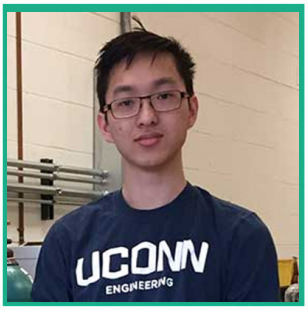
Newsletter 2018



14.007 **7**

N

Nitrogen

15.999 **8**

O

Oxygen

28.085 **14**

Si

Silicon

30.974 **15**

P

Phosphorus

69.723 **31**

Ga

Gallium

72.630 **32**

Ge

Germanium

74.922 **33**

As

Arsenic

78.971 **34**

Se

Selenium

79.904 **35**

Br

Bromine

121.76 **51**

Sb

Antimony

127.60 **52**

Te

Tellurium

207.2 **82**

Pb

Lead

208.98 **83**

Bi

Bismuth

UCONN

10.611 **114**

Fl

Flerovium

IMS | INSTITUTE OF MATERIALS SCIENCE

INSIDE THIS ISSUE

Edited by IMS Administrative Staff
Design and Layout by Rhonda Ward

MESSAGE FROM THE DIRECTOR

Welcome to another edition of the Institute of Materials Science (IMS) Annual Newsletter. Many exciting developments happened over the last year. Most importantly, there are lots of new faces in both the Faculty and Staff in IMS. Five new faculty members were hired: Stefan Schafföner, Lesley Frame, Jasna Jankovic, Yuanyuan Zhu, and Volkan Ortalan. These new faculty members are all members of the Materials Science and Engineering Department (MSE) and have diverse research backgrounds in electron microscopy, ceramics, and catalysis among others.

There are also several new Staff members including Kayla Pittman, administrative assistant for the Office of the Director; Osker Dahabsu, administrative assistant for the IMS Polymer Program; Dr. Curtis Guild who runs the spectroscopy lab; Dr. Nicholas Eddy who runs the magnetics and other instrument labs; and Brianna Demers, finance director. These talented new staff members are great additions to the IMS community.

Many of the IMS faculty were appointed to new administrative roles. Dr. Pamir Alpay is the Executive Director of the Innovation Partnership Building (IPB) at the UConn Tech Park; Dr. Mark Aindow is the Executive Director for Innovation, External Engagement, and Industry Relations; Dr. Rainer Hebert is now Associate Director of IMS; Dr. Bryan Huey is the new Head of MSE; and Dr. Luyi Sun is the Director of the Polymer Program. We congratulate all of them on their new roles across UConn.

There are several new programs and facilities on campus being used by IMS members. The IPB is the new home for IMS electron microscopes as part of the Thermo Fisher Center for Advanced Microscopy and Materials Analysis (CAMMA). In addition, new x-ray fluorescence and thin film x-ray diffraction equipment are also available in the Advanced Characterization Laboratory of the IPB. There are ongoing plans for an exciting new home for IMS in the soon-to-be-constructed Science One building.

The Industrial Affiliates Program (IAP) in IMS continues to expand as does the Electrical Insulation Research Center. There is a new Anton Paar Thermal Analysis partnership which will bring cutting-edge rheology equipment to IMS. The UConn/UTAS Center of Excellence is also ongoing with a focus on aerospace systems and ceramics.

IMS is alive and well due to the hard work of faculty members, staff members, students, and postdoctoral associates. There are many new research endeavors that you can read about on the following pages. As always, feel free to stop in, take a tour, or speak with our faculty and staff.

Steven L. Suib

Steven L. Suib, Director
Institute of Materials Science

Synthesizing Pure Graphene: A Miracle Material

excerpted from UConn Today

Chemistry professor Douglas Adamson, in the lab at IMS on Aug. 23, 2017. (Peter Morenus/UConn Photo)

UConn chemistry professor Doug Adamson, a member of the Polymer Program in IMS, has patented a one-of-a-kind process for exfoliating graphene, a wonder material, in its pure (unoxidized) form, as well as manufacturing innovative graphene nanocomposites that have potential uses in a variety of applications.

GRAPHENE:

- A Single Layer of Carbon Atoms
- Nearly Transparent Material
- Formed Deep Within the Earth
- Stronger than Steel
- Thinner than a Human Hair

If you think of graphite like a deck of cards, each individual card would be a sheet of graphene. Comprised of a single layer of carbon atoms arranged in a hexagonal lattice, graphene is a two-dimensional crystal that is at least 100 times stronger than steel. Aerogels made from graphene are some of the lightest materials known to man, and the graphene sheets are one of the thinnest, at only one atom thick – that is approximately one million times thinner than a human hair. Graphene is also even more thermally and electrically conductive than copper, with minimal electrical charge.

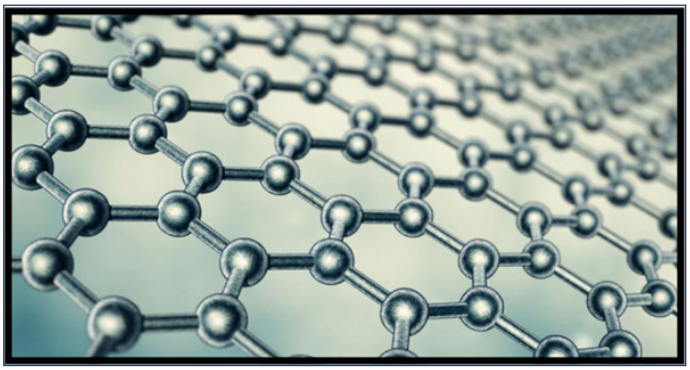
Because of these unique qualities, graphene has been a hot topic for academic researchers and industry leaders since it was first isolated from graphite in 2004. Since then, more than 10,000 scholarly articles have been published about the material. But of these publications, only Adamson's discusses a proprietary process for manufacturing graphene in its pristine form.

"The innovation and technology behind our material is our ability to use a thermodynamically driven approach to un-stack graphite into its constituent graphene sheets, and then arrange those sheets into a continuous, electrically conductive, three-dimensional structure" says Adamson. "The simplicity of our approach is in stark contrast to current techniques used to exfoliate graphite that rely on aggressive oxidation or high-energy mixing or sonication – the application of sound energy to separate particles – for extended periods of time. As straightforward as our process is, no one else had reported it. We proved it works."

> The innovation and technology behind our material is our ability to use a thermodynamically-driven approach to un-stack graphite into its constituent graphene sheets, and then arrange those sheets into a continuous, electrically conductive, three-dimensional structure.
>
> ~ Dr. Douglas Adamson
> Professor of Chemistry

Soon after the initial experiments by graduate student Steve Woltornist indicated that something special was happening, Adamson was joined by longtime collaborator Andrey Dobrynin from the University of Akron, who helped to understand the thermodynamics that drive the exfoliation. Their work has been published in the American Chemical Society's peer-reviewed journal *ACS Nano*.

A distinctive feature of graphene that seems like an obstacle to many – its insolubility – is at the heart of Adamson's discovery. Since it does not dissolve in liquids, Adamson and his team place graphite at the interface of water and oil, where the graphene sheets spontaneously spread to cover the interface and lower the energy of the system. The graphene sheets are trapped at the interface as individual, overlapping sheets, and can subsequently be locked in place using a cross-linked polymer or plastic.



Structure of Graphene

Adamson began exploring ways to exfoliate graphene from graphite in 2010 with a grant from the Air Force to synthesize thermally conductive composites. This was followed in 2012 with funding from a National Science Foundation (NSF) Early-concept Grants for Exploratory Research (EAGER) award. He was also awarded a $1.2 million grant from the NSF Designing Materials to Revolutionize and Engineer our Future program and $50,000 from UConn's SPARK Technology Commercialization Fund program.

"Dr. Adamson's work speaks not only to the preeminence of UConn's faculty, but also to the potential real-world applications of their research," says Radenka Maric, vice president for research at UConn and UConn Health. "The University is committed to programs like SPARK that enable faculty to think about the broader impact of their work and create products or services that will benefit society and the state's economy."

Dr. Adamson's work speaks not only to the pre-eminence of UConn's faculty, but also to the potential real-world applications of their research.

~ Dr. Radenka Maric
Vice President for Research
UConn and UConn Health

Graphene for Water Desalination

While stabilized graphene composite materials have countless potential uses in fields as varied as aircrafts, electronics, and biotechnology, Adamson chose to apply his technology to improving standard methods for the desalination of brackish water. With his SPARK funding, he is developing a device that uses his graphene nanocomposite materials to remove salt from water through a process called capacitive deionization, or CDI.

CDI relies on inexpensive, high surface area, porous electrodes to remove salt from water. There are two cycles in the CDI process: an adsorption phase where the dissolved salt is removed from the water, and a desorption phase where the adsorbed salts are released from the electrodes by either halting or reversing the charge on the electrodes.

Chau Vy, right, a graduate student in the Polymer Program, and Chinthani Liyanage, a graduate student in chemistry, work with graphene in the lab at the Institute of Materials Science. (Peter Morenus/UConn Photo)

Many materials have been used to create the electrodes, but none have proven to be a viable material for large-scale commercialization. Adamson and his industry partners believe that his simple, inexpensive, and robust material could be the technology that finally brings CDI to market in a major way.

"The product we are developing will be an inexpensive graphene material, with optimized performance as an electrode, that will be able to displace more expensive, less efficient materials currently used in CDI," says Michael Reeve, one of Adamson's partners and a veteran of various successful startups.

The team formed a startup called 2D Material Technologies, and applied for a Small Business Innovation grant that would allow them to continue commercializing Adamson's technology. Eventually, they hope to join UConn's Technology Incubation Program to advance their concept to market.

Full Speed Ahead

Using Additive Manufacturing to Repair Ships at Sea

Excerpted from UConn Today

The aircraft carrier USS Ronald Reagan and ships from the Ronald Reagan Carrier Strike Group and the Indian navy transit the Pacific Ocean during a bilateral training operation. UConn engineers devised a way for a ship's crew to identify the exact location of any mechanical trouble and repair or replace the part while still at sea. (Getty Images)

When a ship runs into trouble at sea, it can be time-consuming and disruptive to take it ashore to get it fixed. A team of UConn engineers developed a way for a ship's crew to pinpoint the exact location of any mechanical trouble on board and, instead of taking the ship offline for maintenance, repair or replace the part while the ship is still at sea.

The researchers, led by Associate Professor of Materials Science and Engineering, Rainer Hebert, created a device that uses ceramics on additively manufactured metals to obtain signals about degradation or certain other potential problems, such as overheating. They are also developing a field-deployable manufacturing process that could produce replacement parts from electronic files using a 3-D printer on board ship after the metal-ceramic parts indicate failure or problems.

A change in temperature can signal a potential problem. The new device can simultaneously carry the weight and resist temperature variants of existing components. It then generates an electrical signal that alerts crew members, in real time, to the

Researchers Pamir Alpay, left, and Rainer Hebert, hold a sample of 3-D metal printing at UConn's Innovation Partnership Building. (Peter Morenus/UConn Photo)

"Essentially, what we're trying to do is combine two completely separate materials – ceramics and metals – in an additive manufacturing environment. Such a combination in a 3-D printing process is unique and challenging."

~ Dr. Pamir Alpay, GE Professor in Advanced Manufacturing and Executive Director of UConn's Innovation Partnership Building in Storrs.

change in temperature and the amount of strain placed on that part.

> **This demonstration of feasibility, published last year in Acta Materialia, is new and important because, conventionally, the metals used in conjunction with ceramics on the surface possess specific characteristics that deviate from those found in additively manufactured metals of the same chemistry.**
>
> ~ Dr. Rainer Hebert, Director of UConn's Pratt & Whitney Additive Manufacturing Center

"Essentially, what we're trying to do is combine two completely separate materials – ceramics and metals – in an additive manufacturing environment," says Pamir Alpay, GE Professor in Advanced Manufacturing and executive director of UConn's Innovation Partnership Building in Storrs. "Such a combination in a 3-D printing process is unique and challenging."

The team deposited a ceramic oxide that can sense temperature and strain variations onto an additively manufactured aerospace superalloy, Inconel. The metal is a structured, additively manufactured component that resists temperature variants. The ceramic piece generates an electrical signal that's accessible using radio frequencies, thereby offering real-time monitoring.

"It is a proof-of-concept study that shows it is possible to do this while maintaining functional properties of the oxide," Alpay says.

"This demonstration of feasibility, published last year in *Acta Materialia*, is new and important," says Hebert, the director of UConn's Pratt & Whitney Additive Manufacturing Center, "because conventionally, the metals used in conjunction with ceramics on the surface possess specific characteristics that deviate from those found in additively manufactured metals of the same chemistry."

The combined metal-ceramic idea grew out of the U.S. Navy's desire to extend its maintenance cycles. Navy staff said that if they were able to monitor critical components in real time, they would not have to take a ship offline for inspections and repairs. And if replacement parts could be manufactured on ships, the maintenance cycles might be extended even further.

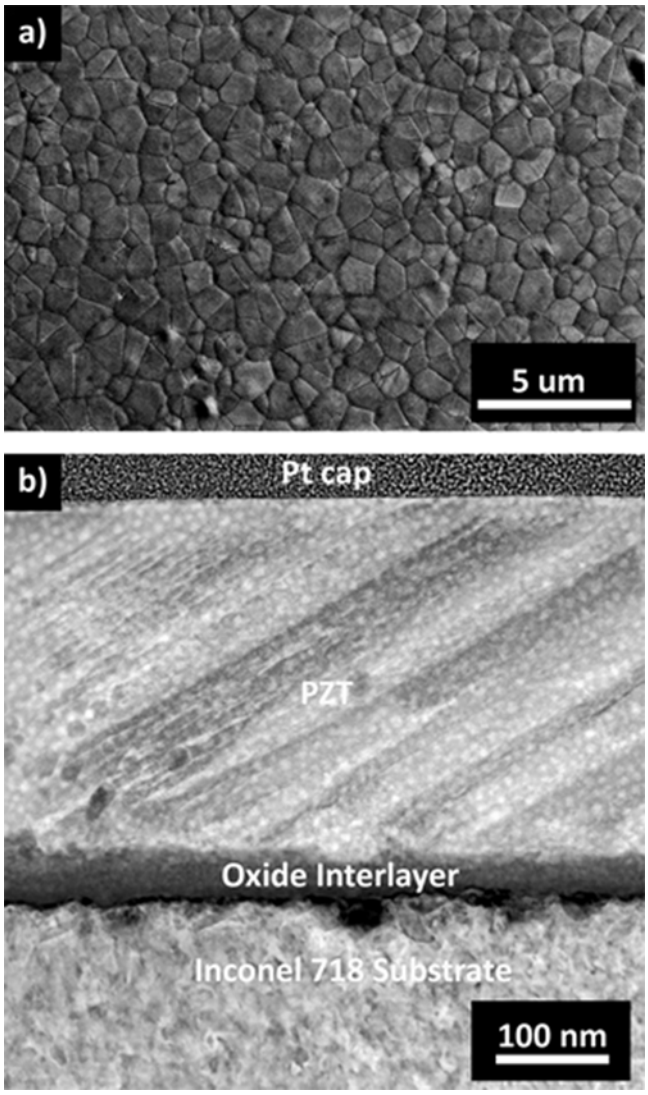
Another benefit to real-time monitoring is that a localized point of stress, such as a small crack, can be detected and repaired before it turns into a major problem. "Technology already exists to alert the crew to temperature fluctuations and trouble in a given zone of the ship, but signaling the exact location of the problem is new," Alpay says.

Once the replacement parts have been printed, additional processing steps will be necessary – for example heating of the as-fabricated parts in furnaces to impart specific properties, or the smoothing of surfaces. But the potential of on-demand, on-site manufacturing and self-diagnostics of structural parts certainly promises weight and fuel reductions with limited maintenance, Hebert says.

Hebert developed a 10-day training course on additive manufacturing for two engineers from the Navy's Naval Air Systems Command (NAVAIR). The training is intended to provide hands-on experience and theoretical background information to spread knowledge of additive manufacturing and its current challenges, opportunities, and limitations more widely in the Navy.

"The potential of additive manufacturing for naval and, more widely, for defense applications is real," Hebert says, "although further basic and applied research is necessary to achieve reproducible results and resilience in field use."

The Navy is not the only expected beneficiary of this discovery. This ceramic-metals combination could be useful to automotive and aerospace applications as well.



Thin Film Structure of Pb1.1Zr0.2Ti0.8O3 (PZT) on Inconel 718 Prepared n this Work, a – Morphology of Surface, b – Cross Section of Layers.

