Message from the Chair

Winter 2018 Newsletter

Greetings! It is my pleasure to write a few opening remarks for this latest edition of the Chemistry Department newsletter. As was the theme of my remarks last year, *change* in Chemistry is a constant.

Chief among these changes is a significant overhaul of general chemistry to feature an "atoms-first" (rather than a "stoichiometry-first") curriculum and more student-centered, evidence-based pedagogy. These changes were implemented in the fall of 2017 after nearly two years of work by department faculty and staff. This work was largely informed by the NSF-sponsored project "Change at the Core", which is now in its fourth year at WWU. Western's commitment to expanding student access and success in chemistry will be further supported by a 5-year Inclusive Excellence grant from the Howard Hughes Medical Institute (see page 10).

The involvement of students in externally-funded research remains the hallmark of our program. This past year our faculty secured $2.0M in new grant funding from external agencies, published 27 peer-reviewed papers with 59 student co-authors, and prepared 32 students to present their WWU research at national conferences! Audrey Cheung and mentor John Gilbertson were recognized by the ACS Division of Inorganic Chemistry Undergraduate Research Award. We are very proud of the WWU Solar Window Team, which took the grand prize at the 2017 Alaska Airlines Environmental Innovation Competition! Our summer NSF-funded Research Experiences for Undergraduates (REU) program funded 10 summer research students and included a day-long symposium which featured alumni of the REU program. We recently learned that our department was awarded funding for another 3 years of REU at WWU!

Several faculty were recognized this past year with national awards: David Patrick (Cottrell Scholar), Robert Berger (Cottrell Scholar), Amanda Murphy (Jean Dreyfus Lectureship), and John Gilbertson (Henry Dreyfus Teacher-Scholar award). In addition, Janelle Leger was named the 2017 Olscamp awardee and Clint Spiegel won the Arlan Norman mentorship award. Congratulations are also due to our Student Affiliates chapter of the ACS (the "Chem Club") and faculty advisors Steven Emory and Betsy Raymond, for a seventh consecutive "Outstanding Chapter" award!

We welcome two new tenure-track Assistant Professors to our ranks: Dr. Ying Bao, who is teaching analytical chemistry and does research in nanomaterials, and Dr. Jeanine Amacher, who is teaching bio- and biophysical chemistry, and does structural biology research (primarily X-ray crystallography of proteins). Professor Catherine Clark joins our department after serving three years as Dean of the College of Science and Engineering. Alumna Linda Grabill returns to WWU to teach in our gen chem series. We also have a new staff member in the front office, Alexi Guddal.

On a somber note, I am saddened to report that Professor Emeritus Mark Wicholas passed away on November 20 following a brief battle with cancer. The Chemistry Department rose to national prominence under Mark's leadership as chair (1982-2007), and the department is formulating plans to honor Mark's legacy later this academic year. We will send more information in the near future regarding that event.

I have only touched on a few of the remarkable achievements of our students, faculty, and staff, and I trust you will enjoy reading up on many more in these pages. We are exceptionally proud of our students and their accomplishments here and post-WWU. Many of you have helped us realize those accomplishments through your generous gifts to the department. I hope this edition of the departmental newsletter gives you a glimpse of how your generosity supports the efforts of our students to achieve their goals. We are sincerely grateful for your support. Thank you and best wishes!

Spencer Anthony-Cahill

Inside:

Thank You to Chemistry Department Donors

We wish to extend a special thank you to alumni and friends of the department who donated to the following Chemistry Department Western Foundation funds from July 2016 through October 2017.

Our program has grown, and your donations are more crucial than ever. Our Foundation funds support a variety of activities including student scholarships and academic awards, undergraduate summer research stipends, student travel to conferences, department seminars, equipment purchase and repair, and events for department majors and alumni. We need and appreciate your support!

If you would like to make a gift, please visit the website (www.foundation.wwu.edu) or call (360) 650-3027.

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Thank You to Chemistry Department Donors (continued)

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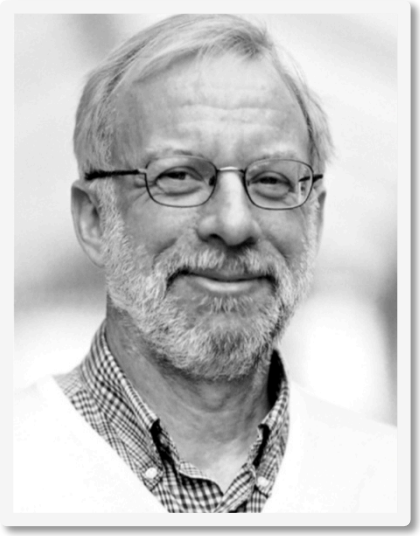
In Memoriam

We are saddened to report that Professor Emeritus **Mark Wicholas** passed away on November 20, 2017 following a brief battle with cancer. The Chemistry Department rose to national prominence under Mark's leadership, and the department will honor Mark's legacy later this academic year.



Mark joined the faculty at Western in 1967 and was chair of Chemistry from 1982-2007. Under his leadership, the department submitted a successful Department Development proposal in 2000 to the Research Corporation for Science Advancement and the Murdock Charitable Trust. This was a significant and critical achievement in the evolution of the department as a national model among primarily undergraduate institutions for the engagement of students in research.

When Mark retired in 2007, an endowed fund was set up in his honor by Chemistry alumni. Earlier this year, Mark made a significant gift to this endowed fund, which will ensure that we have the means to support the development of our students as first-rate researchers now and in the future. We are honored that Mark recognized the department as good shepherds of the legacy he worked diligently to establish.

"The one-on-one mentoring of students in research is the most important thing we can do in preparing them for future careers in science."
– Prof. Mark Wicholas

Left-to-right: Douglas Baumgardner, Prof. John Gilbertson, Prof. Mark Wicholas, Mayra Delgado, Audrey Cheung, and Kyle Burns at the 2016 Linus Pauling Symposium at Pacific Lutheran University

New Faculty and Staff

Jeanine Amacher joined the Department of Chemistry in the fall quarter of 2017 as an Assistant Professor of Biochemistry. Her research interests are in the area of peptide-binding domains, where only a small number of amino acids are recognized in a given interaction.

Specifically, her research interests are focused on the PDZ domain, which is important in signaling and trafficking pathways in the cell. There are over 200 PDZ domains in the human proteome, making it the largest family of peptide-binding domains. Defined motifs include only a couple of positions along the peptide-binding cleft, and do not accurately define the overlapping yet distinct preferences among family members. The Amacher lab will work to understand the selectivity determinants of PDZ domains throughout evolution, as well as to ask questions about why certain ligands target relatively large numbers of PDZ domains, while others target only a few. She will use biochemistry and structural biology to investigate PDZ domains from extant species, as well as by using ancestral protein reconstruction.

Jeanine was born and raised in Portland, Oregon. She did her undergraduate work at the University of Oregon, where her love of research began. Jeanine then transitioned to colder temperatures, and was in Prof. Dean Madden's lab at the Geisel School of Medicine at Dartmouth for her Ph.D., investigating the binding selectivity of two PDZ proteins important in the disease cystic fibrosis. Prior to arriving at Western, she completed a postdoc in Prof. John Kuriyan's lab at UC Berkeley, where she studied tyrosine kinases and E3 ubiquitin ligases. Jeanine is an avid runner and loves the outdoors. She is also a spinning/indoor cycling instructor, enthusiastic Oregon Duck fan, and relatively new mom to a one-year-old boy. Jeanine and her family are ecstatic to be back in the Pacific Northwest!

Ying Bao joined the Department of Chemistry as an Assistant Professor of Analytical Chemistry in the fall of 2017. Ying is originally from Zhejiang Province, China. She came to the United States for her Ph.D. study in materials chemistry at the University of South Dakota (USD) in 2009, and received her Ph.D. in 2013. Her graduate research was mainly related to the fabrication and assembly of SERS-active plasmonic nanostructures and hybrid nanocomposites. Besides research, she also actively participated in community service and outreach events (e.g., organizing a forum at a national meeting and assisting a chemistry workshop). She feels fortunate to have those experiences which allowed her to share her enthusiasm for chemistry with people from different backgrounds. After graduating from USD, she continued her research training as a postdoctoral scholar at the University of Chicago, where her research focus was on assembling plasmonic nanomaterials by optical printing and dewetting approaches.

Outside the lab, Ying is fostering more outdoor hobbies in order to better enjoy the beautiful Pacific Northwest.

