

CHEMISTRY

Missouri S&T | Spring 2019

JAY SWITZER

DRIVEN BY
DISCOVERY

Molecular-level Miner pride

No matter what career path a student takes, chemistry can provide the foundation for understanding our world — and how to expand the possibilities of interaction and reaction to transform lives.

Your annual support is elemental to that process because every dollar you contribute goes to scholarships.

Our department's annual phonathon is underway, and we hope you'll talk with the student who calls. It's a great way to learn what's happening in chemistry and across campus. And it's a great time to show your molecular-level Miner pride by giving back.

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DEAR ALUMNI AND FRIENDS,

In the current academic year, Missouri S&T's chemistry department celebrates its quasiquicentennial!

In 1893, chemistry separated from metallurgy, and **William Seamon** became the first chair. Twenty-five years later — and for the next 47 years (1918–65), chemistry was a combined department with chemical engineering, and the long-term tenure of the fifth chair, **Walter Schrenk**, occurred during this time. In 1965, the chemistry department once again became independent under the leadership of its seventh chair, **William Webb**.

The department grew tremendously over the next 50-plus years. **Philip Whitefield** served as the 14th and 16th chair, and **Klaus Woelk** as the 15th interim chair. And now, as the 17th chair, it is a true privilege to continue their excellent work and to contribute to the department's evolution.

In these last 125 years, the chemistry department has developed into a strong and modern research unit with 22 full-time faculty, seven active adjunct faculty, over 60 graduate and post-graduate students, and some 90 undergraduate majors. With our



international faculty and diverse student body, we are well-positioned to compete internationally in education and research.

Our research addresses the fundamental questions that provide answers to important societal problems. Modern challenges require interdisciplinary approaches, and many of our faculty lead state-of-the-art research centers.

This newsletter highlights just a few of our recent accomplishments and hopefully lets you feel some of the excitement of the scientific discoveries going on in our department.

We're also in the midst of an ongoing renovation of the Schrenk Hall west wing, and future plans exist for the replacement of Schrenk Hall's east wing. These improvements will catalyze the department to compete at the next level, and we need a strong and unified team to succeed. Please join our team and come along with us on this journey.

We are grateful for your continuous input, your honest feedback and your generous support. You are welcome to visit with us any time.

Sincerely,

Rainer Glaser
Professor and Chair,
Chemistry



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Read about a few of our department's grants and other awards.



S&T'S FIRST BOTTOM SCHOLARSHIP RECIPIENT COMPLETES CANCER RESEARCH PROGRAM

Chemistry senior **Rachel Nixon**, the first recipient of the new Carey and Christine Bottom Endowed Scholarship in Undergraduate Chemistry Research, spent eight hours a day in **Risheng Wang's** bionanotechnology lab this past summer as part of a 10-week research program.

Carey B. Bottom, Chem'72, MS Chem'75, PhD Chem'79, established the \$4,000 summer research award to give undergraduate students financial support to become scientists, scholars and leaders in their fields. It will be awarded annually.

Bottom has had a distinguished career as a research chemist, pharmaceutical innovator and executive for companies in the drug and healthcare product industries, from global corporations to startup ventures. He holds four patents and was recognized by the U.S. Food and Drug Administration for his leadership in advancing capsule technology.

The endowment fund also honors Bottom's late wife, **Christine Bottom**, who died of a rare form of cancer in 2013. Her father, **Kenneth G. Mayhan**, PhD ChE'65, was an S&T faculty member before joining the private sector.

Wang, an assistant professor of chemistry and Nixon's mentor, encouraged her to apply for the new summer program.

"Rachel was admitted to Missouri S&T with the Chancellor's Scholarship," Wang says. "She joined my research group in the beginning of 2017 and showed the ability to work independently with great creativity and enthusiasm in the nanotechnology area."

"Without the Bottom Scholarship, I wouldn't have been able to focus as much on the research projects," says Nixon. "I'm very thankful for Dr. Bottom's support. It allowed me to concentrate on making progress with my research and learning all I can about enhancing the nanostructures we're studying."

