Northwestern | McCORMICK SCHOOL OF ENGINEERING

FALL 2019

MATERIALS SCIENCE AND ENGINEERING

‘TROJAN HORSE’ ANTICANCER DRUG DISGUISES ITSELF AS FAT

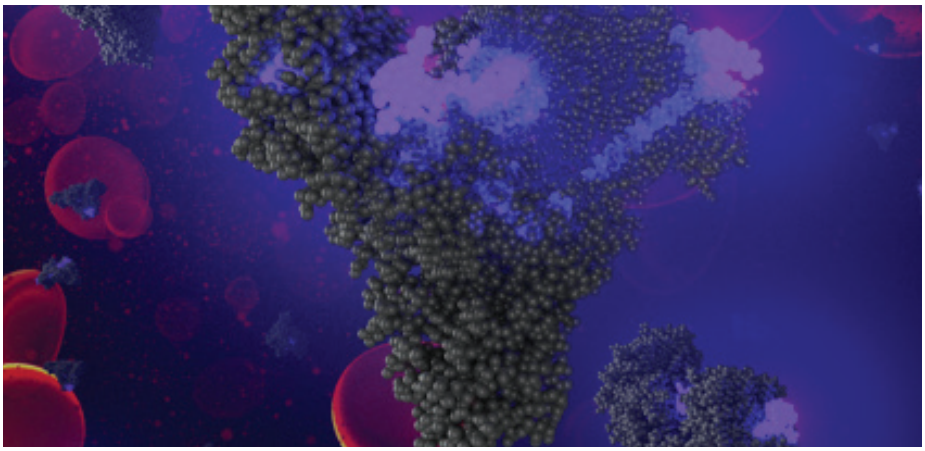
Promising system delivers chemo drug straight into tumors with fewer side effects

A stealthy new drug-delivery system developed by Professor **Nathan Gianneschi** disguises chemotherapeutics as fat in order to outsmart, penetrate, and destroy tumors.

Thinking the drugs are tasty fats, tumors invite the drug inside. Once there, the targeted drug activates, immediately suppressing tumor growth. The drug also is lower in toxicity than current chemotherapy drugs, leading to fewer side effects.

“It’s like a Trojan horse. It looks like a nice little fatty acid, so the tumor’s receptors see it and invite it in. Then the drug starts getting metabolized and kills the tumor cells,” said Gianneschi, Jacob and Rosalind Cohn Professor of Chemistry, Materials Science and Engineering, and Biomedical Engineering.

To develop the targeting system, Gianneschi and his team engineered a long-chain fatty acid with two binding sites — able to attach to drugs — on each end. The fatty acid and its hitchhiking drugs are then hidden inside human serum albumin (HSA), which carries molecules, including fats, throughout the body.



A modified chemotherapy drug hitches a ride through the bloodstream on human serum albumin.

The body’s cellular receptors recognize the fats and proteins supplied by the HSA and allow them inside. Quick-growing and hungry, cancer cells consume the nutrients much faster than normal cells. When the cancer cells metabolize the hidden drug, they die.

“It’s like the fatty acid has a hand on both ends: one can grab onto the drug and one can grab onto proteins,” Gianneschi said. “The idea is to disguise drugs as fats so that they get into cells and the body is happy to transport them around.”

In the study, the researchers used the drug delivery system to carry a common, FDA-approved chemotherapy drug, paclitaxel, into tumors in a small animal model. Disguised as fat, the drug entered and completely eliminated the tumors in three types of cancer: bone, pancreatic, and colon.

Even better: the researchers found they could deliver 20 times the dose of paclitaxel with their system, compared to two other paclitaxel-based drugs. But even at such a high quantity, the drug in Gianneschi’s system was still 17 times safer.

FROM THE CHAIR

Dear Friends,

Summer always ends too quickly, but as the fall quarter approaches at Northwestern, we're looking forward to welcoming new students and new spaces.

Construction is proceeding rapidly on renovations to the Department of Materials Science and Engineering's (MSE) teaching lab, and we anticipate completion in time for fall classes. Relocated to the main Cook Hall corridor, the renovated space will increase MSE visibility to passersby. The main teaching space is designed to better facilitate active learning and small group work, with experimental stations around the perimeter of the main room and two adjacent support rooms for materials processing, synthesis, and characterization. The space is bright, modern, and will enhance the MSE learning experience at all levels.

In addition to new teaching spaces, Professors **Vinayak Dravid** and **John Rogers** have moved their research groups to newly constructed labs in an "in-fill" space between the A and B wings in the northwest corner of the Technological Institute. On the Chicago campus, the Simpson Querry Institute, directed by Professor **Sam Stupp**, will expand into the new Simpson Querry Biomedical Research Center, the largest biomedical academic research building in the US. Professor Rogers, Professor **Mark Hersam**, and Professor **Nathan Gianneschi** are among the MSE faculty part of this effort.