New Faculty and Staff (continued)

Catherine Clark joined the department as a Professor of Chemistry in the fall of 2017. Catherine is originally from South Africa, where she did her undergraduate degree in chemistry. She received her Ph.D. in physical chemistry from Boston University in 1996, followed by a postdoctoral fellowship in marine environmental chemistry at the Rosenstiel School of Marine and Atmospheric Science at the University of Miami. She joined Chapman University in Orange County, California in 2000 as an Assistant Professor of Environmental Chemistry. After 14 years at Chapman, during which she was promoted to Full Professor and served as department chair and associate dean, she joined Western Washington University as Dean of the College of Science and Engineering. After 3 years' service as Dean, she stepped down to join the faculty of the Chemistry Department at WWU in 2017 so she could spend more time with her family. Catherine has taught lower-division courses in general chemistry and upper-division courses in physical chemistry and aquatic chemistry. She has received over $1.3 million in research funding over her career from the Office of Naval Research, the National Science Foundation, and the American Chemical Society's Petroleum Research Fund. She is active in mentoring undergraduate research and publishes regularly with undergraduate students. Her research interests are in the photochemical reactions of pollutant species and the processing of carbon in natural water systems.

Linda Grabill joined the department in the spring of 2017. Linda earned her B.S. in physics and M.S. in chemistry here at WWU. After teaching physics and chemistry at Skagit Valley College, Linda returned to WWU to teach courses in general chemistry and introductory physics. Linda continues to be active in her research interests, theoretically modeling molecular interactions.

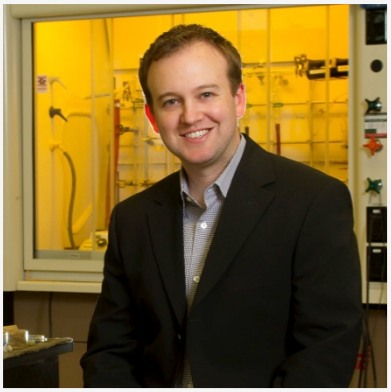
Linda was a non-traditional student, as this is a second career for her. After 14 years in law enforcement in the Los Angeles area, Linda was forced to retire after a spine injury. During her rehabilitation, Linda returned to college to determine what she would do next professionally. She originally tackled math/chemistry/physics with the intent of "taking the Band-Aid off quickly" to put the course work behind her. Linda believed she was bad at math and had no interest in either chemistry or physics. Linda credits the quality and enthusiasm of her professors for her change in mindset. She believes her personal experiences are responsible for her empathy and understanding of non-science majors enrolled in science courses.

While Linda is thrilled to be teaching at WWU, she is in the process of planning her next step academically and hopes to return to school as a student to complete a Ph.D. in chemical physics or theoretical chemistry.

Alexi Guddal joined the department as the Office Assistant in May of 2017. Alexi was raised in Ashford, Washington, near Mt. Rainier. Alexi has always been fascinated by marine biology, and graduated with a B.S. in biology with a marine emphasis from WWU in 2015. While pursuing her undergraduate degree at WWU, Alexi worked for the Western Foundation and completed two minors in chemistry and anthropology. Alexi enjoyed her experiences in the Chemistry Department as a student, and is excited to return.

Alexi married her husband, Gunnar, in the summer of 2016, and they have enjoyed continuing to live in Bellingham as he works on his M.S. in environmental toxicology and chemistry from Huxley College of the Environment at WWU. Outside of the office, Alexi enjoys going on intertidal walks, baking, gardening, and game nights with friends.

Alumni Spotlight: Prof. Dwight Seferos, University of Toronto

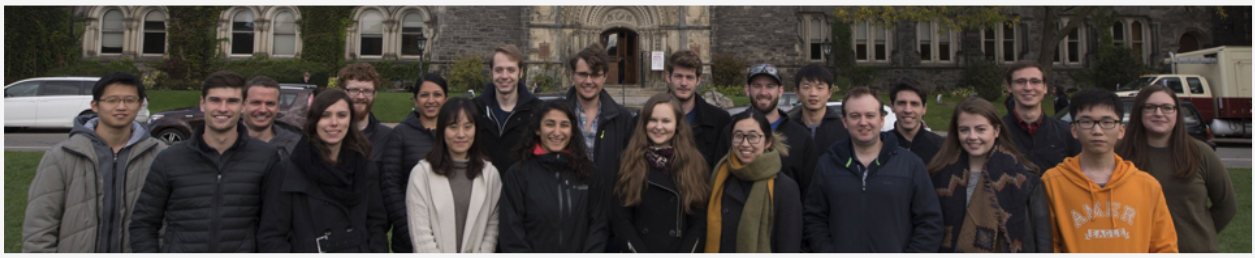


I was an undergraduate at WWU from 1997-2001. My first impression of the department was that it was passionate and rigorous when it came to teaching. Shortly after I declared my major, Dr. David Patrick was assigned as my advisor. I remember the first meeting with him. We met around 9 or 10pm. About 5 minutes into the meeting, one of Dr. Patrick's research assistants came bursting into his office, showing the latest results from the lab. After the discussion, the student left to return to his experiment. Dr. Patrick turned to me and said, "that guy loves what he is doing." That interaction had a lasting impression on me.

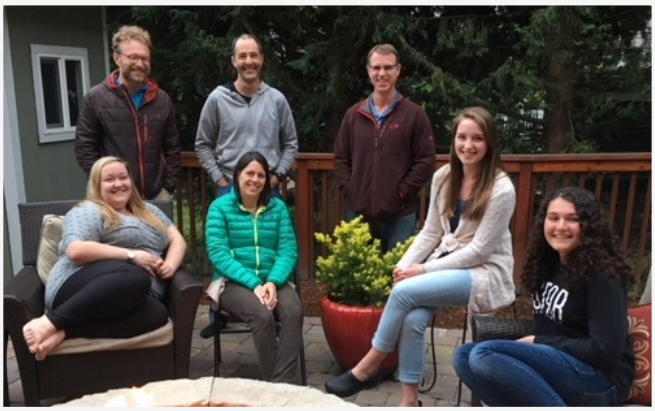
After my second year, I was able to join Dr. Gary Lampman's group, where we worked together on the preparation of cobaloxime derivatives and investigated their reactivity. It was a lot of fun in the organic research laboratory during that period. The organic faculty and their B.S. and M.S. students were working side-by-side in the lab all summer. I learned a huge amount of organic and organometallic chemistry, and importantly, that I wanted to carry out research as a career.

After I graduated, I ultimately decided to go to UCSB and carry out a Ph.D. on the topic of electronic polymers. Chemistry at UCSB was booming, with a couple of recent Nobel Prizes and lots of young, dynamic faculty. I chose to work in Gui Bazan's group, but everything was so collaborative there. I had the opportunity to work and publish with many faculty members including Kevin Plaxco and Alan Heeger. After I completed my Ph.D. in 2006, I became an American Cancer Society Postdoctoral Fellow in Chad Mirkin's Group at Northwestern. Northwestern Chemistry was another booming department. Working in Mirkin's group (which had about 45 members) was absolutely incredible. It was basically the size of a department. Most of the people that overlapped with me have now gone on to faculty or other positions all over the world. I still keep in contact with many of them today.

In 2009, I began as an Assistant Professor at the University of Toronto. The department is large and diverse, and has been nothing but supportive. I have great colleagues and amazing students. My research has focused on selenium- and tellurium-containing polymers and polymers for battery applications. I was promoted to Associate Professor with tenure in 2014 and Full Professor in 2017. In addition to working with all the fantastic students and colleagues, another highlight is all the travel that faculty get to do. I was able to visit WWU a few years ago and give a lecture over in SMATE – a surreal experience! It was fun to visit the department, reconnect with past mentors, and meet all the really fantastic new faculty that have been hired since my time. There is no doubt that WWU will continue to be a world-beating B.S./M.S. chemistry program.



Faculty Promotion



Prof. Emily Borda and her research group

Emily Borda was promoted to Full Professor in the spring of 2017. Her accomplishments during the promotion period include the funding of three external grants: one to study transfer of concepts between courses in a sequence of science content courses in SMATE, funded by the National Science Foundation, and two to promote and enhance faculty development in science teaching and learning and enhanced inclusion in the sciences (the NSF-funded Change at the Core project and the HHMI-funded Inclusive Excellence Project). Three publications and several poster and oral presentations, most co-authored by undergraduates, also accompany Prof. Borda's promotion. These detail research on professional development and chemistry curricula, as well as how students organize their thinking in chemistry. Prof. Borda's biggest accomplishment during this period, however, is continued learning and growing as a teacher. She continues to be challenged and enlightened by the process of trying to approach her teaching from a growing understanding of the struggles students face and resources they bring to bear. She feels lucky to be in a position where her research in science education aligns so well with her teaching, and is excited to keep learning more!

