UNIVERSITY of WASHINGTON

CHEMLETTER

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LETTER FROM THE CHAIR

Dear Friend of Chemistry,

Since my last message to you, we have begun the new academic year with yet another increase in undergraduate enrollment. The University of Washington admissions office was surprised by the number of applicants accepting our offer of admission, so we have several hundred more freshmen than we expected. Unsurprisingly, many of these additional students want to study science, so we have record enrollments in introductory chemistry.

Next year, these additional students will be sophomores, and will add to the burgeoning enrollment in the organic chemistry lecture and lab courses. The latter is facing a facilities bottleneck. The four spacious lab rooms in the new chemistry building which were commissioned in the mid-90s were designed to accommodate much higher enrollments. Enrollment did indeed rise, but much more than we anticipated. We are now at capacity, and need more labs for the sophomore organic class. Fortunately, the administration has allocated funds to renovate the last large instructional lab in Bagley with sufficient ventilation to teach organic chemistry. This project will be completed in time to enroll sophomores by the fall quarter of 2016.

To help us to teach these large numbers of undergraduates, we rely on the contributions of our graduate students, who serve as teaching assistants. The incoming cohort of graduate students for the 2015-16 academic year is 62 students, breaking the previous record of 58. To recruit this group, our faculty carefully reviewed nearly 700 applications from all over the world. Students are attracted to our program by the caliber of the faculty with whom they would study, the UW's tradition of excellence, and the quality of life in the Seattle area. Many schools compete for the very best of these applicants, so we encourage prospective students to attend our open house events, during which they can meet our faculty, see the facilities, and experience Seattle. Forty-four of these new students are from 18 different U.S. states, and 18 international students come from eight different countries. Women are well represented at 45% of the class.

The research program that these students will contribute to continues to prosper. Our faculty have been very successful in winning highly competitive grants to support this work from a variety of sources. The directions of research pursued in the department continue to evolve. Our emphasis on work at the interface with biology continues and will move in new directions with the appointments of Dan Fu and Ashleigh Theberge. Al Nelson will establish a program in polymer chemistry, including intriguing biological applications. Newer areas of research are emerging in materials chemistry with a particular emphasis on applications to energy generation and storage. The new Clean Energy Institute at the UW is encouraging innovative work in these areas involving several science and engineering disciplines.

Our faculty continue to win awards and recognition for their accomplishments. A complete list of awards is found on page 20, but I will mention some highlights here. We are particularly proud

Continued on back page

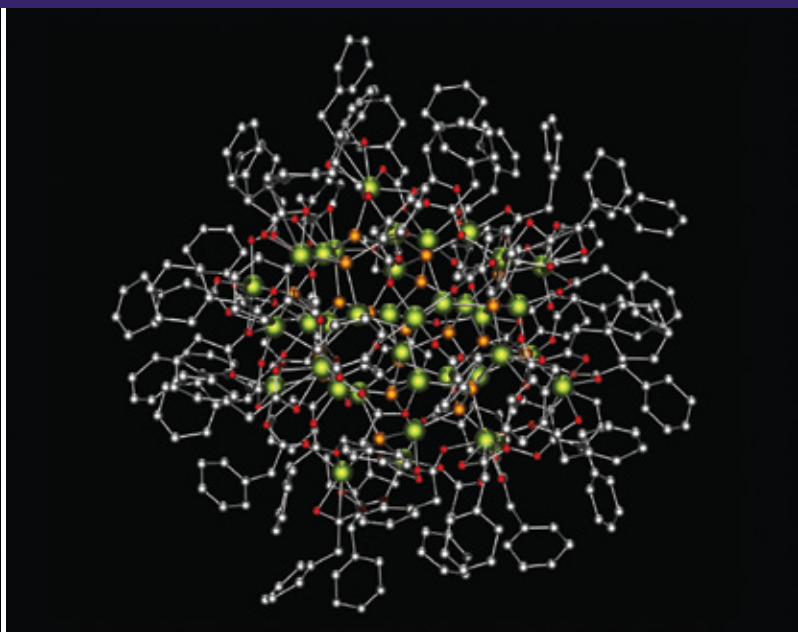
IN THIS ISSUE

CHEMISTRY'S **BRANDI COSSAIRT**

NAMED A 2015 PACKARD FELLOW

JAMES URTON
News and Information, UW Today
October 16, 2015

PORTRAIT OF BRANDI CREDIT: JARED SILVIA; LIGHT EMITTED FROM NANOCRYSTALS SYNTHESIZED IN THE COSSAIRT LAB FOR DISPLAY APPLICATIONS. CREDIT: COSSAIRT GROUP; A SINGLE CRYSTAL X-RAY DIFFRACTION STRUCTURE—THE FIRST OF ITS KIND—OF AN INDIUM PHOSPHIDE NANOCRYSTAL SYNTHESIZED IN THE COSSAIRT LAB. CREDIT: COSSAIRT GROUP



The David and Lucile Packard Foundation has named the University of Washington's Brandi Cossairt as one of 18 Packard Fellows for 2015. The Packard Foundation chooses scientists in the early stages of their careers and supports the more innovative avenues of investigation that traditional funding may not give them the freedom to explore.

"It is really an honor — humbling and amazing," said Cossairt, an assistant professor in the UW Department of Chemistry. The fellowship includes a five-year research grant of $875,000.

Cossairt and the members of her lab — at last count nine graduate students, one postdoctoral fellow and several undergraduates — pursue research to synthesize and manufacture new molecules for applications in green technology such as solar energy and fuel production.

"I like to group chemists into two categories — makers and measurers," said Cossairt. "We're definitely makers."

Cossairt works on crystal formation at the "nanoscale," a window of size between 1 and 100 nanometers. For reference, 1 nanometer is 100,000 times smaller than the width of a human hair. This range of exploration is intermediate between the scale of individual molecules or atoms and larger — but still microscopic — realm of bacteria or crystalline aggregates. It is also a scale with unique properties, especially for the nanocrystals Cossairt studies.

"The properties of materials at this scale just tend to be really different than if they were smaller or larger," said Cossairt. "In the nanoscale, when you change the size of these nanocrystals, their electronic structure changes. You can alter what color of light they absorb and what color they emit, for example."

Many of Cossairt's research projects explore the light-interacting properties of nanocrystals. One goal is to synthesize new light-emitters for energy-efficient lighting and electronic displays. Other projects aim to produce new, efficient light-absorbing compounds for solar cells.

Cossairt's research also explores new methods for fuel production. Just as she hopes semiconductor nanocrystals could harvest light for solar energy, she is looking at how nanocrystals could harvest light directly for fuel formation, such as splitting water molecules to produce hydrogen. In a separate project, Cossairt and her team are exploring how nanocrystals could absorb a pollutant, such as carbon dioxide gas from industrial output, and convert it into octane, a useful hydrocarbon fuel.

In addition to these green applications for nanocrystals, Cossairt and her laboratory study new ways to manufacture nanocrystals quickly and efficiently.

"The tools to work at this scale are developing, and if you don't make your crystals the same size they won't all have the same properties," said Cossairt. "What we really try to do is to make these nanomaterials cheaply and uniformly."

Part of Cossairt's motivation in these projects is a sense of social responsibility for the challenges of the 21st century.

"As a scientist, I ultimately want to do things that help people," she said. "We need green energy, and lots of it, and my background in materials science and chemistry makes this application the right space for my training."

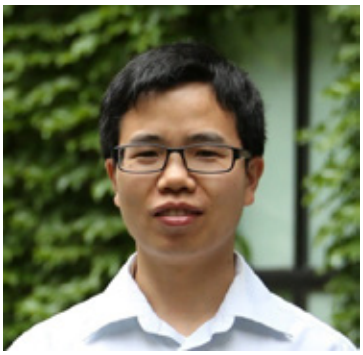
Cossairt earned a bachelor's degree in chemistry from the California Institute of Technology and a doctorate from the Massachusetts Institute of Technology. She began to study nanocrystal properties as a postdoctoral researcher at Columbia University before joining the UW faculty in 2012. Cossairt is the third Packard Fellow to come from the UW Department of Chemistry and the ninth overall for the university, seven of whom are still at the UW.

Every year, about 50 universities are invited to nominate two faculty members who are in the first three years of their careers for consideration as a fellow. A 12-member scientific panel recommends fellows each year for final selection by the Packard Foundation Board of Trustees, in fields from biology to engineering.

"The previous Packard Fellows have been astounding, so I feel like I'm in great company," said Cossairt.

For more information, contact Cossairt at 206-543-4643 or cossairt@uw.edu.

Faculty Introductions



DAN FU

Assistant Professor

Ph.D. in Chemistry, 2009
PRINCETON UNIVERSITY

Thesis: "Developing Novel Nonlinear Optical Contrasts for Biomedical Imaging"
Advisor: Warren S. Warren

B.S. in Chemistry, 2003
PEKING UNIVERSITY

Thesis: "Structure and Magnetic Properties of Fe, Co, Ni Based Inorganic Complexes"
Advisor: Song Gao

Dan was born in a small town in Hubei, China, near the Yangtze River. He became interested in chemistry in high school. After competing in the International Chemistry Olympiad, he decided to learn more about what comprises matter in college.

Starting in his freshman year as an undergraduate in chemistry at Peking University, Dan was fascinated by functional inorganic materials. He did summer research in an inorganic phosphor group for three years and later worked on magnetic materials for his undergraduate thesis. While those research experiences built a strong foundation in chemistry, they also made him realize that measurement tools are as important, if not more so, than the system under study. He decided to change course in graduate school to pursue the development of measurement tools that enable new and powerful ways of interrogating matter.

During his graduate work at Princeton University, Dan worked with Warren Warren on developing ultrafast spectroscopy techniques for studying biological molecules. Interestingly, even though the spectroscopy tools—mostly based on pump-probe spectroscopy—did not find much use in homogenous solutions, they turned out to be extremely useful for studying heterogeneous distribution of absorptive molecules in tissue, resulting in the first label-free imaging of non-fluorescence molecules including melanin and hemoglobin. He further showed that optical imaging tools can be very useful in diagnosing melanoma, the deadliest skin cancer. These developments eventually became his Ph.D. thesis, "Developing novel nonlinear optical contrasts for biomedical imaging."