While we look forward to the innovations emerging from these new spaces, we have also taken time to honor the department's legacy. Sadly, we lost both **Hans** and **Julia Weertman** within months of each other in 2018. The Weertman Symposium, held last November, highlighted the breadth and depth of their work in materials and geological sciences, as well as their commitment to scholarship and inspirational mentorship. We are grateful to the many former students and colleagues who traveled to Evanston to share their heartfelt remembrances of this remarkable couple. We continue to be inspired by their example.

As you'll read in this issue, research efforts continue apace in a wide range of materials-related areas, including biomedicine, computational materials, and materials for computing, energy, colloids, coatings, and more. These efforts have been recognized with significant awards. MSE faculty led two teams that earned two Department of Energy Ten at Ten Awards celebrating a decade of the Energy Frontier Research Center program. In addition, faculty are pursuing research in emerging areas. Professor Hersam and Professor **James Rondinelli**, for example, have received support to explore quantum computing.

The cover story introduces Professor Gianneschi, the Jacob and Rosaline Cohn Professor of Chemistry, Materials Science and Engineering, and Biomedical Engineering, who moved to Northwestern in 2017.

If you will be visiting campus for Northwestern's Homecoming on Friday, October 26th, please stop by the department office in the afternoon to see the new space and visit with old friends.

Lastly, thank you to all who so generously contributed funds to the department, the Fine Lecture, Jerome Cohen Professorship, and the Weertman Graduate Fellowship.

Erik Luijten
Department Chair

Northwestern Awarded $3.6 Million to Study Quantum Computing

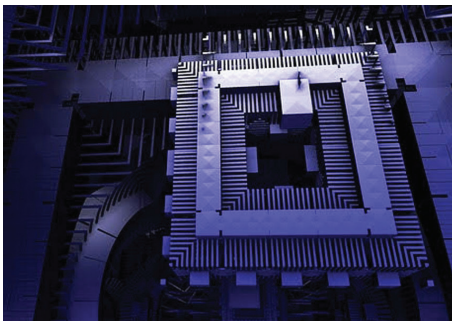
US Department of Energy calls field 'next frontier' in the Information Age

A group of Northwestern University engineers and chemists have been awarded $3.6 million from the US Department of Energy to support their work of creating better qubits, the smallest unit of a quantum computer.

The grant is one of 85 research awards, totaling $218 million, focused on the emerging field of Quantum Information Science (QIS), which is expected to lay the foundation for the next generation of computing and information processing.

Mark Hersam, Walter P. Murphy Professor of Materials Science and Engineering, and **James Rondinelli**, Morris E. Fine Junior Professor in Materials and Manufacturing, are co-investigators on the Basic Energy Sciences grant project.

Possible long-term QIS applications include quantum computers capable of solving large, extremely complex problems that are beyond the capacity of today's most powerful supercomputers. Quantum systems also could be used to create extremely sensitive sensors, with a variety of uses in the fields of medicine, science, and national security. Additionally, quantum computing is expected to revolutionize the field of encryption, which is key to cybersecurity.



Quantum Information Science uses the next generation of computing and information processing.

The awards were made in conjunction with the White House Summit on Advancing American Leadership in QIS.

SENSORS ARE FIRST TO MONITOR BABIES IN THE NICU WITHOUT WIRES

Soft, flexible sensors provide clinical-grade measurements, allow physical bonding between baby and parent

An interdisciplinary Northwestern University team led by Professor **John Rogers** has developed a pair of soft, flexible wireless sensors that replace the tangle of wire-based sensors that currently monitor babies in hospitals' neonatal intensive care units and pose a barrier to parent-baby cuddling and physical bonding.

The team completed a series of first human studies on 70 premature babies at Prentice Women's Hospital and Ann & Robert H. Lurie Children's Hospital of Chicago. The researchers concluded that the wireless sensors provided data as precise and accurate as that from traditional monitoring systems. The wireless patches also are gentler on a newborn's fragile skin and allow for more skin-to-skin contact with the parent. Existing sensors must be attached with adhesives that can scar and blister premature newborns' skin.

"We were able to reproduce all of the functionality that current wire-based sensors provide with clinical-grade precision," said Rogers, the Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, Biomedical Engineering and Neurological Surgery. "Our wireless, battery-free, skin-like devices give up nothing in terms of range of measurement, accuracy, and precision — and they even provide advanced measurements that are clinically important but not commonly collected."

The benefits of the new technology reach beyond its lack of wires — measuring more than what's possible with today's clinical standards.