Faculty Awards and Distinctions

Ian Smith (left) and Prof. Clint Spiegel (right)

Clint Spiegel, along with graduate student **Ian Smith**, received the Arlan Norman Award for Excellence in Student Mentoring. This award recognizes a faculty member from the College of Science and Engineering for excellence in student mentoring. In the past 10 years, Professor Spiegel has mentored over 50 undergraduate research assistants and 10 master's students. It is commonplace for his research students to present at regional and national meetings, be authors on peer-reviewed publications, and many have won awards related to their respective research projects. Ian Smith, who received his undergraduate B.S. in Chemistry in 2012 from WWU, has been one of the critical researchers in studying factor VIII (for more details, see page 12). Recently, Ian has made significant breakthroughs in collaboration with Joey Gish, a new graduate student on the project, to determine the X-ray crystal structure of a next-generation factor VIII therapeutic. This award has helped fund Ian's research efforts with a research stipend for this past summer.

Faculty Awards and Distinctions (continued)

Janelle Leger was the recipient of the 2016 Paul J. Olscamp Research Award. Research in the Leger group focuses on several themes: devices for conversion of solar energy, organic electronic materials and devices, and nanomaterials and nano-optics. In total, she has published 14 peer-reviewed papers or book chapters with WWU students since arriving at WWU in the fall of 2008, has been PI or co-PI on external grants totaling nearly $3M, and has involved 45 undergraduate students (and one master's student) in meaningful, in-depth, independent research experiences. Recently, she was also named a Cottrell Scholar by the Research Corporation for Science Advancement, a title awarded to "outstanding teacher-scholars who are recognized by their scientific communities for the quality and innovation of their research programs and their academic leadership skills".

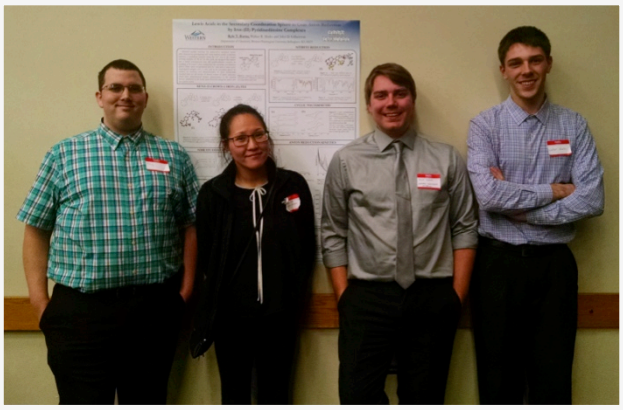
John Gilbertson received the Henry Dreyfus Teacher-Scholar Award ($60,000 over 5 years), which supports the research and teaching careers of talented young faculty in the chemical sciences at undergraduate institutions as independent faculty members. They are recognized for their demonstrated leadership in original scholarly research of outstanding quality, substantially with undergraduates, as well as excellence and dedication in undergraduate education. Prof. Gilbertson's work focuses on the scientific problems associated with carbon dioxide utilization and the chemical reduction of pervasive environmental contaminants. The most important chemical transformations that Nature performs require the movement of both protons and electrons in metalloenzyme active sites. The Gilbertson research group is developing unique and innovative complexes that translate metalloenzyme active site reactivity and selectivity to the realm of synthetic constructs, for the small molecule activation of environmental contaminants.

Robert Berger received a Research Corporation for Science Advancement (RCSA) Cottrell Scholar Award ($100,000 over 3 years), a program which "develops outstanding teacher-scholars who are recognized by their scientific communities for the quality and innovation of their research programs and their academic leadership skills". This award provides funds for early-career faculty to not only conduct research with students, but also to pursue innovative teaching projects. Prof. Berger will use funds from this award to support work in two areas: 1) the computational design and prediction of perovskite materials for energy applications, and 2) the development of interactive computer-based learning modules for use in Western's undergraduate quantum chemistry course. RCSA also selected Prof. Berger to be a Scialog Fellow, and participate in a series of conferences focusing on energy storage.

Grant Funding

The HHMI Inclusive Excellence proposal team, after receiving the 2017 WWU Team Recognition Award

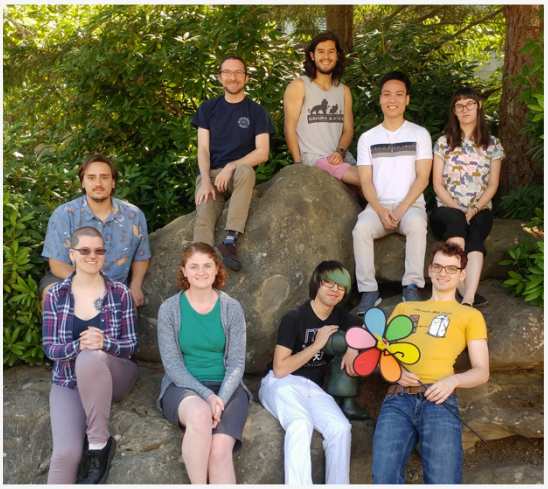
Spencer Anthony-Cahill and **Emily Borda** are members of the core leadership team for the recently funded Howard Hughes Medical Institute Inclusive Excellence (HHMI IE) program, which includes $1M of funding over five years. This was an intensively competitive program, with only 24 out of 550+ colleges and universities nationwide receiving funding. The major goal of the HHMI IE program is to expand access to, and success in, science majors for students from groups historically underrepresented in science. The percentages of students who succeed in most science majors at WWU who are underrepresented minorities, women, and transfer students are lower than for the university as a whole, and it is these groups the project is targeting. The HHMI IE team proposed a multi-faceted approach to improve the success of these students, called Advancing Excellence and Equity in Science (AEES). AEES includes new and restructured coursework and a mentoring program for students, a faculty development program in inclusive, student-centered instruction, and a policy review component to make sure WWU and college policies are aligned with the goals of inclusion in the sciences. In the faculty development program, faculty and teaching assistants will be trained in student-centered teaching strategies; these have been shown to enhance learning by all students. In the revised and restructured courses, students will be in linked courses and in cohorts; these courses will include topics such as scientific and quantitative reasoning, navigating college, and mentoring. The team will also analyze policies and procedures to identify ones that may impede the progress of students and work to improve them. All of these strategies are sustainable so they will continue after the five years of grant support are over. Ultimately, we anticipate the demographics of majors graduating in the natural sciences will mirror those of the university.



Prof. Gilbertson's research group

John Gilbertson received an R15 grant from the National Institutes of Health (NIH, $364,123 over 3 years) for his work entitled "Bioinspired Structure/Function Studies that Leverage Proton-Responsive Secondary Coordination Spheres and Ligand-Based Redox Sites". Many metalloenzymes catalyze reactions vital for maintaining human health, and these chemical transformations are generally multi-electron redox processes requiring both protons and electrons. This research seeks to develop a series of biomimics that integrate a proton responsive secondary coordination sphere and ligand-based redox-active sites to unburden the redox activity from the metal center. This approach is an effective way to model the reactivity of natural metalloenzymes, and these studies will provide a fundamental understanding to provide a blueprint for the formation of metal-ligand constructs that can be tuned for biologically relevant transformations.

Grant Funding (continued)



Tim Kowalczyk received a Research at Undergraduate Institutions (RUI) grant from the National Science Foundation (NSF) to support the development of "Time-Independent Excited State Methods for Computational Screening of Photoactive Materials" ($298,398 over 3 years). This grant will enable Prof. Kowalczyk's group to develop a computationally efficient strategy for simulating excited-state processes in condensed phases. They will employ this strategy to address mechanistic questions about photosensitizers for singlet oxygen and to benchmark multi-scale separations in excited-state simulations. The award also supports the establishment of an Energy Ambassadors initiative within the Institute for Energy Studies. It is the first award to WWU sponsored by the Chemical Theory, Models and Computational Methods program in the NSF's Division of Chemistry.