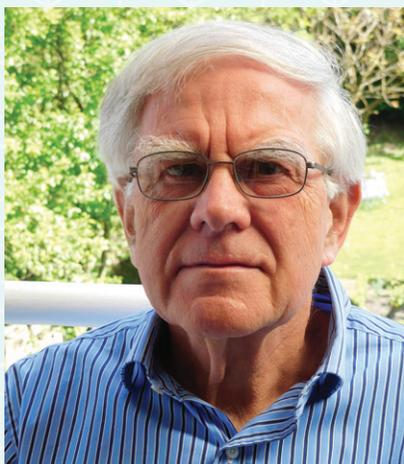
Nixon is the lead author of a paper titled "Exploring the Addressability of DNA Decorated Multifunctional Gold Nanoparticles with DNA Origami Template," which was published by The American Chemical Society's *Bioconjugate Chemistry* journal in July. Nixon's research examines the binding efficiencies of gold nanoparticles for potential use in emerging nanodevices that

can harvest, convert, store and use energy in applications such as cellular imaging, nanoelectronic circuitry and drug delivery.

Nixon's subsequent summer project involved designing a targeted drug delivery carrier from DNA origami nanostructures used in cancer therapy. According to Wang's previous study, "Time-lapse live cell imaging to monitor doxorubicin release from DNA origami nanostructures," DNA nanostructures showed great potential for this purpose, and now Nixon is adding specific molecules to those shapes to make delivery of a widely used anti-cancer drug, doxorubicin, more targeted to the proteins that are overexpressed in cancer cells.

"The study's findings would dramatically enhance drug delivery efficiency with little to no side effects," Wang says.

"I'm glad that the research we're working on is in an area that means so much to Dr. Bottom, and I hope that through this work we can honor his wife, Christine," says Nixon.



CELEBRATING 50 YEARS OF TEACHING AND RESEARCH

Chemistry professor **Gary Long** joined the S&T faculty in 1968, teaching general and inorganic chemistry to undergraduate and graduate students. This past fall, the College of Arts, Sciences, and Business held a reception to honor his five decades of teaching and research excellence.

Long's contributions to the fields of physical inorganic and solid-state chemistry include research using the Mössbauer effect, the atomic process whereby a nucleus emits or absorbs gamma rays without losing energy by recoil. Through observing a Mössbauer spectrum, scientists can determine unique electronic, magnetic and structural properties within materials, particularly compounds containing iron, Long says.

Long's laboratory produced over 400 internationally published scientific papers on the subject, more than from any other U.S. academic institution.

"The best teachers are doing research, and the best researchers are always teaching," says Long.

For the last decade, Long has taught graduate students through his inorganic chemistry lectures. He also teaches students the best practices for a successful scientific career, like how to prepare graphics that are acceptable for publication and how to prepare and convincingly present their research at conferences.

"I enjoy teaching a lot, I enjoy doing it right, and I will continue as long as I enjoy doing so," Long says.



Chariklia Sotiriou-Leventis and Hojat Majedi-Far, PhD Chem'18, use a Bruker Avance III 400-MHz solid-state NMR spectrometer, one of the key instruments used in materials characterization. (photo by Rushi Soni)

S&T'S AEROGELS RESEARCH UNCOVERS NEW KNOWLEDGE FOR CAPTURE AND SEQUESTRATION OF GREENHOUSE GASSES

The research teams led by chemistry professor **Chariklia Sotiriou-Leventis** and **Nicholas Leventis**, a Curators' Distinguished Professor of chemistry, have successfully investigated many syntheses of aerogels, the nanoporous materials made by converting certain pore-filling solvents into supercritical fluids which are then vented off like gases. Aerogels are used in a variety of applications.

One team's most recent work targets the chemical properties of aerogels that can separate carbon dioxide from its emission sources, a finding that could be used in climate management to help bring the level of "carbon avoided" closer to that of "carbon captured."

In this project, **Hojat Majedi-Far**, PhD Chem'18, prepared microporous carbons from specific phenolic aerogels that showed excellent capacity for carbon dioxide adsorption and selectivity, says Sotiriou-Leventis.

"These carbon aerogels showed a far superior CO₂ adsorption capacity at standard temperature and pressure compared to previously tested polymers and other carbons," she says. "Those aerogels are now anticipated to find applications as sorbents for greenhouse gasses like CO₂."

The work was funded by the U.S. Army Research Office and has been published as an invited article in the journal *Macromolecular Chemistry and Physics* 2019, 220, 1800333.