The dual wireless sensors monitor babies' vital signs — heart rate, respiration rate, and body temperature — from opposite ends of the body. One sensor lays across the baby's chest or back, while the other sensor wraps around a foot. (The chest sensor measures 5 centimeters by 2.5 centimeters; the foot sensor is 2.5 centimeters by 2 centimeters. Each sensor weighs about the same as a raindrop.) This strategy allows physicians to gather an infant's core temperature as well as body temperature from a peripheral region.

"Differences in temperature between the foot and the chest have great clinical importance in determining blood flow and cardiac function. That's something that's not commonly done today," said Rogers, who co-led the study published in the journal *Science* with materials scientists, engineers, dermatologists, and pediatricians.

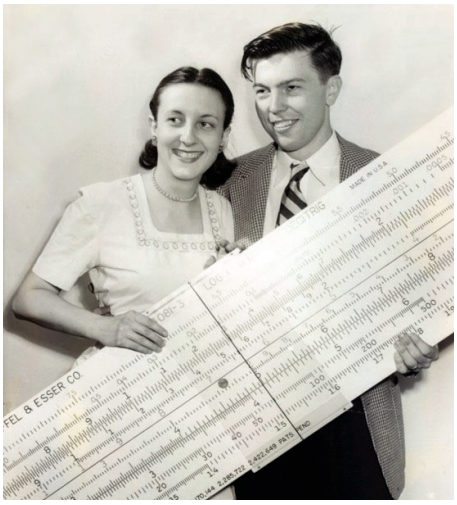
Above: Professor John Rogers outside his lab on the Evanston campus. Left: By placing a sensor on the baby's foot, doctors can measure core and body temperature.

Rogers estimates that his wireless sensors will appear in American hospitals within the next two to three years. With support from two major nonprofit organizations, Rogers's team expects to send sensors to tens of thousands of families in developing countries over the next year as part of an international effort.

> "WE WERE ABLE TO REPRODUCE ALL OF THE FUNCTIONALITY THAT CURRENT WIRE-BASED SENSORS PROVIDE WITH CLINICAL-GRADE PRECISION."
>
> JOHN ROGERS

PROFESSOR EMERITUS JOHANNES WEERTMAN PASSES AWAY

Weertman was an expert on the fatigue and fracture of materials



Julia and Johnannes Weertman

"HANS WAS A QUIET MAN WITH A POWERFUL INTELLECT WHOSE WORK HAD A PROFOUND IMPACT ON BOTH GEOLOGY AND MATERIALS SCIENCE AND ENGINEERING."

PETER VOORHEES

Johannes Weertman, Walter P. Murphy Professor Emeritus of Materials Science and Engineering at Northwestern University, passed away at age 93 on October 13, 2018. He will be remembered as a pioneering researcher, devoted teacher, and esteemed colleague and friend.

During more than four decades of research and scholarship, Weertman made several noteworthy contributions to the study of the mechanical properties of materials, particularly to the fatigue and fracture of metals, the high-temperature creep of crystalline solids, and dislocation theory.

After serving three years in the United States Marine Corps, Weertman attended the College of Science and Engineering at the Carnegie Institute of Technology, now Carnegie Mellon University, where he earned his bachelor's and DSc degrees in physics. Following graduation, he worked at the US Naval Research Laboratory, where he applied his interest in geophysics to the study of glacier flow and ice sheets. His research contributions were honored by the United Kingdom Antarctic Place-names Committee, which established "Weertman Island" in 1960, a 3.5-mile-long island off of the Antarctic coast.

Weertman joined Northwestern in 1959 as an associate professor within the newly formed Department of Materials Science. He taught materials science courses at both the undergraduate and graduate levels and served as chair of the department from 1964-68.

Weertman's continued research into dislocations — atomic-scale defects in materials — led to his 1964 textbook, *Elementary Dislocation Theory* (Reprint, Oxford University Press, 1992), which he co-authored with his late wife, Professor Emerita **Julia Randall Weertman**. The work stands as the first book written specifically for undergraduate students on dislocation theory, an important factor in the study of fracture mechanics.

"Hans was a quiet man with a powerful intellect whose work had a profound impact on both geology and materials science and engineering," said **Peter Voorhees**, Frank C. Engelhart Professor of Materials Science and Engineering. "His unfailing good cheer and sharp insights into the mechanical properties of materials will be greatly missed."

Weertman also held a joint appointment in Northwestern's geological sciences department, now the Department of Earth and Planetary Sciences within the Weinberg College of Arts and Sciences, where he continued his interest in glaciology, studying the migration of subglacial lakes under ice sheets.