Growing with Aquaponics at UConn

Excerpted from UConn Today

UConn's Spring Valley Student Farm is now home to a newly up-and-running aquaponics facility, a welcome addition to the farm, which already grows and provides fresh produce to campus.

The year-round means of growing vegetables is a source of pride for recent graduate Kelly Pfeiffer '18 (CLAS), a psychological sciences major who helped shape an idea into reality.

Starting out as a hope, then transitioning into a grant proposal, the aquaculture plan for Spring Valley Student Farm is finally coming to fruition, through the tenacity of the students who work at the farm.

Kelly Pfeiffer '18 (CLAS) examines aquaponic lettuce growing in a greenhouse at the Spring Valley Student Farm on April 27, 2018. (Peter Morenus/UConn Photo)

Former undergraduates Carl Underwood '16 (CAHNR, CLAS) and Gabriel DeRosa '17 (CAHNR) originally hatched the concept and were awarded an IDEA Grant, which awards funding to support student-designed and student-led projects. When they graduated, Pfeiffer took on the project and carried it to completion as the aquaponics plant care specialist.

Hydroponics:
The cultivation of plants in water

Aquaponics:
Rearing aquatic animals in a hydroponic environment

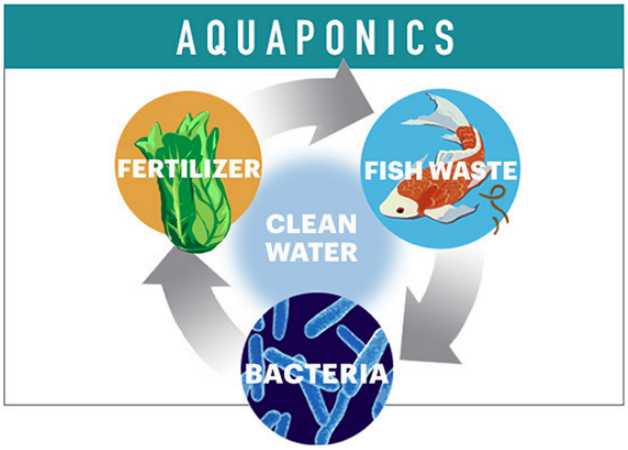
Closing the Loop:
Ammonia and urea are excreted as animal wastes. Bacteria break down the waste to be used as fertilizer.

"My goal was to have the aquaponics system up and running with fish by the time I graduated, and this is now happening, all in time for the summer growing season," says Pfeiffer, one of 11 students who live on the farm.

"We each have our niche project," she adds. "The aquaponics system has been mine."

How the System Works

Hydroponics is the cultivation of plants in water, however aquaponics combines the rearing of aquatic animals in a hydroponic environment. Nitrogen is a nutrient plants rely on for growth and nitrogenous wastes are a fact of life for any organisms, such as fish, that metabolize proteins. The resulting waste is excreted as nitrogen-based compounds, such as ammonia or urea.



An aquaponics system enables farmers to grow more in less space, using the closed loop and symbioses between plants, animals, and bacteria. (John Bailey/ UConn Illustration)

In an aquaculture system, there must be a way to manage and remove excess nutrients from the aquatic environment, otherwise the water becomes toxic to the fish. These wastes, highly rich in nitrogen, are broken down by a community of bacteria into forms of nitrogen that are easily used by plants. No longer simply a nuisance, the fish waste becomes fertilizer.

Pfeiffer explains that aquaponics systems and traditional agriculture are similar, in that they both rely on monitoring of macro and micro nutrients to effectively grow healthy plants. So

> **My goal was to have the aquaponics system up and running with fish by the time I graduated, and this is now happening, all in time for the summer growing season. We each have our niche project, the aquaponics system has been mine.**
>
> **~ Kelly Pfeiffer, Aquaponics Student Researcher**

why grow in an aquaponics system?

"There's a surprising statistic for this technology, that you can grow four heads of lettuce in an aquaponics setting for every one grown through traditional soil growing methods," says Pfeiffer.

In other words, grow more in less space, using the closed loop and symbioses between plants, animals, and bacteria.

Koi fish will be added to the 450-gallon tank of the aquaponics set-up to supply the nitrogenous wastes, creating a symbiosis or closed loop between the animals, bacteria, and the plants, all reliant on one another.

Pfeiffer says striking the right balance can make aquaculture tricky, and will depend on trial and error as well as close, continuous monitoring of nutrient levels in the water.

The system flows from the fish tank, where water and solid fish waste are siphoned off into a filter, and then a large tray filled with porous shale that further filters the water and also creates a medium where the bacteria live.

The expanded shale bed is a two-way filter, filtering as the water levels rise and fall, as well as where the bacteria colonize.

It is also an area of the system where plants can be grown. Although not intentionally planted, a lone squash plant has volunteered and is demonstrating how fertile the planting area is. "Somehow a seed got into the shale and we left it to see how it did," says Pfeiffer, "and it's doing great."

Basil has since been planted in the bed, along with the squash plant.

From the shale bed, the filtered water drains into deep-water culture beds, each around 12 inches deep. The beds are currently home to the system's first crop – romaine lettuce. Through circles cut into blue sheets of Styrofoam insulation board, the lush lettuce plants emerge, their roots reaching into nutrient-rich water below.

"Planting out a crop is a matter of starting the seeds in soil and then transplanting into floating plugs. Since lettuces take only a couple of months to go from seed to harvest, the system will be capable of providing a fair amount of produce throughout the year," Pfeiffer says. The produce will be supplied to UConn's Dining Services.

Growing Collaborations

Besides growing food, the system is also sprouting research projects. Julia Cartabiano, manager of the Spring Valley Student Farm, says there are several collaborations stemming from the aquaponics system in various disciplines across campus, including two professors in the School of Business who plan to use the greenhouses on the farm as a learning lab, and a computer science student in the School of Engineering who hopes to work with the farm as his senior design project.

Undergraduate researcher Tanzin Begam '19 (CLAS), a third-year biology student with a minor in bioinformatics, recently presented a poster on her work studying the microbial community of the aquaponics system. As in any ecosystem, the right mix of bacterial species is vital for the health and success of an aquaponics system.

More specifically, Begam says she was looking at the succession of the bacterial community within the system after set-up and before plants or fish were introduced.

"It has been a great learning experience," she says. "In the fall semester, I was working out the best DNA extraction methods, and this semester I was analyzing the data. I have been learning so much."

Her advisor, facility scientist Kendra Maas, says they weren't able to find published research looking into how microbial communities are established within an aquaponics system, so this re-

Dr. Richard Parnas partnered with the UConn Spring Valley Student Farm to develop aquaponics cultivation technology through a UConn academic plan grant. This project includes a greenhouse, containing a 500 gallon fish tank and four cultivation beds for leafy vegetables. The fish and vegetables exist symbiotically, wherein waste from the fish provides nutrients for the plants and the plants clean the water for recycling back to the fish. Aquaponics provides a route to sustainable food systems due to its high rate of both fish and leafy vegetable growth, its highly efficient use of water and nutrients, and its low environmental footprint. This project is part of a larger activity to transform the Spring Valley Student Farm into a living/learning laboratory that all sectors of the UConn community can use for educational and research activities.

search may be a first. They hope to continue their analysis when the Koi are introduced. Maas hopes to one day make these tests an open service to the expanding aquaponics agricultural community across the state.

"As aquaponics becomes more and more common in Connecticut, this could be a useful service for growers," she says.

The Spring Valley Farm aquaponics system is another great example of how UConn's agricultural roots are helping to grow research innovations in unexpected ways.

After graduation, Kelly Pfeiffer began work as a marine science instructor at the Catalina Island Marine Institute in California. Tanzin Begam hopes to graduate in May 2019, and will continue her study of the aquaponics system's bacterial community in the meantime.

Researchers Accelerating Broken Bone Healing

Excerpted from UConn Today

Dr. Yusuf Khan

To more quickly heal broken bones, UConn Health researchers are exploring the potential combined power of placing gel-encapsulated bone cells inside fractures and using follow-up ultrasound to promote a bone's healing.

To help UConn Health explore the potentially transformative research idea the National Science Foundation (NSF) awarded a $200,000 Early-concept Grant for Exploratory Research (EAGER) to Yusuf M. Khan, Ph.D. of the Department of Orthopedic Surgery and the Institute for Regenerative Engineering at UConn School of Medicine.

Dr. Lakshmi Nair

When someone breaks a bone, orthopedic specialists generally immobilize the fracture with a cast to allow the bone to heal. But the cast does not allow for the broken bone to experience any of the physical force that has been shown to stimulate bone cells to regenerate the bone and promote a broken bone's stability and full healing.

But now researchers at UConn Health are looking at a new way to supplement this traditional broken bone care approach to speed a bone's healing.

Khan believes that adding cells to a fracture site at the earliest stages of fracture repair, and then directing a transdermal physical force to those cells using a low-intensity pulsed ultrasound could accelerate fracture repair and perhaps, in cases where the fracture is unable to heal on its own, provide the necessary stimulus to complete the healing process.

"The new NSF grant will allow us to expand our testing of the gel-encapsulated bone cells in vivo and simultaneously apply and monitor the stimulating effects of ultrasound upon the implanted bone cells to more quickly repair a bone defect," says Khan.

Dr. Bryan Huey

The ultrasound technology's sound waves work to provide a low-level physical force, not unlike one that a bone may typically experience during use. It sends soundwaves through the skin to physically shake the implanted cells, while the hydrogel holds them in place as they grow.

Khan and his co-investigator on the grant, Lakshmi Nair, Ph.D., also of the Department of Orthopaedic Surgery and the Institute for Regenerative Engineering, will be further testing the ultrasound's ability in the laboratory to move and direct the stimulation and growth of bone cells while developing the most optimal hydrogels.

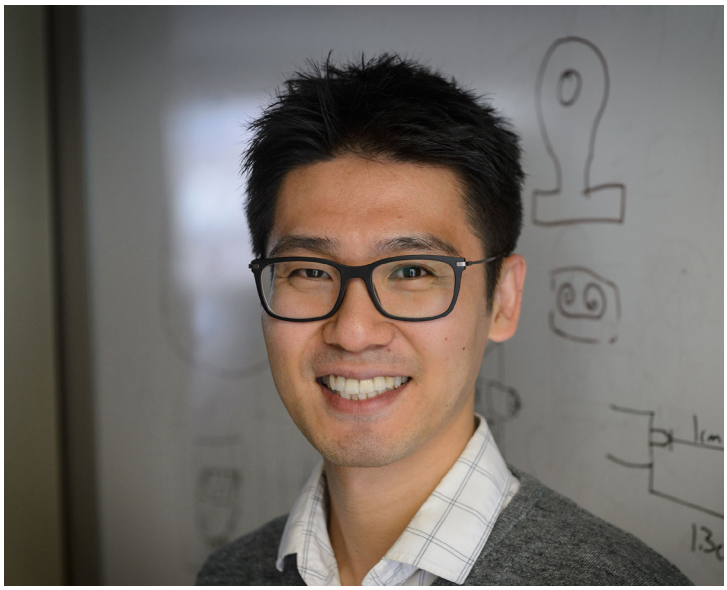
The team's previous research laboratory explorations in mice, funded by an R21 grant of the National Institutes of Health (NIH), demonstrated the successful placement and maintenance of bone-cell-loaded hydrogels, and the ability to control and direct cell behavior based on the mechanical strength of the hydrogel and the magnitude of the applied force. More recently Khan and his team, in collaboration with Professor Bryan Huey of the Department of Materials Science and Engineering at UConn, are testing the engineering of the bone cell gel to see what specific properties or stiffness may be best to bring about the most robust bone regeneration.

"As we work through the scientific process of bringing this potentially transformative research idea to human clinical trials, the good news is that certain aspects of our research, low-intensity ultrasound technology for instance, is already a readily available tool in the healthcare setting and proven to be safe," says Khan.

Khan adds, "If the combination of bone-cell-loaded hydrogels and ultrasound therapy are proven to be effective, its healing power could benefit a great deal of patients young and old who experience a broken or defective bone, or are affected by a large scale defects that occur after traumatic injury or tumor resection in the treatment of bone cancer."

Researchers Discover Super-Elastic Shape-Memory Material

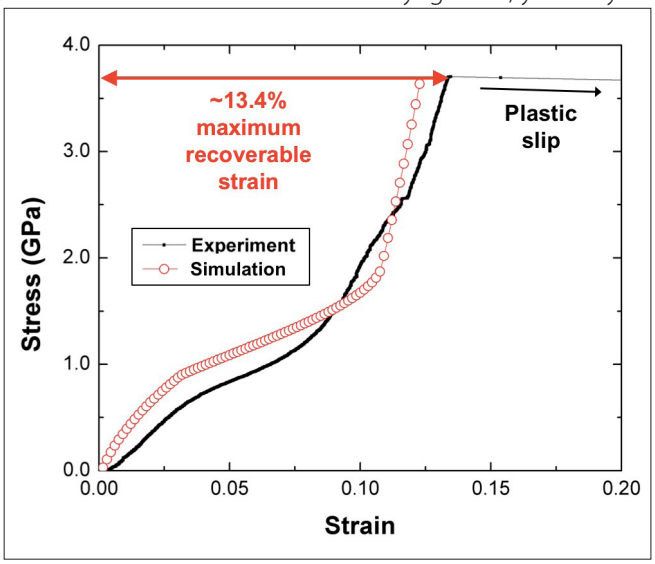
Excerpted from UConn Today



Dr. Seok-Woo Lee

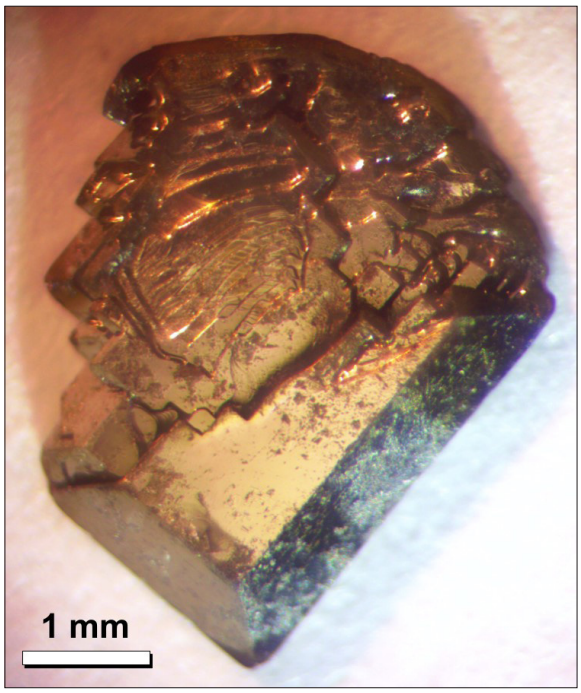
A UConn Materials Science and Engineering research team, which was led by Dr. Seok-Woo Lee, has discovered super-elastic shape-memory properties in a material that could be applied for use as a cryogenic actuator in ultracold environments, such as outer space.

If you have ever had braces or worn eyeglasses, you may have already come in contact with shape-memory materials. With applications in a wide range of consumer products such as "unbreakable" frames for glasses, self-healing concrete for civil industrial structures, and autofocus actuator for a smart phone, materials with shape-memory properties can return to their original shape by applying heat or the magnetic field even after being significantly deformed.



Uni-axial stress-strain curves of calcium-iron-arsenide compound

Dr. Lee, who is Pratt & Whitney assistant professor of Materials Science and Engineering at UConn, studied calcium-iron-arsenide compound ($CaFe_2As_2$), which is better known for its novel superconducting properties. Since the material is commonly used to develop high-temperature superconductors, extensive research had already examined the compound's superconducting and magnetic properties, but its mechanical properties have never studied before. Inspired by previous research at the U.S Department of Energy's Ames Laboratory by Prof. Paul Canfield's group on pressure-dependence of crystal structures, Dr. Lee set out to measure the mechanical properties of calcium-iron-arsenide by using his in-situ micromechanical testing system.

