



Chemistry 2017

NEWS

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Letter from the Department Head

My second year as the chemistry department head continues to be a learning experience. It seems that I am always dealing with two constants: change and uncertainty. As many of you know Wyoming has experienced a severe economic downturn that has resulted in a 10% (\$35M) cut in the university block grant. The reality of such a large budget cut is that it can only be achieved by reducing the salary pool.

Fortunately, much of this has been realized by retirements, but we just learned that an additional 37 more staff positions will be cut starting this summer. Chemistry for the most part has "survived" although we have seen much of our research infrastructure erode away. The Division of Research Support (shops and chemical stockroom housed in physical sciences) has been broken up with the machine shop merging with the shop in engineering and the management of the chemical stockroom being out sourced. We have lost some good people in this climate of uncertainty. It is my hope that we have come through the worst of it and now can start to refocus and work toward a brighter future. My optimism stems from the many talented and devoted people we have working in the department and across campus.

We have now experienced our first full year teaching in the Enzi STEM building with general, organic, and analytical teaching labs now being held in this new facility. After all the delays in construction, the building has really performed well with only minor hiccups. In addition our faculty has worked hard to incorporate a variety of new equipment into the teaching labs. For example, Edward and Margaret Clennan have developed labs for the 3 new teaching NMRs and Franco Basile and Ginka Kubelka have worked to modify a lab to include the new ICP-AE for multi-year monitoring of drinking water around campus. These same faculty members wrote proposals for new computers that will update all the computers in the teaching lab analysis rooms.

Chemistry is also taking a lead role in modernizing the way we teach the core sciences here at UW. Professors Hoberg, Leonard, Hulley, and I along with two chemistry graduate students (Morgan Balabanoff and Melissa Gelwicks) just completed the first year as cohorts in the Science Initiative LAMP program. As part of this program we visited the

University of Minnesota (a leader in active learning) for a grueling 5-day workshop and have participated in monthly meetings reporting on both small and large pedagogical changes we have implemented in our undergraduate courses. We teach over 1000 students per semester in general chemistry alone and we need to continue to work on retention, success, and engagement in our undergraduate classrooms. The thing that is exciting about the LAMP program is that it is campus wide effort which means we are working with other departments and programs to link up learning outcomes and assimilate best practices in teaching.

I am happy to report that Debashis Dutta has been promoted to full professor and Carla Beckett was promoted to Senior Academic Professional Lecturer and granted reappointment. Since arriving in 2006 Debashis and his students have racked up a number of impressive papers on microfluidics and demonstrated a number of skillful applications. Carla managed to move the general chemistry laboratories from physical sciences to the new ENZI building while teaching CHEM 1020/1030 and running the undergraduate laboratories. Professor Dean Roddick was awarded another NSF single PI grant that will enable him to continue his synthetic inorganic research program in catalysis. Associate Professor Jing Zhou has teamed up with Professor Joseph Holles in Chemical Engineering to work on real world catalysis problems funded by the School of Energy Resources new Carbon Initiative Program. We have great faculty and many more of their accomplishments are described in this newsletter. Finally, Assistant Professor Caleb Hill has now completed his first year and has made tremendous progress building his research program in single nanoparticle electro/optic studies.

Our graduate students also continue to excel. Levente Pap was awarded the top prize of the John P. Ellbogen \$30K Entrepreneurship Competition for his wearable dictation device and software for scientific researchers. A number of graduate students also successfully defended (Frederick Mutunga, Tamara Sibray, Samantha Schmuecker, and Shelby Follett) this year and left UW for greener pastures. Shelby Follett and James Thode served as our graduate student ambassadors for graduate recruiting and always did a great job representing the department. Suman Debnath and Theodore Kraus were both co-winners of the Sara Jane Rhoads Graduate Student Research Award. Both have been very productive and Ted has single handedly kept the XPS system working. I also taught the Professional Development graduate course this spring that Keith Carron started. I really enjoyed teaching this course and getting to know the students. This is definitely something we will continue to offer as a way to help our students find rewarding careers in chemistry.

In some ways the organic division is like Thelma and Louise rapidly driving to the edge of a cliff. Given our demographics, it looks like we will be wishing Edward and Margaret Clennan, Robert Corcoran, and Patricia Goodson exciting new adventures in life after UW in the near future. With such impending turnover chemistry was one of only four searches in Arts & Sciences authorized this year. The search did not begin until October and right now we are (hopefully) in the final stages of negotiations with one of our top candidates. I won't say more because I don't want to jinx it.