In his postdoctoral research in Sunney Xie's group at Harvard University, Dan continued developing optical imaging techniques for studying heterogeneous biological systems. There he was able to combine his training in ultrafast spectroscopy and bioimaging with chemistry. He developed the first spectrally-resolved quantitative stimulated Raman scattering microscopy technique, and used it to study a number of interesting biological questions, including lipid metabolism, drug transport, and tissue organization.

In his independent research, Dan will explore different biomedical applications of quantitative chemical imaging and spectroscopy. He is particularly interested in developing optical tools for early disease diagnosis such as cancer and neurological disorders. In addition, he is interested in understanding disease processes, including their metabolism, at single cell resolution. The key challenge is to provide quantitative chemical measurements of a number of molecules at high spatial-temporal resolution, either label-free or with minimal perturbation to the system. To this end, his group will focus on building state-of-the-art laser scanning microscopes and collaborate extensively with pathologists, surgeons, biologists, and engineers.

Assistant Professor Joshua Vaughan notes that Dan's program of research is impressive in two distinct ways. On the one hand, he is able to develop important technical innovations in methods such as two photon microscopy or stimulated Raman scattering microscopy for imaging fixed or living specimens. On the other

hand, Dan is able to apply these improved tools to important biological problems, and he will be using them in a range of applications such as tumor margin detection or studying the role of lipid and protein turnover in various neurodegenerative diseases.

"This powerful combination has also sparked substantial interest from colleagues in the medical school, and we anticipate fruitful collaborations in the future," Josh says. Dan agrees.

"The UW is an exciting place to carry out these projects with its strong tradition of interdisciplinary collaborations," he says.

Dan's interests

Outside of the lab, Dan enjoys hiking, fishing, cooking at home, and movies.

Dan's most notable research achievement to date

Dan feels that his most notable research achievement so far is the development of the pump-probe imaging technique which forms the technical basis for a number of label-free chemical imaging tools including transient absorption microscopy and stimulated Raman scattering microscopy. He is also excited about his recent developments of quantitative chemical imaging and their applications in drug transport and metabolism studies.

ALSHAKIM NELSON

Assistant Professor

Ph.D. in Organic Chemistry, 2004
UNIVERSITY OF CALIFORNIA, LOS ANGELES

Thesis: "Carbohydrate-Containing Macrocycles and Polymers"
Advisor: J. Fraser Stoddart

B.A. in Chemistry, 1999
POMONA COLLEGE

Alshakim (Al) was born in Las Vegas, Nevada. He received a B.A. in chemistry from Pomona College in the Los Angeles area in 1999. During his sophomore year at Pomona, Al was invited to perform research with Daniel O'Leary investigating intramolecular hydrogen bonding interactions of 1,2- and 1,3 diols using NMR spectroscopy. This research opportunity stimulated Al's interest in organic chemistry, and in the two subsequent summers, Al broadened his interest to materials chemistry as an intern at IBM Almaden Research Center.

Upon graduating from college, Al pursued a Ph.D. at the University of California, Los Angeles under the supervision of Professor J. Fraser Stoddart (now at Northwestern University) where he designed and synthesized carbohydrate-based polymers and macrocycles. He was a National Institutes of Health Postdoctoral Fellow working under the supervision of Professor Robert Grubbs at the California Institute of Technology in the Division of Chemistry and Chemical Engineering, where his focus was on the use of molecular templates to pre-organize molecules which were then stitched together using olefin metathesis.

In 2005, Al joined IBM Almaden Research Center as a research staff member to develop a program in the area of self-assembly. During his ten years with IBM Research, Al worked on a broad range of applications that included magnetic nanoparticles for storage media, lithography for semiconductor manufacturing, and biodegradable polymers for nanomedicine. One of his first projects at IBM was a lithography project to develop photo-patternable organosilicates with low dielectric constants. He then moved on to work on other lithography projects which included block copolymer lithography, immersion lithography and electron-beam lithography. Thus, he has developed an understanding of how his knowledge of organic chemistry, supramolecular chemistry, and polymer chemistry can address the challenges associated with lithography, such as feature size and resolution, line-edge roughness, and the speed at which the patterns can be generated.

In 2012, Al became manager of a new group that was called, "Nanomaterials: Synthesis and Assembly." The core mission of the group was to investigate the fundamental aspects of materials synthesis, self-assembly, and synthetic scale-up. His group capitalized on its expertise in lithography to apply it toward developing patterned materials for biological applications.

Al is widely recognized as an innovator and leading scientist in the areas of polymer synthesis, nanofabrication, and nanotechnology. His expertise and leadership during his time at IBM Almaden Research Center will serve him well as he transitions into a principal investigator at the University of Washington.

"There is tremendous potential in bringing in someone with such a well-developed background, history of scientific discovery, and record of service to the polymer community into the collaborative, multi-disciplinary environment that we have here at the UW. We are extremely excited to have him as part of our team," says Assistant Professor AJ Boydston.

Al's current research interests are focused on developing stimuli-responsive materials for patterning applications that can be used at the bio-interface. In particular, his group will focus on designing synthetic polymers for 3D printing applications. The recent resurgence of additive manufacturing is driven by advances in tooling and cost reduction. As these technologies continue to advance, there is a significant opportunity to broaden the scope of applications of 3D printing by developing new printable inks.

Al's interests

Outside of the lab, Al enjoys reading about science and spending time with his family.

Al's most notable research achievement to date

Al developed a process for the rapid self-assembly of nanoparticles on patterned surfaces. This work is important for demonstrating that nanomaterials can be positioned and organized (in 30 seconds of spin-coating) onto silicon substrates using standard semiconductor manufacturing protocols.

Ashleigh's interests

Outside the lab, Ashleigh enjoys sailing, hiking, and almost anything outdoors. She also enjoys cooking with friends and experimenting with 'molecular gastronomy' recipes.

Ashleigh's most notable research achievement to date

Ashleigh has developed techniques to study steroidogenesis (steroid synthesis) which is an important process during early development and throughout life. Her microfluidic culture and analysis methods utilize one hundred fold fewer cells than conventional techniques, making it possible to study rare cell populations. These methods enable studies of potential environmental factors (such as synthetic chemicals) that disrupt steroid synthesis and potentially lead to birth defects.

ASHLEIGH THEBERGE

Assistant Professor

Ph.D. in Chemistry, 2011
UNIVERSITY OF CAMBRIDGE

Thesis: "Droplet-Based Microfluidics for Chemical Synthesis and Integrated Analysis"
Advisor: Wilhelm Huck

B.A. in Chemistry, 2006
WILLIAMS COLLEGE

Thesis: "Methods for the Asymmetric Synthesis of Pyran-Based Natural Products"
Advisor: Thomas Smith

Ashleigh grew up on Orr's Island, a small island in Maine. She began research in high school, studying the effects of herbicides on biological nitrogen fixation, using soil samples collected around Orr's Island and a gas chromatograph at the University of Maine. This lead to participation in the Intel Science Talent Search and the opportunity to work as a synthetic organic chemistry intern at Merck the summer after graduating from high school. As an undergraduate at Williams College, Ashleigh continued her nitrogen fixation work with Lois Banta and David Richardson, applied chemical methods to paleoclimatology with Heather Stoll, and studied polymer dynamics using single molecule spectroscopy with Dieter Bingemann. She conducted her honors thesis research with Thomas Smith in natural products synthesis.

Enjoying both synthetic chemistry and the development of new analytical chemistry techniques, Ashleigh pursued a Ph.D. in the emerging field of droplet-based microfluidics with Wilhelm Huck at the University of Cambridge. Droplet-based microfluidics enables chemical and biological reactions in nano- to picoliter volumes, increasing throughput and the ability to use rare or expensive reagents. During her graduate work, she formed a collaboration with Andrew Griffiths' group at the Université de Strasbourg and spent a year in France developing methods to synthesize libraries of small molecules within picoliter droplets for medicinal chemistry applications.

She came back to the U.S. for her postdoctoral fellowship at the University of Wisconsin–Madison with David Beebe to study cell signaling pathways in prostate disease using microfluidic technology. She worked closely with mentors Will Ricke and Wade Bushman in the Department of Urology to identify clinically relevant questions and develop new analytical chemistry tools to address these questions.

Ashleigh's independent research will combine her longstanding interest in small molecules with a desire to advance medicine. She will develop new microfluidic techniques to integrate biomimetic cell culture with advances in mass spectrometry and metabolomics. Her group studies the chemical mechanisms underlying diseases such as bladder infections, prostate cancer, benign prostatic hyperplasia, and asthma, with a particular interest in studying small molecule-mediated interactions across kingdoms (e.g., between microbes and the human host).

Professor Daniel Chiu, chair of the search committee for the Analytical Division, is pleased to welcome Ashleigh to the Chemistry faculty: "Ashleigh develops microfluidic and analytical techniques to study problems in biology. Many of us work at the interface of multiple disciplines, but Ashleigh truly brings the best of each discipline to bear on solving an important problem. We were impressed by both the breadth and depth of her knowledge in these areas and delighted to have her as a colleague."

Ashleigh first visited Seattle as a child on a nine week family camping trip from Maine to Alaska. She and her husband, James, revisited the Pacific Northwest in 2014 on a motorcycle camping trip, and they are excited to further explore the surrounding mountains and wilderness together.

ANNE McCOY

Professor

Ph.D. in Physical/Theoretical Chemistry, 1992
UNIVERSITY OF WISCONSIN–MADISON

Thesis: "Theoretical Investigations of Highly Excited Rotation-Vibration States of Polyatomic Molecules Using Van Vleck Perturbation Theory"
Advisor: Edwin L. Sibert III

B.S. in Chemistry, 1987
HAVERFORD COLLEGE

Anne comes to the University of Washington after spending 21 years on the faculty at The Ohio State University. During her time at Ohio State, she received a CAREER Award from the National Science Foundation in 1997 and a Camille Dreyfus Teacher-Scholar Award in 1999. She is a fellow of the American Chemical Society, American Physical Society, and American Association for the Advancement of Science. In 2013, her work was recognized with a Distinguished Scholar Award from Ohio State and she also received the Harlan Hatcher Distinguished Faculty Award from the College of Arts and Sciences at Ohio State. In addition to her regular faculty responsibilities, Anne has been a senior editor of the American Chemical Society's *Journal of Physical Chemistry* since 2005 and the deputy editor for the *Journal of Physical Chemistry, A* since 2011.

