mr. Zubin Jimmy Wadia, M.S.

"Qualifying 17-4 PH Steel Powder in Additively Manufactured Parts"

Major Advisor: Dr. Rainer Hebert

Dr. Shuyang Xiao

"Mechanical Behavior of SrNi2P2 Single Crystals at Small Length Scales"

Major Advisor: Dr. Seok-Woo Lee

Dr. Jiyao Zhang

"Investigation of Strontium Zirconate as a Promising Ceramic Shell Mold Material for Investment Casting of Nickel Superalloys"

Major Advisor: Dr. Steven L. Suib

Dr. Jiuzhou Zhao

"Layer-by-layer Assembled Polyamide for Endogenous Redox-active Interference Molecules Rejection"

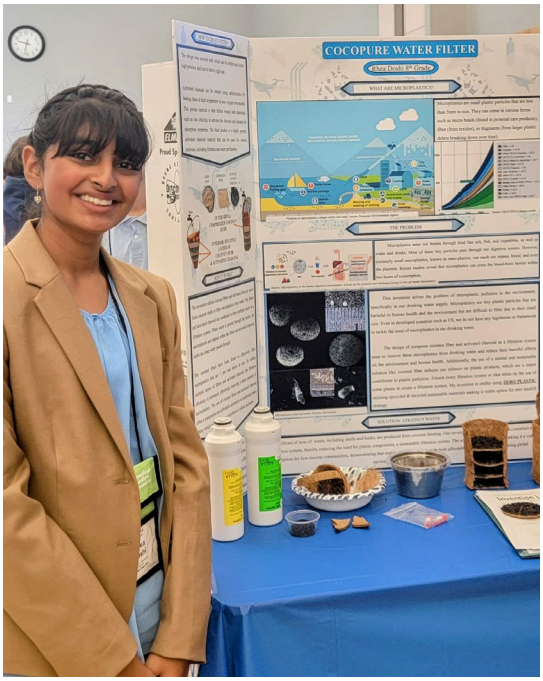
Major Advisor:
Dr. Fotios Papadimitrakopoulos

IMS Congratulates all of our graduates and wish each of them success as they embark on their careers, taking the knowledge gained here at UConn into the worlds of industry and academia.

Outreach News
Staff News

CIC Award Winner Repurposing Waste to Decontaminate Water

From the Institute of Materials Science



Rhea Doshi with her CIC invention, CocoPure Water Filter.

Congratulations to Rhea Doshi for winning the 2023 Excellence in Materials Science award for her project titled "CocoPure Water Filter"! This award was created by the Institute of Materials Science in partnership with the Connecticut Invention Convention (CIC) and is issued annually to CIC participants.

The CIC is an internationally recognized educational organization that uses invention and entrepreneurship to develop student skills in creative problem-solving and critical thinking and has supported STEM initiatives for students in grades K-12 since 1983. The State Finals were hosted on the University of Connecticut Storrs campus this past year. The competition included the top 250 student inventors out of the 12,000+ that participated in Invention Convention programming during the 2022-2023 academic year.

Rhea was an eighth-grade student at Talcott Mountain Academy upon her win in spring of 2023. Her current interests lie in science, mathematics, and coding. She was able to display her talent for the sciences at this year's CIC State Finals, her first time participating in the competition. She shared, "My motivation for participating was to receive feedback on my invention so that it could be improved and made better in every way. The concept and creation I created had value to me, and I wanted to know if others felt the same way about using my invention."

The concept was inspired by a family trip to India where discarded coconut husks sparked an intrigue in how this naturally decomposing waste could be repurposed. Using the coconut fibers and activated charcoal derived from the husks, Rhea created the CocoPure Water Filter which helps remove microplastic contamination in water. Describing the filtration process Rhea explains, "When water is poured into the filter, the coconut fibers serve as the preliminary layer, capturing larger contaminants. The active charcoal, due to its adsorption properties and micropores, then adsorbs and captures micro and nano-sized particles, effectively removing microplastics."

The objective was to find a material that was abundant, cost-effective, upcycled, and zero waste that could contribute to cleaner water worldwide by combating microplastic contamination. However, this goal did not come without its challenges. The first being finding a material that fit each of those criteria, the second being how to measure the microplastic contaminants, and a third being durability, so as to not only create something effective but long-lasting. Rhea overcame each of these challenges stating, "In essence, the invention process taught me the value of persistence and adaptability. Every setback was a lesson, every challenge an opportunity to learn and innovate further."