On more somber notes, we learned of the passing of Leland L. Burger (BA Chemistry, UW 1939) and William "Doug" Wheeler this year. I will always remember Doug in a warm light because when I started here he would give my research group leftover helium from the NMRs. The department has always felt like an extended family and our thoughts and prayers are with the loved ones they leave behind.

We always welcome gifts from alumni and friends. During these tough budget times we rely more and more on gifts to keep the department moving forward. Your gifts go toward awards, student travel to meetings, and helping students with financial needs. It is easy to help out at our website <http://www.uwyo.edu/chemistry/giving.html>

You can keep abreast of chemistry department events by visiting our website at <http://uwadmnweb.uwyo.edu/Chemistry/>. You might even recognize an old friend or two on our alumni page (started by Keith). Please send us your stories so that we can post them. I love hearing from alumni and friends about memories of UW and Laramie or what is currently going on in your lives. So please drop me an email and make us aware of your accomplishments!

Best Regards, Dave

Faculty, Staff and Department Highlights



Carla Beckett

I have now been in the new ENZI STEM building for one full year. It is such an amazing building! The students and teaching assistants all love the new teaching labs with the well-lit labs and great technology. We are now revising the actual experiments and improving the lab manuals to make the students' experiences in general chemistry even better. In addition to managing the general chemistry labs, I taught a CHEM 1020 course in the fall semester and this semester I am teaching environmental chemistry.



General chemistry laboratory in the new Enzi STEM building.



Franco Basile

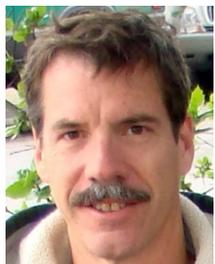
Highlights from 2015-2016 in the Basile research group included the graduation of three group members (Chenglin Liu, Liang Lu and Rong Zhou) and the successful funding of a NSF grant. This 3-year NSF-funded project will be focusing on the development of protocols for molecular imaging of tissues with MALDI-ToF/ToF-MS (acquisition funded in 2015 by NSF-MRI) and will be conducted by a multi-disciplinary team of investigators from Chemistry, Mechanical Eng. and Mol. Biology departments. Our group is currently conducting research in Analytical Chemistry and Mass Spectrometry with a focus on the analysis of antibiotic-resistant bacteria, the development of new

LC-MS instrumentation for the analysis of complex mixtures of polycyclic aromatic hydrocarbons (PAH's) in coal samples, and performing several collaborative projects with other UW faculty in areas of metabolomics and lipidomics of bacteria and bees. Current group members include graduate students Rudy Mignon, Mitch Helling and Tony Maus, and undergraduate students Andrew Goodenough, Stephany Montgomery and Sophia Kwende Daisy. A major highlight on 2016 was the first "Lab Wedding" between group members Rong Zhou and Rudy Mignon in a beautiful ceremony here in Laramie on February 6 congratulations!



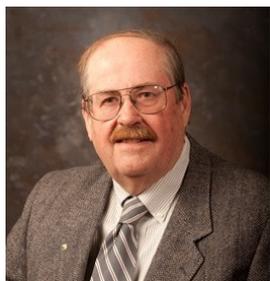
John Hoberg

The Hoberg group research continues to involve a mixture of organic synthesis and coordination chemistry to produce organometallic complexes for use as light-driven metal catalysis. This research is led by Melissa Gelwicks and Amanda Landis, who are both pursuing their PhDs in the Hoberg Group. In collaboration with Professor Bruce Parkinson, we are also synthesizing two-dimensional materials that are highly ordered, functionalized nanopores materials. These are in the same class as graphene but are nitrogen containing and thus have a distinctly different set of properties and applications. The work is supported by the UW Carbon Initiative and involves undergraduates Veronica Spaulding, Jordan Brophy and Jon Kephart. We are also continuing our REU (Research Experience for Undergraduates) summer program, which is supported by NSF. The program focuses on bringing Wyoming Community College students to UW for a 10 -week summer research experience.