Weertman's career has been marked by several accolades. In 2014, the Department of Materials Science and Engineering established the Johannes and Julia Randall Weertman Graduate Fellowship in honor of the couple's impactful contributions to materials science and to Northwestern. In 2017, The Minerals, Metals & Materials Society (TMS) renamed its TMS Educator Award to the TMS Julia and Johannes Weertman Educator Award.

His other honors include membership in the American Academy of Arts and Sciences as well as the National Academy of Engineering. He received the International Glaciological Society's Seligman Crystal, the Acta Metallurgica Gold Medal, the Champion H. Mathewson Gold Medal, the American Geophysical Union's Robert E. Horton Award, a Guggenheim Fellowship, and a Fulbright Fellowship. He was a fellow of the Geological Society of America, ASM International, American Physical Society, American Geophysical Union, TMS, and the American Academy of Mechanics.

JOHANNES AND JULIA WEERTMAN REMEMBERED FOR THEIR PIONEERING RESEARCH, GENEROSITY

Daylong symposium honored emeriti faculty, who both passed away in 2018

Many will remember **Julia** and **Johannes "Hans" Weertman** as an academic power couple whose materials science research at Northwestern Engineering spanned decades and garnered them multitudes of awards.

But the legacy they left when they passed away in 2018 also includes stories of professional dedication, mentorship, personal passions, and friendships — stories like Julia's letter-writing campaign in support of a Cuban dissident, and Hans's quest for the perfect emerald for Julia.

Dozens of friends, family, and colleagues gathered at Scott Hall on November 16, 2018 for a daylong symposium and remembrance in honor of the Weertmans. More than 24 colleagues and former students from universities and research institutions around the world shared research experiences and personal stories.

Such a turnout was "a real testament to the impact the Weertmans had on our department," said **Erik Luijten**, chair of the Department of Materials Science and Engineering.

Colleagues spoke of how the Weertmans's success in research into the properties of materials and nanomaterials did not make them unapproachable. When **David Dunand**, professor of materials science and engineering, joined the department more than two decades ago, he was "in awe of them," he said. "Very quickly this awe changed when I realized how gentle, self-effacing, generous, and scholarly Hans and Julia were." That generosity was evident in Julia's willingness to provide mentorship to the next generation of female engineers.

Memories and honors shared during the symposium are proof of the Weertmans's legacy, said **Julio M. Ottino**, dean of Northwestern Engineering.

"An institution is defined by its intellectual leaders," he said. "The beauty of academia is that your memory is perpetuated through a trail of students, papers, and books. And the way I see the Weertmans playing a role in Northwestern and materials science is that they are part of the compass that guides what the department aspires to be."

Friends, family, and colleagues gathered in November 2018 for a daylong symposium and remembrance in honor of the Weertmans. Speakers included (from left to right): Carelyn Campbell, Paul Sanders, Helena Moens-Van Swygenhoven, Jeffrey Eastman, Linn Hobbs, Stuart Stock, Carolyn Aita, William Nix, Peter Jemian, Koichi Tsuchiya, Bill Nieman, David Cole, Lynne Karabin, Howard Sizek, Gabrielle Long, James Conley

EGU Medal Changed to Honor Julia and Johannes Weertman

The European Geosciences Union Cryospheric Sciences Division medal, awarded to individuals in recognition of outstanding scientific contributions to the study of the cryosphere on Earth or elsewhere in the solar system, has changed its name to the Julia and Johannes Weertman Medal. The change aims to highlight the Weertmans's joint contribution to the development of the field, both in education as well as basic research.

Electron-behaving Nanoparticles Rock Current Understanding of Matter

Discovery will lead to new methods for materials design

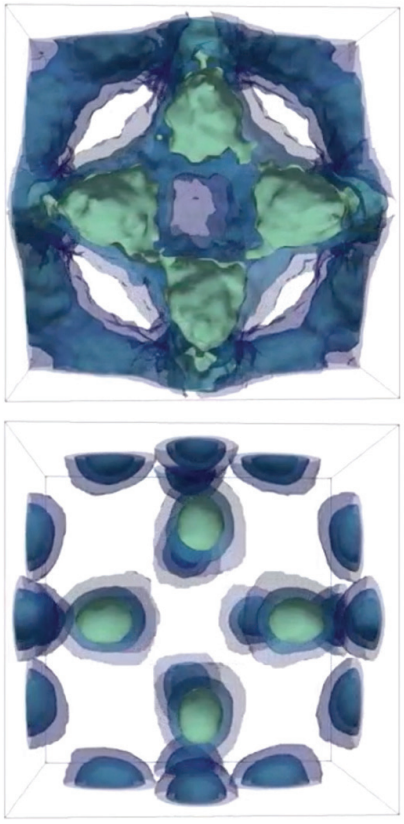
Professors **Monica Olvera de la Cruz** and **Chad Mirkin** have made a strange and startling discovery that nanoparticles engineered with DNA in colloidal crystals — when extremely small — behave just like electrons. Not only has this finding upended the current, accepted notion of matter, it also opens the door for new possibilities in materials design.