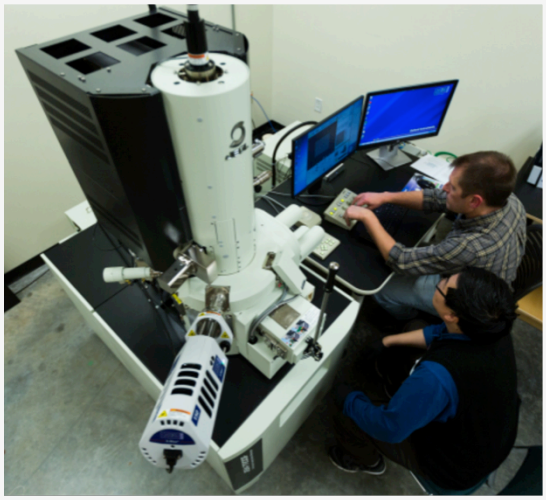
Prof. Kowalczyk also received an Undergraduate New Investigator grant from the American Chemical Society Petroleum Research Fund (ACS PRF, $55,000 over 2 years). This award, "Simulating the Electronic Consequences of Embedding and Encapsulation of Photoactive Molecules within Porous Frameworks", supports the Kowalczyk group's efforts to apply established tools in computational materials science to understand the impact of local chemical environments on excited-state properties of light-absorbing organic materials. Examples of materials within the scope of this investigation include organic charge-transfer dyads embedded in inorganic mesopores; dye-sensitized solar cells; and photoactive covalent organic frameworks. The modeling is complementary to materials preparation and characterization by collaborators in the U.S., Thailand, and Japan.

Marc Muniz was awarded an IUSE (Improving Undergraduate STEM Education) grant from the National Science Foundation (NSF) for his work entitled "POGIL-PCL: Student Learning in the Laboratory through Sustained Faculty Development" ($532,384 over 4 years). Prof. Muniz will be using the funds to investigate how students learn in physical chemistry laboratories across multiple types of institutions (minority serving, small liberal arts, regional comprehensive, and large research-intensive). In particular, his group will be studying student learning outcomes in teaching laboratory environments in which POGIL-PCL (Process Oriented Guided Inquiry Learning - Physical Chemistry Laboratory) experiments are facilitated. The POGIL-PCL framework engages students in a learning cycle that consists of pre-experiment questions, predictions, experimental protocols, interpretation of results, decisions regarding the next steps, and post-experiment prompts. Prof. Muniz's award is linked collaboratively with a separate award made to Profs. Sally Hunnicutt (Virginia Commonwealth University), Alex Grushow (Rider University), and Robert Whitnell (Guilford College).

Grant Funding (continued)

Clint Spiegel was awarded an R15 grant from the National Institutes of Health (NIH, $388,000 over 3 years) for studying immune complications that arise following hemophilia A treatment. Hemophilia A is an X-linked genetic disease that affects one in 5,000 males worldwide, and results from an inability to clot blood due to a deficiency in a protein called 'Factor VIII'. For decades, treatment of hemophilia A has consisted of therapeutic infusions of either recombinant or plasma-derived functional factor VIII to maintain hemostasis. For individuals with a severe form of the disease, over 30% develop an immune response that results in inhibitory antibodies that block the ability of the therapeutic infusion to work correctly. Together with hematologists from Emory Children's Hospital in Atlanta, Georgia, Prof. Spiegel's lab works to structurally characterize different inhibitory complexes the arise in circulation following hemophilia A treatment. Through their collaborative studies, they hope to develop next generation therapeutics that are more active and less immunogenic. This award will fund both graduate and undergraduate researchers who directly contribute to this project by determining structures of factor VIII protein complexes to atomic resolution with X-ray crystallography.

David Patrick, in collaboration with **John Gilbertson**, **David Rider**, and Stephen McDowall (WWU Mathematics) received a Research at Undergraduate Institutions (RUI) grant from the National Science Foundation (NSF) to support their research entitled "Engineering Nanoscale Disorder in Polymer-Semiconductor Nanocrystal Composites for Minimized Optical Losses" ($390,000 over 3 years). Profs. Patrick, Rider, and **Mark Bussell** also received two grants to upgrade the Scientific and Technical Services (STS) Electron Microscopy Laboratory at WWU: one from the Murdock Charitable Trust ($272,000), and a second from the Joint Center for the Deployment and Research of Earth Abundant Materials ($200,000). These funds were used to acquire a JEOL 7200F field emission scanning/transmission electron microscope (S/TEM) with Energy Dispersive X-Ray Spectroscopy (EDS), a RMC cryo-ultramicrotome for sample preparation, and have allowed WWU to hire a Research Associate with expertise on these instruments. All together, the Electron Microscopy Laboratory can now interrogate a wider range of samples with higher resolution and magnification and precise chemical characterization. The suite of instruments will be used for countless research and teaching projects in the fields of materials science, chemistry, engineering, geology, physics, and biology. Much of WWU's SEM user base, including students, faculty, and staff, have used or witnessed the instruments in action and already better understand their project materials all the way from the millimeter to the nanometer scale!



Chemistry Research Associate Dr. Yongjun Chen (front) and electron microscopy technician Dr. Michael Kraft (back), examining $CuInS_2$ quantum dots as part of ongoing solar energy research

Faculty Sabbaticals

Mark Bussell and his wife (Prof. Kristi Lemm, WWU Psychology) spent 2016-17 working at Yale-NUS College in Singapore. The college is a collaboration of Yale University and the National University of Singapore that was started in 2013 with the goal of bringing American-style education in the liberal arts and sciences to Asia. Mark's primary responsibility during the year in Singapore was to help the Yale-NUS faculty develop the college's undergraduate research program in the sciences for the first senior class that graduated in May of 2017. This year provided a remarkable opportunity to learn about the education and research culture in Southeast Asia as well as the rapid economic development in the region. Outside of work, Mark and Kristi had ample opportunity to travel in Indonesia (Bintan Island, Bali), Malaysia (Penang, Johor Bahru), Thailand (Phuket), and Laos (Luang Prabang).

Serge Smirnov had a sabbatical position during the 2016-17 academic year in the laboratory of Prof. Lawrence McIntosh in the Chemistry/Biochemistry Department at the University of British Columbia. The NMR facility in the host lab offers spectrometers operating at 500, 600, and 850 MHz, all equipped with cryogenic probes. This state-of-the-art set of capabilities combined with the solution NMR expertise in the McIntosh lab enriched Prof. Smirnov's knowledge and allowed him to collect advanced heteronuclear NMR data on a number of samples: double-stranded DNA duplexes with clustered base modifications (damage and epigenetic modifications) and novel protein fragments. Notably, a series of dedicated advanced heteronuclear NMR recordings allowed for the backbone and side chain resonance assignment of sizable disordered polypeptides from plant villin samples. The recorded data contributed to three publications: one published in PLoS, one submitted to Biochemistry (currently under review), and the third being prepared for submission.

Other Department Highlights

Tim Kowalczyk was selected as the 2017 Snohomish Public Utility District Professor of Energy Studies within the Institute for Energy Studies (IES). In this role, Prof. Kowalczyk is launching an Energy Ambassadors program which will couple summer research experiences for IES students with energy literacy outreach at high schools in the region. Energy Ambassadors meet as a cohort during the summer to share progress and ideas while learning to communicate the big picture of their research and its relevance to energy and society. The first cohort of Energy Ambassadors will conduct their outreach activities this academic year.

Other Department Highlights (continued)

Washington Governor Jay Inslee (center) with students from the Nova Solar Glazing team, including chemistry major Amy Morren (right)

Nova Solar Glazing, WWU's team of chemistry, business, industrial design, and electrical engineering students, was awarded the $15,000 Wells Fargo grand prize at the 2017 Alaska Airlines Environmental Innovation Challenge (EIC) hosted by the University of Washington's Buerk Center for Entrepreneurship. In concert with research in Prof. **David Patrick**'s group on luminescent solar concentrators, the team developed an accessible, affordable, and practical insert for windows that converts them into energy-producing solar windows. The team first submitted a business summary of their product, and then attended a trade show-style competition, where they presented their prototype to more than 170 judges.

This luminescent solar concentrator technology was recently licensed to New Mexico-based company UbiQD. As Prof. Patrick emphasizes, "The fact that so many Western undergraduate students participated in the research, development, and demonstration of this technology speaks volumes for the importance of our public institutions' roles as innovators and partners with entrepreneurs in the private sector like UbiQD."

Pui Man (Audrey) Cheung of Hong Kong and her faculty advisor, Prof. **John Gilbertson**, were awarded the Division of Inorganic Chemistry Award for Undergraduate Research from the American Chemical Society (ACS). The award recognizes the collaborative research of an outstanding undergraduate student/mentor team in the field of inorganic chemistry. Audrey was given her award at the ACS national meeting in San Francisco in April, 2017. As part of her award, Audrey gave a talk at the conference's "Frontiers in Undergraduate Research" symposium. Her undergraduate work focused on copper complexes, where she discovered some copper(I) complexes with unusual geometries. This award is only given to one student from a primarily undergraduate institution such as Western each year.