Dean Roddick

The Roddick group consists of three graduate students and an undergraduate working in our lab. Suman Debnath (Ph.D., 6th year) and Phil Miller (Ph.D., 6th year) both continue their thesis research, and Tanner Remick is preparing for his preliminary examination this spring. My 3-year NSF renewal grant was approved last fall for \$465,000 and will run through 2019. Suman and Phil both presented their research at the Spring National ACS Meeting in San Diego in 2016. Last July Dean presented a poster at the Organometallic Gordon Conference in Newport, Rhode Island, and this April presented Suman's research at the San Francisco National ACS meeting as a participant in the Antonio Togni Fluorine Award symposium. Two peer-reviewed papers were published in 2016, including one very significant one, which describes unusual platinum superacid coordination chemistry. This work spurred an invitation to be a featured speaker at Free University and Humboldt University in Berlin, Germany this June. Dean and Patricia are taking this opportunity to tour Germany for several weeks and are brushing up on their German language skills.



Edward Clennan

The Clennan research group currently consists of one graduate student, Jacob Weber. Jacob is working on the synthesis and study of heli-acenes. Helicenes are fascinating and beautiful molecules that have a myriad of practical uses. Our first published contribution to this area appeared in *Organic Letters* in 2014 (DOI: 10.1021/ol1502180y). Subsequent published manuscripts appeared in *The Journal of Organic Chemistry*, *Tetrahedron*, and in *Phosphorus, Sulfur, and Silicon*. This work was supported by a National Science Foundation grant and presented at the 27th International Symposium on Organic Chemistry of Sulfur in Jena Germany during July 2016. Ed continues to be a member of the Petroleum Research Foundation (PRF) Advisory Board, a member of the Editorial Board of the *Journal of Physical Organic Chemistry*, and the Editor of the *Journal of Sulfur Chemistry*. Ed chaired the 2016 *Journal of Sulfur Chemistry* Advisory Board Meeting in Jena. Last year he also attended PRF Advisory Board Meetings in Chicago and in Nashville.



Caleb Hill

I joined the department at the start of the Fall 2016 semester. Previously, I was a postdoctoral researcher at the University of Texas at Austin. Our first graduate student and three undergraduate students joined the group during the Fall semester. Currently, everyone in the group is working to study various types of electrochemical reactions at individual nanostructures using combined optical-electrochemical methods.



Debashis Dutta

The Dutta research group currently has two members, Sakur Mahmud, and Rajesh Deb. While Sakur is presently developing microfluidic approaches to improving the capabilities of the ELISA technique, Rajesh is getting started on designing a micro-/nanofluidic platform that may enable a new approach to DNA and particle separations. In addition, Ravi Peesara, a previous student in the Dutta group, successfully defended his dissertation this spring and is currently working with Piramal Pharma Solutions in Lexington, KY. The Dutta group members published three articles over the past year in the journals of Analytical Chemistry, Analytica Chimica Acta, and Journal of Chromatography A. Prof. Dutta also hosted a seminar series organized last summer which featured talks on micro-scale electrophoretic separations by Prof. Michael Bowser from the University of Minnesota. Research work in the Dutta group currently funded through grants from the National Institutes of Health and the Wyoming INBRE program.



Alexander Goroncy

The nuclear magnetic resonance (NMR) facility has been updated with the acquisition of three additional NMR spectrometers: Anasazi Eft-60 NMR Spectrometers. They will be used mainly for undergraduate teaching, starting in Fall 2016. The instruments are capable of performing proton, carbon, as well as multidimensional experiments that are useful for organic, analytical, and biological work. Suitable experiments for each are currently being tested and should delight the students. The installations of the diffusion, imaging and solid-state NMR probes for the Bruker Avance III 300 wide-bore NMR spectrometers have been completed. Together with the high-resolution Bruker Avance III NMR 400 MHz and 600 NMR MHz instrument with liquid and solid-state capabilities and variable temperature control, these make the NMR facility at UW even more remarkable in its versatility. It is also especially suitable for the special Wyoming's strength in the primary energy sector (oil, coal, rocks), but certainly not limited to it. The facility attracts many users within the department, the university, and beyond. I am happy to work with them.