The roots of Anne's interest in science and computing go back to her childhood. Her mother was a systems engineer for IBM in the early 1960s, and was forced to give up her position and this career track when her first child was born. When computer terminals were installed for remedial math exercises in Anne's elementary school in the mid 1970s, Anne's mother recognized that these terminals could be used for more than that, and came to her school as a volunteer to teach fifth and sixth grade students to program in BASIC. It was through this that Anne learned to program while still in elementary school. When personal computers became available in the early 1980s, her parents purchased one, and she and her siblings were encouraged to develop their own computer program, signing up for time on the Apple II. Anne's interest in chemistry developed several years later through her high school chemistry teacher, Ronald Perkins, whose love of the subject and for teaching was contagious, and Anne was sucked in.

After taking two years of chemistry in high school, Anne arrived at Haverford College well-prepared to major in chemistry. At that time, rather than allowing such students to go directly into the organic chemistry class, Anne and her classmates were encouraged to take an honors version of the general chemistry course. Instead of using an advanced general chemistry text, the class was based on a physical chemistry textbook intended for biochemistry majors. The class was small, and challenging, but it fueled Anne's interest in physical chemistry. When Anne was a junior, Haverford hired their first theoretical chemist, and this opened Anne's eyes to the possibility of combining her interest in computing with her chemistry major.

After spending one year teaching high school chemistry at The Hotchkiss School, Anne moved to the University of Wisconsin–Madison to pursue her Ph.D. with Ned Sibert. Her thesis work focused on using high order vibrational perturbation theory to investigate excited states of a variety of small molecules including H_2O, HCCH, HCN, H_2CO and CO_2 with vibrational energies up to ~10,000 cm^{-1}. Today one can perform such calculations by picking the appropriate keyword in an electronic structure program. At that time these were challenging calculations. By using perturbation theory, Anne and Ned were able to get insights into the nature of the couplings that were important in these molecules, something that is harder to tease out from other computational approaches. During her time in Madison, Anne enjoyed the strong connections between the experimental and theory groups, laying the ground work for many of the collaborations she enjoys today.

After graduating, Anne moved to Jerusalem to pursue postdoctoral work with R. Benny Gerber at The Hebrew University of Jerusalem. With Benny, she studied the dynamics of photo-induced processes in clusters. At the time, Ahmed Zewail and others were using van der Waals complexes to provide starting geometries for initiating dynamics by photodissociating one of the molecular constituents. During her time in Jerusalem, Anne learned about quantum dynamics approaches, and Benny's strong ties to experimental groups further influenced the direction of Anne's research.

After two years as a postdoctoral fellow, Anne moved to The Ohio State University in 1994, where she was hired as an assistant professor and rose through the ranks. Her research has continued to focus on the spectroscopy and dynamics of vibrationally excited molecules in the gas phase. Like her mentors, Anne has valued close collaborations with experimental groups. While one can develop and solve model problems, she has found it to be important to remain grounded by what is measured. Further, trying to understand and interpret experiments often requires Anne and her students to push the theory and calculations that they perform further and in directions that they would not have thought to pursue.

In recent years, much of Anne's research has focused on studies of molecules of interest in astronomical or atmospheric chemistry or in molecular systems that allow Anne and her co-workers to investigate more general questions. One class of systems that Anne and her students have been studying are solvated ions, e.g., protonated water clusters, or complexes of molecular ions (e.g., $CaOH^+$) with several water molecules. The charged nature of these species leads to unusually strong hydrogen bonds, which manifest themselves in broad features in the vibrational spectrum, as illustrated in Figure 1. Anne and her student, Laura Dzugan, developed a computational approach that accounts for this broadening (black curve) observed in the Johnson group at Yale. Based on their analysis, the breadth can be attributed to molecular rearrangements upon proton transfer. Such effects are seen in a variety of chemical species including peptides, and help establish spectroscopic signatures of proton migration.

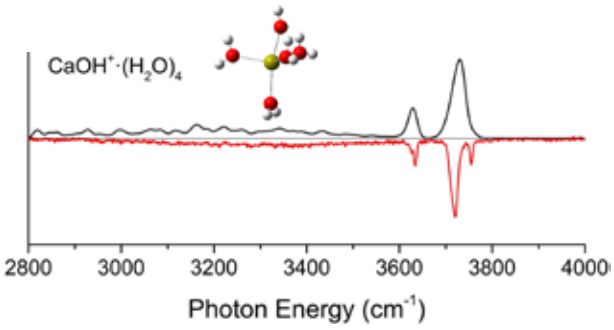


FIGURE 1. JOHNSON, C. J.; DZUGAN, L. C.; WOLK, A. B.; LEAVITT, C. M.; FOURNIER, J. A.; MCCOY, A. B.; JOHNSON, M. A. MICROHYDRATION OF CONTACT ION PAIRS IN $M^{2+}OH^-(H_2O)_{n=1-5}$ (M = Mg, Ca) CLUSTERS: SPECTRAL MANIFESTATIONS OF A MOBILE PROTON DEFECT IN THE FIRST HYDRATION SHELL. *J. PHYS. CHEM. A* **2014**, *118*, 7590–7597.

In another study, Anne and her co-workers explored solvent-mediated long-range electron transfer processes, focusing on small anions, IBr^-, ICN^- or $BrCN^-$, solvated by a small number of CO_2 molecules or argon atoms. By combining experimental studies in the Lineberger group at the University of Colorado with theoretical investigations, they were able to elucidate the role of solvent in these electron transfer processes that occur when the fragments are separated by as much as 7 Å! (Figure 2.)

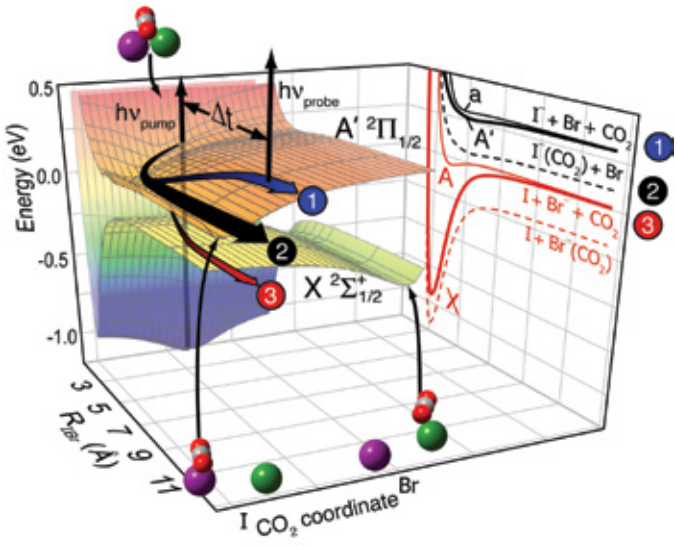


FIGURE 2. SHEPS, L.; MILLER, E. M.; HORVATH, S.; THOMPSON, M. A.; PARSON, R.; MCCOY, A. B.; LINEBERGER, W. C. SOLVENT-MEDIATED ELECTRON HOPPING: LONG-RANGE CHARGE TRANSFER IN $IBR^-(CO_2)$ PHOTODISSOCIATION. *SCIENCE* **2010**, *328*, 220–224.

In addition to her research, Anne is dedicated to the education of students in her research group, in her classes, and through activities on national committees. While at Ohio State, she taught general chemistry on a regular basis. She particularly enjoyed teaching the honors version of the course, as it allowed her to share the ideas of physical chemistry with an exceptionally bright group of students. She actively encouraged these students to start undergraduate research early and has had several undergraduate students work in her group for three or more years, starting as freshmen or sophomores.

Anne looks forward to opportunities at the UW to teach physical chemistry at all levels (graduate, undergraduate, and general chemistry). She will be teaching CHEM 152 (the second quarter of general chemistry) this winter. This class will focus on thermodynamics and chemical equilibrium.

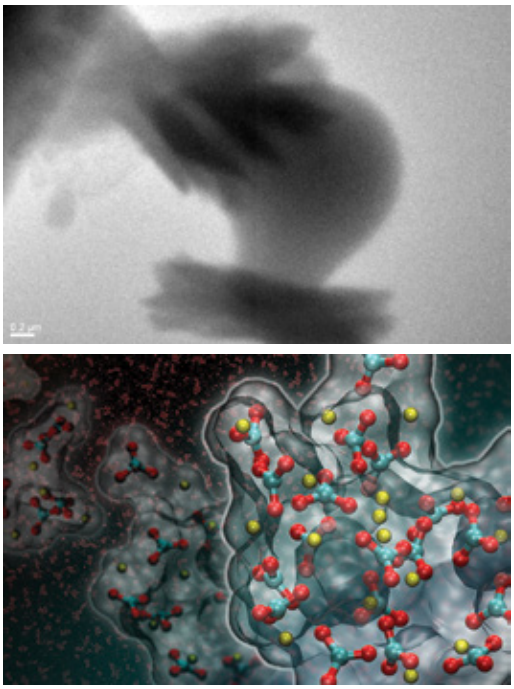
Since 2008, Anne has been a member of the American Chemical Society's Committee on Professional Training. This committee is focused on all aspects of post-secondary chemical education, although it is best known for administering the ACS's approval program for chemistry—establishing the guidelines and evaluating approved programs every five years. Anne chaired the committee from 2012–2014 and led the latest revision of the "ACS Guidelines for Bachelor Degree Programs." She has also served on the Graduate Education Advisory Board of the ACS since 2012.

Spotlight on Chemical Sciences

UNDERSTANDING CRYSTAL FORMATION

James De Yoreo, UW affiliate professor of Chemistry and Materials Science and Engineering, and chief scientist at Pacific Northwest National Laboratory, recently published an article in *Science* bringing together researchers from a wide range of fields to report their advances in understanding crystallization in synthetic and natural systems. The paper explores the process of crystallization by particle attachment along with the various factors that influence it such as interactions with the surrounding solvent and within the crystal itself. The research is expected to have broad implications and included researchers in geochemistry, physics, biology and the earth and materials science.