"We have never seen anything like this before," said Olvera de la Cruz, who made the initial observation through computational work. "In our simulations, the particles look just like orbiting electrons."

With this discovery, the researchers introduced a new term called "metallicity," which refers to the mobility of electrons in a metal. In colloidal crystals, tiny nanoparticles roam similarly to electrons and act as a glue that holds the material together.

"This is going to get people to think about matter in a new way," said Mirkin, who led the experimental work. "It's going to lead to all sorts of materials that have potentially spectacular properties that have never been observed before. Properties that could lead to a variety of new technologies in the fields of optics, electronics, and even catalysis."

> "THIS IS GOING TO GET PEOPLE TO THINK ABOUT MATTER IN A NEW WAY."
>
> CHAD MIRKIN



The findings by Professors Monica Olvera de la Cruz and Chad Mirkin could lead to new methods for materials design.

Fluid-inspired Material Self-heals Before Your Eyes

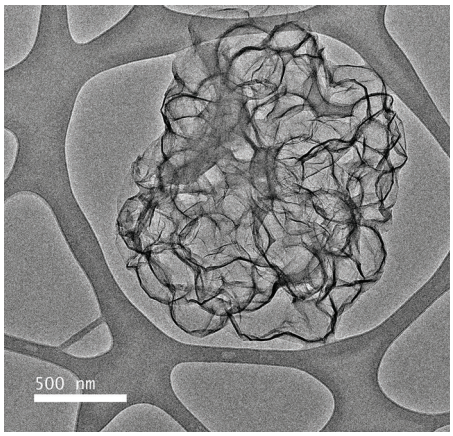
Coating for metals rapidly heals over scratches and scrapes to prevent corrosion

Professor **Jiaxing Huang** has developed a new coating for metal that self-heals within seconds when scratched, scraped, or cracked. The novel material could prevent tiny defects from turning into localized corrosion, which can cause major metal structures to fail.

"When a boat cuts through water, the water goes right back together," Huang said. "The 'cut' quickly heals because water flows readily. We were inspired to realize that fluids, such as oils, are the ultimate self-healing system."

Huang and his team created a system comprised of oil and a network of graphene capsules fluidic enough to flow automatically, but not so fluidic as to drip off metal surfaces. When the network is damaged by a crack or scratch, it releases the oil to flow readily and reconnect.

The coating not only sticks, it sticks well — even under water and in harsh chemical environments. Huang imagines that it could be applied to surfaces that are normally submerged in water, like bridges and boats, as well as metal structures near leaked or spilled highly corrosive fluids.



The novel material could prevent tiny defects from turning into localized corrosion, which can cause major structures to fail.

MSE Faculty and Students Teach in Uganda

JUAMI convened more than 60 materials science students from around the world

The Joint Undertaking for an African Materials Institute (JUAMI) presented its third workshop in December 2018 at Makerere University in Kampala, Uganda, for more than 60 students from universities all over the world, including Northwestern.

The program included seminars, poster sessions, hands-on labs, and collaborative projects on topics such as photovoltaics, thermoelectrics, and nanoparticles. It also included a plenary talk by Sir David King, senior strategy adviser to the president of Rwanda, who discussed the impending challenges involving climate change around the world.

Department of Materials Science and Engineering professors **Sossina Haile**, **G. Jeffrey Snyder**, and **Jiaxing Huang** taught during the 2018 program.

Beyond lectures and labs, a main component of the program revolved around continuing facilitating global research collaborations. For instance, one team including **Luke Prestowitz**, a fourth-year PhD student in materials science and engineering, looked at using local resources like clays and mud in Uganda to develop better water filters.

"The biggest thing I took away was an appreciation for what I have access to as a grad student in the United States," Prestowitz said. "It was motivating to see all of these students who are working hard but don't have access to all the resources we have access to. It was good encouragement to work hard and have an attitude of hope and optimism."

> "THE BIGGEST THING I TOOK AWAY WAS AN APPRECIATION FOR WHAT I HAVE ACCESS TO AS A GRAD STUDENT IN THE UNITED STATES"
>
> LUKE PRESTOWITZ

Luke Prestowitz works with a team member during a JUAMI lab activity.

To Create a High-temperature Superconductor, Try These Materials

Researchers identified 14 compounds with specific electronic trait

Northwestern Engineering researchers have identified 14 compounds that could potentially be good candidates for high-temperature superconductivity.

