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Chemistry and Advanced Materials Science Building



In 1948, the UMD Science Building (now the Chemistry Building) was built in a field uphill from the (then) main campus on East 5th Street. It was one year after the Duluth State Teacher’s College had become the University of Minnesota Duluth. The new building inaugurated a new campus and provided critically important new educational opportunities in Duluth, MN. Today the building is the oldest structure on the main UMD campus (exceeded in age only by the Research Laboratory Building housing the Large Lakes Observatory, the Limnology Building on London Road, and Glensheen - all of which are more remote UMD buildings). Designed to serve 300 students in all science disciplines, the Chemistry Building now serves over 3,000 students studying chemistry and biochemistry courses. While much-loved, it no longer provides the cutting-edge laboratory space, and the necessary classroom, office and instrument space needed by our department.

(continued on page 3)

Dear Friends and Alumni of UMD Chemistry and Biochemistry,



I am happy to share with you highlights from the past year. The department is educating and graduating amazing students (congratulations to the 67 undergraduates and 15 graduate students who received degrees this year! See p. 18-19), pushing back the frontiers of scientific knowledge (with 48 publications in peer-reviewed journals), improving pedagogy (see p. 9, 15), and making a difference in the northern Minnesota region (e.g., our Chemistry and Biochemistry Club work, p. 17 and faculty participation in Science on Deck, p. 11). We have also been busy planning a new building (CAMS, p. 1, 3), which, pending bonding and additional funding, would house our department for years to come.

I hope that you enjoy reading through this copy of Transitions as much as I have. The work that we do here is much enhanced by the generous support of our alumni and friends. Your gifts help us to provide scholarships to deserving students, to maintain a strong undergraduate research tradition, and to support our instructional labs and undergraduate and graduate student development.

Please share with us your recent accomplishments and stop by if you are in the area. In October 2016, we will be celebrating the department's Diamond Jubilee (60 years of providing chemistry and biochemistry teaching and research!). Please join us if you can (see p. 12 for more details).

We will have many new and interesting things to share with you in our next issue!

Sincerely,

Elizabeth Austin-Minor

Transitions - Summer 2016

The Newsletter of the UMD Department of Chemistry and Biochemistry

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Chemistry and Advanced Materials Science Building, cont.



With \$2.25 million in design funding (\$1.5 million of this from the State of Minnesota), the department has been hard at work over the past two years designing a beautiful new state-of-the-art building. Led by former department chair Bilin Tsai, the Building Committee of department faculty and staff has worked with architectural firm BWBR to create architectural plans for a \$43-million, 56,000-square-foot building, with \$27.2 million of the building's construction costs requested through this year's state bonding bill. The CAMS

(Chemistry and Advanced Materials Science) Building is designed to house both the Department of Chemistry and Biochemistry (which now has 22 faculty and graduated 67 majors this year) and the Advanced Materials Center (AMC), a new center whose personnel will focus on research of importance to the region and the state, both economically and environmentally. Pending passage of the state bonding bill, we are ready to begin construction, and are excited to be adding a handsome and highly functional building to the Duluth campus to complement our state-of-the-art teaching and biochemical research facilities in the Swenson Science Building. It is planned for a location by the Medical School, with a skywalk connecting it to the rest of campus. Its themes include "Science on Display" and linkages between the past, the present, and the future, and it is designed to celebrate Duluth's cultural connections to the bedrock and forest and lake, and to industry and materials.

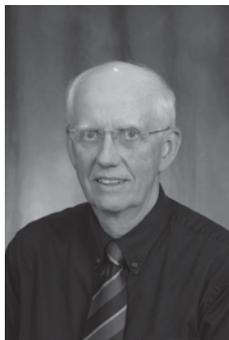
There will be three floors with offices, laboratory space, and gathering places for students and faculty. The departmental office and the AMC office will be located on the first floor, which will be a gateway into the campus from the surrounding road and parking areas. The skywalk on the second floor will connect to the existing Medical School Building and the rest of campus. The third floor will consist of research lab, office space, and gathering areas for small group discussions. The exterior of the building is designed to highlight its position overlooking Lake Superior and to provide lots of natural light for the science on display. There will be outdoor seating areas and landscaping providing a perfect setting for our summer departmental cookouts and other gatherings.



Please feel free to contact the department office for further information on this building's progress.

Faculty & Staff Updates

Fond Farewell To:



Robert Carlson retired in May 2016 after fifty years on the UMD faculty. Dr. Carlson grew up in the small town of Howard Lake, MN and earned a B.S. in Chemistry from the University of Minnesota. After graduating with honors from the U of M, he went on to earn a doctorate degree from Princeton University. He then completed a fellowship at Harvard University, where he worked with Professor E. J. Corey, a Nobel Prize winner.

Robert joined the UMD Department of Chemistry in 1966 as an Assistant Professor. He was promoted to Associate Professor in 1970 and to Professor in 1974. In 1986, Dr. Carlson began a two-year term as Acting Vice Chancellor for Academic Administration, followed by an additional two-year appointment as Vice Chancellor for Academic Administration from 1988 to 1990. He also served as the director of the Institute for Lake Superior Research from 1990 to 1993.