De Yoreo, J. J.; Gilbert, P. U. P. A.; Sommerdijk, N. A. J. M.; Penn, R. L.; Whitelam, S. B.; Joester, D.; Zhang, H.; Rimer, J. D.; Navrotsky, A.; Banfield, J. F.; Wallace, A. F.; Michel, F. M.; Meldrum, F. C.; Cölfen, H.; Dove, P. M. Crystallization by particle attachment in synthetic, biogenic, and geologic environments. *Science* **2015**, *349* (6247):aaa6760. DOI: 10.1126/science.aaa6760.



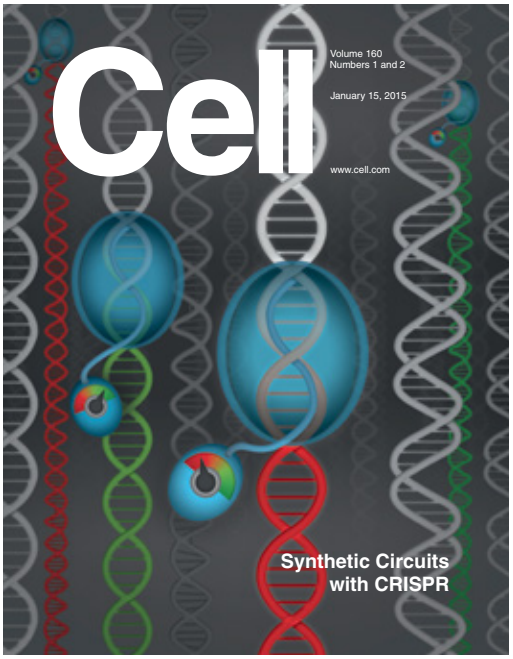
(TOP) ARAGONITE CRYSTALS FORMING ON CALCIUM CARBONATE. PACIFIC NORTHWEST NATIONAL LABORATORY/JAMES DE YOREO

(BOTTOM) AN ARTIST'S RENDITION OF THE EARLY CRYSTALLIZATION PROCESS OF CALCIUM CARBONATE. ADAM F. WALLACE/UNIVERSITY OF DELAWARE/DAVID J. CAREY

ZALATAN'S WORK ON COVER OF *CELL*

Assistant Professor Jesse Zalatan and collaborators at the University of California, San Francisco have developed a method to encode complex, synthetic transcriptional regulatory programs using the CRISPR-Cas system. Natural biological systems can switch between different functional or developmental states depending on the particular set of genes being expressed, and the ability to synthetically control gene expression has important implications as both a research tool and as a means to engineer novel cell-based therapeutics and devices. Zalatan and collaborators designed CRISPR-Cas RNA scaffold molecules that specify both a DNA target and the function to execute at the target, so that sets of RNA scaffolds can be used to generate a synthetic, multigene transcriptional program in eukaryotic cells in which some genes are activated and others are repressed. These types of programs can be used to reprogram complex reaction networks in biological systems, such as metabolic pathways or signaling cascades.

Zalatan, J. G.; Lee, M. E.; Almeida, R.; Gilbert, L. A.; Whitehead, E. H.; La Russa, M.; Tsai, J. C.; Weissman, J. S.; Dueber, J. E.; Qi, L. S.; Lim, W. A. "Engineering Complex Synthetic Transcriptional Programs with CRISPR RNA Scaffolds." *Cell* **2015**, *160,* 339-350.

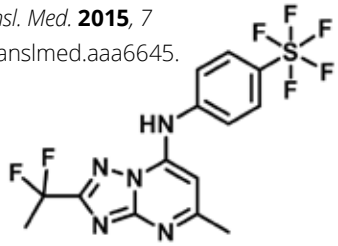


ARTWORK BY JENNIFER SUNAMI

NEW COMPOUND TO FIGHT MALARIA

In a paper published this summer in *Science Translational Medicine*, **Professor of Chemistry Pradip Rathod** and an international team of researchers demonstrated that a new compound to fight malaria is ready for human trials. The compound, labeled DSM265, is novel in its approach to fighting malaria because it is the first to target the DHODH protein that malaria parasites require to express and copy their genes as they divide and reproduce.

Phillips, M. A., et al. A long-duration dihydroorotate dehydrogenase inhibitor (DSM265) for prevention and treatment of malaria. *Sci. Transl. Med.* **2015**, *7* (296):296ra111. DOI: 10.1126/scitranslmed.aaa6645.



DSM 265

POLYMERS THAT CHANGE COLOR WHEN STRETCHED

Assistant Professor AJ Boydston and co-workers have developed a technique to use a commercial 3D printer to create force sensors that change color when stretched. With further development, these materials may be useful in measuring the mechanical load history of structural components, including the magnitude and frequency of applied strain. More generally, their demonstration signifies an ability to rapidly integrate mechanoresponsive polymers and additive manufacturing technology to provide functional devices that would be challenging to make otherwise. Boydston notes that color change is just one of many mechanical-to-chemical processes that are possible, and combined with the expertise in additive manufacturing at the UW, there is great potential for breakthroughs through collaborative research.

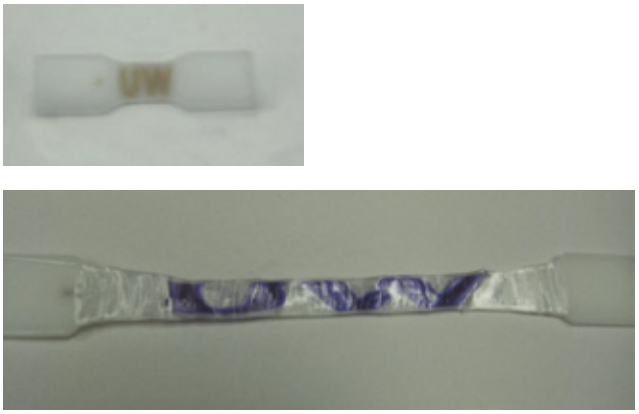
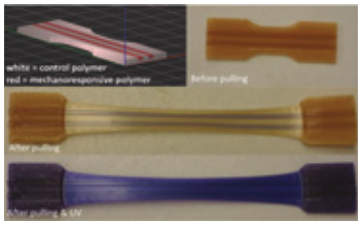
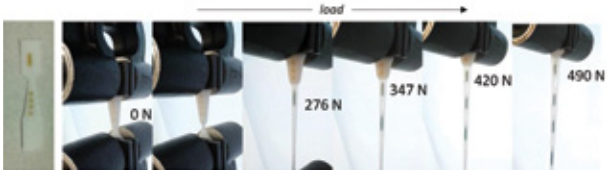


FIGURE 1. THE SAME 3D-PRINTED SPECIMEN IS PICTURED TWICE; SHOWN AFTER STRETCHING IN THE SECOND PANEL.

NOVEL METAL-FREE ROUTE TO POLYMERIZATION

Assistant Professor AJ Boydston and co-workers have developed a technique that uses organic initiators for ring-opening metathesis polymerization (ROMP), rather than transition metals. ROMP is a widely used polymerization strategy both industrially and in academic settings, and this is owed largely to incredible breakthroughs in the development of metal-based catalysts. Caveats related to metal contaminants in the final products, and high costs of well-defined catalyst systems, often impose limitations on the use of ROMP for applications in biotechnology and organic electronics. Boydston's team saw an opportunity to circumvent metal-mediated mechanisms for ROMP altogether by employing a redox-based approach. Moreover, their method has been developed to use photoredox catalysis and visible light, which enables one to essentially turn the polymerization on and off with the flip of a switch.





FIGURES 2 AND 3. OTHER DEVICES PRINTED BY THE BOYDSTON GROUP, INCLUDING A FORCE SENSOR.

Featured Alumni

Nick Peterson, son of **Donald Peterson (Ph.D. 1956)** and Juanita Peterson (M.S. 1954 Mathematics), wrote to let us know that his mother, now 85, still remembers fondly her college years at the UW with her husband Don and others. Juanita continues to support the Department of Chemistry in memory of her dearly departed Don. "Here is a picture of them at the UW around the time Dad got his Ph.D. Mom already had her master's in mathematics by then and went on to get a Ph.D. in education at UC Berkeley," writes Nick. Thanks, Nick, for sharing this treasured photo with us!

Julian Steenbergen (B.S. 1938) joined other Chemistry friends and alumni at the Burke Museum of Natural History and Culture in October for dinner and a lecture by Professor Sarah Keller. Julian celebrated his 100th birthday this year; he also renewed his driver's license and his hunting license! We were honored by his presence, along with his son, John.

We hope to catch up with Julian this winter so that we can share more about him in the next *ChemLetter*, including his memories from the UW, his namesake wine and his career at the Upland Estates winery, his family orchard, and maybe even some advice on longevity and happiness!

PHOTO ABOVE (LEFT TO RIGHT) DAMIEN CHAPMAN (DIRECTOR OF ADVANCEMENT, UW COLLEGE OF ARTS & SCIENCES), **JULIAN STEENBERGEN (B.S. 1938)**, BOB CASTONGUAY (M.S. 1976), AND JOHN STEENBERGEN.

Call For Help—Find The Postdocs!

The Department of Chemistry is hoping to reestablish contact with our former postdoctoral research associates. We have contact information for just a small number of the hundreds of postdocs who have studied with us through the years. Can you help us? Do you know the whereabouts of any postdocs you knew or worked with when you were at the UW? We would appreciate hearing from you if you know the address or current employer of any former UW Chemistry postdoc. E-mail us at chemdept@uw.edu and spread the word!

More about the incoming cohort of graduate students for the 2015-16 academic year

Forty-four of these 62 new students are from 18 different U.S. states, and 18 international students come from eight different countries. All but eleven majored in chemistry as undergraduates. Exactly half (50%) plan to conduct research in the field of physical chemistry while at the UW, 24% in organic chemistry, 15% in analytical chemistry, and 11% in inorganic chemistry.

NSF GRADUATE RESEARCH FELLOWSHIPS

The NSF Graduate Research Fellowship Program recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited U.S. institutions. Fellows benefit from a three-year annual stipend along with a cost of education allowance for tuition and fees, opportunities for international research and professional development, and the freedom to conduct their own research at any accredited U.S. institution of graduate education they choose.

This year, seven graduate students in the Department of Chemistry were awarded 2015 National Science Foundation Graduate Research Fellowships and nine graduate students received honorable mentions.