"These materials could exhibit interesting and potentially exotic properties, including superconductivity," said **Chris Wolverton**, Jerome B. Cohen Professor of Materials Science and Engineering and co-author of the research. "By finding these compounds, we are telling our experimental colleagues which candidates to test in the lab.

"The search for high-temperature superconductors has been difficult, since scientists and engineers don't completely understand the quantum mechanisms behind superconductivity. In 1986, scientists found that materials called cuprates — ceramic compounds of copper and oxygen — exhibited superconductivity at what was considered a high temperature of 35 kelvins, or around -397 degrees Fahrenheit.

Chris Wolverton

Scientists agree one important atomic characteristic of cuprates that leads to superconductivity is the presence of an electronic property called a single correlated d band in the low-energy spectrum.

To find materials with this characteristic, Wolverton turned to his Open Quantum Materials Database, which houses the thermodynamic and structural properties of more than 600,000 materials. The researchers developed a new process involving screening materials and running calculations based on the materials' chemistry, symmetry and structure, electrons, and thermodynamic stability.

In the end, the researchers identified 14 compounds. Thirteen were copper compounds — including bromide, oxide, selenate, borate, pyrophosphate, hydrogen phosphate, and pyrosilicate chemistries — and one was an iron oxide compound.

HILLIARD SYMPOSIUM 2019

The 32nd annual John F. Hilliard Symposium, organized by Professor **Jiaxing Huang**, was held on May 16. Alumna **Ruth Schlitz** (PhD '12, Lauhon), delivered the keynote address. After graduation from Northwestern, Schlitz went to UC Santa Barbara as a postdoctoral researcher, where she studied n-type organic thermoelectrics under the supervision of Professor Michael Chabinyc. She joined electrochemic glass provider SageGlass in 2014, where she focuses on developing machine vision for quality inspection.

Lincoln Lauhon and Ruth Schlitz

Speakers

1ST PLACE

Xiaomi Zhang (Dravid) "Understanding the Intrinsic Microstructure of Thermoelectric Materials"

2ND PLACE

Megan E. Beck (Hersam) "Self-Aligned van der Waals Heterojunction Diodes and Transistors"

3RD PLACE

Jingtian Hu (Odom) "Reconfigurable Lattice-Resonance Metalenses on Coupled Nanoparticles" and **Garrett Lau** (Stupp) "Programming Anisotropy with Light and Magnetic Fields for Robotic Function"

Hadallia Bergeron (Hersam) "Electronics in Two-Dimensions: Vapor-phase Growth of Ultrathin MoS2/Al2O3 Heterostructures"

Yvonne Chart (Barnett) "High-Performance Oxygen Electrodes with Multi-Scale Architectures for Low Temperature Reversible Solid Oxide Cells"

Yaoyao Chen (Shull) "Self-Stabilized Thermo-Thickening Polymer Suspensions"

Jingshan S. Du (Mirkin) "Classical Electron Equivalent Nanoparticles in Metal-like Colloidal Crystals"

Yao Du (Chung) "Design and Development of High-temperature Steels"

Megan O. Hill (Lauhon) "Total Tomography at the Nanoscale: Illuminating Structure-Property Relationships in Quantum Emitters"

Liliang Huang (Mirkin) "Ligand-Free Synthesis of High-Index Facet Nanoparticles"

William J. Jeang (Rogers) "Wireless, Battery-Free, Dual-Function Neural Implant for Optogenetic Stimulation and Chemical Sensing"

Boran Ma (Olvera de la Cruz) "Materials Design of Ion-Containing Polymers"

Ryan Paull (Marks) "Lanthanide Scandates as Model Supports for Noble Metal Catalysts"

Kazi Sadman (Shull) "Solvation-Driven Assembly of Charged Polymers to Oil/Water Interfaces"

Fernando L. Reyes Tirado (Dunand) "Searching for Low-Density Co-Based Superalloys for Next Generation Turbine Blades"

Nicholas Wagner (Rondinelli) "A Data-Driven Model for Discovery of Materials with Metal-Insulator Transitions"

Department Celebrates Recent PhD Graduates

The Department of Materials Science and Engineering celebrates its PhD candidates who graduated between September 2018 and June 2019. They are listed with their current job placements.

Vuk Brajuskovic (Petford-Long)

Fernando Cuauhtli Castro (Dravid)
Gatan Inc.