For 20 years, the S&T aerogels research teams have been making new discoveries about the chemistry and properties of these exciting materials, paving the way for their myriad uses in sensors, drug delivery systems, thermal insulation in extreme climatic conditions, such as in offshore oil pipelines and NASA's planetary rovers, and in applications where the shape memory of biomimetic materials is needed. Work on aerogels at S&T has been also funded by the National Science Foundation and the U.S. Department of Energy.



JAY SWITZER

DRIVEN BY DISCOVERY

For **Jay Switzer**, Curators' Distinguished Professor of chemistry, one of the most rewarding experiences of his teaching career is when a student realizes that no experiment is a failure.

△ Jean de Dieu "JD" Nubundiho, a Ph.D. student in chemistry, works with Jay Switzer (right) on the electrodeposition of epitaxial cuprous oxide.

"That's how we make important discoveries — I ask them to tell me what happened," says Switzer, who also serves as the Donald L. Castleman/FCR Endowed Professor of Discovery in Chemistry at S&T and a senior investigator at the university's Materials Research Center. "I know we've reached a milestone when they understand that experiments don't go like you think they will."

And to inspire his students to explore, after nearly 30 years in academia, he's still passionate about teaching Qualitative Analysis.

"I'm teaching the fundamentals behind chemistry, not equations and theories," says Switzer. "It's basic, descriptive chemistry that's not offered today in a lot of universities. Students do classic tests and identify the unknowns, and they love it."

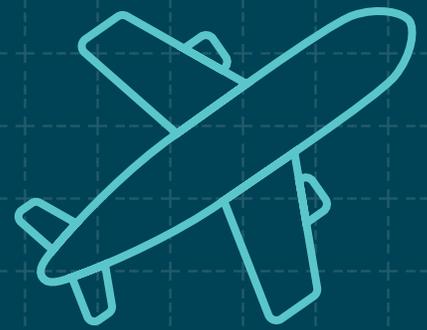
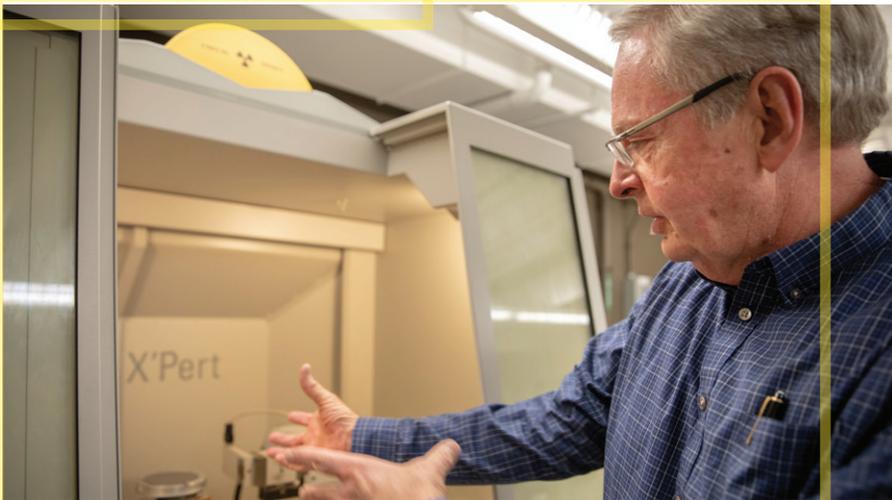
As a prolific researcher in electrochemistry, Switzer has made his share of notable discoveries that are documented by nearly 120 refereed publications and 13 U.S. patents. He believes his most important discovery to date was an unprecedented process for the electrodeposition of ceramic metal oxides that was patented in 1986.

Switzer's work bridges the gap between chemistry and materials science by integrating the efforts of graduate, undergraduate and even high school students from both fields into his research teams.



◀ Jay Switzer (left) and John Tubbesing, a senior in chemistry from Lee's Summit, Mo., works on using 2-D surfaces for chiral recognition of molecules, such as L-dopa.

▽ Switzer and other researchers use the X'Pert machine, an X-ray diffractometer, to determine the structure and orientation of epitaxial films.



S&T ESSENTIAL TO INDUSTRY'S FIRST JET FUEL EMISSIONS REPORT

In May, The National Academies of Sciences, Engineering, and Medicine Transportation Research Board released a flagship report on the air quality impacts of sustainable alternative jet fuel (SAJF) emissions that was based in part on reviews by **Philip Whitefield**, professor of chemistry and director of the S&T Center for Research in Energy and Environment (CREE), and **Donald Hagen**, professor emeritus of physics.