Whether by household filters where clean drinking water is scarce, water treatment facilities lacking proper methods for addressing microplastics, or water grates to intercept microplastics before they reach our oceans, Rhea sees her invention assisting with the global microplastics issue in the future. She hopes to continue her research by delving deeper into such topics as longevity of the filter and potential bioremediation techniques. Rhea hopes her passion to help others will lead to a future in the healthcare field where she can continue to use her innovative ideas to change our world for the better.

Rhea Doshi in the lobby of the Science 1 Research Center

IMS Industrial Affiliates Program Hosts 2023 Annual Meeting

From the Institute of Materials Science

IMS Industrial Affiliates Program members in the Science 1's Active Learning Classroom during the 2023 Annual Meeting Morning Session

On May 25, 2023, the Institute of Materials Science (IMS) Industrial Affiliates Program (IAP) held its first in-person annual meeting since the onset of the COVID-19 pandemic in 2020.

The meeting began with a welcome message by Dr. Hatice Bodugoz-Senturk, Associate Director of the IMS Industrial Affiliates Program, followed by remarks by Dr. Steven L. Suib, Director of IMS, and Dr. Paul Nahass, Director of the IMS Industrial Affiliates Program. Dr. Bryan Huey, Department Head of Materials Science and Engineering (MSE) gave an overview of the MSE department and its achievements; and Dr. Kelly Burke, Director of the IMS Polymer Program, discussed the latest developments in polymer science.

The morning session featured three presentations by IMS faculty members from different departments. Dr. James "Nate" Hohman, Assistant Professor of Chemistry, talked about his research on experimental foundations for next-generation materials and interfaces, and how he uses big science, big data, and big AI to discover new materials for various applications. Dr. Georgios Matheou, Assistant Professor of Mechanical Engineering, presented his work on predictive modeling and simulation of multi-physics flows, and how he collaborates with industry partners in renewable energy, aerospace, and health care sectors. Dr. Vahid Morovati, Assistant Professor of Civil and Environmental Engineering, explained his theoretical framework to model the long-term mechanical behavior of elastomeric materials considering damage accumulation and degradation.

The luncheon session featured a keynote address by Dr. Anne D'Alleva, Provost and Executive Vice President for Academic Affairs, who shared her vision and goals for UConn's academic excellence and innovation. She also highlighted the importance and impact of materials science and engineering in addressing the global challenges and opportunities in the 21st century. The luncheon concluded with closing remarks by Dr. Paul Nahass.

The meeting was attended by more than 100 participants from industry affiliates and external partners along with IMS faculty, students, and alumni. The meeting also showcased the annual Joint Poster Session by IMS Polymer Program and Materials Science and Engineering (MSE) students, demonstrating their projects and achievements in materials science and engineering. Industry partners were also given tours of core laboratories in the Science 1 building, the new home to IMS.

The IMS Industrial Affiliates Program provides materials characterization services to its industry partners. The program also facilitates collaborations between IMS faculty and students and industry partners on research projects of mutual interest.

The Institute of Materials Science is an interdisciplinary research institution that supports over 100 faculty members from 15 departments across UConn's schools and colleges. The institute offers advanced degrees in polymer science and materials science, as well as state-of-the-art research.

A Conversation with Industrial Affiliates Program Associate Director, Hatice Bodugoz-Senturk

From the Institute of Materials Science

Dr. Hatice Bodugoz-Senturk is Associate Director of the IMS Industrial Affiliates Program, IMS's industry outreach program.

You have conducted extensive research into developing new materials and medical devices, methods and technologies for musculoskeletal system disorders and soft tissue repair, specifically PVA hydrogels for the replacement of damaged cartilage. In fact, you have patents related to this research. What are PVA hydrogels and how can they benefit patients? What led to your work in this field?