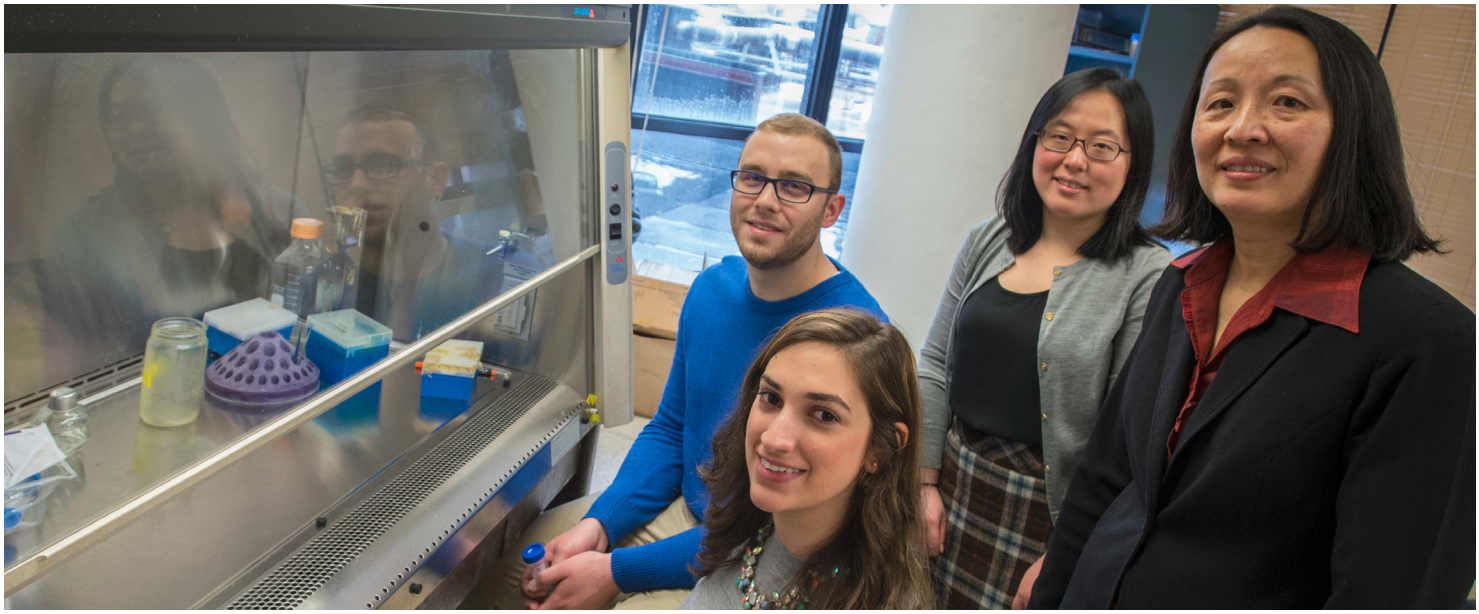


Single crystalline calcium-iron-arsenide compound

Working with a team of graduate (John Sypek and Keith Dusoe) and undergraduate students (Amanda Giroux and Hetal Patel) at UConn and collaborators at Ames Laboratory (Professor Paul Canfield) and Colorado State University (Professor Christopher Weinberger), Dr. Lee discovered that not only did a calcium-iron-arsenide compound exhibit the ability to "bounce" back into its original shape, it showed "giant super-elasticity." While normal metal alloys or intermetallic compounds recover only less than one percent of the pre-deformation shape once the compressing force has been removed, a calcium-iron-arsenide compound recovers more than 13 percent. This work was supported by the NASA Early Career Faculty Award and UConn Research Excellence Program. This discovery was published in *Nature Communications* [Volume: 8, Article Number: 1083 (2017)].

Spider Silk Key to New Bone-Fixing Composite

Excerpted from UConn Today

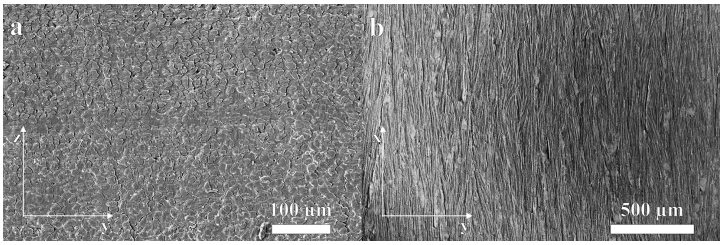


Professor Mei Wei, right, withAssociate Professor Dianyun Zhang (back right), Ph.D. candidate in materials science Bryant Heimbach, and undergraduate Beril Tonyali at their lab in the Materials Science Institute. (Sean Flynn/UConn Photo)

UConn researchers have created a biodegradable composite made of silk fibers that can be used to repair broken load-bearing bones without the complications sometimes presented by other materials.

Repairing major load-bearing bones such as those in the leg can be a long and uncomfortable process.

To facilitate repair, doctors may install a metal plate to support the bone as it fuses and heals. Yet that can be problematic. Some metals leach ions into surrounding tissue, causing inflammation and irritation. Metals are also very stiff. If a metal plate bears too much load in the leg, the new bone may grow back weaker and be vulnerable to fracture.



Composite Internal Structure

Seeking a solution to the problem, UConn professor Mei Wei, Ph.D., a materials scientist and biomedical engineer, turned to spiders and moths for inspiration. In particular, Wei focused on silk fibroin, a protein found in the silk fibers spun by spiders and moths known for its toughness and tensile strength.

The medical community has been aware of silk fibroin for a while. It is a common component in medical sutures and tissue engineering because of its strength and biodegradability. Yet no one had ever tried to make a dense polymer composite out of it, and that is what Wei knew she needed if she was going to create a better device for healing broken load-bearing bones.

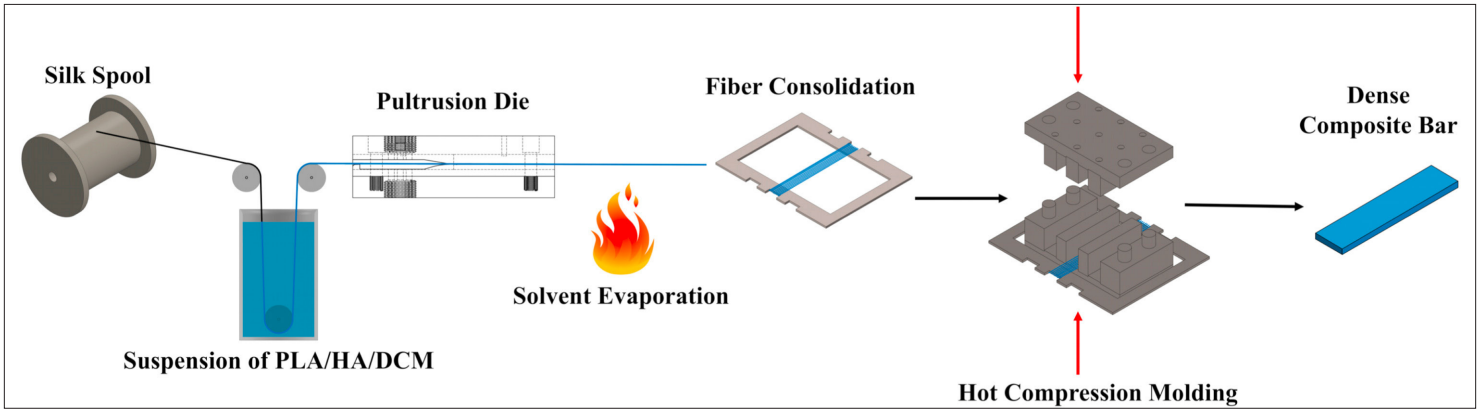
Working with UConn associate professor Dianyun Zhang, Ph.D., a mechanical engineer, Wei's lab began testing silk fibroin in various composite forms, looking for the right combination and proportion of different materials to achieve optimum strength and flexibility. The new composite certainly needed to be strong and stiff, yet not so much so that it would inhibit dense bone growth. At the same time, the composite needed to be flexible, allowing patients to retain their natural range of motion and mobility while the bone healed.

After dozens of tests, Wei and Zhang found the materials they were looking for. The new composite consists of long silk fibers and fibers of polylactic acid – a biodegradable thermoplastic derived from cornstarch and sugar cane – that are dipped in a solution in which each is coated with fine bioceramic particles made of hydroxyapatite (the calcium phosphate mineral found in teeth and bones). The coated fibers are then packed in layers on a small steel frame and pressed into a dense composite bar in a hot compression mold.

In a study recently published in the *Journal of the Mechanical Behavior of Biomedical Materials,* Wei reports that the high-performance biodegradable composite showed strength and flexibility characteristics that are among the highest ever recorded for similar bioresorbable materials in literature.

And they could get even better.

"Our results are really high in terms of strength and flexibility, but we feel that if we can get every component to do what we want them to do, we can get even higher," says Wei, who also serves as the School of Engineering's associate dean for research and graduate education.

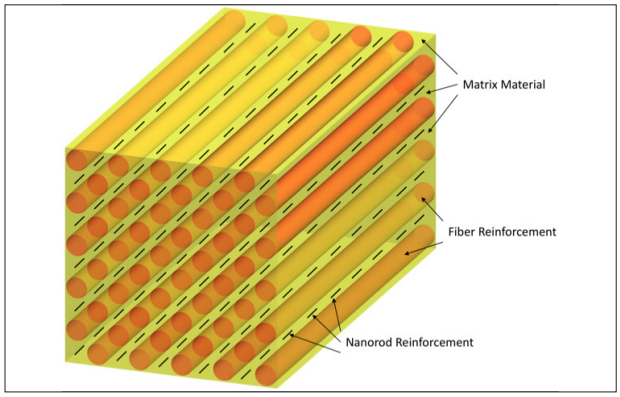


An overview of the processing techniques used to fabricate high-performance biodegradable composites to assist with bone healing. (Mei Wei/UConn Image)

The new composite is also resilient. Large leg bones in adults and seniors can take many months to heal. The composite developed in Wei's lab does its job and then starts to degrade after a year. No surgery is required for removal.

Joining Wei and Zhang in the research were Bryant Heimbach, a Ph.D. candidate and materials scientist in Wei's lab; and Beril Tonyali, a UConn undergraduate pursuing a degree in materials science and engineering.

The team has already begun testing new derivatives of the composite, including those that incorporate a single crystalline form of the hydroxyapatite for greater strength and a variation of the coating mixture to maximize its mechanical properties for bones bearing more weight.



A 3-D rendering of a novel bone-fixing composite developed by a research team led by UConn materials scientist Mei Wei. (Image courtesy of Bryant Heimbach/UConn)

UConn Chemist Wins Patent for Tunable Metal Oxide Synthesis Method

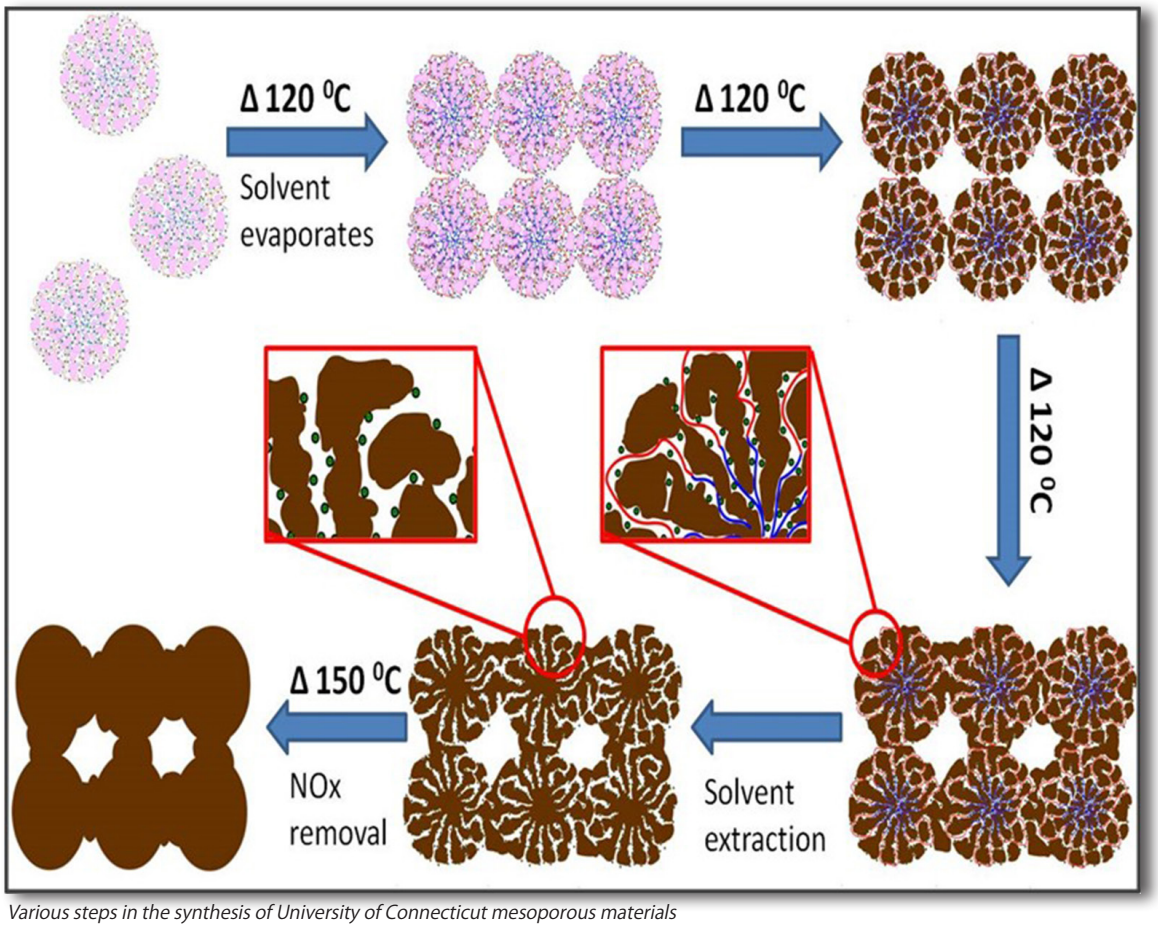
Excerpted from UConn Today

Altug Poyraz, left, with Steven Suib, distinguished professor of chemistry. (Peter Morenus/UConn Photo)

University of Connecticut Chemistry Professor Steven Suib, Ph.D., has been granted a US patent (9,908,103) for a new method developed with his former student Altug S. Poyraz, Ph.D., now an inorganic chemistry professor at Kennesaw State University. The technology is capable of synthesizing and customizing a type of compound that has unique catalytic and electronic properties.

Suib and Poyraz patented their process for synthesizing thermally stable mesoporous transitional metal oxides. Their process also allows them to control the size of the mesopores and nano-sized crystalline walls.

Mesoporous materials have many advantages when it comes to developing materials for practical applications. They have narrow pores with a high surface area, biocompatibility, and low toxicity for use in human medical practices. They can be used for drug delivery systems, as catalysts for chemical



Various steps in the synthesis of University of Connecticut mesoporous materials

reactions, electrodes in electrochemical energy storage for batteries and supercapacitors, diagnostics, absorbing pollutants from water, or storing gases and chromatography.

"We believe that this method is quite generic, so it can be used to generate many different families of materials with extensive compositions and structures," says Suib.

For decades, scientists have been searching for a way to create these valuable porous metal oxides. All previous attempts to synthesize later transition metals have been unsuccessful. Poyraz and Suib's process frees itself from dependence on indirect parameters like heat and condensation which caused the failure of other attempts.

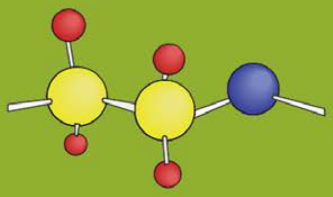
This process not only allows for the possible synthesis of numerous previously unavailable mesoporous metal oxides, but will allow scientists to manipulate certain properties to tailor these metal oxides for specific applications.

The tunable pore size enabled by this process will be greatly beneficial to these molecules' use in catalyzing reactions, say the inventors. It will allow for applicability for size-selective reactions (i.e. size-selective oxidation of alcohols) and greater mobility of ions in batteries and other similar applications. Sample synthetic applications of these catalysts include efficient conversion of benzyl alcohol to benzyaldehyde, which is an almond-like flavoring for foods and is also safe for use in cosmetics and personal care products. They are also versatile enough to convert sugars derived from biomass into more high value products like methylevulinate.

This new method also allows scientists to control the crystal structure of the compounds. Different oxide crystal structures of the same transition metal lend themselves to different uses as they produce different optic, magnetic, and catalytic properties.

Suib received his Ph.D. from the University of Illinois, Urbana-Champaign. He currently serves as the director of the Institute of Materials Science at UConn. His research focuses on the synthesis of environmentally friendly materials and characterizing their properties, the synthesis, characterization, and catalytic studies of porous transition metal oxide materials, redox catalytic cycles and using microwave heating to make novel nano-sized particles and drive catalytic reactions.