Left-to-right: Division of Inorganic Chemistry Chair John Protasiewicz, Audrey Cheung, John Gilbertson

Kathleen Kitto, Vice Provost for Research and Dean of the Graduate School, was presented an award for Outstanding Service to the University at the Chemistry Department awards ceremony. Dean Kitto retired at the end of the 2016-17 academic year, after nearly 30 years at Western during which she also served as a Professor and Chair of the Department of Engineering Technology, and Associate Dean of the College of Sciences and Technology. Our department thanks Dean Kitto for her steadfast support of chemistry students, staff, and faculty!

Dean Kathleen Kitto (front and center) with the Chemistry Department faculty

Chemistry Faculty Publications in 2016-2017

In the past academic year, the chemistry faculty have published **27 articles** detailing their research, which include **34 undergraduate and 25 master's chemistry student co-authors**.

*WWU undergraduate student co-author, †WWU master's student co-author

Courtney, AH; **Amacher, JF**; Kadlecek, TA; Mollenauer, MN; Au-Yeung, BB; Kuriyan, J; Weiss, A. "A phosphosite within the SH2 domain of Lck regulates its activation by CD45". *Mol. Cell* **2017**, *67*, 498-511.

Antos, JM; Ingram, J; Fang, T; Pishesha, N; Truttman, MC; Ploegh, HL. "Site-specific protein labeling via sortase-mediated transpeptidation". *Curr. Protoc. Protein Sci.* **2017**, *89*, 15.3.1-15.3.19.

*Tsui, KY; *Onishi, N; **Berger, RF**. "Tolerance factors revisited: Geometrically designing the ideal environment for perovskite dopants". *J. Phys. Chem. C* **2016**, *120*, 23293-23298.

Borda, EJ; Boudreaux, A; Fackler-Adams, B; Frazey, P; Julin, S; *Pennington, G; *Ogle, J. "Adapting a student-centered chemistry curriculum to a large-enrollment context: Successes and challenges". *J. Coll. Sci. Teach.* **2017**, *46*, 8-13.

Bussell, ME. "New methods for the preparation of nanoscale nickel phosphide catalysts for heteroatom removal reactions". *React. Chem. Eng.* **2017**, *2*, 628-635.

†Kwon, Y; †Delgado, M; Zakharov, L; Seda, T; **Gilbertson, JD**. "Nitrite reduction by a pyridinediimine complex with a proton-responsive secondary coordination sphere". *Chem. Commun.* **2016**, *52*, 11016-11019.

†Delgado, M; **Gilbertson, JD**. "Ligand-based reduction of nitrate to nitric oxide utilizing a proton-responsive secondary coordination sphere". *Chem. Commun.* **2017**, *53*, 11249-11252.

Nozawa, R; Tanaka, H; Cha, W-Y; Hong, Y; Hisaki, I; Shimizu, S; Shin, J-Y; **Kowalczyk, T**; Irle, S; Kim, D; Shinokubo, H. "Stacked antiaromatic porphyrins". *Nat. Commun.* **2016**, *7*, 13620.

†Komoto, KT; **Kowalczyk, T**. "How parallel are excited state potential energy surfaces from time-independent and time-dependent DFT? A BODIPY dye case study". *J. Phys. Chem. A* **2016**, *120*, 8160-8168.

Surakhot, Y; *Laszlo, V; Chitpakdee, C; Promarak, V; Sudyoadsuk, T; Kungwan, N; **Kowalczyk, T**; Irle, S; Jungsuttiwong, S. "Theoretical rationalization for reduced charge recombination in bulky carbazole-based sensitizers in solar cells". *J. Comput. Chem.* **2017**, *38*, 901-909.

*Owen, RC; *Murphy, KS; *Hoke, KG; *Morgan, TJ, Johnson, BL; **Leger, JM**. "Detection of guided-wave plasmon polariton modes in a high-index dielectric MIM structure". *J. Appl. Phys.* **2017**, *122*, 123101.

*Fengel, CV; *Bradshaw, NP; †Severt, SY; **Murphy, AR**; **Leger, JM**. "Biocompatible silk-conducting polymer composite trilayer actuators". *Smart Mater. Struct.* **2017**, *26*, 055004.

*Blatz, TJ; *Fry, MM; *James, EI; *Albin, TJ; *Pollard, Z; **Kowalczyk, T**; **Murphy, AR**. "Templating the 3D structure of conducting polymers with self-assembling peptides". *J. Mater. Chem. B* **2017**, *5*, 4690-4696.

*Larson, JD; *Fengel, CV; *Bradshaw, NP; †Romero, IS; **Leger, JM**; **Murphy, AR**. "Enhanced actuation performance of silk-polypyrrole composites". *Mater. Chem. Phys.* **2016**, *186*, 67-74.

Chemistry Faculty Publications in 2016-2017 (continued)

*WWU undergraduate student co-author, †WWU master's student co-author

†Severt, SY; *Maxwell, S; *Bontrager, J; **Leger, JM**; **Murphy, AR**. "Mimicking muscle fiber structure and function through electromechanical actuation of electrospun silk fiber bundles". *J. Mater. Chem. B* **2017**, *5*, 8105-8114.

†Stockdale, TF; **O'Neil, GW**. "Regio- and diastereoselective samarium-mediated allylic benzoate reductions". *Synlett* **2017**, *28*, 2267-2271.

O'Neil, GW; †Cummins, EJ. "Iodine-mediated rearrangements of diallylsilanes". *Tetrahedron Lett.* **2017**, *58*, 3406-3409.

O'Neil, GW, †Williams, JR; *Craig, AM, Nelson, RK; Gosselin, KM; Reddy, CM. "Accessing monomers, surfactants, and the queen bee substance by acrylate cross-metathesis of long-chain alkenones". *J. Am. Oil Chem. Soc*. **2017**, *94*, 831-840.

O'Neil, GW; *Craig, AM; †Williams, JR; Young, JC; **Spiegel, PC**. "Synthesis of the C_1-C_{23} fragment of the archazolids and evidence for V-ATPase but not COX inhibitory activity". *Synlett* **2017**, *28*, 1101-1105 (highlighted in *Synform*).

†Sumner, R; *Eiselt, S; Kilburn, TB; Erickson, C; *Carlson, B; Gamelin, DR; McDowall, S; **Patrick, DL**. "Analysis of optical losses in high-efficiency $CuInS_2$-based nanocrystal luminescent solar concentrators: Balancing absorption versus scattering". *J. Phys. Chem. C* **2017**, *121*, 3252-3260.

†Schaaf, C; *Jenkins, M; *Morehouse, R; *Stanfield, D; McDowall, S; Johnson, BL; **Patrick, DL**. "Predictive modeling of nanoscale domain morphology in solution-processed organic thin films". *Phys. Rev. Materials* **2017**, *1*, 043404.

†Taylor, AK; *Perez, DS; Zhang, X; Pilapil, BK; Engekhard, MH; Gates, BD; **Rider, DA**. "Block copolymer templated synthesis of PtIr bimetallic nanocatalysts for the formic acid oxidation reaction". *J. Mater. Chem. A* **2017**, *5*, 21514-21527.

†Brown, EA; **Rider, DA**. "Pegylated polybenzoxazine networks with increased thermal stability from miscible blends of tosylated poly(ethylene glycol) and a benzoxazine monomer". *Macromolecules* **2017**, *50*, 6468-6481.

†Hoppins, JJ; †Gruber, DR; †Miears, HL; Kiryutin, AS; Kasymov, RD; Petrova, DV; Endutin, AV; Popov, AV; Yurkovskaya, AV; †Fedechkin, SO; †Brockerman, JA; Zharkov, DO; **Smirnov, SL**. "8-Oxoguanine affects DNA backbone conformation in the *Eco*RI recognition site and inhibits its cleavage by the enzyme". *PLoS ONE* **2016**, *11*, 0164424.

†Carlson, MA; *Haddad, BG; †Weis, AJ; *Blackwood, CS; *Shelton, CD; †Wuerth, ME; †Walter, JD; **Spiegel, PC**. "Ribosomal protein L7/L12 is required for GTPase translation factors EF-G, RF3, and IF2 to bind in their GTP state to 70S ribosomes". *FEBS J.* **2017**, *284*, 1631-1643.