We hope you will enjoy learning about these gifted and hardworking students. In this issue, we introduce you to Emily Dieter, Marco Howard, and Johanna Schwartz. Look for more profiles of fellowship recipients in future issues of the *ChemLetter.*

NSF GRADUATE RESEARCH FELLOWSHIP RECIPIENTS:

Emily Dieter

Advisor: Professor Dustin Maly

Emily Dieter is a second-year graduate student in the research group of Professor Dustin Maly. The Maly group works to develop new chemical tools to understand cellular signaling, in particular the role of protein kinases. Protein kinases are enzymes that chemically modify other proteins by phosphorylation—the transfer of a phosphate group from ATP to a new protein. Through phosphorylation cascades, protein kinases mediate critical cell signaling events in our cells. Unsurprisingly, misregulation of protein kinases can lead to serious health problems such as cancer and inflammatory diseases, and as a result, protein kinases are major drug discovery targets. Kinase inhibitors are mainly ATP-competitive small molecules, but it has proven difficult to create inhibitors that selectively target specific kinases due to the highly conserved structure of kinase ATP-binding sites. Despite their highly conserved structure and catalytic function, individual kinases are able to play distinct, non-redundant cellular roles. It is thought that this non-redundancy is achieved through non-catalytic function such as substrate recruitment/recognition, scaffolding, and DNA binding. Developing methods to understand kinase non-catalytic function, although challenging, is important for a complete understanding of how individual kinases engage intermolecular binding partners and participate in signaling cascades. Specifically, Emily has been investigating the kinase-independent roles of PAK1.

PAK1 (p21-activated kinase 1) is a serine/threonine protein kinase that has been shown to be involved in cellular pathways that regulate cell cycle progression, cell motility, and cytoskeletal regulation. PAK1 consists of an autoregulatory domain and a kinase domain. When the autoregulatory domain binds to the kinase domain, PAK1 is in a closed, inactivated conformation, preventing PAK1 from phosphorylating other proteins. When PAK1 becomes activated through phosphorylation by upstream activators, binding between the autoregulatory domain and the kinase domain is interrupted, resulting in an open, active conformation, allowing PAK1 to phosphorylate and activate other proteins. Although many studies have been done on the role of active PAK1, it has recently been shown that PAK1 also has kinase-independent activity. In other words, some cellular effects do not require PAK1 to have the ability to phosphorylate other proteins. For example, in the PDK1-Akt pathway, which regulates cell motility, when PAK1 is present, an increase in phosphorylation is observed for Akt, which is not dependent on the ability of PAK1 to phosphorylate other proteins. Therefore, it has been hypothesized that in this pathway, PAK1 acts as a scaffold: although it does not phosphorylate Akt, it brings together proteins that do phosphorylate Akt, thus making the phosphorylation more efficient.

The Maly group has developed inhibitors that stabilize specific active or inactive ATP-binding site conformations. By using these inhibitors in biochemical assays and manipulating specific conformations of the kinase, Emily's research will allow a more complete understanding of the allosteric relationships that occur between the regulatory domain and the kinase domain of PAK1, and a better understanding of PAK1's unique roles in the cell.

Emily earned a B.S. degree in biochemistry at Saint Michael's College, with minors in math and physics. Her undergraduate research included working on synthesizing an isotopically labeled biological tag, which targets small polar carboxylic acids, allowing for enhanced detection using LC-MS under the guidance of Associate Professor Shane Lamos at Saint Michael's College. Additionally, she spent a summer working in a maize genetics laboratory at the University of Missouri with Associate Professor David Braun understanding how plants partition carbohydrates. In her free time, Emily enjoys exploring Seattle on her bike and binge watching terrible Netflix shows.

Marco Howard

Advisor: Assistant Professor Joshua Vaughan

Marco David Howard is a United States Air Force (USAF) veteran with a B.S. in chemistry from the University of Texas at Austin. Marco grew up in Ecuador—in the heart of the Andes Mountains—and is an avid outdoor enthusiast. When not in the lab, he enjoys cycling on the Burke-Gilman Trail, hiking in the beautiful Cascades, listening to progressive house and techno music, and sipping on craft brews from the famous Pacific Northwest microbreweries. Before this chapter of his life comes to a close, he wants to summit Mt. Rainier.

Marco began his career as an airborne cryptologic linguist in the USAF five months after his eighteenth birthday. Marco attended basic military training at Lackland Air Force Base. Then after graduation he went to sunny California for Korean language training at the Presidio of Monterey. After language training he was stationed in Omaha, Nebraska, at Offutt Air Force base for three years, where he completed his flight training and flew operational sorties supporting counter-narco-terrorism. In 2010 his military contract expired and Marco decided to go to college.

Marco moved to Austin, Texas, where he enrolled in Austin Community College for a semester—glad he was done enduring fierce Midwestern winters. Then he transferred to the University of Texas at Austin where he found his interest in fluorescence spectroscopy and microscopy. As an undergraduate, he was responsible for setting up a standard epifluorescence microscope with total internal reflection illumination, which was used for measuring diffusion in lipid bilayers, and ligand binding kinetics on the surface of lipid bilayers. As Marco was learning about microscopy, he stumbled upon papers written by Joshua Vaughan concerning stochastic optical reconstruction microscopy (STORM).

He was so fascinated by the beauty of the images that could be obtained with this technique that he reached out to Professor Vaughan and applied to the University of Washington. In 2014, Marco was formally accepted to the University of Washington and he joined Professor Vaughan's research group.

Marco is beginning his second year in the Vaughan group, where he studies the photophysics of organic dyes used in STORM. The technique works by densely labeling a specimen with fluorescent dyes which can be photoconverted between an emissive and non-emissive state. In one acquisition cycle, a sparse sub set of dyes is photoconverted to an emissive state, and then the fluorescence for the individual molecules is detected. The position of the fluorescent molecules are determined with high precision, and the activated subset is deactivated. The activation-detection-deactivation process is repeated many times to determine the positions of the fluorophores which label the specimen. Finally, a STORM image may be reconstructed with knowledge of the determined positions. While elegant in principle, practical implementation critically depends on the photoswitching properties of the dyes used for imaging. For his research, Marco seeks to first gain fundamental understanding of the dye's photoswitching mechanisms. Second, he wants to apply that knowledge to rationally design a palette of dyes to permit investigators to obtain robust multicolor images at 3-5 nm resolution.

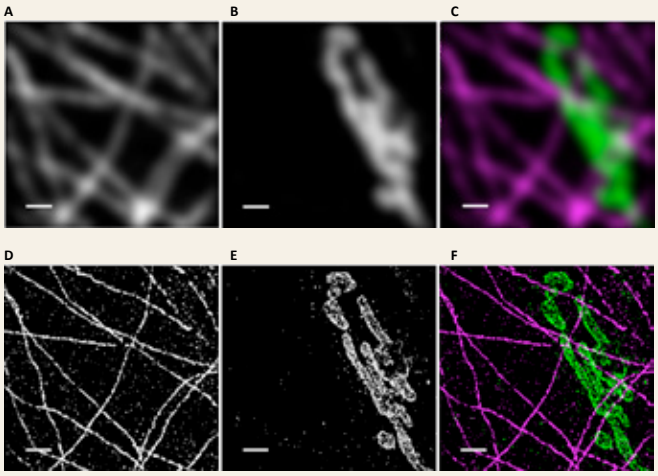


FIGURE 1. (A-C) CONVENTIONAL IMAGES OF ALEXA647 LABELED (A) MICROTUBULES, (B) MITOCHONDRIA, AND (C) OVERLAY OF (A) AND (B) IN BSC-1 CELLS. (D-F) STORM IMAGES OF (A-C).

For figures in right column

FIGURE 1. GENERAL DESIGN OF DLP 3D PRINTER (GREG PETERSON)

FIGURE 2. SIMPLE OBJECTS (DOG BONE ON THE LEFT) CAN BE MADE BY PROJECTING THE SAME SHAPE FROM THE DLP PROJECTOR, WHEREAS MORE COMPLEX OBJECTS, LIKE AN OCTET TRUSS STRUCTURE (RIGHT), REQUIRE A SPECIFIC SEQUENCE OF IMAGES TO BE PROJECTED.

Johanna Schwartz

Advisor: Assistant Professor AJ Boydston

Johanna Schwartz is a second-year graduate student in Assistant Professor Andrew J. Boydston's research group. Her work primarily focuses on developing new materials and methods for use in additive manufacturing, also known as 3D printing (3DP). Much of her research is part of an interdisciplinary collaboration with Professors Mark Ganter and Duane Storti, co-directors of the Solheim Additive Manufacturing Laboratory in the Department of Mechanical Engineering. Her current research focuses on Digital Light Processing (DLP) 3DP, in which a projector is used to display an image into a vat of liquid monomer resin (Figure 1). This resin can contain various monomers, photoinitiators, photoinhibitors, pigments, and solvent. Upon being irradiated with light, the monomer polymerizes into a solid polymer in the corresponding shape of the image projected (Figure 2). Adjustments to the components in the monomer vat allows for control of the polymer composition. Her research also attempts to control the composition and material properties of the resulting polymer further through adjustments in the wavelength and intensity of light. In this way, she is developing novel methods of 3D printing and polymeric materials with gradation in mechanical properties and composition.