Poyraz received his Ph.D. from UConn in 2014 where he worked with Suib as a graduate student researcher. He worked at the Brookhaven National Laboratory as a research associate until 2017 when he joined Kennesaw State University as an assistant professor of inorganic chemistry. His current research focuses on the synthesis and characterization of nanocrystalline mesoporous materials for aqueous energy storage devices.



POLYMER PROGRAM SEMINARS

Fall Semester 2018

"Self-Assembly of Multi-Layered Metallo-Supramolecules with Increasing Complexity"
***Prof. Xiaopeng Li**, University of South Florida*

"Exploiting Light to Push the Limits of Controlled Radical Polymerization and Macromolecular Metamorphosis"
***Prof. Brent Sumerlin**, University of Florida*
(A joint seminar with the Chemistry Department)

"3D Printing of Adaptive, Structured Liquids"
***Prof. Thomas Russell**, University of Massachusetts, Amherst*

"Engineering Nanoparticles for Intracellular Delivery of Proteins for Cancer Therapy and Genome Editing"
***Prof. Qiaobing Xu**, Tufts University*

Chemistry / Polymer Symposium
***Prof. Jintao Zhu (Huazhong University of Science and Technology)**: "Polymer Particles with Tunable Shape and Internal Structures";*
***Prof. ZhongAn Li (Huazhong University of Science and Technology)**: "Molecular Engineered Dopant-free Hole Transporting Materials for Efficient Perovskite Solar Cells"*

"Systems-Level Control of Structural Hierarchy in Nanocomposites"
***Prof. Robert MacFarlane**, Massachusetts Institute of Technology*

"Molecular Design of Materials for Membrane-based Separations"
***Prof. Zachary Smith**, Massachusetts Institute of Technology*

Biopolymers and Antibacterial Surfaces"
***Prof. Jessica Schiffman**, University of Massachusetts, Amherst*

For more information, please contact Osker Dahabsu at osker@uconn.edu or visit *polymer.ims.uconn.edu*

IMS INSTITUTE OF MATERIALS SCIENCE

polymer.ims.uconn.edu/seminars/

UCONN

IMS Director Inducted into National Academy of Inventors

Excerpted from UConn Today

Dr. Steven L. Suib (center), Director of IMS, is inducted into the National Academy of Inventors by Dr. Paul R. Sanberg (left), President of the Academy, and Mr. Drew Hirshfeld (right), Commissioner for Patents for the U.S. Patent and Trademark Office

Board of Trustees Distinguished Professor of Chemistry Steven L. Suib, Ph.D. has some advice for early career faculty and student researchers who are interested in inventing. Given that Suib was recently named a fellow of the National Academy of Inventors (NAI), it would probably be smart to grab a pencil.

"Ask a lot of questions, know the literature, don't be afraid to move on from ideas that just aren't working. But above all, keep an open mind and work with other people," offered Suib.

Throughout his nearly 40-year research career, Suib has lived by these words. As a preeminent expert in solid state chemistry and the synthesis of novel materials with a strong environmental focus, his work has produced numerous discoveries with a variety of applications in several industry sectors.

Designated a "Chemical Pioneer" by the American Institute of Chemists in 2005, Suib holds more than 31 U.S. patents and has disclosed well over 100 inventions, the most of any UConn faculty member. He joins three other colleagues who have previously been named NAI Fellows – Dr. Pramod Srivastava, Dr. Cato Laurencin, and Dr. Lakshmi Nair all from UConn Health. Suib is UConn's first NAI Fellow from the Storrs or regional campuses.

"It's a great honor to be named an NAI Fellow, especially as the first representative from Storrs," Suib said. "I'm sure there will be many more inventors from UConn to follow, both from our faculty and from our student population."

Election to NAI Fellow status is the highest professional accolade bestowed solely on academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and welfare of society.

With the election of the 2017 class, there are now 912 NAI Fellows, representing more than 250 research universities and governmental and non-profit research institutes. The 2017 Fellows are named inventors on nearly 6,000 issued U.S. patents, bringing the collective patents held by all NAI Fellows to more than 32,000 issued U.S. patents.

As an expert on solid materials such as catalysts, polymers, ceramics, and semi-conductors, Suib's research explores how we can control their properties for industrial use. He also studies how to control the size and shape of holes in porous materials and nano-particles. In all of his research projects, he seeks to

> **Ask a lot of questions, know the literature, don't be afraid to move on from ideas that just aren't working. But above all, keep an open mind and work with other people.**
>
> **~ Dr. Steven L. Suib**
> **Board of Trustees Distinguished Professor of Chemistry**

make the chemical process or the final material more affordable to produce, more effective for its intended use, and also "greener," to limit the impact on the environment.

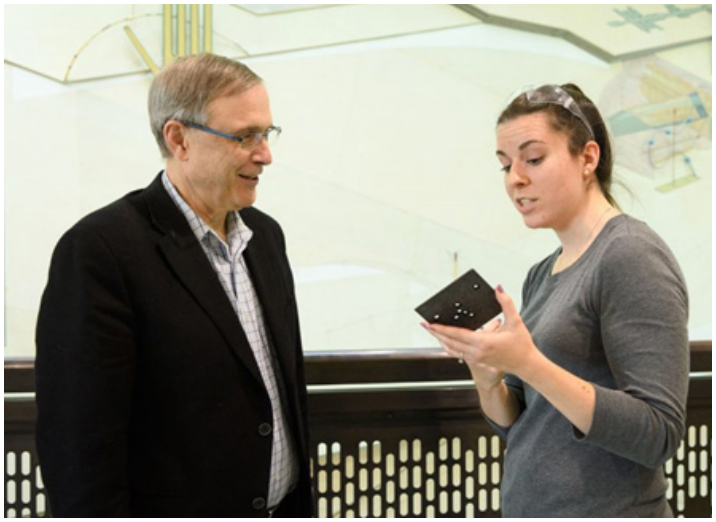
One of the green technologies Suib is responsible for discovering is a method for making a class of porous materials that allows for greater manufacturing controls. To date, the process has resulted in the creation of more than 75 new families of materials, and that number continues to grow. Because the key catalyst in this process is recyclable and can be reused after it is extracted with no harm to the final product, it is both more environmentally friendly and more efficient than the longstanding water-based method.

Since coming to UConn in 1980, Suib has won $7.5 million in federal and state research funding, and has attracted almost $7 million in corporate-sponsored research funding from global industry leaders including United Technologies, ABB Lummus, Toyota, Rohm & Haas, GE, Fujitsu, Texaco, and others.

Many of Suib's patents are jointly owned with these corporate partners and respond directly to challenges faced in industry. Some of these innovations include a method for making ceramic fiber composites to increase strength of materials and prevent corrosion used by United Technologies, and a process using microwave energy and a catalyst to generate high value products used by Texaco and Toyota.

According to Suib, some of the greatest benefits of being an academic inventor are the opportunities it allows him to provide to his students, many of whom will work in industry after graduating from UConn. These students gain hands-on experience solving real-world problems while still in an academic research setting.

"Inventorship gives you perspective and forces you to consider not only the basic scientific implications of your work, but also the practical uses of your discoveries," explains Suib. "This way of thinking has opened many doors for collaborations with partners from a whole host of sectors, which has in turn opened a lot of doors for my students. It's been amazing to work with these companies."



Newly named NAI Fellow Steven Suib, left, with Shannon Poges '17 Ph.D. at the Chemistry Building. Poges is holding a sample of a composite material produced in their lab. (Peter Morenus/UConn Photo)

> **Technology commercialization is critically important to the University's mission to benefit society with innovative research and discoveries. We are committed to supporting creative faculty like Professor Suib as they navigate the complex process of transforming an idea into a tangible product. We are truly proud of his accomplishments.**
>
> **~ Dr. Radenka Maric, Vice President for Research UConn and UConn Health**

Recently Suib and his students collaborated with Connecticut-based Loos & Co. as part of the Quiet Corner Innovation Cluster to conduct chemical analyses of the company's materials and monitor processing factors that impact and improve product quality. The work for the project was conducted at the UConn-Thermo Fisher Scientific Center for Advanced Microscopy. Suib is the director of this center, which is housed at the Innovation Partnership Building at the UConn Tech Park.

Suib and a team of student researchers analyzed the chemical compositions, structures, shapes, and other properties of materials Loos & Co. sources from around the world. They determined that the variance in material strength stemmed from abnormal interlamellar spacing in the pearlite found in steel.

"The opportunity to meet with the next generation of researchers, the next generation of engineers, was one of the factors that drew us into working with UConn, and it's going to pay dividends for years to come," said Robert Davis, vice president of sales and marketing at Loos & Co., in a previous statement.

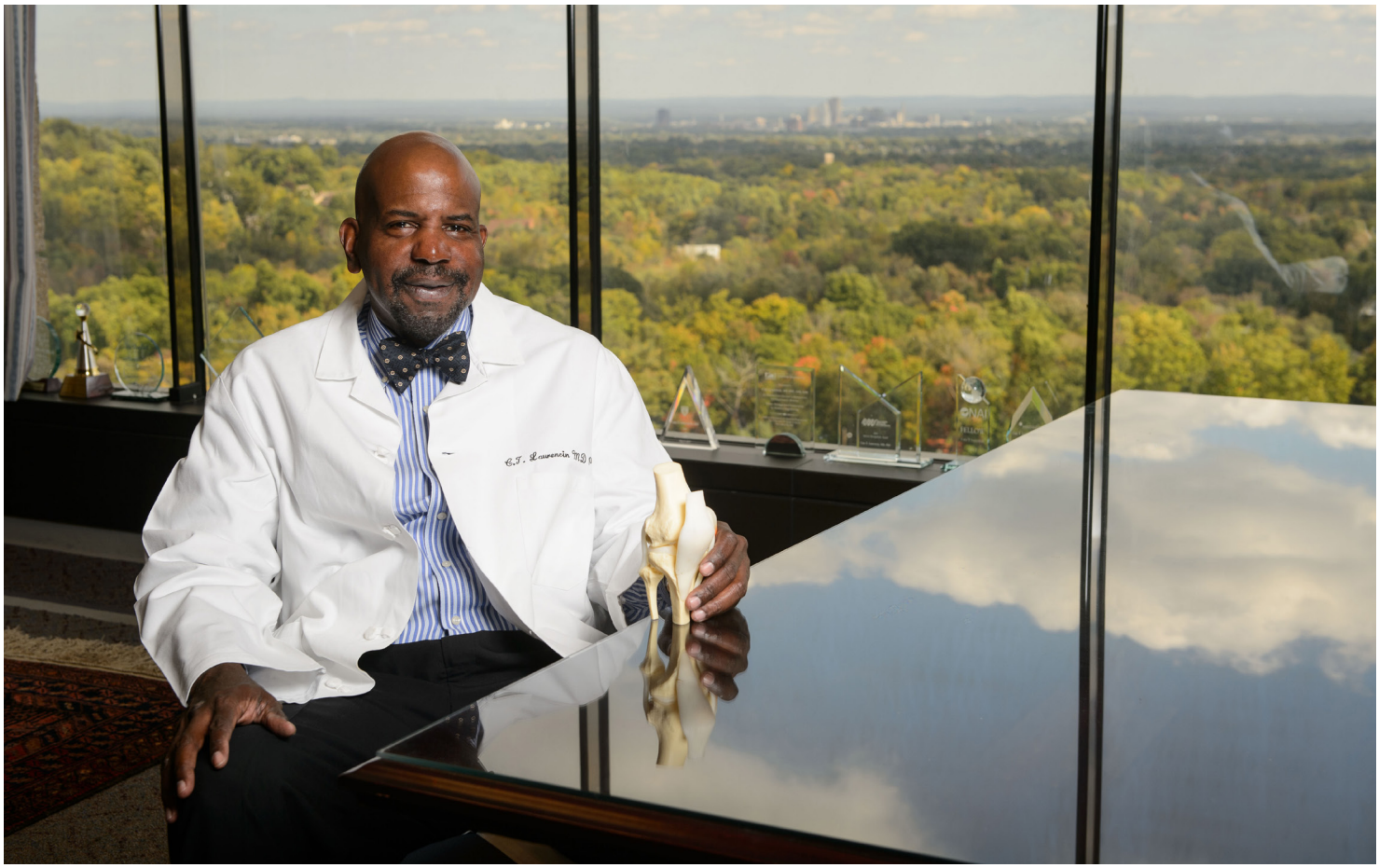
In addition to keeping an open mind and seeking internal and external partnerships to be a successful inventor, Suib also credits the University with providing significant financial and institutional support through matching funds, specialized equipment, and expertise from technology transfer experts within the Office of the Vice President for Research to patent and market his discoveries to potential licensees.

"Technology commercialization is critically important to the University's mission to benefit society with innovative research and discoveries," says UConn's Vice President for Research, Radenka Maric. "We are committed to supporting creative faculty like Professor Suib as they navigate the complex process of transforming an idea into a tangible product. We are truly proud of his accomplishments."

In April 2018, Suib and the other 2017 NAI Fellows were inducted into the Academy as part of the Seventh Annual Conference of the National Academy of Inventors in Washington, D.C. He plans to continue to be an active member of UConn's NAI Chapter, which launched in September 2017 with 24 chapter members to promote academic inventorship at the University.

UConn Engineering Professor to Receive Honorary Degree from the Icahn School of Medicine

Excerpted from UConn Today



Dr. Cato Laurencin at his office at UConn Health in Farmington, CT (Peter Morenus/UConn Photo)

Dr. Cato T. Laurencin, the University of Connecticut's 8th University Professor in school history, and a tenured professor in the Chemical and Biomolecular Engineering Department, the Materials Science and Engineering Department, and the Biomedical Engineering Department, received an honorary Doctor of Science degree from the Icahn School of Medicine at Mount Sinai on May 11, recognizing his impact and contributions to the medical field and his pioneering work in Regenerative Engineering.

More specifically, his citation states, "Doctor Cato T. Laurencin, for your revolutionary impact on the fields of biomaterials, stem cell science, nanotechnology, drug delivery systems, and regenerative engineering, for advancing our ability to treat diseases and heal injuries, and for inspiring important lines of inquiry now and in the future, it is a privilege to confer upon you the degree of Doctor of Science, Honoris Causa"

Laurencin's work in nanotechnology, polymer-ceramic systems, and engineered tissue regeneration has been funded by the National Institutes of Health and National Science Foundation for three decades and has had a tremendous impact on the field, inspiring numerous new technologies that are either available to patients or in the clinical pipeline, and countless other technologies to be developed in the future. His ground-breaking work is also the basis for lifesaving clinical products used in the treatment of brain tumors and musculoskeletal injuries requiring bone and ligament repair, for which he was honored in 2016 with the National Medal of Technology and Innovation, the nation's highest honor for technological achievement.

Kazem Kazerounian, Dean of the UConn School of Engineering, echoed the sentiment of the citation, and emphasized the importance of Laurencin to the UConn community and beyond:

"Dr. Laurencin is an asset to the School of Engineering, as an accomplished educator and a voracious researcher," Kazerounian said. "This honor is well-deserved, and reflects the reputation he has in the medical community, as well as the reverence he holds among his peers."

IInternationally-renowned, Laurencin serves a dual role with UConn Health, as the Albert and Wilda Van Dusen Distinguished Endowed Chair in Orthopaedic Surgery and director of both the Raymond and Beverly Sackler Center for Biomedical, Biological, Physical and Engineering Sciences and the Institute for Regenerative Engineering at UConn Health. He is also CEO of the Connecticut Institute for Clinical and Translational Science (CICATS), UConn's cross-university translational science institute. He previously served as the UConn Health Center's Vice President for Health Affairs and Dean of the UConn School of Medicine, and prior to that was the Lillian T. Pratt Distinguished Professor and chair of the Department of Orthopaedic Surgery at the University of Virginia, as well as the Orthopaedic Surgeon-in-Chief at the University of Virginia Health System. He is an elected member of both the National Academy of Medicine and of the National Academy of Engineering.