The report gives airlines the information they need to start figuring out strategies for switching to alternative jet fuels.

"The 'State of the Industry Report on Air Quality Emissions from Sustainable Alternative Jet Fuels' is the first review of its kind," says Whitefield. "It distills the current knowledge of emissions data from 51 sponsored SAJF emissions analyses, laying the groundwork to define the environmental impact of SAJF emissions on air quality in and around airports."

By using SAJFs, airlines can reduce criteria pollutants categorized in legislation like the Clean Air Act, including carbon monoxide, sulfur dioxide, nitrogen oxide, particulate matter, commonly known as soot, unburnt hydrocarbons and hazardous air pollutants.

"Until this report, these pollutant reductions had not been well-defined," says Whitefield. "Airlines are also constrained by emissions limits set by the EPA and must make sure that by using SAJFs, they will not be out of compliance with air regulations."

And his approach gets results.

One of the teams recently discovered an inexpensive way to use single silicon crystals as a base for growing flexible, nanometer-thick gold foils — a process that can improve the performance of devices that require highly-ordered flexible electronics, such as wearable medical devices and solar cells.

Although Switzer considers this discovery a "happy accident," it represents over a year's worth of experiments. The research was published in 2017 in the journal *Science* by the American Association for the Advancement of Science (AAAS) and led to his speaking engagements at scientific conferences in Germany, Italy and Israel; and at recent meetings sponsored by the American Chemical Society, the Electrochemical Society and the U.S. Department of Energy; as well as at the chemistry department of Washington University.

"My ultimate goal with this work is to create a silicon surface with metals deposited on it we can use to make single enantiomers of a chiral molecule by chemical reaction," says Switzer. "This discovery would be a disruptive innovation for isolating the 'right' hand molecule of a chiral drug and have many positive effects for the pharmaceutical industry, including improved drug safety."

To that end, Switzer was awarded a \$550,000 extension to a \$2.3 million grant from the U.S. Department of Energy to cover a three-year research period 2018–21. With this work he hopes to determine whether 2-D chiral surfaces produced by electrodepositing metal films onto miscut silicon wafers can direct the enantiospecific crystallization of chiral compounds, a discovery that has yet to be made.

For Switzer, every day holds the possibility of discovery — of coming up with an original concept or observing something that no one has ever seen before about the interactions of electrical energy and chemical change. And it's the prospect of finding answers that drives him forward.



CHEMISTRY ALUMNA, SELECTED FOR US ASTRONAUT HALL OF FAME

Veteran astronaut **Janet Kavandi**, MS Chem'82, has been selected for induction into the U.S. Astronaut Hall of Fame on April 6 at Kennedy Space Center Visitor Complex in Florida.

Kavandi has logged more than 33 days in space and orbited the Earth 535 times. She has served in various leadership capacities with NASA and is currently director of NASA's John H. Glenn Research Center in Cleveland.

Kavandi was selected as a NASA astronaut in December 1994 as a member of the 15th class of U.S. astronauts. She is a veteran of space flights, STS-91 in 1998, STS-99 in 2000 and STS-104 in 2001.

Born in Springfield, Mo., Kavandi earned a bachelor of science degree in chemistry from Missouri Southern State University in Joplin and a Ph.D. in analytical chemistry from the University of Washington in Seattle.

Kavandi, the first presenter in Missouri S&T's James O. Stoffer Lecture in Chemistry Series in 2016, spoke at Missouri S&T's commencement ceremonies in 2015 and was awarded the doctor of science, honoris causa. In 2002, S&T presented her with the Award of Professional Distinction.

RETIREMENT

In June 2018, **Yinfa Ma** retired from S&T, where he served as associate dean for research and external relations in the College of Arts, Sciences, and Business and Curators' Distinguished Teaching Professor of chemistry. Ma joined S&T in 2000 and quickly established himself as a top-level teacher, mentor and researcher. He relocated to California where he now works as associate dean in the College of Natural Sciences and Mathematics at California State University, Sacramento, and lives in close proximity to his family.