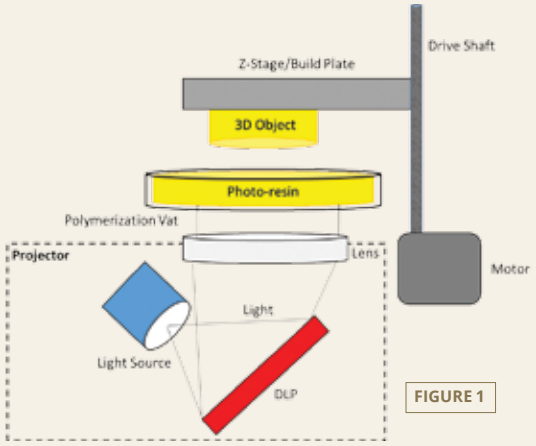


FIGURE 1

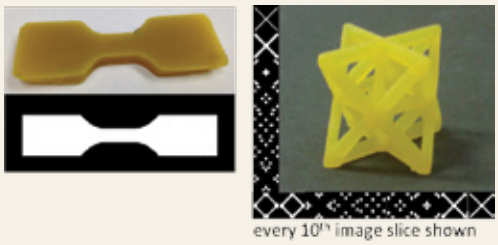
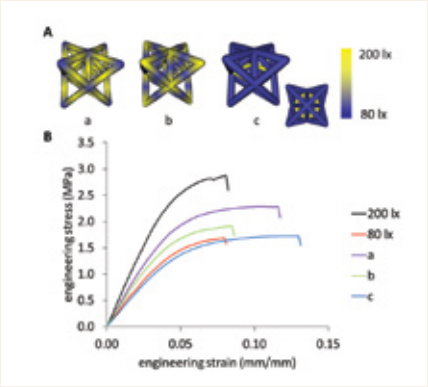


FIGURE 2

While objects with graded properties are found in nature, such as the arranged toughness/porosity in bone or the variable hardness present in a squid beak, replicating these properties using current manufacturing technologies is often difficult. More often than not, the material is not fully graded, but has separate discreet layers with different properties. Using images in DLP 3DP that have a light intensity gradient, a polymer can be printed that also displays gradation in its mechanical properties. This is ascribed to a gradient in its crosslinking density, or the amount of entangled polymer chains present within the material, caused by the difference in light intensity projected (Figure 3). Alternatively, by using various monomers that respond to different wavelengths of light, gradient properties can be achieved simply by tuning the wavelength of light displayed. Johanna also works on expanding the library of 3DP resins, printing with new and non-commercial monomers, and creating stimuli-responsive materials.

Johanna received a B.A. from Bard College at Simon's Rock, majoring in both chemistry and biology. Her bachelor's thesis work with Dr. David Myers focused on the synthesis and evaluation of antibiotically and antifungally active butenolides found naturally in sea sponges. She grew up in Las Vegas, Nevada, and her hobbies include guitar, photography, and any form of arts and crafts.

FIGURE 3. BY PRINTING MATERIALS AT HIGH (200 LX), LOW (80 LX), AND GRADED INTENSITIES OF LIGHT, GROUP ALUMNUS GREG PETERSON WAS ABLE TO VARY THE MECHANICAL PROPERTIES OF TRUSS STRUCTURES HE PRINTED. JOHANNA IS MOVING FORWARD IN THIS AREA TO HYDROGELS WITH GRADED PROPERTIES (BOTTOM).



Tyler Chozinski

Advisor: Assistant Professor Joshua Vaughan

Tyler is working on developing and implementing a high-throughput method for screening fluorescent proteins in order to evolve and optimize them for super-resolution fluorescence microscopy.

Zuzana Culakova

Advisor: Professor Karen Goldberg

Zuzana investigates transition metal catalysts for the hydrogenation of carbonyl substrates, ultimately seeking to make methanol and other fuels from CO_2 and H_2.

Rachel (Rae) Eaton

Advisor: Assistant Professor Matthew Bush

"I hope as an educator to one day use my research experience to encourage others to study science."

Read more about Rae on pages 6-7 of the Summer 2015 issue of the *ChemLetter*, available online at http://depts.washington.edu/chem/

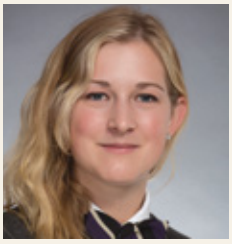
Karena Smoll

Advisor: Professor Karen Goldberg

"Since a very early age, my grandparents and parents emphasized the necessity of a good education."

HONORABLE MENTIONS:

Maike Blakely



Advisor: Professor Julie Kovacs

"I want to become a professor to be able to be a mentor to other women in the science fields."

Caitlin Cornell

Advisor: Professor Sarah Keller

"Science is not some austere and sterile discipline but a study of the form and function of living systems and the dynamic world they produce."

Andy Dang

Advisor: Professor František Tureček

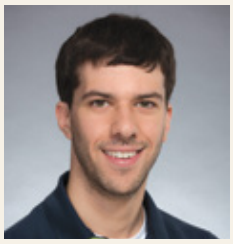
Career aspiration: Becoming a tenured-track professor leading young scientists at the forefront of novel instrumentation and technique development to combat global issues in healthcare and waste management.

Michael De Siena

Advisor: Professor Daniel Gamelin

"I have a deep and long-lasting love for nature, especially for the world's oceans, and this has only spurred my interests in developing and understanding energy materials, in developing technology that will only aid in creating a more efficient planet where the beauty of the oceans and environment is conserved for generations."

Michael Enright



Advisor: Assistant Professor Brandi Cossairt

"As my interest and knowledge of chemistry developed, I always kept the messages of Silent Spring *in mind and promised myself to consider the environmental implications of widespread chemical use."*

Lauren Gagnon

Advisor: Assistant Professor Joshua Vaughan

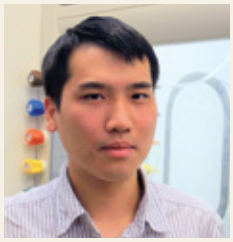
"My interest in quantum dots stems from their potential forensics applications as a method of trace drug and explosive detection."

Troy Kilburn

Advisor: Professor Daniel Gamelin

"Luckily for me, I [entered] the graduate level when solid state research is expanding."

Francis (Ray) Lin



Advisor: Professor Alex K.-Y. Jen

Notable achievement: 12 publications in undergraduate research

Chloe Lombard

Advisor: Professor Dustin Maly

"I began to realize that I wanted to fight for a purpose; that I wanted to use my curiosity and love for chemistry to improve or extend the lives of those battling this devastating disease [cancer]."

65TH LINDAU NOBEL LAUREATE MEETING

Chemistry graduate student Stephen Oja was selected to participate in the 65th Lindau Nobel Laureate Meeting Interdisciplinary: Physiology/Medicine, Physics, Chemistry, which took place from June 28 to July 3, 2015. Only young scientists up to the age of 35 are eligible to apply to participate and selection is a once in a lifetime opportunity, as attending a past meeting renders an applicant ineligible for future consideration. Doctoral students who are selected must show a genuine interest in science and research, show a strong commitment to their principal field of studies and to interdisciplinary work, receive strong support of their application by their academic advisor, belong to the top 5 percent of their class, show excellent academic accomplishments, and have produced some very good research work. Congratulations to Stephen for this remarkable achievement!

My Science Fairytale

I was fortunate enough to be chosen as one of the U.S. delegates to the 65th Lindau Nobel Laureate Meeting in Lindau, Germany this past summer. The best way I can think of to describe my experience at the weeklong meeting is as a sort of science fairytale. One day I was living the graduate student life, working on experiments in a dark basement lab, and the next I was on an island on a lake in a foreign country with Nobel laureates and young scientists from around the world attending a meeting organized by a countess! Throughout the week, I attended lectures and various discussion sessions led by the 65 laureates in attendance. Between these professional activities were meals and breaks that gave us time to relax and chat with the laureates and fellow young scientists. It was a remarkable experience to interact with so many Nobel laureates on a personal level.

While one would expect to receive excellent advice from any Nobel laureate, my most vivid memory from the week came from what I hope was not so excellent advice. During dinner, I was carefully describing my research to a laureate, and upon finishing, I was curtly told the work was pointless and that I should work on other things! I've taken that as a good lesson on handling criticism. The overarching message from the laureates was to always keep an open mind for the subject of your work and to search for a problem that both excites you and isn't being pursued by others.

While interacting with so many laureates was certainly a once-in-a-lifetime experience, so was the opportunity to interact with such a diverse group of young scientists. There were more than 650 other young scientists there, representing 88 different countries. As the meeting included scientists working in chemistry, physics, and medicine, interacting with them was truly an enlightening experience. I met people from countries I had never heard of that work in fields I had never heard of. Learning about these different research fields and the science cultures in other countries was my favorite part of the experience. It was motivating and encouraging to hear about the diverse array of problems that people are addressing around the world. In asking others what they planned to do with their careers, the response I most often heard was along the lines of, "Get a position in the United States." This was a humbling and motivating response and a reminder of how fortunate we are to have the jobs that we do.

In short, the meeting was an absolutely wonderful experience for which I'm humbled to have had the opportunity. I don't think there will be another opportunity in my life to have a week like this, in which young scientists from around the world and Nobel laureates come together in one place and interact on the same level. I recommend that any interested student should apply to attend this meeting.

I give my sincere thanks to the Department, the University, and Oak Ridge Associated Universities for supporting my nomination to attend the meeting and to the National Science Foundation for financial support.

– Stephen Oja

ROW 2 THE NOBEL LAUREATES PICTURED TOGETHER WITH THE COUNTESS AND THE PRESIDENT OF GERMANY...AND PROOF OF STEPHEN'S ATTENDANCE; HE IS IN THE CENTER OF THE AUDIENCE. PHOTO BY ROLF SHULTES/LINDAU NOBEL LAUREATE MEETINGS

STEPHEN (LEFT) AND A PSYCHOLOGY RESEARCHER BREAK FOR COFFEE BETWEEN LECTURES. PHOTO BY ROLF SHULTES/LINDAU NOBEL LAUREATE MEETINGS

ROW 3 DEPARTMENT OF CHEMISTRY'S RECENT LINDAU MEETING ALUMNI PICTURED WITH NOBEL LAUREATES: ALISHA JONES (2013) WITH STEVEN CHU, JOAN BLEECKER (2013) WITH EDMOND FISCHER, AND JONATHAN LITZ (2012) WITH WALTER KOHN.