Vyvyan, JR; †Engles, CA; *Bray, SL; *Wold, ED; *Porter, CL; *Konev, MO. "Synthesis of substituted *Z*-styrenes by Hiyama-type coupling of oxasilacycloalkenes: Application to the synthesis of a 1-benzoxocane". *Beilstein J. Org. Chem.* **2017**, *13*, 2122-2127.

†Shelton, P; †Ligon, TJ; †Dell (née Meyer), JM; *Yarbrough, L; **Vyvyan, JR**. "Synthesis of cananodine by intramolecular epoxide opening". *Tetrahedron Lett.* **2017**, *58*, 3478-3481.

2016-2017 Chemistry Awards

CRC Press Chemistry Achievement Award
Ashley Arthur

Outstanding Honors Chemistry Student
Autumn Harding

Outstanding Organic Student
Holly Jones

Outstanding Analytical Student
Briana Mulligan

Outstanding Inorganic Student
Jordan Jacobson

Outstanding Physical Student
Thomas Morrissey

Hypercube Scholar
Nicole Onishi

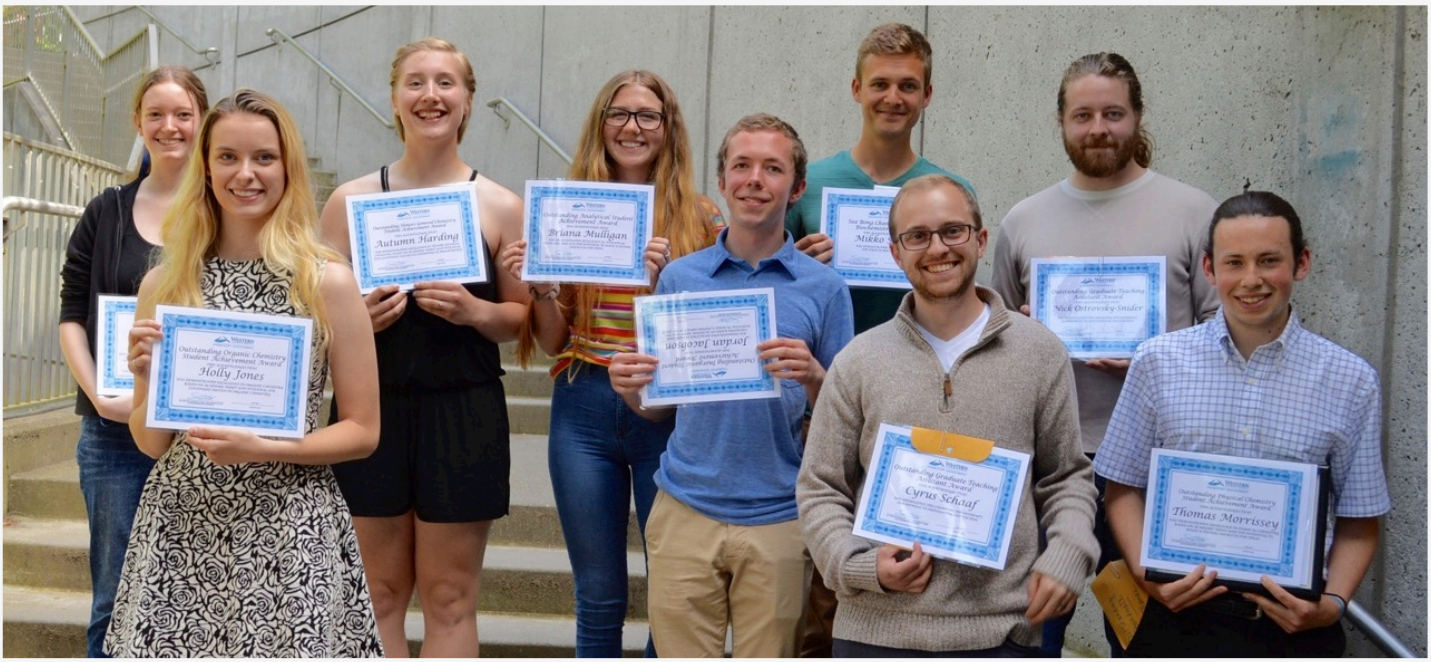
Sea Bong Chang Memorial Biochemistry Award
Mikko Sayre

Advancing Chemistry Through Service (ACTS) Award
Rachel Blazevic
Diane Perez

Chair's Award for Outstanding Student Initiative
Rachel Blazevic
Galen Herz
Serena Wo

Outstanding Graduate Teaching Assistant
Cyrus Schaaf
Nicholas Ostrovsky-Snider

Outstanding Department Graduate
Thomas Morrissey



First row (left-to-right): Holly Jones, Jordan Jacobson, Cyrus Schaaf, Thomas Morrissey
Second row (left-to-right): Ashley Arthur, Autumn Harding, Briana Mulligan, Mikko Sayre, Nicholas Ostrovsky-Snider

2017-2018 Student Fellowships and Scholarships

WWU Chemistry Scholarships
Jade Porubek
Star Summer

Verna Alexander Price Chemistry Scholarship
Sasha Alden

Jerry Price - Nancy Sherer Scholarship
Shaye Fowler

Ruth Watts Female Scientist Scholarship
Alena Rainsberry

Barbara French Duzan Scholarships
Connor Aamot
Amy Morren
Stephanie Neely
Kelly Yokuda

Oscar Edwin Olson Scholarships
Stephanie Maxwell
Tian Qing Yen

Knapman Chemistry Scholarships
Ellie James
Chris Myers

Rathmann Family Foundation Scholarship
Douglas Baumgardner

Women in Science Scholarship
Holly Jones

HACH Land Grant Undergraduate Scholarships
Cassidy Crickmore
Megan Deshaye

Barbara Ellen Maguire Scholarship
Ellie James

Jean Dreyfus Lectureship for Undergraduate Institutions: Summer Research Stipend
Alena Rainsberry

Elwha Undergraduate Summer Research Award
Kelly Yokuda

Denice (Ambrose) Hougen Undergraduate Fellowship
Ellie James

Karen and Joseph Morse Research Fellowships
Megan Deshaye
Robert Johnson
Evangeline Starchman

First row (left-to-right): Megan Deshaye, Stephanie Neely, Cassidy Crickmore, Ellie James, Amy Morren, Alena Rainsberry, Sasha Alden, Tian Qing Yen; **Second row (left-to-right):** Jade Porubek, Holly Jones, Kelly Yokuda, Chris Myers, Douglas Baumgardner, Stephanie Maxwell

Left-to-right: Evangeline Starchman, Megan Deshaye, Kelly Yokuda, Ellie James, Alena Rainsberry, Robert Johnson

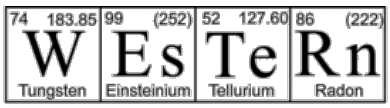
Outstanding Graduate of 2017

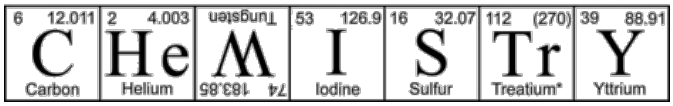
Thomas Morrissey

Thomas Morrissey is the Chemistry Department's Outstanding Graduate for 2016-2017. Thomas is from Littlerock, Washington and a graduate of Tumwater High School. During his studies at WWU, he completed his B.S. in Chemistry and a Materials Science minor with a GPA of 3.93. Thomas has won numerous awards and scholarships while attending WWU, including the CRC Press Chemistry Achievement Award from the Chemistry Department (2014) and the Earnest F. Hollings Undergraduates Scholarship (2016). Since 2014, he has supported his peers through work at WWU's Tutoring Center and other private tutoring. Thomas has also been highly active as an undergraduate researcher. He spent the summer of 2016 at the James J. Howard Marine Sciences Laboratory on a summer research project and, since the spring of 2016, has worked collaboratively with Prof. Rider and Prof. Patrick on the fabrication, testing, and modeling of organic photovoltaics coupled to solar concentrators. He has authored his own research proposals to fund parts of the work (RSP Creative Opportunities Award in the fall of 2016) and a draft of a document aimed at publishing the work. He has presented his work nationally and internationally, including posters at Nanolytical 2016 (awarded best undergraduate poster) and the American Chemical Society's National Spring 2016 Meeting in San Francisco. Thomas is currently pursuing his Ph.D. at the University of British Columbia with Prof. Curtis Berlinguette and has already been awarded a QMI QuEST Scholars prize to partially fund his studies. Congratulations, Thomas!