Throughout my research journey, I was always drawn to solving complex problems. After completing my Ph.D. in conductive polymers, I had several options to choose among those problems. I decided to work on cartilage repair and joined Harris Laboratories as a postdoc. A good place to start to answer why it was my choice is to look at why we need repair modalities for cartilage. Articular cartilage is a complex tissue covering all joints and cushioning our movements. It has an extremely low-friction surface resembling the interaction of ice on ice. Low friction is critical for the joints to withstand high-body load activities such as walking, climbing, and running. We lose cartilage tissue as we age, or it can be damaged by trauma or disease, causing the bones to rub directly against each other, eventually resulting in arthritis. Nearly 55 million Americans suffer from joint diseases or pain. There are repair modalities for late-stage cartilage loss, such as total hip and knee replacement, which can work miracles. However, these treatments are very invasive for early-stage cartilage loss. The regenerative approach has been the main focus for early-stage repair, such as grafting healthy cartilage as an autograft or allograft to the damaged area. Tissue engineering of the cartilage has also been long studied, which involves growing cartilage in a scaffold and implanting this scaffold, which could be degraded in the body as the cartilage grows. This approach has two obstacles: cartilage has extremely low regeneration capabilities, and the scaffold is often not strong enough to hold during the time needed for integration. To tackle these challenges, my group chose a nondegradable cartilage-like material; this is where polyvinyl alcohol (PVA) came in. PVA is a polymer. It can be made into a hydrogel using physical crosslinking through hydrogen bonding between the OH groups in the polymer backbone. Hydrogels are three-dimensional networks that can hold high amounts of water. Polyvinyl alcohol (PVA) hydrogels are a good candidate for cartilage replacement materials due to their biocompatibility, high water content, chemical stability, and easily adjustable mechanical properties. My group was already studying PVA when I joined as a postdoc. While PVA was an excellent candidate for cartilage repair, maintaining its high water content and lubricity while making it mechanically strong was difficult. All the known procedures used to make the gels strong reduced the water content and closed the pores, thus increasing the surface friction; my research goal was to develop processes that would keep the gel robust while reducing surface friction and keeping the water content high (above 80%). We took the research one step further and added pores big enough for cartilage cells to live and interact with each other. While I am no longer in cartilage repair, our research has shown that PVA hydrogels can be used in cartilage repair.

You were an instructor of Orthopedic Surgery specializing in biomaterials for over 10 years. Can you talk a bit about your approach and expectations from your students?

My group hired grad students seeking experience before applying to medical school or a Ph.D. program since we were not part of a program that would grant these degrees. The student would be hired as

a biomedical engineer for two years. We also worked with postdocs. The overall expectation from the students was to be curious, collaborative, and open-minded. My biggest expectation was for them to be inquisitive. Before hiring, I often asked students if they could handle the fast pace of the research and ever-increasing timeline pressure. In turn, our lab provided exposure to high end characterization techniques, open space for discussion, collaboration with other academic centers and industry partnerships. All students were given proper training and knew they were encouraged to ask questions but only expected a straight answer from me. I was there to help them answer their question, guiding them through what they already knew and teaching them how to tackle a complex problem. They were confident and armed with tools when ready for the next step in life.

> **"The urge to understand the day's most pressing issues shaped my M.Sc. and Ph.D. research"**
>
> ~ Hatice Bodugoz-Senturk

In your work for the IMS Industrial Affiliates Program, you manage projects from industry partners, coordinating with IMS Core lab managers. Can you talk about the types of projects you manage and how IAP assists its industry partners?

The most significant appeal of the Industrial Affiliates Program is that we provide support in such a broad span of research and application fields. The core crew members come from various backgrounds, and we often collaborate with UConn faculty with the experience needed for a specific project. This broad experience helps us handle projects from the manufacturing, construction, energy, communication, and biotechnology industries. At any given moment, you might find a project in our list from aerospace, automotive, batteries, energy storage, electronics, polymers, thin films, cable, dyes, coatings, insulators, composites, biomedical devices, and biomaterials. IAP offers annual membership and also welcomes fee-for-service projects. In turn, we provide access to state-of-the-art core facilities at IMS, such as an electron microscopy, mechanical characterization (tensile, compression, dynamic mechanical analysis, thermomechanical analysis), X-ray analysis (micro-computed tomography, diffraction, and scattering), chromatography (gas, liquid chromatography, and gel permeation chromatography), mass spectroscopy, spectroscopy (infrared and UV spectroscopy), elemental analysis (Atomic absorption, inductively coupled plasma, Elementar), nuclear magnetic resonance (liquid and solid state), thermal analysis (differential scanning calorimetry, thermogravimetric analysis), surface analysis (X-ray photoelectron spectroscopy, secondary ion mass spectrometry, Auger electron spectroscopy), polymer processing, and rheology. The projects are run by lab managers with Ph.D. degrees in relevant fields. These capabilities are listed on our website. We strongly encourage our partners and potential partners to contact us if they are still looking for the particular capability that must be listed on our website. We often collaborate with other centers and faculty to use their lab capabilities.