Jing Zhou

Jing Zhou's group continues the research effort on the growth of doped ceria thin films and the understanding of structure-reactivity relationships of ceria-supported Ni and Au nanoparticles. Erik Peterson, a 4th year PhD candidate, is working on the project. Last summer, the group received a two-year grant with an amount of \$307,764 from Wyoming Carbon Engineering Initiatives to embark the new research direction on the conversion of coal and coal by-products into syngas in collaboration with Prof. Joseph Holles from Chemical Engineering. The group welcomed Dr. Sachin Nandanwar as a postdoctoral researcher for the project. This grant also allowed us to purchase new research equipment including an Agilent GC and a Hiden mass spectrometer. Last summer, the group hosted Prof. Michael Cuddy and his student, Samantha Hallett, from Northwest Community College, Powell, WY, for summer REU research funded by NSF. The group is delighted to have two new members, Yunkai Zou and Linze Du who are currently in their 1st year of the PhD program in Chemistry. Yunkai is the recipient of UW CPAC Undergraduate Research Fellowship as well as the UW Academic Affairs Graduate Assistantship. The group is also delighted to have Dr. Sanjaya Senanayake from Brookhaven National Laboratory for an invited Chemistry and Materials Science Symposium Seminar in the spring of 2016. We are thankful for the financial support from NSF (CHE1151846) and UW School of Energy Resources to sponsor our exciting research projects and presentations of results at the American Chemical Society and American Vacuum Society Meetings as well as in peer-reviewed journal articles.



Jan Kubelka

The Kubelka group has been involved in a number of research projects that range from the structure and function of biological molecules (peptides, proteins, enzymes) to uncovering the origins of life (molecular predecessors of nucleic acids) and from computational modeling of various organic and organometallic systems to understanding ligand-induced chirality in metal nanoparticles and semiconductor quantum dots. The group currently consists of one graduate student Shambhavi Tannir, who is focusing on the synthesis and characterization of quantum dots with chiral ligands, an undergraduate Josh Geiser, whose project is computational modeling of heli-acenes, and Dr. Brian Francis, now retired

former member of the Molecular Biology department, who is working on identifying information molecules that preceded nucleic acids in the early life.



Elliott Hulley

This will be a busy year for our group as we finalize four publications (at least) and continue to build on our work in C–H activation, magnetic cluster synthesis, and activation of other small molecules. We have also welcomed two new graduate students (Zach Hecht and Siwei Sun) and one new undergraduate (Alex Sawaya) into our group. Jonathan Kephart (undergraduate, 2016) has graduated and will go on to graduate study, joining the ranks of other Hulley group undergraduate alumni that have begun their Ph.D. studies (Drew Newman at UPenn and Rachael Coleman at Cornell). Outside of research, group member Levente Pap was also awarded the top prize at the John P. Ellbogen Entrepreneurship Competition based on his idea for wearable technologies for scientific applications. Levi's proposal was selected from more than seventy applicants.



Patricia Goodson

This academic year, my teaching responsibilities have focused on general chemistry (CHEM 1020). I love this course because it gives me the opportunity to blow up hydrogen balloons, electrocute pickles, and produce colored flames by burning salt solutions. There are a couple of outreach efforts that I participated in that are becoming well-established activities for our department at the end of spring semesters. We welcomed Jennifer Merriam's advanced high school chemistry class from Cheyenne for an instrumentation field trip. Drs. Roddick,

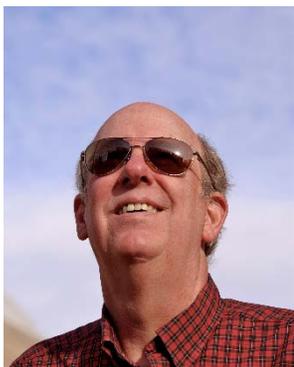
Arulsamy, Leonard, Basile, and Lehmann gave morning tours of the department's X-ray, Mass Spec, and NMR facilities, followed by my afternoon "Solving NMR Spectra" workshop. In addition, as a part of UW's "Women in Science Conference," Dr. Ginka Kubelka, graduate student Melissa Gelwicks, and I offered a workshop on "Turning Pennies into Gold" to groups of 5th and 6th grade students. On a personal note, I will be traveling to Germany with my husband (Dean Roddick) for a couple of weeks this summer. Dean has been invited to give a talk in Berlin.



Ginka Kubelka

In the fall of this academic year, I was teaching Biological Chemistry, Physical Chemistry Lab I, and assisted Dr. Debashis Dutta with the Instrumental Analysis Lab, where we included one of the new instruments in the STEM building. During the spring semester, teaching Intro to Organic Chemistry, Physical Chemistry Lab II, and supporting Dr. Franco Basile with the laboratory part of Quantitative Analysis kept me busy. This spring we had four lab sections in

Quantitative Analysis, which is one of the labs that moved to the new STEM building last year. All new instruments were implemented into the scheduled experiments, so that all students were able to get some hands-on experience with state of the art instrumentation in the nice new lab.