FYRE IGNITES SOPHOMORE'S STEM PASSION

Chemistry sophomore **Kaysi Lee** came to Missouri S&T from St. Louis last fall with a passion for science.

It wasn't long before she was accepted into the College of Arts, Sciences, and Business' First Year Research Experience (FYRE) program. The program immerses students in hands-on research and helps build critical thinking, communication and leadership skills.

Lee worked with **Klaus Woelk**, associate professor of chemistry, and chemistry graduate student **Ming Huang**, MS Chem'17.

"We try to involve our students in research at the earliest time possible," says Woelk. "And even more importantly, what we're calling research is not repeating what others have already solved — it's cutting edge and excitingly new."

Lee, Woelk and Huang tested nuclear magnetic resonance (NMR) spectroscopy for pH measurement as a replacement for measuring with traditional pH electrodes. They hope to determine the pH of an aqueous sample based on the NMR spectra and chemical shifts they observe without taking the sample out of the machine.

When Woelk saw Lee's grasp of the project, he encouraged her to present her work at scientific conferences, like the S&T Undergraduate Research Conference, the Missouri Academy of Science and the international Experimental Nuclear Magnetic Resonance Conference in Orlando.

"I learned to assimilate everything I knew about our project and to be able to answer questions on the spot," Lee says. "Those experiences helped me find my voice and build confidence."

Lee's FYRE participation led to the more advanced Opportunities for Undergraduate Research Experiences (OURE) program, where she will expand her work with pH and NMR.

"It's great that someone took me under their wing," says Lee. "I'm learning where I want to go and what working with pharmaceuticals would be like. Right now, I want to pursue a Ph.D. I want to keep going ... and it all started with FYRE."

NEW INSTRUMENTATION ADVANCES MODERN TEACHING AND RESEARCH

More than ever, chemical experimentation relies on analytical instrumentation for testing substances, guiding syntheses and elucidating mechanisms. In the last years, the chemistry department was able to acquire capital equipment that enables nationally and internationally renowned key research projects and supports modern higher education. In particular, these include:

SOLID-STATE NMR SPECTROMETER

Nuclear magnetic resonance (NMR) spectroscopy is an important analytical technique. In fact, the American Chemical Society (ACS) requires undergraduate chemistry students to have hands-on access to NMR spectrometers in their professional training.

The acquisition of a Bruker Avance III 400-MHz solid-state NMR spectrometer (valued at approximately \$500K with funding from the U.S. Army Research Office, PI **Nicholas Leventis**) greatly expands upon S&T's existing liquid-state NMR facilities. This instrument is particularly valuable in regard to the university's materials research emphasis and prominent applications include developments of low-density nanoporous polymeric, metallic and ceramic aerogels, studied by Leventis and **Chariklia Sotiriou-Leventis** and of basic NMR methodology for **Klaus Woelk**.

Several publications resulted from the use of this instrument and potential economic benefits were protected by patents, including "Flexible to Rigid Nanoporous Polyurethane-Acrylate (PUAC) Type Materials for Structural and Thermal Insulation Applications," by Leventis, Sotiriou-Leventis and **Abishek Bang**, PhD Chem'14, which was awarded U.S. Patent No. 9,994,516 on June 12, 2018, and "Solid State NMR Spectroscopy/Imaging in situ Measuring Devices and Methods for Calibration and Determining one or more Quantitative Properties of a Target Sample," by **Lingyu Chi**, PhD Chem'18, **Ming Huang**, MS Chem'17, electrical and computer engineering visiting associate research professor **Rex E. Gerald II**, and **Woelk**, which was awarded U.S. Patent No. 10,067,079 on Sept. 4, 2018.

CONFOCAL MICROSCOPE

The recent acquisition of a Nikon Eclipse Ti2 confocal microscope (valued at \$360K with funds from S&T) is the result of an interdisciplinary and interdepartmental effort of chemistry, biological sciences, materials science, environmental engineering and others.

The state-of-the-art instrument now serves the entire S&T science community and supports medical research on antioxidant-based treatments for age-related cataracts with **Nuran Ercal** and functionalized nanodiamonds as drug delivery vehicles with **Vadym Mochalin** in chemistry.