You received your M.Sc. and Ph.D. from Hacettepe University in Turkey. What brought you to the U.S.?

I wanted to pursue a research career. The urge to understand the day's most pressing issues shaped my M.Sc. and Ph.D. research. During my undergraduate years, I was haunted by the images of the wildlife affected by the oil spill during the 1991 Gulf War. For my M.Sc. research, I jumped on the opportunity to work on developing microbeads, which could be a novel way to clean the damage. These beads would be selective to oil and could swell in the oil, expanding to a thousand times bigger than their original volume. I decided to study conductive polymers to develop a flexible form of polyaniline after attending a presentation at a conference and learning that it was a massive problem in the field. After completing my Ph.D. studies, I wanted to continue academic research as a postdoc. Cartilage repair was among the several research opportunities I had at the time. I was involved with biomaterials research and tissue engineering as side projects during my Ph.D., and I always wanted to be engaged in a more focused search. This is why I came to the US and joined Harris Lab as a postdoc. While the challenge proved to be more than I bargained for, I thoroughly enjoyed working in the field and cherish the experience.

When you are not thinking about materials characterization and analysis how do you spend your free time?

I make the most of my limited time outside work by spending time with my husband, son, and our golden retriever, Teddy. We go for long walks, listen to music, watch movies, discover new restaurants. We cook, and gather at the table to have a meal and laugh. When I am not with my husband and son, my favorite pastime is spoiling Teddy rotten. Next is reading, a constant in my life since age four. I read anything and everything, but I always keep my three favorite books close: Physical Chemistry (Walter John Moore), Ulysses (James Joyce), and The Lord of the Rings trilogy (John Ronald Reuel Tolkien). I have plans to go back to playing the flute, but it has yet to materialize.

Mustafa Selman Yavuz is the New Manager of the Clean Room at Science 1 Research Center

From the Institute of Materials Science

Dr. Mustafa Selman Yavuz

IMS is pleased to welcome Dr. Mustafa Selman Yavuz to our scientific and technical team. Mustafa joins IMS as the manager of the clean room at Science 1 Research Center.

Mustafa received his Ph.D. in Chemistry at UConn working with Dr. Greg Sotzing. He completed his postdoctoral work at Washington University with Dr. Younan Xia. Mustafa was formerly the R&D Director of 3BC Inc., a consultant, and Director at Biyotez Kimya Limited. Mustafa is responsible for running the clean room and training researchers on the proper use of clean room equipment.

Frances Nicholas Has Joined IMS Administrative Team

From the Institute of Materials Science

IMS is excited to welcome Frances Nicholas to the post-award team. Frances will support post-award research administration for IMS sponsored research accounts including payroll, purchasing, and other project-specific transactions.

Frances worked previously as Administrative Support in the Educational Psychology Department at the NEAG School of Education. Before working at UConn, she served as an Office Manager at the University of Miami in the Chemical, Environmental and Materials Engineering Department. She has over seven years of experience working as an administrator in higher education. She completed her Master of Science in Media Management at the University of Miami.

Frances Nicholas

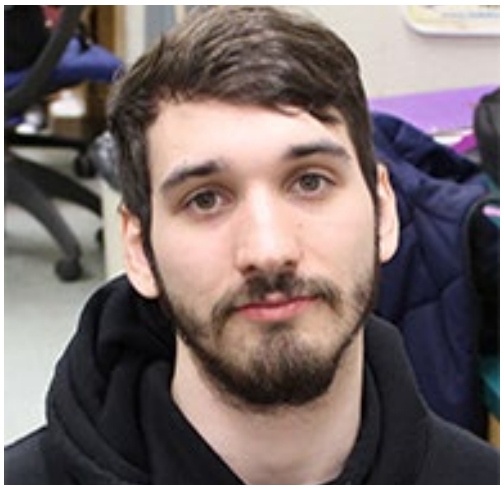
Frances says she "hopes to come into this position with an open mind to learn, provide dependable service to support the hardworking faculty and staff of IMS, and bring an innovative nature to introduce a fresh perspective."