Pengcheng Chen (Mirkin)
UC Berkeley

Yaoyao Chen (Shull)
3M

Shawn H. Chen (Shull)
National Institute of Standards and Technology

Charlotte Hui Chen (Stupp)

Ming Du (Jacobsen)
Argonne National Laboratory

Jingtian Hu (Odom)
Northwestern University

Karl Alexander Hujsak (Dravid)
McKinsey & Company

Garrett Lau (Stupp)
Lilac Solutions

Alane Tarianna Ocampo Lim (Huang)

Qinyuan Liu (Barnett)

Matthew Lu (Barnett)

Samuel Aaron Miller (Barnett)
Owens Corning

Taegon Oh (Mirkin)
Korea Institute of Science and Technology

Matthew Peters (Voorhees)
SpaceX

Kazi Sadman (Shull)
Next Science

Nicholas Allen Sather (Stupp)
Northwestern University

Zhiyuan Sun (Lauhon, Seidman)
Apple

Spencer Allan Wells (Hersam)
Facebook

Xiankai Yu (Barnett)
Lawrence Berkeley National Laboratory

Min Zhang (Brinson)
Duke University

Shengshuang Zhu (Mirkin)
Earli

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Semyon Vaynman, PhD and Ms. Dora Vaynman
Julia Ann Weertman, DDS
Ms. Jacqueline H. Wilson

Donations made between July 18, 2018 and July 25, 2019. If you would like to contribute to MSE funds, please contact Patrick Hankey at partick.hankey@northwestern.edu.

Duran Addresses PhD Graduates

Alumna **Carolyn Duran** (PhD '98), vice president in the data center group and general manager of memory and I/O technologies at Intel Corporation, delivered the address at the Northwestern Engineering PhD Hooding Ceremony in June. She advised the graduates to leverage the intellectual curiosity, creative thinking, and problem-solving skills developed in their programs in order to tackle the world's biggest challenges.

ALUMNI HONORED

Sung-Chul Shin and Michael S. Arnold received awards at the annual banquet

Two outstanding alumni from the Department of Materials Science and Engineering were recognized at the 2019 Annual Alumni Celebration in May. **Sung-Chul Shin** received the Distinguished Career Achievement Award, and **Michael S. Arnold** received the Early Career Achievement Award.

Sung-Chul Shin

(PhD '84)

Shin is an internationally renowned scientist in the field of nanomagnetism, having made pioneering contributions to understanding the magnetization reversal dynamics. An innovative leader in higher education, he has served as the 16th — and first alumnus — president of KAIST since 2017.

Michael S. Arnold

(PhD '06, Stupp and Hersam)

Arnold is a professor of materials science and engineering at the University of Wisconsin-Madison, where he directs the Advanced Materials for Energy and Electronics Group. His research seeks to overcome the fundamental challenges to exploit the transformative potential of carbon nanomaterials in (opto)electronics technology.

Top: Sung-Chul Shin (center) with his wife, and his wife, Won-Ki Min, and Professor Erik Luijten
Bottom: From left: Professor Samuel Stupp, Michael Arnold, and Professor Mark Hersam

Upcoming Special Lectures

Dow Lecture:
Nicola Spaldin
ETH Zurich
October 29, 2019

Dow Lecture:
Andrea Liu
University of Pennsylvania
November 5, 2019

Cohen Lecture:
Christopher Murray
University of Pennsylvania
January 13-14, 2020

FACULTY NEWS

Professor Jian Cao

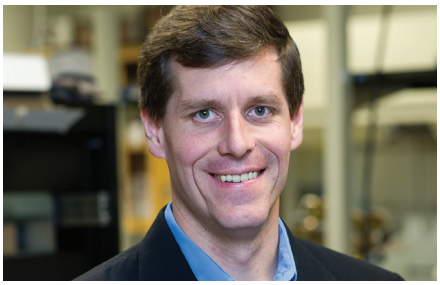
Jian Cao was named a fellow of the American Association for the Advancement of Science.

Professor Stephen Carr

Stephen Carr was named a fellow of the Society of Plastics Engineers.

Robert P. H. Chang and **Mercouri Kanatzidis** received one of the US Department of Energy's Ten at Ten Awards for creating the first demonstration of all-solid-state solar cells using halide perovskite materials through the Center for Light Energy Activated Redox Processes.

Ali Erdemir, adjunct professor and distinguished fellow and senior scientist at Argonne National Laboratory, was elected to the National Academy of Engineering.

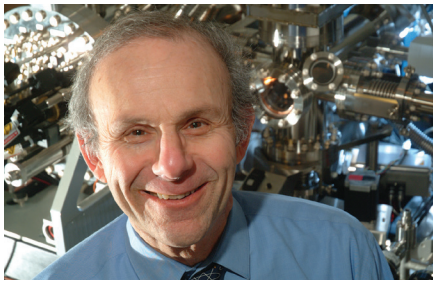


Professor Mark Hersam

Mark Hersam received one of the US Department of Energy's Ten at Ten Awards for developing new electrode technologies for next-generation lithium-ion batteries. The technology is the basis for Hersam's battery startup company, Volexion, which he co-founded with **Ted Seo** ('10, PhD '16, Hersam).