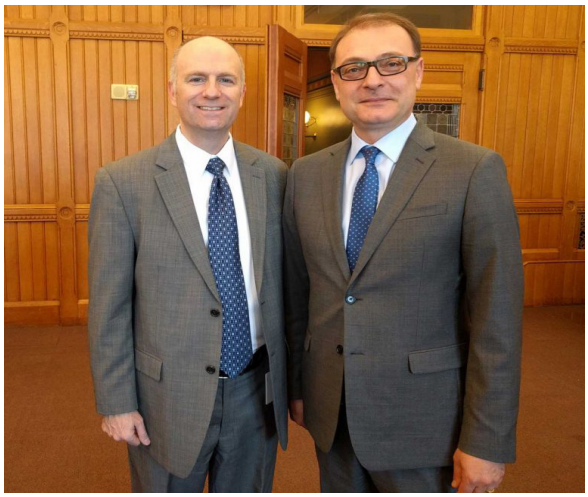
Laurencin has a degree in chemical engineering from Princeton University, graduated Magna Cum Laude with an M.D. from Harvard Medical School, and holds a Ph.D. in Biochemical Engineering/Biotechnology from MIT.

MSE Professor Pamir Alpay Receives 2018 UConn- AAUP Excellence Award

by Amanda Olavarria for UConn Tech Park

GE Professor of Advanced Manufacturing Pamir Alpay was one of the few distinguished recipients of the 2018 UConn-AAUP Excellence Awards. He received the Excellence in Research & Creativity: Career Award, which is given to faculty who have contributed to a field of knowledge or area of inquiry. This award honors research excellence and creativity that enhances the University's academic reputation. It recognizes scholarship with a national and international reputation, outstanding service in promoting scholarship at UConn, and long-term impact on UConn scholarship. The recipient must have a record of scholarly and creative productivity and must have worked at UConn for at least 10-years.

The UConn-AAUP seeks nominations of its members in areas of teaching, research, and service recognition. A formal presentation was held April 23, 2018, at the State Capitol building to honor this year's recipients. Colleagues, friends, and families gathered to congratulate these deserving recipients on their achievements.



State Representative Gregg Haddad (l), IPB Director and GE Professor of Advanced Manufacturing Pamir Alpay (r)

Dr. Jie He Receives UConn-AAUP Excellence Award

Dr. Jie He

Dr. Jie He was awarded the Excellence in Research & Creativity: Early Career Award recognizing outstanding scholarship, which may include journal articles, conference papers, books, exhibitions of creative work, external funding and other appropriate criteria as determined by the evaluating committee, with an emphasis on scholarship performed at UConn.

Dr. He has published his research extensively in such journals as the Royal Society of Chemistry's *Dalton Transactions,* the American Chemical Society's *Nano Letters*, and the *Journal of Polymer Science*.

He is the head of the Materials Synthesis Group, which works at the interface of polymers and inorganic nanomaterials. The main research themes of the group include, programmable synthesis of polymer/inorganic hybrid materials, molecule-mimicking self-assembly of anisotropic colloids in solution, and catalytic applications of hybrid materials.

Dr. Harold Brody Honored by Advanced Casting Research Center

The Advanced Casting Research Center (ACRC) of Worcester Polytechnic Institute bestowed its Merton C. Flemings Award upon Dr. Harold Brody. The award is given biennially to recognize individuals who have made significant contributions to the understanding of solidification processing fundamentals, which have been applied commercially in the foundry industry.

Dr. Brody, a Distinguished Professor of Materials Science and Engineering, focuses his research on understanding casting and solidifications processes, applying computer-aided analysis and design to materials processing with emphasis on casting, and innovating in engineering education. At the Massachusetts Institute of Technology (MIT), as a student, as a member of the research staff, and as a visiting professor, Dr. Brody collaborated with Professor Merton Flemings and his team to provide models for solute redistribution during dendritic solidification of casting and welds, for application of directional solidification to high temperature superconductors, and for undercooled alloys.

Merton C. Flemings Award presented to Professor Harold D. Brody (left) by Professor Merton C. Flemings of MIT (center), with Professor Diran Apelian of Worcester Polytechnic Institute and founding Director of ACRC (right)

The ACRC is an academic-industry partnership headquartered on the campus of Worcester Polytechnic Institute in Worcester, MA. The center focuses on assisting industry partners with technical issues, specifically in the areas of light metals, non-ferrous alloys, and semi-solid processing.

Dr. Challa V. Kumar Honored by Chemical Research Society of India

Dr. Challa V. Kumar

The Council of the Chemical Research Society of India (CRSI) selected Dr. Challa V. Kumar for its Honorary Fellowship/CRSI Medal 2018. The medal is conferred on Chemists of Indian origin working outside India who have contributed extensively to the promotion of Chemical Research.

Dr. Kumar's research focuses on creating a new field of chemistry, Biological Materials, using standard chemical reactions to modify proteins to create novel and exciting materials. He joins an international list of exceptional researchers from institutions that include the University of Cambridge, Louis Pasteur University, Harvard University, Stanford University, and MIT.

Through his research, Dr. Kumar has brought significant attention to UConn and the Chemistry Department, having been awarded an American Association of University Professors (AAUP) Research Excellence Award in 2015 and a Fulbright Scholarship in 2014. His research is widely published and he has been granted numerous research funding grants.

As part of the honor, Dr. Kumar was invited to present his research at the 22nd National Symposium in Chemistry and 12th CRSI-RSC Symposium at the Pt. Ravishankar Shukla University in Raipur, India in February 2018.

The Chemical Research Society of India was established in 1999 with a mission to "recognize, promote and foster talent in chemistry and chemical sciences and to improve the quality of chemical education at all levels."

Mark Aindow Appointed Executive Director for Innovation, External Engagement, and Industry Relations

Excerpted from UConn Today

Dr. Mark Aindow was appointed Executive Director for Innovation, External Engagement, and Industry Relations effective fall 2018. In this role, Dr. Aindow will serve as a catalyst for new interactions between faculty, potential commercial partners, and other research organizations to support and articulate UConn's technology innovation and research capacity. He is tasked with identifying and promoting initiatives that provide growth opportunities for applied research through technology transfer and industry partnerships. We will also look to Dr. Aindow to develop large-scale interdisciplinary, center-level initiatives, and proposals involving multiple researchers, and to coordinate with the Office of the Vice President for Research (OVPR) and Government Relations to keep state agencies and congressional offices informed as appropriate, as we seek to gain support for new federal initiatives that align with UConn's strategic priorities.

Dr. Aindow brings with him 27 years of experience in collaborative, interdisciplinary research with industry, academic, and other partners. He understands that in order for UConn to expand our research funding portfolio, it is essential that we look beyond the boundaries of traditional opportunities and that we increase outreach in emerging areas of strength for the University.

Dr. Aindow's research, which is often interdisciplinary and invariably includes an industrial partner or sponsor, involves the study of microstructural development in engineering materials using, primarily, electron microscopy techniques. These projects include work with companies like GE Energy, Thermo Fisher Scientific (formerly FEI), and UTC Aerospace Systems, and all are associated with broader industry partnerships with UConn including: the GE/UConn partnership, the UConn/FEI Center for Advanced Microscopy and Materials Analysis (CAMMA), and the UConn/UTAS Center for Advanced Materials.

Dr. Aindow received a B.Eng. in Metallurgy and Materials Science in 1985 and a Ph.D. in Materials Science and Engineering in 1988 from the University of Liverpool. He joined the faculty at the University of Connecticut in 1999 and is currently a Professor of Materials Science and Engineering. While at UConn, Dr. Aindow served as Director of the MSE Program from 2006-2009 and as Associate Director for the Institute of Materials Science from 2013-2017. He has published over 350 peer-reviewed papers in journals and conference proceedings, and has graduated 29 Ph.D.s.

Pamir Alpay Named Executive Director of UConn's Innovation Partnership Building

Excerpted from UConn Today

UConn's Innovation Partnership Building (IPB) at the UConn Tech Park has new leadership. Professor of Materials Science and Engineering, Dr. S. Pamir Alpay now serves as Executive Director of the state-of-the-art facility and associated industry partnerships. Dr. Alpay replaces Dr. Radenka Maric, who served in the role until her promotion to Vice President for Research at UConn and UConn Health in July 2018.

"We are thrilled to have someone with Pamir's extensive experience as a scientist and collaborator leading the Tech Park," says Dr. Maric. "Having already worked closely with several of the companies associated with the Tech Park and currently leading the UTAS Center for Advanced Materials which will be housed at the IPB, I am confident that Dr. Alpay will be able to hit the ground running as Executive Director. We are excited to see him build on the progress already achieved by centers located at the IPB, the School of Engineering, and the Institute of Materials Science."

Dr. Alpay received his Ph.D. in Materials Science and Engineering in 1999 from the University of Maryland, where he specialized in modeling of functional materials systems. He remained at the University of Maryland in the Materials Research Center as a postdoctoral research associate until 2001. Dr. Alpay then joined UConn's Department of Materials Science and Engineering (MSE) as an Assistant Professor. He was promoted to the rank of Associate Professor (with academic tenure) and then to Professor in 2007 and 2010, respectively. Beginning in 2013, he served as the Department Head of MSE.

Dr. Alpay has an impressive research background, which includes an NSF-CAREER Award in 2001, the UConn School of Engineering Outstanding Junior Faculty Award in 2004, over 180 peer-reviewed journal publications and conference proceedings, four invited book chapters, and an invited book co-authored on compositionally graded ferroelectric materials.

According to university leaders, Dr. Alpay also has a proven record as a capable collaborator, having successfully organized several international symposia in major conferences on a variety of topics, including ferroelectric thin films, multiferroic materials, and functional materials in nanoscale. Dr. Alpay is a respected leader in his field, and has delivered nearly 100 invited talks/seminars at academic institutions, national laboratories, industry, and in international meetings and workshops.

Dr. Alpay is an elected member of the Connecticut Academy of Science and Engineering (CASE), is a Fellow of the American Physical Society, and was the United Technologies Corporation (UTC) Associate Professor in Engineering Innovation from 2008 to 2010. His research focuses on smart/functional materials and multi-scale materials modeling. He is also currently an editor for the *Journal of Materials Science*.

In this important leadership role, Dr. Alpay represents the university in all matters relating to the Tech Park, and leads efforts to establish new industry partnerships that leverage the space and sophisticated resources available in the IPB with the expertise and capabilities of UConn's world-class faculty.

"The IPB and Tech Park will be an important part of UConn's legacy as a leading public research university," says Alpay. "So much progress has already been made to build this unique facility and establish strong partnerships. I am honored to have the opportunity to continue this work and to play a part in shaping this legacy."

Rainer Hebert Appointed Associate Director of IMS

Dr. Rainer Hebert was appointed Associate Director of the Institute of Materials Science. Dr. Steven Suib made the announcement in August 2017, highlighting Hebert's "dedication to IMS, his excellent scholarship, and outstanding research program."

Dr. Hebert earned his Ph.D. from the University of Wisconsin-Madison in 2003 and held postdoctoral fellowships at Research Center Karlsruhe, Germany and the University of Wisconsin-Madison, both from 2003 to 2005. He joined the faculty of UConn in 2006 and has since built an outstanding set of credentials which include serving as the director of the Additive Manufacturing Innovation Center, Director for Undergraduate Studies for the Materials Science and Engineering Department, and in 2016 he was honored by the School of Engineering with a Castleman Professorship in Engineering Innovation.

Dr. Hebert's research specialties include alloy development through additive manufacturing, additive manufacturing process capabilities, improvements in elevated temperature strength for high strength low alloy steel, and devitrification reactions in metallic glasses.

Bryan Huey is New Department Head of Materials Science and Engineering Department

Dr. Bryan Huey recently served as a United Technologies Professor of Engineering Innovation as well as the Director for Graduate Students in MSE. His path to academia began with a B.S. in Materials Science and Engineering at Stanford University in 1993. Professor Huey went on to obtain his Ph.D. from the University of Pennsylvania in 1999, where he first started working with AFM in Dawn Bonnell's group. While there he developed scanning surface potential microscopy to attain the first nanoscale measurements of potential barriers in varistors.

Professor Huey has published over 75 papers in a variety of journals such as *Nature*, *Nanoletters*, and *Applied Physic Letters*. He has co-organized an annual symposium and was recently selected as one of five co-organizers for the ~7000-attendee Materials Research Society (MRS) Fall Meeting for 2019.

Luyi Sun Named Head of IMS Polymer Program

Dr. Luyi Sun was appointed head of the IMS Polymer program effective fall semester 2018. Luyi joined UConn under the Eminent Faculty Initiative. He received his Ph.D. at the University of Alabama in 2004. He was an assistant professor of chemistry at Texas State University from 2009-2013 and was a post-doctoral fellow at both Texas A&M and the University of Alabama.

Professor Sun's research focuses on multi-functional nanostructured materials; polymeric materials and new polymer processing development; layered compounds; green science and engineering; and hydrates and porous materials for energy storage.

Academic Promotions

Dr. Douglas Adamson
Professor

Dr. Avinash Dongare
Associate Professor

Dr. Pu-Xian Gao
Professor

Dr. Rajeswari Kasi
Professor

Dr. Luyi Sun
Professor;
Castleman Professor in Engineering Innovation

Dr. Anson Ma
Associate Professor

Dr. Lesley Frame (MSE) joined the Materials Science and Engineeering Department as an assistant professor effective fall semester 2018. Lesley's most recent positions include Associate Professor of Technology Management at the University of Bridgeport and Director of Product Development at Thermatool Corporation, an Inductotherm Group company in East Haven, CT.

Dr. Frame earned her S.B. from Massachusetts Institute of Technology in the Department of Materials Science Engineering. She then completed her M.S. and Ph.D. in MSE at the University of Arizona. After receiving her Ph.D., she remained at the University of Arizona as a postdoctoral researcher with the Arizona Research Institute for Solar Energy, and in this position, she worked on the novel design and construction of a solar-thermal desalination unit for use by the Navajo Nation to generate potable water for livestock.

Dr. Jasna Jankovic (MSE) brings to the Materials Science and Engineering Department over 20 years of industry and research experience in various areas of engineering. Specifically, her areas of expertise include fuel cell materials fabrication and characterization, advanced microscopy techniques, ceramic materials processing, polymer coatings, fuel refining, and catalyst deactivation.

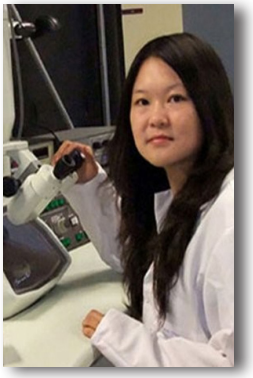
Dr. Jankovic completed her doctoral research at the University of British Columbia where she worked on proton conductive ceramic materials for an intermediate temperature proton exchange fuel cell. Her work provided an understanding of the conductivity mechanisms in these novel materials and opened the door for further development in the future.

Dr. Stefan Schafföner (MSE) joins the Materials Science and Engineering Department as an assistant professor, beginning Fall 2018. Dr. Schafföner earned his Diplom-Ingenieur (M.S. equivalent) in 2009 and his Ph.D. in 2015 at Technische Universität Bergakademie Freiberg. He served as a postdoctoral scholar in the Department of Materials Science and Engineering at the Norwegian University of Science and Technology as well as at the Technische Universität Bergakademie Freiberg. Dr. Schafföner's research has taken him to diverse settings and, as a result, he is able to both speak and write in German, English, Chinese, and Portuguese.

Dr. Schafföner's research interests include ceramic materials, composites for high temperature applications and titanium alloys, including materials synthesis, industrial application, and failure and damage analysis.

Dr. Volkan Ortalan (MSE) joins the Materials Science and Engineering Department as an associate professor, beginning Fall 2018. Dr. Ortalan earned two B.S. degrees in 2005 at Middle East Technical University, one in mechanical engineering and another in metallurgical and materials engineering. In 2010, he earned his Ph.D. in materials science at the University of California-Davis. Dr. Ortalan went on to work as a postdoctoral scholar at the Physical Biology Center for Ultrafast Scince and Technology at California Institute of Technology with Nobel Laureate Ahmed Zewali. He also served as a visiting scientist at the National Center of Electron Microscopy at Lawrence Berkeley National Laboratory and at the Advanced Microscopy Laboratory at the Oak Ridge National Laboratory.

Dr. Ortalan's research interests include the development of ultrafast dynamic transmission electron microscopy for atomic-scale visualization in space and time as well as applications of in situ (ultrafast dynamical) TEM to phase and structural transformations, materials under extreme conditions, nucleation and growth of nanomaterials, molecular-level dynamic imaging of biological structures, and high resolution environmental TEM for heterogeneous catalysis.



Dr. Yuanyuan Zhu (MSE) joins the Materials Science and Engineering Department as an assistant professor, beginning Fall 2018. Dr. Zhu earned her B.S. in metallic materials engineering from Sichuan University in 2006, her M.S. in solid atomic imagining division from the Chinese Academy of Science in 2009, and her Ph.D. in materials science and engineering from Texas A&M University in 2013.