SOLID-STATE NMR SPECTROMETER



CONFOCAL MICROSCOPE



INDUCTIVELY-COUPLED PLASMA MASS SPECTROMETER (ICP-MS)

INDUCTIVELY-COUPLED PLASMA MASS SPECTROMETER (ICP-MS)

The Perkin-Elmer NexION 300D ICP-MS (valued at \$300K with funds from Perkin Elmer Inc. and matching funds from the University of Missouri System's "Rising to the Challenge" initiative) is a key analytical instrument for S&T's Center for Single-Molecule, Single-Nanoparticle, and Single-Cell Monitoring (CS³M).

The ICP-MS supports a variety of timely research projects aimed at metal element and nanoparticle analysis, nanomaterials and bacterial toxicity studies, as well as investigations about harmful algal bloom treatments with **Honglan Shi**, PhD Chem'10. The instrument greatly enhances the education of S&T students in analytical chemistry courses.



CONFIDENT IN CHEMISTRY

Jennifer See, a senior in chemistry from DeSoto, Mo., is enthusiastic about her S&T education and her career commitment to chemistry.

See came to S&T last year from Jefferson College in Hillsboro, Mo., where she began in engineering and later discovered her love of chemistry through an elective class.

"I want to help people by being able to control things that can affect the environment, and chemistry provides answers," says See, who envisions also earning a Ph.D. in chemistry.

She is thankful for all her university scholarships, including those from the William Hamlet Webb Endowment Fund and the Doe Run Co., an S&T corporate partner in Boss, Mo., where she previously worked as an environmental science intern. See also worked as an R&D intern at Brewer Science, reporting to **Tony Flaim**, PhD Chem'83. She's still at Brewer working part time, enjoying her research on solid state batteries.

Last year See participated in the First Year Research Experience (FYRE) program where she studied renewable energy catalysts under the direction of **Manashi Nath**.

"I wanted to join a research group," says See. "It's nice being in the lab with graduate students. They explain things and help you find what you're looking for in a grad school."

See says she also appreciates the conscientious guidance of her advisor, **Klaus Woelk**. In her quiet but self-directed way, See has taken advantage of Missouri S&T's unique offerings that support student success.

Scholarships, caring faculty and corporate partner internships combine to support a bright student's scientific success

S&T CHEMISTRY VANGUARD PRESENTS STOFFER LECTURE



William J. James, professor emeritus of chemistry, shared compelling highlights of his 65-year academic career at Missouri S&T during the third annual Dr. James O. Stoffer Lecture.

James joined the chemistry and chemical engineering department at Missouri S&T in 1953 after completing a Ph.D. in chemistry and mathematics at Iowa State University.

He played a key role in the formation of S&T's doctoral program in chemical engineering and helped establish the Graduate Center for Materials Research in 1964, serving as director until 1975. At 96, he still keeps office hours there, consulting with former students on research projects related to his crystallographic expertise.

That center, now known as the Materials Research Center, is housed in Straumanis-James Hall, a building that was renamed

in 2010 to honor James and former metallurgical engineering professor **Martin Straumanis**.

James O. Stoffer, Curators' Distinguished Professor emeritus of chemistry, established the lecture series in 2016 to give the campus and Rolla communities an opportunity to learn from scholars and innovators in the field of polymer chemistry.

Stoffer, who taught organic and polymer chemistry to generations of young scholars, was instrumental to the development of the university's polymer chemistry program, one of the first in the United States to be accredited by the American Chemical Society.

His pioneering research with the late **Thomas J. O'Keefe** led to the development and patent of the first environmentally friendly alternative to the toxic chromium-based anti-corrosion coatings used on military aircraft and on aluminum components in the aerospace industry.

Royalty funds from that patent allowed Stoffer to give \$50,000 to establish the lecture series. S&T matched that gift with an additional \$50,000 in patent royalties.