WWU Chemistry Department Newsletter #18 was produced by:

Rob Berger (chair): writing, editing, layout
Alexi Guddal: information gathering
Gary Carlton: artwork
Sal Russo: editing





Find us on Facebook!
www.facebook.com/wwuchem

2016-2017 Department Graduates

Congratulations to all **74** of our graduates from Fall 2016 to Summer 2017!

BS Biochemistry

Michael Anderson
Alexander Atwood
Colby Blackwood
Rachel Blazevic
David Brzovic
Giulia Corbet
Alexander Craig
Matthew Dean
Stacylynn de Boer
Samantha Fairbanks
Jesse Gansler
Ben Gerhart
Alyssa Goodey
Samantha Grosslight
Nicholas Horvath
Kiley Hughes
Anya Kalata
Joshua Kirsch
Nathan Markus
Russell McFarland
Maxim Odarenko
Brady Phillips
Brian Rowe
Aaron Russo
Mikko Sayre
Hope Spargo
Moon Sun
Bethany Wahlquist

BS Chemistry

Jonathan Bontrager
Gabriel Bourne
Sean Brzoska
Timothy Bultman
Hilary Fitzgerald
Spencer Gueno
Ian Hunter
Jordan Jacobson
James Kussy
Khoa Le
Alex Manjarrez
Zachary McLaughlin
Thomas Morrissey
Nicole Onishi
Amanda O'Sullivan
Diane Perez
Connor Ransom
Christopher Swanson
Gary Wilson

BA Chemistry

Minju Bang
Adam Benton
Brandon Bol
Chelsea Croshaw
Inness Davis
Glen Eggers
Karina Hanson
Shane Hennig
Jennifer Hwang
Jared Ickert
Gordon Kordas
Dustin Langley
Hannah Lazich
Sarah Mitchell
Quynh-Nhu Nguyen
Feaven Tesfai
Roderick van der Linden

MS Chemistry

Orion Banks
Mayra Delgado
David Gruber
Keenan Komoto
Heather Miears
Nicholas Ostrovsky-Snider
Cyrus Schaaf
Peter Topalian
Amanda Weis
Serena Wo

Spring Commencement 2017

Summer Research Program

In the summer of 2017, ***50*** undergraduate students received summer stipends for research either through the Chemistry Department or through AMSEC. Forty-four students were supported by external grants. The remaining six were internal fellowship awardees: Ellie James (Denice Hougen Undergraduate Fellowship), Kelly Yokuda (Elwha Undergraduate Research Award), Megan Deshaye, Robert Johnson, Evangeline Starchman (Karen and Joseph Morse Research Fellowship), and Alena Rainsberry (Jean Dreyfus Lectureship Award).

Summer 2017 was also the 6th year for our NSF-funded Research Experience for Undergraduates (REU) program. This program is intended to provide undergraduate students from community colleges and small universities with an authentic research experience that is not available at their home institutions. This year, we were able to host nine students: Sasha Alden, Roselyn Cachero, Mohammad Khan, Lauren Jenkins, Tiffany Nakama-Fukuhara, Colton Romannose, Erin Rosencrantz, Rhemrose Sabio, and Jason Yu. Prof. Clint Spiegel has been the director of this program for the last three years, and has done a fantastic job recruiting students, as well as organizing training and development activities for the students. The 2017 end-of-summer symposium featured talks from invited speakers Steven Staben (Senior Scientist at Genentech and 2002 WWU alum) and Brian Korgel (Department of Chemical Engineering at UT Austin). We also invited back alumni Donovon Adpressa (2012 alum) and Caileen Brison (2013 alum) to discuss their current research and career trajectories.

Top left: REU students and Prof. Spiegel visit the Shannon Point Marine Center

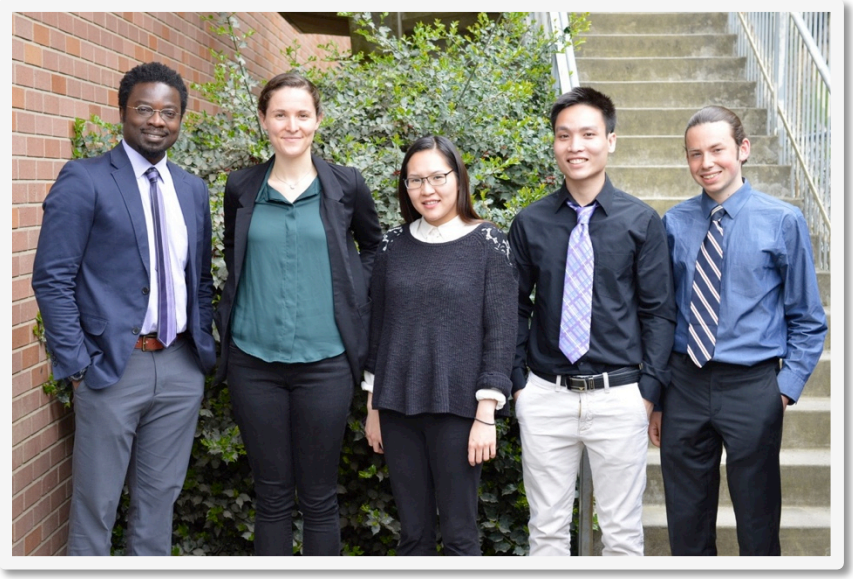
Top right: REU students Roselyn, Rhemrose, Tiffany, Sasha, and Lauren at Deception Pass

Bottom: Poster presentations at the end-of-summer REU symposium

Scholars Week 2017

WWU's 2017 Scholars Week event included a banquet for research students and their advisors, as well as opportunities for students to present their research in campus-wide poster sessions. The Chemistry Department was very well represented, with ten undergraduate chemistry research students (see below) recognized with Outstanding Poster Awards. This honor was conferred on only 15% of the 168 posters presented university-wide.

The Chemistry Department also organized its own Scholars Week activities, which included presentations from WWU chemistry students, as well as a visit from a prominent scientist. This year, the department was pleased to host Prof. Richmond Sarpong, a synthetic organic chemist from the University of California at Berkeley. Prof. Sarpong's research focuses on the total synthesis of complex, biologically active natural products and the development of new synthetic strategies. Prof. Sarpong spent two days interacting with students and faculty. His visit culminated in a symposium on May 19, in which WWU chemistry students Samantha Grosslight, Audrey Cheung, Khoa Le, and Thomas Morrissey gave oral presentations as part of completing their Honors Theses, followed by a keynote address by Prof. Sarpong. All of these activities were made possible by the Pavia-Lampman-Kriz Chemistry Endowment and The Western Foundation Chemistry Fund.



Scholars Week symposium speakers, left-to-right:
Prof. Richmond Sarpong, Samantha Grosslight, Audrey Cheung, Khoa Le, Thomas Morrissey

Undergraduate Poster Awards

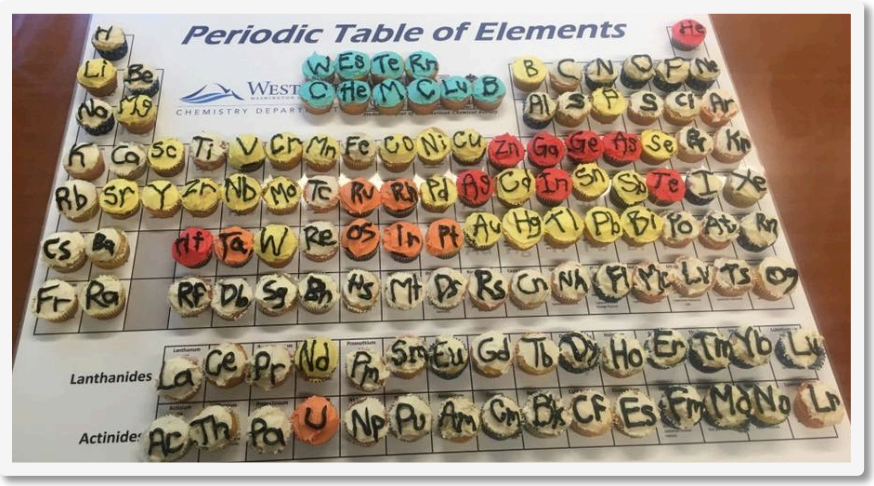
- Sasha Alden (PI: David Rider) "The development of a stable cuprous oxide nanocatalyst for photoelectrochemical proton reduction"
- Rachel Blazevic (PI: Clint Spiegel) "Lipid binding studies of blood coagulation factor VIII C1 and C2 domains"
- David Brzovic (PI: John Antos) "Enhancing sortase mediated transpeptidation reaction conversion via metalpeptide complexation"
- Jack D'Amelio (PI: Tim Kowalczyk) "Structural screening of photoactive covalent organic frameworks"
- Tatum Fuller (PI: Amanda Murphy) "Enhancing silk fibroin scaffolds for utilization as nerve conduits"
- Samantha Grosslight and Hope Spargo (PI: James Vyvyan) "Synthetic studies on guaipyridine alkaloids: Rupestines B-D, G, L and M"
- Khoa Le (PI: Tim Kowalczyk) "Ground and excited state energies of solar thermal fuel candidates from density functional theory (DFT) and density functional tight-binding (DFTB) calculations"
- Huy Nguyen (PI: Janelle Leger) "Plasmonic enhancement of organic photovoltaic devices"
- Nicole Onishi (PI: Robert Berger) "Geometrically designing the ideal environment for perovskite dopants"