Dr. Zhu has over ten years of electron microscopy experience. Until recently, she served as a staff scientist at the Energy and Environment Directorate at Pacific Northwest National Laboratory. Dr. Zhu also worked at the R&D Division at Haldor Topsøe A/S, Demark, in collaboration with the National Center for Electron Microscopy at Lawrence Berkeley National Laboratory (LBNL) and Daresbury SuperSTEM, UK. Dr. Zhu has a broad materials research background, which includes experimental and theoretical investigation of mechanical properties of carbon/carbon composites, high-T superconductivity and flux-pinning enhancement, strain engineering of strongly correlated electronic heterosystems, chemical inhomogeneity in 2D transition metal dichalcogenides, promoted catalysts and catalytic dynamics, and advanced analysis of defects in nuclear structural alloys. Currently, her research interests involve developing in situ and operando STEM for gas environmental atomic microscopy, diffraction contrast imaging (DCI-STEM) for dislocation characterization, and deep-data electron microscopy.

IMS Faculty Members

IMS resident faculty are indicated in bold

Biomedical Engineering

Dr. Ki Chon
Dr. Alix Deymier
Dr. Martin Han
Dr. Kazunori Hoshino
Dr. Cato T. Laurencin
Dr. Tannin Schmidt
Dr. Sina Shahbazmohamadi
Dr. Wendy Vanden Berg-Foels

Chemical & Biomolecular Engineering

Dr. George M. Bollas
Dr. Kelly A. Burke
Dr. Cato T. Laurencin
Dr. Yu Lei
Dr. Anson W. K. Ma
Dr. Jeffrey R. McCutcheon
Dr. Mu-Ping Nieh
Dr. Richard S. Parnas
Dr. Leslie Shor
Dr. Luyi M. Sun
Dr. Julia A. Valla

Chemistry

Dr. Douglas H. Adamson
Dr. Alfredo Angeles-Boza
Dr. Alexandru D. Asandei
Dr. William F. Bailey
Dr. Jie He
Dr. Rajeswari Kasi
Dr. Challa Vijaya Kumar
Dr. Yao Lin
Dr. Tomoyasu Mani
Dr. Fotios Papadimitrakopoulos
Dr. Eugene Pinkhassik
Dr. Rebecca Quardokus
Dr. Jessica Rouge
Dr. James F. Rusling
Dr. Thomas A. P. Seery
Dr. Gregory Sotzing
Dr. Steven L. Suib
Dr. Jing Zhao

Civil & Environmental Engineering

Dr. Jeong-Ho Kim
Dr. Baikun Li
Dr. Ramesh Malla
Dr. Kay Wille
Dr. Arash E. Zaghi
Dr. Wei Zhang

Electrical & Computer Engineering

Dr. Rajeev Bansal
Dr. Necmi Biyikli
Dr. Yang Cao
Dr. Maria Chrysochoou
Dr. Ali Gokirmak
Dr. Faquir C. Jain
Dr. Helena Silva
Dr. Geoff Taylor

Marine Sciences

Dr. Heidi M. Dierssen

Materials Science & Engineering

Dr. Mark Aindow
Dr. S. Pamir Alpay
Dr. Harold D. Brody
Dr. Avinash M. Dongare
Dr. Lesley Frame
Dr. Pu-Xian Gao
Dr. Rainer J. Hebert
Dr. Bryan D. Huey
Dr. Jasna Jankovic
Dr. Theodore Z. Kattamis
Dr. Cato T. Laurencin
Dr. Seok-Woo Lee
Dr. Radenka Maric
Dr. Serge M. Nakhmanson
Dr. Volkan Ortalan
Dr. George A. Rossetti Jr.
Dr. Stefan Schafföner
Dr. Mei Wei
Dr. Yuanyuan Zhu

Mechanical Engineering

Dr. Baki Cetegen
Dr. Xu Chen
Dr. Wilson K. S. Chiu
Dr. Robert X. Gao
Dr. Kazem Kazerounian
Dr. Leila Ladani
Dr. Ying Li
Dr. George Lykotrafitis
Dr. Thanh D. Nguyen
Dr. Julian A. Norato
Dr. David M. Pierce
Dr. Savas Tasoglu
Dr. Dianyun Zhang

Molecular & Cell Biology

Dr. James L. Cole
Dr. Kenneth M. Noll
Dr. Victoria L. Robinson
Dr. Carolyn M. Teschke

Nutritional Sciences

Dr. Yangchao Luo

Oral Health & Diagnostic Sciences

Dr. Mazhar I. Khan

Pathobiology

Dr. Mazhar I. Khan

Pharmaceutical Sciences

Dr. Robin H. Bogner
Dr. Diane J. Burgess
Dr. Bodhisattwa Chaudhuri
Dr. Devendra Kalonia
Dr. Debra A. Kendall
Dr. Xiuling Lu
Dr. Michael Pikal

Physics

Dr. Elena E. Dormidontova
Dr. Niloy Dutta
Dr. Gayanath W. Fernando
Dr. George Nicholas Gibson
Dr. Philip L. Gould
Dr. Douglas S. Hamilton
Dr. Jason Hancock
Dr. Menka Jain
Dr. Richard T. Jones
Dr. Jeffrey S. Schweitzer
Dr. Boris Sinkovic
Dr. Barrett O. Wells

Plant Science & Landscape Architecture

Dr. Cristian P. Schulthess

UConn Health Center

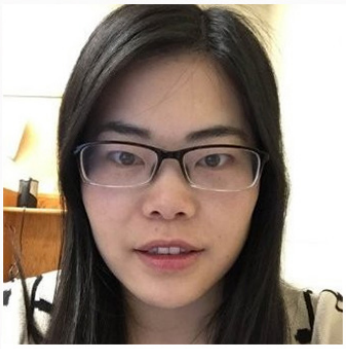
Dr. Douglas J. Adams
Dr. A. Jon Goldberg
Dr. J. Robert Kelly
Dr. Yusuf Khan
Dr. Liisa Tiina Kuhn
Dr. Sangamesh Kumbar
Dr. Cato T. Laurencin
Dr. Wai Hong (Kevin) Lo
Dr. Lakshmi S. Nair
Dr. Syam Nukavarapu

Emeritus/Retired Faculty

Dr. Thomas Anderson
Dr. James P. Bell
Dr. Philip E. Best
Dr. Robert R. Birge
Dr. Joseph I. Budnick
Dr. C. Barry Carter
Dr. Anthony DiBenedetto
Dr. Harry Frank
Dr. James Galligan
Dr. Norman Garrick
Dr. Maurice Gell
Dr. William Hines
Dr. Eric H. Jordan
Dr. Lawrence A. Kappers
Dr. Quentin Kessel
Dr. James Knox
Dr. Harris L. Marcus
Dr. Matthew Mashikian
Dr. Robert Northrop
Dr. Arthur McEvily
Dr. Douglas Pease
Dr. Donald Potter
Dr. Wolf-Dieter Reiter
Dr. Dan A. Scola
Dr. Montgomery T. Shaw
Dr. Winthrop W. Smith
Dr. William C. Stwalley
Dr. Chong Sook P. Sung

Congratulations Graduates

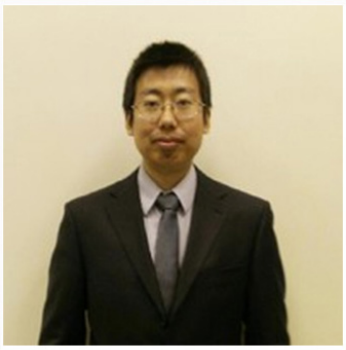
Congratulations 2017-2018 graduates. IMS wishes all of you all the best as you begin your careers.



Dr. Changmin Hu, Ph.D. Materials Science
Advisor: Dr. Mei Wei

Dr. Tahereh Jafari, Ph.D. Materials Science
Advisor: Dr. Steven Suib

Mr. Eric Krantz, M.S., Polymer Science
Advisor: Dr. Rajeswari Kasi

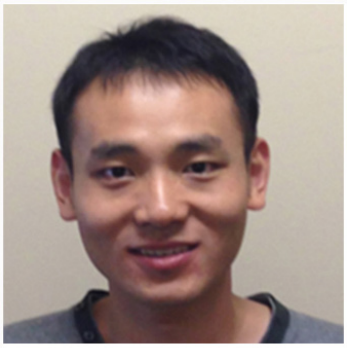


Dr. Mengfang Li, Ph.D. Polymer Science
Advisor: Dr. Gregory Sotzing

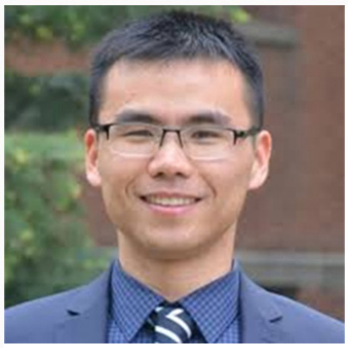
Dr. Jingjing Liu, Ph.D. Materials Science
Advisor: Dr. Luyi Sun

Dr. Krishna Pitike, Ph.D. MSE
Advisor: Dr. Serge Nakhmanson

Dr. Vignesh Vasu, Ph.D. Polymer Science
Advisor: Dr. Alexandru Asandei

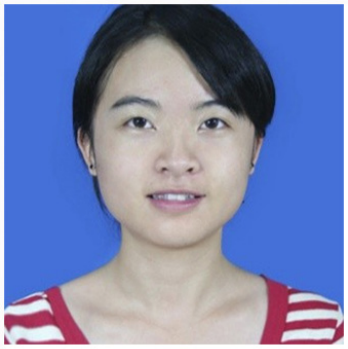


Dr. Jin Wang, Ph.D. MSE
Advisor: Dr. Avinash Dongare



Dr. Shiqi Yin, Ph.D. Physics
Advisor: Dr. Menka Jain

Dr. Xiaozheng Zhang, Ph.D. Polymer Science
Advisor: Dr. Gregory Sotzing



Dr. Wei Zhong, Ph.D. Materials Science
Advisor: Dr. Steven Suib

Ph.D. Student, Cain Hung, Explores the Possibilities of Additive Manufacturing

by Amanda Olavarria for MSE

Everyone in the field of materials science and engineering has a distinct definition of what it means to study the subject, but for 3rd-year graduate student, Cain Hung it means the understanding of how to make one thing into another. He uniquely compared this concept to the idea of a legendary substance known as the philosopher's stone, which can turn any base metal into gold.

Much like this alchemical substance, Cain Hung believes that the application of materials science and engineering can too have this transformative effect. Since materials science essentially explores how things are made, Cain found this field to be incredibly relevant and applicable.

In fact, the research he participated in as an undergraduate was what sparked his interest in an area of materials science known as additive manufacturing or 3D printing. "There is something great about being around a machine with the capability to create many possibilities," he claimed in reference to the 3D printing machine. Cain found that the more he learned about these machines, the more he discovered what type of designs he could make with them. In opposition to the misconception that 'one can make anything,' he has found that various factors go into the kinds of designs one can make, including the type of material and machine.

Ph.D. student, Cain Hung

When searching for a university to pursue his Ph.D. Cain's primary interest was finding one with a specialization in 3D printing. After looking into Dr. Rainer Hebert's group, which focuses on additive manufacturing, Cain was convinced to continue his education at UConn as a part of Hebert's research group.

Currently, Cain works on a project called aluminum alloy development for additive manufacturing, in which he is tasked with figuring out which aluminum alloys can be printed and have useful properties. His research is especially important due to the recent push from industry for new alloys tailored for additive manufacturing.

The MSE Department's interconnectedness played a huge role in Cain's success as a Ph.D. student and he believes it to be one of the department's many assets. At UConn MSE, sharing expertise is encouraged between research groups and often assists in further developments in research. In Cain's current project he works with the groups of Drs. Pamir Alpay, Mark Aindow, and Seok-Woo Lee. This allows him to receive input from experts in advanced characterization techniques, computational materials science, and traditional metallurgy.

Along with the insight gained from working with several research groups, Cain has also received excellent support from his advisor, Dr. Hebert. He has helped Cain in pointing out valuable resources, showing him the best research books to utilize, and assisting him with any questions he may have.

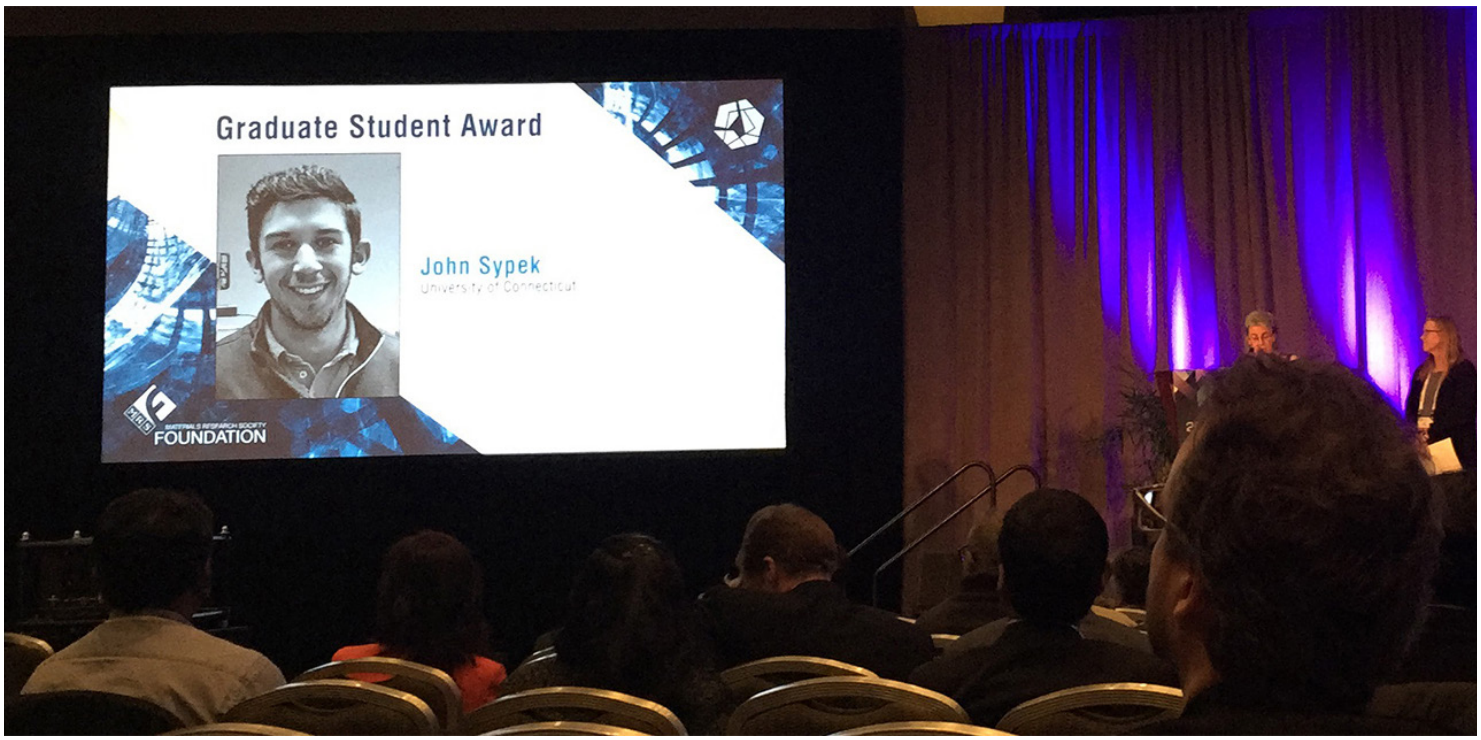
Dr. Hebert commented that "Cain's creativeness and talent combining computational approaches and experimental work has helped the research team to make good progress. He guides undergraduate students in their own research projects, which enhances his own educational experience. With a research topic that is firmly anchored in decades of metallurgical relevance, yet is directed toward cutting edge manufacturing technologies, Cain is on an excellent trajectory to become a research leader in industry in the near future."

The nature of the research project Cain is currently working on requires that he gives frequent talks to companies about his research progress. By doing this, he has gained knowledge on how to present his research effectively. "I have come to learn how to present my research in an understandable way, making sure to emphasize certain aspects depending on the audience," he explained.

Ultimately, Cain hopes to utilize the skills he has acquired in both his undergraduate and graduate years to pursue a career in research and development within the industry.