Fünfzen
BONITA


EDUCATE. INSPIRE. CONNECT.
SINCE 1951
LINDAU
NOBEL LAUREATE
MEETINGS

FACULTY AWARDS & HONORS

AJ Boydston

CAREER Award, National Science Foundation

Distinguished Teaching Award for Innovation with Technology, University of Washington

Jasmine Bryant

Distinguished Teaching Award for Innovation with Technology, University of Washington

Matthew Bush

2014 Eli Lilly and Company Young Investigator Award in Analytical Chemistry

Charles Campbell

Medard W. Welch Award, American Vacuum Society

Brandi Cossairt

2015 Award for Early Career Achievement, Association for Women in Science, Seattle Chapter

Sloan Research Fellowship, Alfred P. Sloan Foundation

3M Faculty Award

2015 Packard Fellow

Colleen Craig

Distinguished Teaching Award for Innovation with Technology, University of Washington

Larry Dalton

2015 Paul B. Hopkins Endowed Faculty Award

Thom Dunning

Elected Member, International Academy of Quantum Molecular Science

Daniel Gamelin

2015 Inorganic Chemistry Lectureship Award, American Chemical Society, Division of Inorganic Chemistry

Elected Member, Washington State Academy of Sciences

Karen Goldberg

Carol Tyler Award, International Precious Metals Institute

Robert Bergman Lecturer, University of California, Berkeley

Alvin Kwiram

Distinguished Retiree Excellence in Community Service Award, University of Washington-UW Retirement Association

Pradipsinh Rathod

Visiting Professor, Mahidol University (Bangkok, Thailand)

Stefan Stoll

CAREER Award, National Science Foundation

Cottrell Scholar Award, Research Corporation for Science Advancement

Distinguished Teaching Award for Innovation with Technology, University of Washington

POSTDOCTORAL RESEARCH ASSOCIATE FELLOWSHIPS & AWARDS

Matthew Blosser

Ruth L. Kirschstein National Research Service Award, National Institutes of Health

Carl Brozek

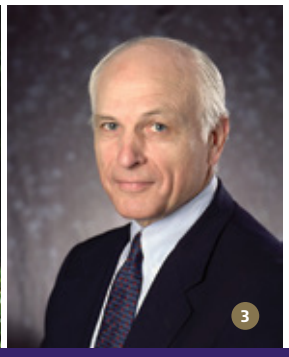
Washington Research Foundation Innovation Fellowship

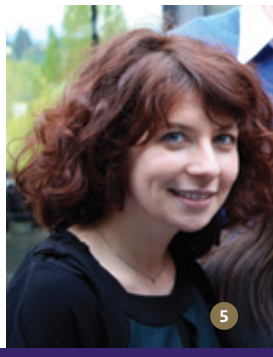
Arianna Marchioro

Early Postdoc Mobility Fellowship, Swiss National Science Foundation

Zhaoxia Qian

Washington Research Foundation Innovation Fellowship





1 KAREN GOLDBERG **2** LARRY DALTON **3** ALVIN KWIRAM **4** MATTHEW BLOSSER **5** ARIANNA MARCHIORO

GRADUATE FELLOWSHIPS & AWARDS

Todd Anderson

Lloyd E. and Florence M. West Endowed Fellowship in Chemistry

Jose Araujo

2015-16 Clean Energy Institute Fellowship

Pacific Northwest National Laboratory Graduate Fellowship

Megan Armstrong

Lewis R. and Joan M. Honnen Endowed Fellowship in Chemistry

Wilson Bailey

Eugene S. Mindlin Endowed Fellowship in Chemistry

Sam Barlow

Mark A. Jones–ARCS Foundation Endowed Fellowship

Charles Barrows

2014-15 Clean Energy Institute Fellowship

Kelsey Berrier

Lyle H. Jensen Graduate Fellowship

Maike Blakely

Honorable Mention, National Science Foundation Graduate Research Fellowship

Joan Bleeker

Arthur G. Anderson Endowed Fellowship in Chemistry

Nicholas Brune

David M. Ritter Endowed Fellowship in Chemistry

Jacob Busche

Martin P. Gouterman Endowed Fellowship in Chemistry

Tyler Chozinski

National Science Foundation Graduate Research Fellowship

Caitlin Cornell

Honorable Mention, National Science Foundation Graduate Research Fellowship

Kathryn Corp

2015-16 Clean Energy Institute Fellowship

Zuzana Culakova

Chateaubriand Fellowship

National Science Foundation Graduate Research Fellowship

Andy Dang

Honorable Mention, National Science Foundation Graduate Research Fellowship

Dane deQuilettes

Joseph Bouknight Endowed Fellowship for Chemistry

Michael De Siena

2014-15 Clean Energy Institute Fellowship

Honorable Mention, National Science Foundation Graduate Research Fellowship

Emily Dieter

National Science Foundation Graduate Research Fellowship

Ashley Dostie

Edwin and Phyllis Motell Endowed Fellowship in Chemistry

Natt-Lingafelter Endowed Fellowship in Chemistry

Rachel (Rae) Eaton

National Science Foundation Graduate Research Fellowship

Pacific Northwest National Laboratory Graduate Fellowship

Michael Enright

2015-16 Clean Energy Institute Fellowship

Honorable Mention, National Science Foundation Graduate Research Fellowship

Pacific Northwest National Laboratory Graduate Fellowship

Christian Erickson

2015-16 Clean Energy Institute Fellowship

Lucas Flagg

2015-16 Clean Energy Institute Fellowship

Andrew Francis

Mary K. Simeon and Goldie Simeon Read Chemistry Research Endowed Fellowship

Lauren Gagnon

Honorable Mention, National Science Foundation Graduate Research Fellowship

James Gaynor

2014–15 Outstanding Teaching Assistant

Nathan Gelman

Rowland Endowed Fellowship in Chemistry


6


7


8


9

6 TODD ANDERSON AND PROFESSOR ROBERT SYNOVEC **7** MEGAN ARMSTRONG
8 (BACK ROW) JONATHAN LITZ, MOSHE GORDON, (FRONT ROW) JOAN BLEECKER, SCOTT RAYERMANN, CAITLIN CORNELL, RANEE JAMES **9** JACOB BUSCHE

Benjamin Glassy

George and Agnes Irene Cady Endowed Fellowship in Chemistry

2014-15 Clean Energy Institute Fellowship

Joshua Goings

Bernard and Claudine Nist Research Fellowship in Chemistry

Harrison Goldwyn

George H. Hitchings Endowed Scholarship

Stephanie Hemmingson

Martin P. Gouterman Endowed Fellowship in Chemistry

Danielle Henckel

2015-16 Clean Energy Institute Fellowship

Seoyeon Hong

Schomaker Endowed Fellowship in Chemistry

Camille Houferak

Nicole A. Boand–ARCS Foundation Endowed Fellowship

Marco Howard

National Science Foundation Graduate Research Fellowship

Lauren Kang

2015-16 Clean Energy Institute Fellowship

Joseph Kasper

Howard J. Ringold Endowed Fellowship in Chemistry

Brenda Kessenich

Mickey and Karen Schurr Endowed Graduate Fellowship in Chemistry

Troy Kilburn

Honorable Mention, National Science Foundation Graduate Research Fellowship

Adelaide Kingsland

Lyle H. Jensen Graduate Fellowship

Kenneth Laszlo

Tomas Hirschfeld Endowed Fellowship in Chemistry

Mitchell Lee

Lloyd E. and Florence M. West Endowed Fellowship in Chemistry

Patrick Lestrange

2014-15 Clean Energy Institute Fellowship

Brian R. Reid Endowed Fellowship in Chemistry

Francis (Ray) Lin

2014-15 Clean Energy Institute Fellowship

Honorable Mention, National Science Foundation Graduate Research Fellowship

David Lingerfelt

2014-15 Clean Energy Institute Fellowship

Jonathan Litz

Schomaker Endowed Fellowship in Chemistry

Chloe Lombard

Honorable Mention, National Science Foundation Graduate Research Fellowship

Chenyi Mao

George H. Hitchings Endowed Scholarship

Sophia Masi

Ruth L. Kirschstein National Research Service Award, National Institutes of Health

Brigit Miller

2014-15 Clean Energy Institute Fellowship

Laura Murphy

National Defense Science & Engineering Graduate Fellowship, Department of Defense

Kelli Ogawa

2015 Reaxys PhD Prize finalist

Jarred Olson

2015-16 Clean Energy Institute Fellowship

Robert Pepin

Leon J. Slutsky Endowed Fellowship in Chemistry

Stephen Percival

George H. Hitchings Endowed Scholarship

Gregory Peterson

Bernard and Claudine Nist Research Fellowship in Chemistry

2015 College of Arts & Sciences Dean's Graduate Medal in the Natural Sciences

Samantha Phan

Leon J. Slutsky Endowed Fellowship in Chemistry

David Pinkerton

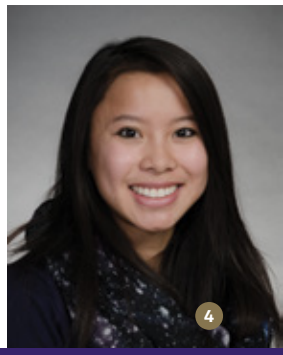
2014–15 Outstanding Teaching Assistant

Timothy Pollock

2014-15 Clean Energy Institute Fellowship

Jake Precht

Clean Energy Institute Recruiting Fellowship



1 JOSE ARAUJO, MARJA (BETH) MUNDY, AND JAMES GAYNOR **2** BRENDA KESSENICH
3 BENJAMIN GLASSY, MICHAEL ENRIGHT, ASSISTANT PROFESSOR BRANDI COSSAIRT, AND MARJA (BETH) MUNDY **4** SAMANTHA PHAN

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2015-16 Clean Energy Institute Fellowship

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Amy Register

A. Bruce Montgomery Endowed Fellowship in Chemistry

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Natt-Lingafelter Endowed Fellowship in Chemistry

Melissa Ryskamp

Gary and Sue Christian Graduate Fellowship in Chemistry

Alexander Santiago

ARCS Foundation Endowed Fellowship

Johanna Schwartz

National Science Foundation Graduate Research Fellowship

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Lewis R. and Joan M. Honnen Endowed Fellowship in Chemistry

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2014-15 Clean Energy Institute Fellowship

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Mark Ziffer

2014-15 Clean Energy Institute Fellowship

2014–15 ALMA MATER TRAVEL AWARDS

Recipients of these travel awards receive funds to present a seminar on their Ph.D. research at their undergraduate alma mater.