FACULTY

ACCOMPLISHMENTS

AWARDS

- » **Garry Grubbs**, assistant professor of chemistry, won a 2019 Flygare Award, which recognizes outstanding contributions in molecular spectroscopy by early career scientists and is given to only two people every two years. Grubbs will speak at the International Symposium on Molecular Spectroscopy in June in Champaign-Urbana, Ill.
- » **Jay Switzer**, the Donald L. Castleman/ Foundation for Chemical Research Professor of Discovery and Curators' Distinguished Professor of chemistry, was selected as a 2018 fellow of the Electrochemical Society (ECS). The society inducts a maximum of 15 distinguished members a year in recognition of their scientific achievements.
- » **Richard Dawes**, professor of chemistry, was one of four S&T faculty members to receive the 2018 Faculty Excellence Award, which recognizes sustained excellence in teaching, research and service.
- » **Manashi Nath**, associate professor of chemistry, was one of nine S&T faculty members to receive the 2017 Faculty Research Award for excellence in research and scholarship and significant long-term contributions to the field.
- » **Klaus Woelk**, associate professor of chemistry, was one of three S&T faculty members to receive the 2017 Faculty Service Award for displaying exemplary, sustained service to the university and to the profession. He was also one of eight faculty members to receive the 2017 Faculty Teaching Award for excellence in teaching-related activities.

GRANTS

- » **Casey Burton**, Chem'13, PhD Chem'17, director of medical research at Phelps Health, and adjunct assistant professor; **Honglan Shi**, PhD Chem'10, chemistry research professor; **Paul Nam**, associate professor of chemistry; and Donald James, DO, senior vice president of research and governmental affairs at Phelps Health, received \$1.3 million from the Leonard Wood Institute to develop a technique to detect biomarkers for traumatic brain injury.
- » **Amitava Choudhury**, associate professor of chemistry, and **Aleksandr Chernatynskiy**, assistant professor of physics, received a \$411,000 NSF grant to improve the way materials are invented, especially for use in lithium batteries.
- » **Richard Dawes** received \$57,000 from the NSF to study electronic structure theory and dynamics with applications to nonadiabatic processes.
- » **Rainer Glaser**, chair and professor of chemistry, is co-PI on a \$503,000 NSF grant titled "MRI: Acquisition of an ultraviolet amplified laser system" that will improve optics research, nanomedicine, nanotechnology and nanoscience.
- » **Garry Grubbs**, assistant professor of chemistry, received a \$60,000 NSF EAGER grant to find a new way to rapidly identify atomic structure of chiral molecules through a three-wave molecular spectroscopy mixing technique.
- » **Nicholas Leventis**, Curators' Distinguished Professor of chemistry, and Professor **Chariklia Sotiriou-Leventis** received a \$136,614 NSF continuation, totaling \$410,273 since 2016 for low-cost, large-scale nanomanufacturing of superinsulating aerogels and lightweight, mechanically strong aerogels.
- » **Manashi Nath** and **Julia Medvedeva**, professor of physics, received \$381,500 from the NSF to study mixed metal chalcogenides for electrocatalytic water oxidation.
- » **Honglan Shi**, PhD Chem'10, research professor of chemistry, received \$155,000 from the NIH National Cancer Institute to study metabolites in progressive breast cancer. **Casey Burton**, Chem'13, PhD Chem'17, director of medical research at Phelps Health, and **Yinfa Ma**, Curators' Distinguished Teaching Professor emeritus, are co-investigators. Shi also received \$75,000 from the Missouri Department of Natural Resources for a project to improve Missouri drinking water by minimizing disinfection by-product formulation.
- » **Pericles Stavropoulos**, associate professor of chemistry, received \$63,000 from the NIH for the study of electrophilic amination of hydrocarbons.
- » **Jay Switzer** received a three-year, \$550,000 U.S. Department of Energy renewal of his original \$2.3 million grant award for the electrodeposition of single-crystal metal foils and metal oxide thin films for energy conversion and storage and the electrodeposition of 2-D chiral surfaces to direct enantiospecific crystallization of chiral compounds.
- » **Risheng Wang**, assistant professor of chemistry, received \$350,000 from the NSF's Division of Computing and Communications Foundation to discover ways to fabricate miniaturized electrode junctions using DNA-based origami nanostructures.
- » **Phillip Whitefield**, professor of chemistry and director of the Center for Research in Energy and Environment, received \$117,000 from Booz Allen Hamilton for a multidisciplinary airborne experiment.



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WITH YOUR SUPPORT, THERE'S NO LIMIT TO WHAT WE CAN ACHIEVE.

Thank you to everyone who made contributions to last year's Phonathon. This spring, a student representative will call you to swap stories about your Rolla experiences, share information about the university and talk with you about making a gift to S&T.

**Help keep S&T's future
bright. Answer the call.**

→ chem@mst.edu



Sean Welter, junior in chemistry
from Arlington Heights, Ill.