Bruce Parkinson

The Parkinson Group now consists of two post docs (Lenore Kubie and Josh Stecher) and four graduate students - Kevin Watkins, Brandon Durant, Ted Kraus and a recent addition Yuqi She. Ted was recently awarded Sara Jane Rhoads Award for Outstanding Research as a graduate student in chemistry at UW. There are three funded research projects in the Parkinson group including a grant for the Basic Energy Sciences division of the Department of Energy for studying fundamental aspects of photoexcited electron transfer across the semiconductor electrolyte interface, a grant from the National Science Foundation to investigate the storage of solar energy in a photochargeable redox flow battery and a joint NASA funded project with Carrick Eggleston in Geology that is investigating photoelectrochemical processes on Mars with a joint post doctoral scientist Tom Sorenson and a geology graduate student Alero Gure. We are also excited about a project where, in collaboration with the Hoberg Group, we are developing a new class of nanoporous two dimensional covalent organic framework polymers that have a myriad of potential applications. A composition of matter patent has been filed on these novel materials and we are making significant progress on their synthesis and applications with some internal money from the School of Energy Resources. Our science outreach project, the Solar Hydrogen Activity research Kit (SHArK), the engages undergraduates and high school students to discover new materials capable of storing solar energy by splitting water into hydrogen and oxygen recently lost its funding but post doc Lenore Kubie and Professor Parkinson have started a company, SHArK Science Outreach LLC (<http://sharkscienceoutreach.com>), to attempt to keep this project alive since some student participants actually produced some useful materials that have resulted in peer reviewed papers in high impact journals.



Brian Leonard

The Leonard research group has had many exciting changes over the last year. Sami defended her PhD and graduated in December. In addition, Dale Clouser and Chris Bammerlin graduated in May. Current group members James Thode and Daniel Harris are working toward their PhDs and Dan passed his preliminary exam this spring. Ken Madsen has been visiting several graduate schools and will be graduating in May of this year. The Leonard group also picked up several new undergraduate researchers this spring including Alex Fox, Nicholas Bolton, Lance Kailey, and Ben Staldine. Through the help of the current and former students, the group published four papers and have several more under review. Ken and Brian attended the national ACS meeting at San Diego and presented their research and Yagya represented the group at the Fall ACS meeting in Philadelphia. Former student, Jack Stacy graduated from UW with a master's degree in chemical engineering and is now in medical school in North Dakota. Dr Leonard was granted tenure last summer and became the Chair of the WY section of the ACS. He also continues to serve as an Advisory Board Member for the Journal Materials Research Express. Last fall, he invited his post-doctoral advisor Frank DiSalvo out to Wyoming to deliver the annual Coates Lecture.

Alumni Corner

Gregory Waetzig, B.S. 2013

Growing up on the plains of Gillette, Wyoming I always had an interest in materials under extreme conditions given that I worked as a wellhead pumper/roustabout during my summers in high school where there was always a constant struggle to prevent paraffin buildup on tubing and rods used in the downhole environments of oil wells. This experience instilled in me an interest in materials with an emphasis on the design of materials that can operate under harsh conditions as required for many applications in conventional and renewable energy.

With my interest in materials and the ability to attend the University of Wyoming declaring for a chemistry B.S. degree once I moved to Laramie in the Fall of 2009 appeared to be the natural choice. While at the University of Wyoming, I successfully ran for and elected President of the American Chemical Society undergraduate chapter my sophomore, junior, and senior years. I am very thankful I did as the experience opened up the door for an undergraduate research opportunity with Prof. Brian Leonard during my sophomore year. The chance to perform research under the supervision of Prof. Leonard was an easy decision as he was also interested in working with materials under extreme conditions where we designed bimetallic carbide catalysts using a salt flux synthesis to function in the harsh environments of a PEM fuel cell. The success we had from my undergraduate research led to two published manuscripts, one in *Journal Materials Chemistry A* where the journal referees designated it as a "Hot Paper!" and another in *Materials Research Express (MRX)* where the MRX Board Members nominated Prof. Leonard for Emerging Investigator in Materials Science. I enjoyed doing research so much that it made me realize that I should and could push my experience and knowledge further by looking into pursuing a Ph.D. in chemistry.