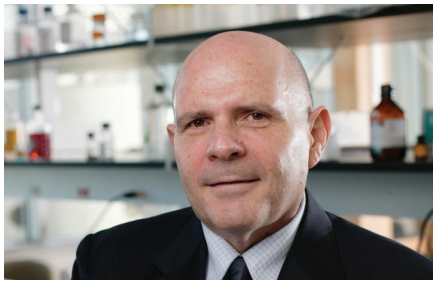
Chad Mirkin received a 2019 Nakamura Award from the American Association for Advances in Functional Materials.

John Rogers received the 2018 Materials Research Society Medal "for pioneering contributions to materials for diverse classes of bio-integrated electronic systems." He also received a 2019 Nakamura Award from the American Association for Advances in Functional Materials.



Professor David Seidman

David Seidman received the 2019 Peter Duncumb Award from the Microanalysis Society honoring his exceptional contribution to the field of microanalysis through improved atomistic characterization with atom probe tomography. He was also elected to the Tel Aviv University Board of Governors and named a member of the European Union Academy of Sciences.



Professor Sam Stupp

Sam Stupp was elected to the National Academy of Inventors in recognition of his seminal work on bioactive and supramolecular materials.

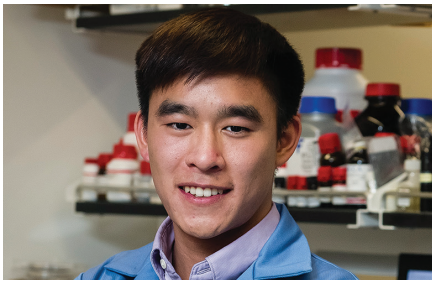
STUDENT NEWS

Graduate student **Megan Beck** (Hersam) earned a fall 2018 Materials Research Society Gold Graduate Student Award. She also received the Outstanding Collegiate Member Award from the Society of Women Engineers.

Leah Borgsmiller received the Outstanding MSE Junior Award.

Paul Brown received the Outstanding MSE Sophomore Award. He also received a Meister Summer Research Award.

Yvonne Chart received the Hilliard Award for Leadership, Scholarship, and Service.



William Jeang

William Jeang (Rogers) received the Acta Materialia Inc. Undergraduate Scholarship from the Minerals, Metals & Materials Society.

Postdoctoral student **Jae-Yel Lee** (Seidman) won the third prize Jan Evetts Award for an article that appeared in the journal *Superconductor Science and Technology*.

NSF Graduate Fellowships were awarded to **Young-Ah Lucy Lee** (Odom), **Stephanie Liu** (Hersam), **Surabhi Madhavapathy** (Rogers), **Elodie Sandraz** (Wolverton), and **Garrett Watson** (Luijten).

Daniel Ng (Dunand) received the Hilliard Award for Research and Design for his project titled "Effect of Rafting on Tensile Creep of Single Crystal Cobalt-based Superalloy."

Jakob Reinke (Barnett), **Joshua Winograd** (Rogers), and **Cristabella Wolff** were awarded Menezes Summer Research Awards.

Joshua Roan (Stupp) was awarded a Meister Summer Research Award.

ALUMNI NEWS

Jim Ciston (PhD '09, Marks) a staff scientist at Lawrence Berkeley National Laboratory, received a PECASE award.

Charles Kuehmann (PhD '94, Olson) and **Chris Schuh** (PhD '01) were elected to the National Academy of Engineering.

Advanced battery materials startup NanoGraf Corporation (formerly SiNode Systems), co-founded by **Joshua Lau** ('12, MS '12) and **Thomas Yu** (PhD '17), received an additional $7.5 million from the United States Advanced Battery Consortium to continue progress on the commercialization of high-energy anode materials.

Former postdoc researcher in Professor David Duannd's group, **Cong Wang**, has been selected to receive the 2019 ASM Silver Medal Award at the Materials Science & Technology 2019 conference.

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Pardon Our Dust: Teaching Lab Renovation Underway

The Department of Materials Science and Engineering at Northwestern University is reimagining its Teaching Lab for faculty and students. Construction began this summer on a revamped space in Cook Hall that will enhance the learning experience of MSE students as well as increase the Department's visibility to the Northwestern community.

Designed to promote an environment of active learning and facilitate small group work on both experimental and computational problems, the Teaching Lab will feature experimental lab stations around the perimeter of the main room, as well as two adjacent rooms that will house facilities for materials processing, synthesis, and characterization.

The new Teaching Lab is expected to open in time for the start of fall 2019 classes.