UConn Graduate Student Takes Home Gold at National Engineering Conference

by Amanda Olavarria for MSE



Sypek on screen at award announcement ceremony.

A Ph.D. candidate at the University of Connecticut has received the Materials Research Society's (MRS) Gold Graduate Student Award for its fall 2017 meeting.

John Sypek from the Department of Materials Science and Engineering has been recognized for his outstanding contributions to the progress of materials research through work to identify an intermetallic compound with his advisor, Dr. Seok-Woo Lee. The compound has remarkable shape-memory properties that can potentially be used for a range of purposes including deep space travel.

"It's a huge honor. MRS is an esteemed organization and this meeting is one of the biggest conferences in the world for researchers in the field," Sypek said. "To even be a finalist and then to win the Gold Award is really wonderful, especially to represent UConn and the Materials Science and Engineering Department."

The calcium-iron arsenide alloy Sypek is studying exhibits super-elasticity and shape memory effect, meaning it is highly compressible and it can "remember" its shape after being subject to extremely cold cryogenic temperatures of 30 to 40 degrees Kelvin, which is around minus 400 degrees Fahrenheit.

Dr. Lee received a grant for $586,648 from NASA to study the mechanical properties of the compound in hopes of unlocking the potential of using it to create a cryogenic actuator, a mechanical component of many kinds of spacecraft.

"John's work in this discovery speaks to his capability as a researcher in his own right and within a team," Lee said. "His results open a new direction for materials research on super-elasticity and shape memory effect. We have high expectations for his future career successes."

This research is Sypek's first venture in materials science after he graduated from UConn in 2014 with a degree in mechanical engineering.

A team Sypek was working with began studying this compound and other similar materials as a superconducting material, one that produces no electrical resistance and expels magnetic flux fields, when they discovered its astounding shape resilience.

Sypek said he looks forward to studying the function of this compound on a larger scale that is required for practical development.

"I'm excited for the opportunity to explore further into this material through testing based on the small nano and micro scale, and to size up our discoveries to get an actual working device," he said.

Sypek is expected to graduate in 2019 and plans to pursue a career in industry working in aerospace or renewable energy once he has earned his degree.

Two MSE Graduate Students Participate in Civic Engagement at the Nation's Capital

by Amanda Olavarria for MSE

Two UConn Materials Science and Engineering graduate students Tulsi Patel and Manny Rivas were invited to attend the 2018 Catalyzing Advocacy for Science and Engineering (CASE) Workshop in Washington, D.C.

CASE is an innovative program that provides information about Congress, the federal budget, and appropriations processes to upper-classmen and graduate students in science, mathematics, and engineering. This opportunity is specifically geared towards STEM students who want to learn more about science policy. Students are taught the federal policy-making process and how to voice their research throughout their careers.

This three-and-a-half-day program provides participants with the tools for effective science communication and civic engagement. The students who attended this year's workshop actively participated in interactive seminars about policy-making and communication. On the last day, students formed teams and held meetings with their elected members of Congress and congressional staff.

Tulsi stated, "Participants had the opportunity to voice their passion for science to members of Congress. The students from UConn had the pleasure of meeting Congressmen Courtney's legislative director and talk about research and tenure as graduate students. This experience has not only taught me how to be a better advocate for science, but also a more engaged citizen in our democracy."

This dynamic program bridges the gap between science and government policy. Instead of working in the classroom or the lab, MSE students Tulsi and Manny were granted the unique opportunity to explore the world of science through government involvement.

"It was an incredible experience learning about the federal budget process, how science policy is made, and communicating science to a broader audience. I gained insight on how to pave a career path in science policy, but more importantly, appreciate the process of how science is funded in this country," Tulsi claimed.

UConn graduate students with Congressman Courtney's legislative director in Washington D.C. Left to right: Alexa Combelic, Tulsi Patel, Tanisha Williams, Manuel Rivas

Manny added, "Attending this workshop has provided me with a greater understanding of how policies are made and the vital role we as citizens and engineers play. It also emphasized the importance of how science influences policy, how policy influences science, and how the ability of communicating the importance of your work to a non-technical audience is needed." These MSE students are not only making an impact for developments in materials science but also science communication through civic engagement.

2018 Polymer Program/MSE Joint Poster Session

The IMS Polymer Program and the Materials Science and Engineering Department held their annual joint poster session to coincide with the IMS Industrial Affiliates Program's 2018 Annual Meeting. The session, held at the new Innovation Partnership Building, provided an opportunity for Affiliates Program members and other industry partners to interact with students and learn about the research they are conducting. 31 posters were presented by students from IMS faculty member groups. The posters presented showcased students' academic achievements and potential for future success in polymer science.

The Polymer Program also presented its student awards as part of the day. The Stephanie H. Shaw Award is designated for female students showing academic achievement and potential for future success in polymer science. A committee of polymer program faculty and graduate students selected Danielle Heichel as the recipient of the award for the 2017-18 academic year. Ms. Heichel,

Students and industry partners during IMS/MSE Joint Poster Session

the first awardee in five years, was selected for her academic achievements and effectiveness in organizing and leading students toward increased involvement in scholarly activities

The Samuel J. Huang Student Research Award recognizes a graduate student, currently under the advisement of a Polymer Program faculty member, for outstanding research in the field of polymer science and engineering. A faculty committee selected Vignesh Vasu as the award recipient for the 2017-18 academic year. Mr. Vasu was selected for his strong work ethic, tremendous growth as a scientist during his five years as a graduate student, and successfully publishing two papers during the academic year.

Vignesh Vasu (l) is presented the Samuel J. Huang Student Research Award by Dr. Rajeswari Kasi (r)

Danielle Heichel (center), recipient of the Stephanie H. Shaw Award, with Drs. Montgomery Shaw (l) and Kelly Burke (r)

UConn MSE Alumna Janet Callahan Facilitates a Conversation About Student Success

by Amanda Olavarria for MSE

IMS Students with Professor Janet Callahan

MSE seminar speaker guest and alumna Janet Callahan, Ph.D., returned to UConn to give a seminar and also lead a discussion panel for senior MSE students in Associate Professor Rainer Hebert's senior design class. Professor Janet Callahan is the Chair of the Micron School of Materials Science and Engineering at Boise State University.

The panel consisted of MSE graduate students Tulsi Patel, Bahar Deljoo, Alexis Ernst, Pamela Dyer, Hannah Leonard, and Alexandra Longacre. In the panel, each of these graduate students spoke about their experience and what led them to pursue engineering.

Panel questions ranged from asking about a graduate student's daily schedule, to asking about possible internship opportunities. Since these seniors will either be graduating soon or applying to graduate school this was a very important discussion that gave guidance and instruction to these soon-to-be graduates.

This discussion made seniors aware of all the opportunities they have in different areas of the field. The graduate students also set straight any misconceptions about graduate school and provided more information about the process.

In the seminar titled "Student Success-and Myth Busting", Callahan spoke about what determines student achievement. In the seminar, Callahan refuted a common myth that one needs to take Calculus in high school or in their first semester at college to be successful in engineering. Her research showed that a student's success as an engineering student could be predicted by strong performance in the first math class taken in college- regardless of math course level. The same is true for English coursework; doing well in the course is what matters most. Dr. Callahan's advice for freshmen is to "Go to class, do your homework, and focus on your learning." She also said "Don't push yourself into a course for which you are not fully prepared!"

According to Callahan a student's self-efficacy influences the way students respond to tasks and challenges. She described self-efficacy as an individual's belief in his or her capacity to execute behavior necessary to produce specific results. Her talk was focused on student persistence and how this influences later success.

She later went on to describe how a complete overhaul in a first year course at Boise State University led to a nearly 10% increase in retention for women and minorities in STEM fields. The overhaul was accomplished through strong and sustained instructor interactions, leading to active learning, a strongly coordinated course and more.

Professor Callahan graduated from UConn with degrees in chemical engineering (BS) and metallurgy and materials science (MS and Ph.D.). Her Ph.D. advisor was Dr. Donald Potter and her thesis focused on ion implantation effects of reactive elements in alloys. After a post-doc in Australia, she was Assistant and Associate Professor at Georgia Tech until 2004 when she joined Boise University to help establish the BS program in Materials Science and Engineering.

Her research interests include surface modification of materials, combustion chemical vapor deposition of oxides, biomaterials, engineering education, and institutional change. Callahan is not only a member of the University of Connecticut Academy of Distinguished Engineers, but she also is a NSF CAREER awardee, and is on the Engineering Accreditation Commission for ABET.

MSE Department head at the time, Pamir Alpay was pleased with the event and said, "We are very proud of Professor Callahan and her many achievements. Having her back on campus was a pleasure and we benefited greatly from her visit. The panel she set up was terrific and the discussions inspired all our seniors."

IMS Industrial Affiliates Program

2018 saw continued growth as the IMS Industrial Affiliates Program (IAP) added five new members. *Pratt and Whitney*, a division of United Technologies Corporation and manufacturer of aircraft engines based in East Hartford, CT, has worked with UConn and IMS closely for many years and recently became a member of the program; *Unilever's* Trumbull R&D Centre supports over a dozen brands across it's skincare, haircare and deodorants divisions; *Henkel Corporation*, with leading innovations, brands and technologies in adhesive technologies, beauty care and laundry & home care, holds globally leading market positions in both the consumer and industrial business sectors; *Cabot Corporation* is a leading global specialty chemicals and performance materials company headquartered in Boston with a world-class technology campus in Billerica, MA; and *Cadenza Innovation*, founded by preeminent lithium-ion battery experts with more than 125 patents, is capitalizing on its intellectual property, field-proven operational and mass production expertise and partner networks to establish itself as a leader in low-cost, safe, and energy-dense storage solutions.

Industry partners listen to presentation by Dr. Linnaea Ostroff during morning session of IMS Industrial Affiliates Program 2018 Annual Meeting

In addition to new industry partners, the program saw changing faces in its staff. Two long-time lab managers retired. Mark Dudley, who managed the GPC and mechanical testing labs, retired after 22 years of service to UConn; and Gary Lavigne, who ran the spectroscopy lab, retired after 37 years. New lab managers have taken up the reins: Curt Guild for spectroscopy, and Nicholas Eddy for GPC, mechanical testing, and NMR. Both are chemists who received their Ph.D.s from UConn. Nicholas and Curtis bring an exciting combination of industry, teaching and research experience to the program.

The growth of the IAP is also evident in the highly successful annual meeting of 2018, which welcomed industry partners from over 35 companies. Faculty presentations have led to numerous collaborations between faculty and companies. The facility tours of the Innovation Partnership Building (IPB) stimulated industry attendees' thinking about how available instrumentation could advance their research and development programs. And student poster presentations highlighted future bright stars in materials.

IAP continues to expand its reach throughout UConn, engaging faculty in numerous departments to assist industry partners in solving problems. Research projects have been executed between industry partners and IMS faculty including Drs. Kelly Burke, Douglas Adamson, Alexandru Asandei, Montgomery Shaw, Steven Suib, and others. Outside of IMS, projects with Drs. Linnea Ostroff of Physiology and Neurobiology, Sina Shabazmohamadi of Biomedical Engineering, Dianyun Zhang of Mechanical Engineering, Kay Wille of Civil Engineering, Jeff McCutcheon of Chemical Engineering, and many others, have commenced.

Another tool IAP brings to bear to assist companies in resolving difficult technical problems is instrumentation. This year saw the opening of the highly impressive Industrial Partnership Building, or IPB. This state-of-the-art facility houses the Advanced Characterization Laboratory, which includes 10 electron microscopes, digitial microscopes, two micro-CT scanners, x-ray diffraction, and x-ray fluorescence; and the Additive Manufacturing Innovation Center, which includes three metal powder bed 3D printing machines, and numerous advanced metals processing and physical property measurement instruments.

IAP Partners with eBeam Film for SBIR Grant

IAP partnered with local small business, eBeam Film LLC of Shelton, CT, to win a $225,000 Small Business Innovation Research (SBIR) Phase I award from the National Science Foundation, for a project titled "*Medical Devices for Real-time Radiation Dosimetry at Sub-millimeter Spatial Resolution.*" The device under development will have the unique ability for radiation dose measurement at sub-millimeter resolution in real time. The innovation of this project lies in combining and adapting key elements of two well-established commercial technologies, piezoelectric polymers and radiochromic film, to produce a hybrid dosimeter. This dosimeter preserves the high spatial resolution of radiochromic film while improving its usability by making the changes caused by radiation exposure to become detectable by electronic means in real-time. This overcomes key drawbacks of existing devices which are incapable of spatial resolution below five millimeters and unsuitable for the small radiation fields associated with stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) treatments. Drs. Paul Nahass, Bryan Huey and Raji Kasi are managing UConn's materials research contribution to the project, which began in September 2017 and concludes in August 2018.

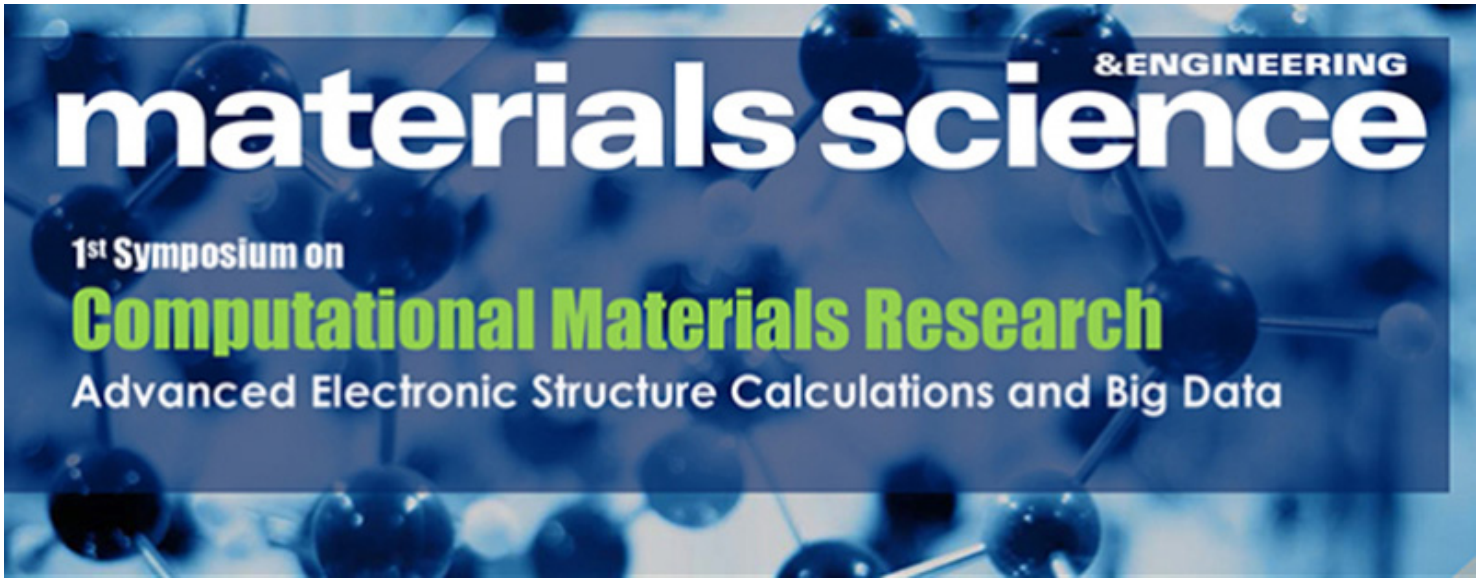
Industrial Affiliates Program Short Course
October 24 and 25, 2018

Unpacking the Black Box: Defining and Utilizing Chromatographic Separations and Spectroscopy
An IMS Industrial Affiliates Program Short Course

The goal of this two-day short course is to familiarize participants with separation and analytical techniques, including chromatography (GC/LC), mass spectrometry (MS), vibrational (IR/Raman) and magnetic resonance (NMR/EPR) spectroscopy. Participants will be introduced to quantitative and qualitative methods for analyses of complex systems, and learn the strengths and weaknesses of individual techniques. Understanding the complimentary nature of the discussed methods will allow the participant to appreciate and interpret spectroscopic data when applied to critical applications. The course subject matter will range from basic introductions and overviews to the complimentary nature of these methods and design of experiments to leverage the strengths and limitations of these techniques.