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Kenyon College (Gambier, Ohio)

Caroline Weller

University of Colorado at Boulder (Boulder, CO)

UNDERGRADUATE FELLOWSHIPS & AWARDS

Christine Buffalow

ACS Outstanding Student in Analytical Chemistry

Julia Carlstad

Mary Gates Research Scholar

Alice Chu

Zalia Jencks Rowe Undergraduate Tuition Scholarship

Luwan Ekubazgi

Usha and S. Rao Varanasi Endowed Diversity Scholarship in Chemistry

Matthew Ellis

Distinguished Achievement in Chemistry Research

Donald J. Hanahan Endowed Scholarship in Chemistry or Biochemistry

Amilla Frehner

Zalia Jencks Rowe Undergraduate Tuition Scholarship

Mary Gates Research Scholar

Xing Yee Gan

Hypercube Scholar


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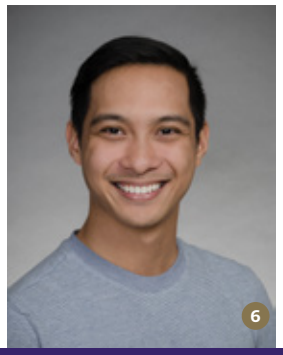
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5 ERICA CHONG, JONATHAN LITZ, ADELAIDE KINGSLAND, DAVID LINGERFELT, AND JEREMIAH LI **6** ALEXANDER SANTIAGO **7** SOPHIE RUBASHKIN.
8 LUWAN EKUBAZGI (CENTER) WITH USHA AND S. RAO VARANASI

Moshe Gordon

Rex J. and Ruth C. Robinson Endowed Scholarship in Chemistry

John Hamilton

Mary Gates Research Scholar

Alec Heckert

Distinguished Achievement in Chemistry Research

Victoria Hildreth

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Jordan Rixon

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Melvin Soetrisno

P. C. Cross Award

Torin Stetina

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Elizabeth Thayer

Mary Gates Research Scholar

Jeremy Tran

ACS Outstanding Student in Inorganic Chemistry

Earl W. Davie Endowed Scholarship in Chemistry or Biochemistry

Branden Vandermoon

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Levinson Emerging Scholar

James White

Hyp Dauben Award

Wenbi Wu

Levinson Emerging Scholar


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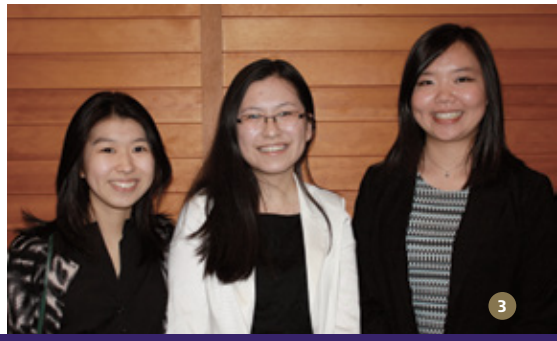
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1 (LEFT TO RIGHT) ALICE CHU, MEGHAN COWAN, CHAAU YAN (PENNY) POON, XING YEE GAN, AND WENBI WU **2** MATTHEW WALKER AND PHILIP LINDSTEDT
3 LEVINSON EMERGING SCHOLARS JANE KWON, WENBI WU, AND CINDY WEI

DOCTORAL DEGREES AWARDED

Nicholas Bigelow, Ph.D. Chemistry

Electron Energy-Loss Spectroscopy Theory and Simulation Applied to Nanoparticle Plasmonics

(Assistant Professor David Masiello)

Joan Bleecker, Ph.D. Chemistry

Relating Phase Separation and Thickness Mismatch in Model Lipid Membranes

(Professor Sarah L. Keller)

Liam Bradshaw, Ph.D. Chemistry

Luminescent Manganese in Nanocrystals

(Professor Daniel Gamelin)

Jennifer Brookes, Ph.D. Chemistry

Insight into the Local Solvent Environment of Biologically Relevant Iron-nitroysl Systems through Two-Dimensional Infrared Spectroscopy

(Associate Professor Munira Khalil)

Feizhi Ding, Ph.D. Chemistry

Towards Efficient and Accurate Description of Many-Electron Problems: Developments of Static and Time-Dependent Electronic Structure Methods

(Professor Xiaosong Li)

Megan Duda, Ph.D. Chemistry

Palladium-Catalyzed Cross-Coupling of N- Sulfonylaziridines with Boronic Acids and Synthetic Approaches to Organic Polymer-Supported One-Dimensional Metal Wires

(Associate Professor Forrest Michael)

Brian Fitz, Ph.D. Chemistry

Advances in Instrumentation and Data Analysis Techniques for Increasing Peak Capacity and Peak Capacity Production in One and Two-Dimensional Gas Chromatography

(Professor Robert Synovec)

Carrie Gower, Ph.D. Chemistry

Selective Bivalent Reagents for the Study of Protein Kinases

(Professor Dustin Maly)

Chelsea Hess Haupt, Ph.D. Chemistry

New Methods for Investigating the Interplay of Photoluminescence Intermittency and Local Dielectric Constant

(Professor Philip Reid)

Alisha Jones, Ph.D. Chemistry

Development and Evaluation of Peptide Mimetic Inhibitors of HIV-1 Replication. Structure of the Conserved Core Region of the lincRNA Cyrano

(Professor Gabriele Varani)

Michael Larsen, Ph.D. Chemistry

Fundamental and Applied Investigations in Solid-State Polymer Mechanochemistry

(Assistant Professor AJ Boydston)

Hirokazu Nagaoka, Ph.D. Chemistry

Long-Lived Charge Carrier Dynamics in Polymer/Quantum Dot Blends and Organometal Halide Perovskite

(Professor David Ginger)

Kelli Ogawa, Ph.D. Chemistry

Metal-free Methods Utilizing Single-electron Oxidations

(Assistant Professor AJ Boydston)

Stephen Percival, Ph.D. Chemistry

Electrocatalytic and Fundamental Properties of Nanoscale Materials and Development of New Nanoscale Electrochemical Methods

(Associate Professor Bo Zhang)

Gregory Peterson, Ph.D. Chemistry

Exploration and Application of Mechanoresponsive Polymers: Polymer Architecture, Amplified Response, and Additive Manufacturing

(Assistant Professor AJ Boydston)

Thomas Porter, Ph.D. Chemistry

Reactivity and Thermochemistry of First-Row Transition Metal Complexes with Organic Radical

(Professor James Mayer)

Jason Prantner, Ph.D. Chemistry

Monomethyl Pt Complexes Coordinated to Hemilabile Facially Coordinating Ligands in Aqueous Solution: Aerobic Oxidation and C-O Coupling to Form Methanol

(Professor Karen Goldberg)

Anthony Reynolds, Ph.D. Chemistry

Examining Low Frequency Molecular Modulations from the High Frequency Vantage Point: Anharmonically-Coupled Low Frequency Modes in PCET Model Systems

(Associate Professor Munira Khalil)

Alina Schimpf, Ph.D. Chemistry

Electronic and Impurity Doping in Colloidal Semiconductor Nanocrystals

(Professor Daniel Gamelin)

Karla Slenkamp, Ph.D. Chemistry

Examining the Vibrational Couplings and Dynamics in Cyanide-Bridged Transition Metal Mixed Valence Complexes Using Ultrafast Nonlinear Infrared Spectroscopy

(Associate Professor Munira Khalil)

Hans Henrik Bertil Sperber, Ph.D. Chemistry

microRNAs and Metabolites in Naïve to Primed Human Embryonic Stem Cell Transition

(Professor Hannele Ruohola-Baker)

Andreas Tillack, Ph.D. Chemistry

Electro-Optic Material Design Criteria Derived from Condensed Matter Simulations Using the Level-of-Detail Coarse-Graining Approach

(Professor Bruce H. Robinson)

Mycah Uehling, Ph.D. Chemistry

Gold-Catalyzed Asymmetric Synthesis of Cyclic Ethers and Copper-Catalyzed Hydrofunctionalization of Alkynes

(Assistant Professor Gojko Lalic)

Marissa Wood, Ph.D. Chemistry

Electrochemistry under Confinement: Controlling Dynamics in Nanochannels via Tunable Mass Transport

(Associate Professor Bo Zhang)

Yitong (Jenny) Zhang, Ph.D. Chemistry

Taking Artemisinin to Clinical Anticancer Applications: Design, Synthesis, and Characterization of pH-responsive Artemisinin Dimer Derivatives in Lipid Nanoparticles

(Professor Tomikazu Sasaki)

Chunxiang (Jake) Zheng, Ph.D. Chemistry

Proteomics in 3D: Development of New Technology and Computational Tools for Structural Analysis

(Professor James Bruce)

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During the past decade, we have seen a remarkable transition in publicly funded higher education. A decade ago, gift-derived funds played a small role in our programs, funding the occasional student fellowship or lecture. A decade later, we and other public institutions of higher education are heavily reliant upon gift funds for support of our baseline program. Today, annual gifts and endowment-derived funds are critical to every aspect of our teaching and research. Students, faculty, and staff are the beneficiaries of your gifts.

The UW Department of Chemistry is extraordinarily fortunate to have literally thousands of friends and alumni, a large fraction of whom contribute generously to our programs. We are deeply indebted to the donors named below. With your help, we are providing state of the art education to the current generation of students. Thank you!

If you are among our chemistry or biochemistry alumni who have never given back to the Department of Chemistry, we hope you will reconsider that choice. Our ability to help the current generation of students to achieve their dreams depends upon your gift. Thank you in advance for thinking of our students.

If your name is missing or misspelled we apologize and hope you will let us know.

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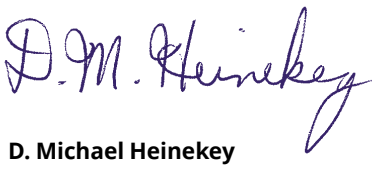
LETTER FROM THE CHAIR *continued from page 1*

of our award winning junior faculty members. Assistant Professor AJ Boydston has received a CAREER award from the National Science Foundation. Assistant Professor Matt Bush has been named as the recipient of the Eli Lily and Company Young Investigator Award in Analytical Chemistry. Assistant Professor Brandi Cossairt won a Sloan Fellowship from the Alfred P. Sloan Foundation. In October, we learned that Brandi has also won a very prestigious Packard Fellowship from the David and Lucille Packard Foundation. Assistant Professor Stefan Stoll has received the Cottrell Scholar Award from the Research Corporation and a CAREER award from the NSF.

In an initiative which will have great benefit for undergraduate instruction, Boydston and Stoll have worked with lecturers Jasmine Bryant and Colleen Craig to develop new ways to use technology to enhance our classroom instruction. This groundbreaking work was recognized with the UW Distinguished Teaching Award for Innovation with Technology.

The details of our state budget for the next two years are still being filled in. The legislature has increased our state appropriation, but has directed us to reduce the tuition charged to state resident students. We continue to rely on the generosity of our friends, whose donations provide a vital supplement to our state funding. Your gifts impact directly the quality of the instruction that we can offer to our students. Thank you for giving back.

Sincerely,



D. Michael Heinekey
Professor and Chair

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