"I hope to come into this position with an open mind to learn, provide dependable service to support the hard-working faculty and staff of IMS, and bring an innovative nature to introduce a fresh perspective."

~Frances Nicholas

Seth March Named Manager of CAMMA Lab

From the Institute of Materials Science



Dr. Seth March

Seth March has been named manager of the UConn/Thermo Fisher Scientific Center for Advanced Microscopy and Materials Analysis (CAMMA) laboratory.

Seth joined IMS in 2022 as a postdoc in CAMMA Lab after completing his Ph.D. in organic chemistry advised by IMS Director Steven L. Suib. He earned his B.S. from UConn in 2017.

Seth also served as a research assistant and a teaching assistant and has extensive research experience in materials characterization and data analysis.

His research interests include materials synthesis, characterization and gas-phase catalysis.

Say Hello to Our Little Friend

From the Institute of Materials Science

Shortly after the Institute of Materials Science moved their administrative offices to the new Science 1 Research Center (Science 1), staff members began noticing a recurring visitor near the building, mostly in the area of the woodland corridor. The beautiful doe was likely feasting on some plant or other, or perhaps checking out the new residents at Science 1.

Part of the Northwest Science Quad, the woodland corridor adjacent to Science 1 is filled with indigenous shade trees and plants that attract pollinators. It is a Sustainable Sites Initiative SITES-certified landscape, meaning the space was designed, developed, and is managed to be a sustainable and resilient landscape.

The woodland corridor at the Northwest Science Quad is one of several initiatives by UConn to build sustainably and with consideration for the environment and wildlife. These sites are designed to protect small mammals, birds, insects, and even deer. No wonder our visitor looked so at home hanging out on the periphery of Science 1.

UConn IMS held a contest among staff to name the whitetail deer. Director Steve Suib, Bonnie Suib, and the Demers twins served as judges in the blind selection process. From the many entries (including Snow Whitetail, Jane Doe, Lucky, and Polly for the IMS Polymer Program), the name Cookie-Doe, submitted by Business Operations Specialist Lena Dwelley won out in the end. A name befitting our little friend, with a nod to the UConn Dairy Bar!

Cookie-Doe

Cookie-Doe outside the Science 1 Research Center

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Support the Institute of Materials Science

For nearly 60 years, the UConn Institute of Materials Science (IMS) has invested in scientific development within the state, across the nation, and around the globe. Our students, faculty, staff, and alumni continue to make countless contributions made possible by the educational, outreach, and research efforts of IMS. We are home to more than 150 graduate students performing research in our materials science, materials science and engineering, and polymer science programs.

Please consider donating to the Institute as we make strides toward a richer future. Your donation to the fund(s) of your choice will directly contribute to our efforts to keep our research infrastructure and graduate education strong.

IMS General Fund Account (20312)
This account supports all IMS activities, from maintenance of supplies to industrial collaborations.

IMS Endowment Fund (30264)
Gifts to the IMS Endowment Fund provide long-term financial support for the Institute of Materials Science.

IMS Equipment and Maintenance Fund (21753)
This account provides cutting-edge equipment and maintains IMS facilities. IMS houses a wide range of advanced research instruments and facilities.

IMS Polymer Mixture Thermodynamics Fund (20334)
This account supports graduate students and faculty studying polymer mixtures.

IMS Surface Science Research Fund (20328)
Gifts to the Surface Science Research Fund provide support for research at the Institute of Materials Science.

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Gifts to the Institute of Materials Science Electrical Research Fund provide support for research supplies and equipment.

Stephanie H. Shaw Alumni Fellowship Fund (22176)
Gifts to the Stephanie H. Shaw Alumni Fellowship Fund support female Ph.D. students in the Institute of Materials Science Polymer Program.

Julian F. Johnson Alumni Fellowships Fund (22177)
This account provides fellowships to graduate students in the IMS Polymer Program. The IMS Polymer Program is the only center in Connecticut dedicated to research and education in polymer science and engineering and is nationally and internationally recognized for its excellence.

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