Course Highlights:
Separations and Detectors: Choosing Relevant Techniques
Defining and Utilizing Analytical Systems
Quantitative And Qualitative Methods
Complimentary Techniques: Pairing Analyses for Complex Questions

Postdocs Hold First Symposium on Computational Research




Dr. Sanjeev Nayak


Dr. S. Pamir Alpay

Postdoctoral researchers from the Institute of Materials Science and the Materials Science and Engineering Department held their 1st Symposium on Computational Research. IMS News asked Dr. S. Pamir Alpay, head of the Materials Science and Engineering Department at the time, and postdoctoral researcher, Dr. Sanjeev Nayak, coordinator for the symposium, about their expectations for the first year of the event:

How did the idea of this symposium come about?

As new students joined our group, there was a requirement to introduce them to the field. But, materials science and engineering is such a vast subject covering all the disciplines of STEM, it was desirable to have them see beyond the research interests of the group. Hence, a thought came that we should arrange a symposium. From another perspective, there existed no formal postdoctoral researcher's activity in the IMS/MSE and we know their important contribution in research. This symposium was planned such that IMS/MSE postdoctoral researchers could take the lead, discuss their research and create an active and brainstorming session. The IMS/MSE postdoctoral members from modeling and theory division voluntarily came forward and hence the symposium touches the theoretical aspect.

What are your expectations for the symposium and what does success look like?

Our expectations for this symposium are at the individual research level. For example, if someone is stuck in a bottleneck situation pertaining to one's research, it would be easy to seek help from a more experienced researcher in that field. We expect that the students and researchers would make themselves known to one other so that each would know where to find help. Maintaining a list of participants of this (and future) symposium will provide that necessary contact information. Our measure of success is simple, more active engagement with people and a sense of collective academics. The tone of this symposium is at the level of idea-exchange and concept development. If we can set a playground for conceptual development, naturally we would be doing creative research. We are glad that people from departments like, Mechanical Engineering, Chemistry, Physics, Mathematics, Statistics, Computer Sciences, and Electrical and Computer Engineering have signed-up for the symposium.

As this is being billed as the 1st, what are your expectations for future symposia?

We believe that isolated events cannot accomplish the broad goals and hence we encourage annual meetings of this kind. This year's program is an IMS/MSE postdoctoral activity and attendees have signed up from various departments of UConn and one guest from the Roger Williams University, Rhode Island. We can see that this type of symposium on fundamental research raises a lot of interest among researchers. Our effort for future symposia would be to accommodate selected experts from universities, national labs and industries from across the nation. Such gatherings will help our young members to assimilate, build up networks and possibly also find jobs.

MATERIALS SCIENCE & ENGINEERING

Fall 2018 Seminar Series

Structural Integrity Assessment of Composite Structures: Challenges and Opportunities
Dr. Mark R. Gurvich, Technical Fellow, Structural Analysis
United Technologies Research Center

Microwave Materials at NIST
Dr. Nathan D. Orloff, Microwave Materials Project Leader
Communications Technology Laboratory
National Institute of Standards and Technology, CO

CaFe2As2: From Fe-based Superconductivity to Superelasticity
Dr. Paul Canfield, Distinguished Professor of Physics
Senior Physicist, Ames Laboratory
Iowa State University

Towards Heterogeneous Integration of Functional Materials on Flexible and Non-Standard Substrates to Create Microsystems
Dr. Angus Kingon, Professor
School of Engineering
Brown University

Shock Initiated Detonation in Nanoporous Energetic Materials
Dr. Ryan R. Wixom, Manager, Nanostructure Physics Department
Center for Integrated Nanotechnologies (CINT)
Sandia National Laboratories, NM

Feedstock Powder: The Building Blocks for Additive Manufacturing, Specifically Cold Spray Processing
Dr. Danielle Cote, Assistant Professor
Materials Science and Engineering
Worcester Polytechnic Institute

Title TBD
Dr. Boris Feigelson
Power Electronics Branch
United States Naval Research Laboratory

Hierarchical Silicon Nanostructures Produced with Regenerative Electroless Etching (ReEtching), Metal Assisted Catalytic Etching (MACE) and Laser Ablation
Dr. Kurt W. Kolasinski, Professor
Department of Chemistry
West Chester University

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Dr. Liaoyong Wen

Liaoyong Wen Receives SEED Grant

IMS Postdoctoral associate Dr. Liaoyong Wen, along with two other Postdoctoral associates, was awarded the 2018 inaugural Postdoctoral Seed Grant of UConn. The Seed Grants are a result of the highly qualified and engaging applications from across the university, which will provide funds to support UConn postdoctoral research associates as they develop new research projects with high potential for securing external funding through their preliminary activities. Dr. Wen will work with Professor Pu-xian Gao on a research proposal entitled "Template-guided Integration of Large-scale Arrays of Heterogeneous Nanoarchitectures".

Heterogeneous nanoarchitectures that integrate two or more dissimilar nanocomponents by solid-state interfaces represent an important family of advanced nanomaterials that can facilitate unique synergistic coupling of various functions inherited by the comprised nanocomponents. To fully establish the synergistic coupling effects in Heterogeneous nanoarchitectures, the development of a general manufacturing methodology that enables precisely control over each nanocomponent and their interfaces is highly demanded. Dr. Wen will design, validate, and develop an innovative manufacturing technique for realizing large-scale array of heterogeneous nanoarchitectures based on binary-pore anodic aluminum oxide templates.

Postdoc Mona Ghassemi is Assistant Professor at Virginia Polytechnic Institute

Dr. Mona Ghassemi

Dr. Mona Ghassemi was appointed assistant professor at The Bradley Department of Electrical & Computer Engineering of Virginia Polytechnic Institute and State University, one of the internationally renowned academic research programs in power engineering. Over the past two years, Dr. Ghassemi was a postdoctoral fellow at IMS Electrical Insulation Research Center (EIRC) working in the fields of streamer modeling for a Department of Energy (DOE) funded subsea O&G electrification project as well as gas dynamic computation for GE. Based on her work at IMS, Dr. Ghasssemi has published, jointly with her advisor Dr. Yang Cao, multiple journal papers at IEEE Transactions.

Mona received her M.S. and Ph.D. degrees both with the first honor in electrical engineering from the University of Tehran, Iran in 2007 and 2012, respectively. She spent two years researching as Postdoctoral Fellow at high voltage laboratory of NSERC/Hydro-Quebec/UQAC Industrial Chair on Atmospheric Icing of Power Network Equipment (CIGELE) and Canada Research Chair on Power Network Atmospheric Icing Engineering (INGIVRE), University of Quebec at Chicoutimi (UQAC), QC, Canada from 2013 to 2015.

Dr. Ghassemi is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), a registered Professional Engineer, Associate Editor of Journal of High Voltage (IET) and Associate Editor of International Journal of Electrical Engineering Education. Her research interests include dielectrics and electrical insulation materials and systems containing those in power electronics modules and systems, high voltage technology, multiphysics modeling, plasma science, electromagnetic transients in power systems and power system modeling.

IMS Administrative Staff

Osker Dahabsu
Administrative Assistant
Polymer Program

Brianna Demers
Finance Director

Nancy Kellerann
Administrative Assistant
Purchasing

Shari Masinda
Financial Assistant

Maria Mejias
Administrative Assistant

Kayla Pittman
Administrative Assistant
Office of the Director

Joshua Strecker
Manager
Building Services

Rhonda Ward
Administrative Assistant
Industrial Affiliates Program

Staff Retirements

YoungHee Chudy

YoungHee Chudy, administrative assistant for the IMS Polymer Program retired after 31 years of service to IMS.

Mark Dudley

Mark Dudley retired after 22 years managing the Mechanical Analysis and Gel Permeation Chromatography (GPC) labs and as a member of the IMS Industrial Affiliates Program.

Gary Lavigne

Retired after 37 years, Gary Lavigne retired as manager of the Gas Chromatography and Spectroscopy Lab and a member of the IMS Industrial Affiliates Program

Kimberly Post

Kimberly Post retired after 30 years of service to IMS, supporting the office of the Director.

Rick George

Rick George retired after 31 years of service to IMS as Manager of Technical Projects.

New IMS Staff Members

Brianna Demers

Brianna Demers, our new finance director, comes to us most recently from an accounting manager position at Travelers Insurance Company in Hartford, but is no stranger to UConn. A Certified Public Accountant, she received her B.S. and M.S. degrees right here at the Storrs campus and was adjunct faculty for UConn's MS in Accounting program. Teaching a course in Global Financial Reporting and Analysis, her students developed and tested expectations about the content of financial reports worldwide based on an understanding of how national culture and subculture attributes affect financial reporting in a principles-based decision environment.

Bri joined the University's ranks of professional employees back in the fall of 2010 after working for years as a public accountant. In her initial position at the School of Nursing, she gained experience in both Sponsored Projects and the quirks of UConn's fiscal system before transitioning to a position as University Accountant within the Office of the Controller. In that role, Bri enjoyed learning the ins and outs of the University's financial and reporting systems while playing a key role in the production of the UConn's audited financial statements that earned national recognition for excellence in financial reporting in fiscal years 2016 and 2017!

When her twin sons reached school age in fall of 2017, it was time to continue moving along the career trajectory and Brianna is thrilled to have found a home here at IMS where she is able to apply her knowledge and experience to the University's exciting and expanding research endeavors.

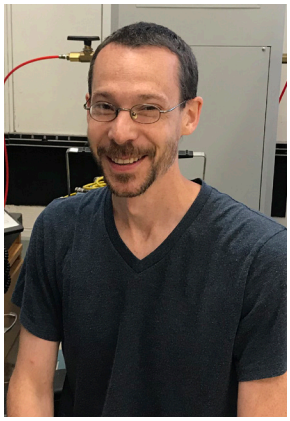
New IMS Staff Members (continued)

Osker Dahabsu

B.FA, Painting and Art History, William Paterson University

In November 2017, Osker Dahabsu joined the IMS Staff as the Polymer Science Graduate Program Coordinator. In 2007, he began his UConn career in the Chemistry Department as the Undergraduate Program Assistant and Academic Advisor for freshman and sophomore students. After working with undergraduates for ten years, Osker joined IMS to support the needs of Polymer and Material Science graduate programs. An aspiring artist, Osker creates both paintings and, more recently, music.

Nicholas Eddy



B.Sc./M.Sc. Indiana University of Pennsylvania, Ph.D. University of Connecticut

Nicholas started his career at IUP as an organic chemist, with aspirations as a biochemist, separating small molecules by chromatography and analyzing them with NMR. He studied chemical biology at UConn under the direction of Gabriel Fenteany making biologically active compounds for the study of cell migration. During his doctoral work, he utilized various chromatography and spectroscopic techniques for analysis of compounds. After a year postdoctoral work in 2013 at Purdue University with Arun Ghosh, Nicholas returned to UConn in 2014 as temporary teaching faculty lecturing on general and organic chemistry while aiding researchers in both liquid and solid state NMR. In May 2018, Nicholas joined IMS as the GPC and NMR lab manager.

Curtis Guild

B.S. Chemistry, Keene State College, Ph.D. Inorganic Chemistry, Univ. of Connecticut

At Keene State, Curt was a research participant in synthetic, analytical, and inorganic laboratories. He was a three year orientation leader for STEM programs as well as a tutor in Chemistry & Physics, and head tutor for the Aspire Center, a TRIO program. For this work, Curt was awarded the Chemistry Department Faculty Award in 2011.

Dr. Guild received his Ph.D in Inorganic Chemistry from the University of Connecticut in 2017, where his research focused on nanomaterials and in situ studies of various systems for materials, energy and environmental applications. During this time, he focused on spectroscopy and chromatography as techniques for study of a wide variety of systems. Afterwards, he spent a year in industry as a process development engineer in fiber optics manufacturing before returning to UConn to manage the Gas Chromatography/ Spectroscopy Laboratory at IMS.

Kayla Pittman

B.A. History, University of Oklahoma; M.A. History, University of Massachusetts, Amherst

Kayla joined IMS in January 2018 serving as an Administrative Assistant in the Office of the Director where she supports Director Dr. Steven Suib and plays a role in most of IMS's ongoing efforts. She quickly became the smiling "face of IMS" and enjoys working with IMS's diverse community.

Kayla Pittman comes to IMS from the humanities. After completing the Monticello-University of Virginia Archaeological Field School as well as earning a Bachelor of Arts in history from the University of Oklahoma and a Master of Arts in history as well as Certificate in Public History from the University of Massachusetts Amherst, Kayla focused on highlighting the histories of traditionally marginalized peoples. She worked on various projects for James Monroe's Highland in Charlottesville, VA, as well as for Wethersfield Historical Society in Wethersfield, CT and Historic Westville in Columbus, GA where she spent two weeks in Oklahoma working closely with the Muskogee (Creek) Nation. While working for James Monroe's Highland, her research helped inform the consensus that the extant structure never served as the Monroe family residence despite the interpretation as such for years. Using documentary, architectural, and archaeological evidence as well as dendrochronology (the study of tree ring dating), researchers believe this structure was most likely a guesthouse for Monroe's visitors; the Monroe family residence was lost to history. Recently however, archaeologists believe they recovered the foundation of Monroe's residence and in doing so, revealed evidence that the larger, grander structure suffered a significant fire, which erased it from the landscape.

Kayla continues her work in the humanities through Connecticut's Kid Governor program as an Advisory Committee Member. Connecticut's Kid Governor is a program that engages fifth graders statewide in civics education through the election process. In addition, she volunteers as a regional judge for Connecticut History Day, a program that actively engages 6-12 grade students in history from the local to global scale. Kayla also volunteers with Wethersfield Historical Society and Portland Middle School, where she actively works to enhance learning experiences in social studies classrooms.

A Conversation with Brianna Demers

What was your favorite job before settling into accountancy?

I had the great pleasure of working for the Appalachian Mountain Club in New Hampshire during summers as an undergraduate student. My responsibilities were to live on the side of a large mountain, carrying supplies by foot up and down as needed, cooking meals for hut guests, educating hikers about the local ecology, and rescuing folks that found themselves in difficult situations in my area of the wilderness. It was rough living, but certainly a most rewarding experience to live engulfed by nature and yet poised in a capacity to share my passion for a singular area of North America's natural resources.

How do you spend your spare time?

Other than spending time with my family (including two old dogs), my time is largely spent either reading or running. If I wish to relax, there is nothing comparable to settling in with a good book and a big cup of hot tea; but as a high-energy person, long distance running is my go-to to stay healthy, happy, and focused. When in training, I compete locally for the Manchester Running Company, and have enjoyed participating in many races as a member of that team. Last fall, I was proud to round out my competitive season with an invitation to participate as one of "New England's Finest" at the Hartford Marathon where I turned out a 5th place finish in 02:51:32. I now look forward to training for the Boston Marathon in April 2019.

What are you most excited about in your role as the Finance Director of IMS?

It would be difficult to pinpoint a sole feature that I believe will be most rewarding, because IMS is exciting due to the variety of attributes that all come together here to make the Institute what it is. It is generally understood that accounting can be dull, yet I view it as a series of interesting and intricate puzzles to be solved to ensure that each attribute falls precisely where it was intended to. As an accountant, I prize both efficiency and accuracy down to the most minute of details, and the challenge of building a more robust set of internal financial procedures and controls is one I am approaching with verve. The goal is for financial administration as a whole to operate seamlessly supported by my team, thereby allowing the focus of faculty to remain on their research endeavors.

What do you consider your greatest accomplishment?

This may be anti-climactic, but there is nothing I am prouder of than my twin boys. In July of 2012, my identity changed so that now first and foremost, before being a runner or a foodie or a musician, I am a parent. With each new phase of their development (they are fraternal and truly as different as siblings could be given their shared genetics), we three learn together to find excitement in new subjects, great and small, while we overcome the challenges that are inherent to growing up within modern society. In addition to their individual areas of interest, they both love reading, science experiments (what child doesn't get excited when you add vinegar to baking soda?!), and exploring the woods and fields near our home.

images: top: Brianna running the Hartford Marathon; bottom: Landon(l) and Jackson(r) Demers

Support the Institute of Materials Science

For over fifty 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.

The Owen F. Devereux MSE Undergraduate Excellence Scholarship (31384)
Funds will be used to provide undergraduate merit based scholarships in honor of Professor Owen F. Devereux to students in the Materials Science & Engineering Program.

IMS Equipment and Maintenance (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 (20334)
This account supports graduate students and faculty studying polymer mixtures.

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

Julian F. Johnson Alumni Fellowships Fund (22177)
This account provides fellowships to graduate students in the IMS polymer program. The 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.

Materials Science and Engineering (MSE) General Fund Account (22165)
This account supports the materials science and engineering program offered by the Department of Materials Science and Engineering. MSE focuses on the production, processing, characterization, selection, design, and modeling of materials.

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