Upon joining the Prof. Sarbajit Banerjee's group in Buffalo, NY in the summer of 2013 I instantly found out how much of an influence his work had on not just the materials science/inorganic chemistry community as he accepted an offer from Texas A&M University to move his research group down to College Station the following year.

Since moving to College Station my research has focused on utilizing low-temperature solution-chemistry to trap different polymorphs and morphologies of metal oxides and oxyhalides with a non-hydrolytic sol-gel approach. One thrust of my research has been to try to stabilize tetragonal HfO_2 at room temperature as it has some very intriguing dielectric properties, but is generally only accessible at temperatures above 1720 °C. I successfully stabilized the tetragonal phase though by scaling the material to nanometer-sized dimensions where the increased contribution from surface energy terms outweigh the contribution from the bulk free energy. Upon making this discovery, we published our findings to *Chemical Science*. We've also published further findings where we've been able to observe in real-time the atom-by-atom transformation from the monoclinic to tetragonal polymorph in *Nature Communications*. The second thrust of my research examines the modulation of electronic structure through dopant incorporation in rare-earth oxyhalides for photoluminescent nanomaterial applications. My findings for this project has been published in *Nanoscale* where we demonstrate successfully doping Tb^{3+} into a GdOCl lattice where we then examine the activation pathways and recombination channels upon X-ray excited optical luminescence since direct optical excitation has been well established.

The opportunity to do undergraduate research and learn about materials from Prof. Leonard is one that has been invaluable as well as enlightening to me since it set up the path for me to go to graduate school as well as experience the joy of making independent discoveries while designing materials. The personal realization of the vast amount of knowledge that I had yet to discover is what drove me to be successful and with the advice from Prof. Leonard, consider pushing it even further by pursuing a Ph.D. in inorganic chemistry and materials science. Thank you to everyone who has helped me along my path, especially Brian Leonard, the Department of Chemistry, and the University of Wyoming.

2017 Undergraduate Awards

The following students were acknowledged at our Annual Undergraduate Awards Luncheon on April 20th, 2017.

Superior Student Award

Jessica Hunt

Jacob Williams

Kaycee Fillmore

Joshua Walmsley

Alexander Sawaya

Trae Travitz

Dakota Lucht

Sean Kasprisin

Matthew Poremba

Elayna Mahone

Samuel True

Eva Koplín

Tyler Schriber

Hannah Mills

Sally Ann Murray

Alexander Fox

Aaron Erickson

Ashley Moody

Kenneth Madsen

Erin Fulton

Andrew Goodenough

Tyler Myers

Jonathan Cauffman

Jim Schroeder

Sophia K. Indah Daisy

Francis Castellarin

Karissa Resnik

Cody Anderson

Jacob Coleman

Courtney Colwell

Wendy Hansard



Department of Chemistry Awards



CRC Press Freshman Chemistry
Achievement Award
Eva Koplín

2017 Undergraduate Award in
Analytical Chemistry
Tyler Schrieber

2017 Undergraduate Award in
Inorganic Chemistry
Kristina Quick

2017 Undergraduate Award in
Organic Chemistry
Jonathan Kephart



Board of Visitors Student
Service Award
Kasey N. Trotter



Outstanding Freshman Award
Tyler Myers

Outstanding Sophomore Award
Kaycee Fillmore

Outstanding Junior Award
Jacob Williams

Outstanding Senior Award
Erik Herrera

Howard H. Heady Scholarship in Chemistry
Cody Anderson

Walter F. and Barry D. Gasdek
Scholarship
Trae Travitz & Joshua Walmsley

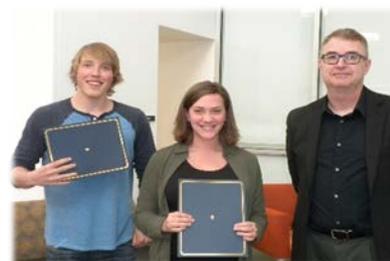
Arthur Gray Janssen Award
**Courtney Colwell, Sally Ann Murray
& Kasey N. Trotter**



Asplund Academic Excellence Prize
Jonathan Cauffman



Asplund Undergraduate
Research Prize
Veronica Spaulding



Raulins Undergraduate
Research Prize
Jordan Brophy & Kenneth Madsen

Edgar Bailey Smith
Chemistry Scholarship
Jim Schroeder

Clifford C. Hach Memorial Scholarship
Ethyn Etchechoury & Rylie Pilon



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