WWU Chem Club: Explosions, Cupcakes, and Excellence

It has been another successful, jam-packed year for the Chem Club. Some of the year's highlights include: presenting numerous science shows at local elementary schools, organizing a hands-on science workshop for WWU's Girls in Engineering, Math & Science (GEMS) Academy, making science pun signs and a "Periodic Table of Cupcakes" for Bellingham's March for Science, performing our first demo show for adults at The Shakedown, and creating bigger and better explosions (carefully controlled, of course) for Wizards@Western and Chemplosion demo shows. We were also pleased to host our 2nd annual Campus-2-Career Alumni Panel at which Western alumni shared their career experiences with our current students.

September brought the announcement of the seventh Outstanding Student Chapter Award from the American Chemical Society! Only 52 student chapters nationwide received such distinction in 2017. The award provides well-deserved recognition to the students who volunteer so much of their precious time making chapter events so successful. Prof. Steven Emory and Prof. Betsy Raymond are fortunate to be able to work with such a fine group of students. In addition, Prof. G McGrew has also served as an advisor for the group and has helped coordinate activities with other student groups including Out in Science and SACNAS. You can follow the Chem Club's activities through our Facebook page (www.facebook.com/wwuchem).

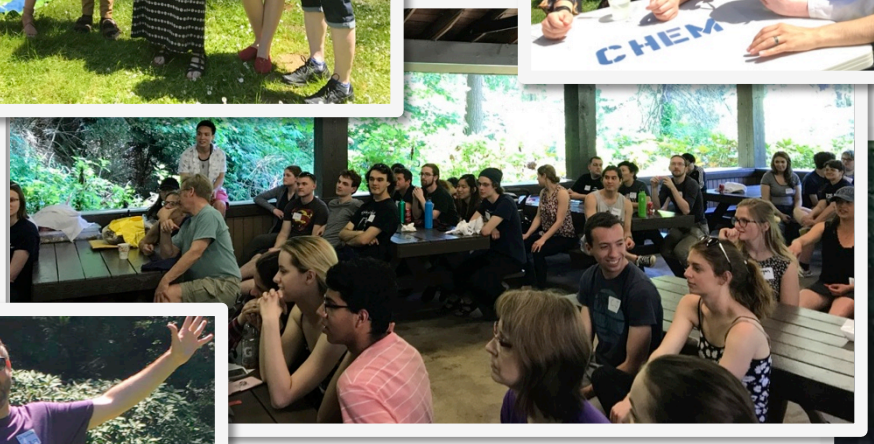
Alumni and friends of the department are always welcome at events. We would particularly love to see you at the annual picnic, Saturday June 2, 2018, at Whatcom Falls Park. We have continued to improve and add activities at the picnic including a new cornhole tournament (complete with its own terribly wonderful trophy) and an updated Molympics competition. Anyone interested in forming an alumni Molympics team?



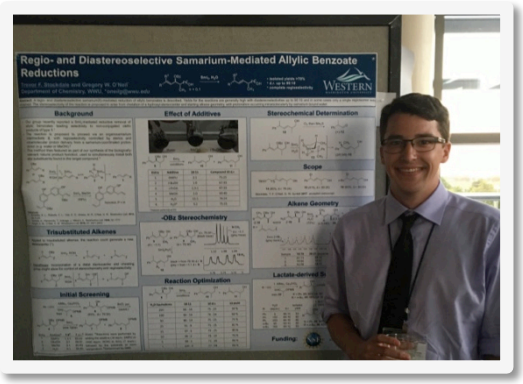
Left: Periodic Table of Cupcakes

Right: Rachel Blazevic and Cassidy Crickmore accepting the Outstanding Student Chapter Award at the ACS National Meeting

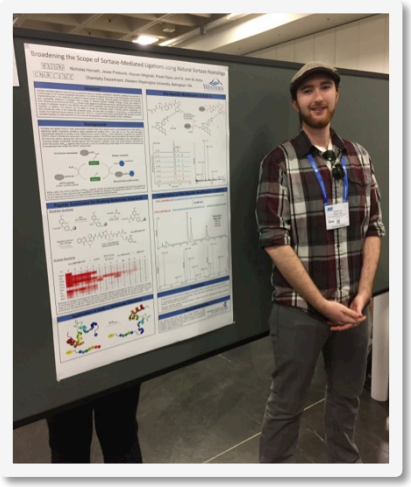
Photos from the 2017 Department Picnic

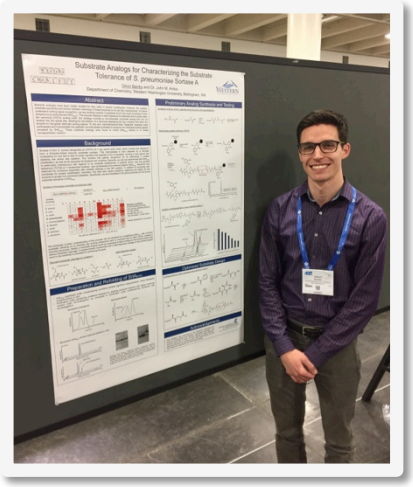


Student Attendance at National and International Conferences

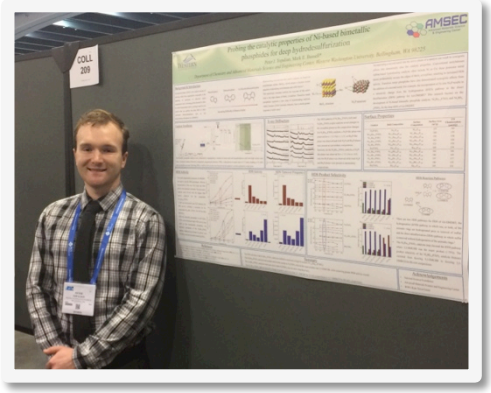


Trevor Stockdale – O'Neil Lab
ACS Organic Symposium, June 2017, UC Davis



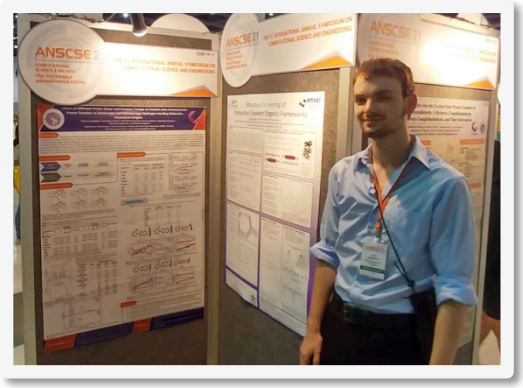


Nicholas Horvath (left) and Onion Banks (right) – Antos Lab
ACS National Meeting, April 2017, San Francisco

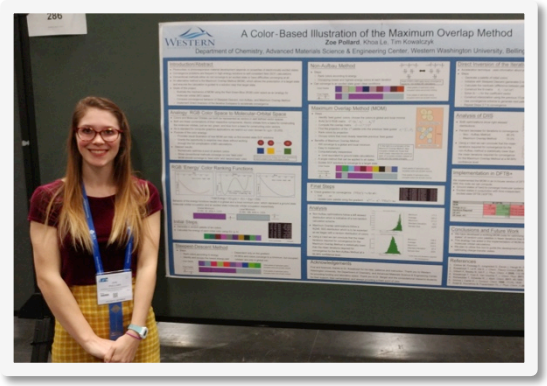


Peter Topalian – Bussell Lab
ACS National Meeting, April 2017, San Francisco

Erin Brown (left) and Jo'Elen Hagler (right) – Leger Lab
APS National Meeting, March 2017, New Orleans



Jack D'Amelio – Kowalczyk Lab
Annual Symposium on Computational Science and Engineering, August 2017, Thailand



Zoe Pollard – Kowalczyk Lab
ACS National Meeting, April 2017, San Francisco