During his time at UMD, Robert published 80 papers in scholarly journals and received 15 patents. Most importantly, he mentored countless students, both undergraduate and graduate, during their time at UMD and beyond. Dr. Carlson is looking forward to his position as the director of the Advanced Materials Center project currently in the planning stages.



James P. Riehl retired in December 2015 after sixteen years on the UMD faculty. Dr. Riehl was appointed SCSE Dean in 2000 and served the College in this capacity for fourteen years. During his time as Dean, undergraduate enrollment grew 49%, graduate enrollment grew 110%, twelve new academic programs were added to the College, and the number of degrees awarded increased 85%.

Jim Riehl is now fully retired, but he is working on finishing several writing projects involving molecular chirality, applications of group theory in chemistry, and international STEM education.

Welcome To:



Jacob Gauer joined the department in January 2016 as an Instructor in Biochemistry. He earned B.S. degrees in Biology and Biochemistry and Molecular Biology and an M.S. in Chemistry from UMD where he studied weak interactions between peripheral membrane binding proteins using calorimetry and thermodynamic modeling. He then earned a Ph.D. in Biological Chemistry with an emphasis in Molecular and Cellular Biophysics from the University of North Carolina at Chapel Hill where he studied DNA bending dynamics induced by DNA mismatch repair proteins using single-molecule fluorescence microscopy. Throughout his training, Dr. Gauer also studied and implemented evidence-based teaching practices in undergraduate and graduate level chemistry courses, and he has contributed this expertise to proposed developments in the graduate curriculum in collaboration with other SCSE faculty. As an educator, he strives to create classroom environments and course content that help students create connections between different scientific disciplines, between coursework and real-life, and between people.

In addition to his teaching interests, Jacob is committed to bolstering the campus climate for LGBTQ+ students at UMD by serving on the campus-wide GLBT Commission and the SCSE Multicultural and Diversity Committee. He is also working to revamp the graduate student orientation program in the Chemistry and Biochemistry Department to better prepare incoming and returning graduate students to serve as teaching assistants. Jacob and his partner, Aaron, are both avid classical musicians and are both excited to join community-based ensembles, including the Twin Ports Wind Orchestra and the Lyric Opera of the North.

Faculty & Staff Updates, cont.



Melissa Maurer-Jones joined the department in January 2016 as an Assistant Professor with a specialty area of analytical chemistry. She earned a B.S. in Chemistry from the University of St. Thomas and a Ph.D. in Chemistry from the University of Minnesota-Twin Cities, where she applied bioanalytical tools to study the toxicity of engineered nanoparticles. Dr. Maurer-Jones completed her postdoctoral training at ETH Zurich in Switzerland. Working in the Institute for Biogeochemistry and Pollutant Dynamics, she examined the role of sunlight in the photodegradation of biodegradable polymers. The Maurer-Jones group at UMD works at the intersection of analytical chemistry, materials science, microbiology, and environmental chemistry to ask questions related to the health of our natural water systems. Using a variety of analytical chemistry tools, the group aims to understand how plastics and organic pollutants found in lakes, rivers, and oceans are transformed by sunlight and microbial forces. Her research emphasis fits with many of the research themes at UMD and Dr. Maurer-Jones looks forward to the collaborative opportunities through the Swenson College of Science and Engineering and beyond.

Melissa particularly enjoys working with students, both in the research lab and the classroom. She finds it exciting to watch students gain the breadth and depth of the field in the classroom and then master their craft in the research lab. In addition to her work at UMD, Melissa, husband Jonathan, and kids enjoy hiking and exploring the North Shore and this spring have enjoyed watching/playing baseball.



Erin Sheets joined the department fully in May 2016 as an Associate Professor in biochemistry and biophysical chemistry after several years in a shared position between the College of Pharmacy and Chemistry and Biochemistry Department. Dr. Sheets earned a bachelor's degree in Chemistry from Juniata College (PA) and a M.S. and Ph.D. in Chemistry from the University of North Carolina at Chapel Hill. She next joined the Department of Chemistry and Chemical Biology at Cornell University as a postdoctoral associate. She joined the Penn State Chemistry Department as an Assistant Professor and moved to the University of Minnesota College of Pharmacy in 2009 as an Associate Professor. The Sheets Research Group is driven to understand how molecules interact to control biological function in live cells and biomimetic systems. Her laboratory works at the interface of biophysics, biochemistry, cell and molecular biology, analytical and physical chemistry, optics and materials science. Her group investigates functional interfacial lipid-lipid and lipid-protein interactions, signal transduction, and the roles of macromolecular crowding on protein-membrane and intermembrane interactions that mimic exocytosis. These experimental approaches are also useful for investigating interactions at biosurfaces and biosensors. Erin has enjoyed longstanding research collaborations with her departmental colleagues, Drs. Ahmed Heikal and Anne Hinderliter.

Dr. Sheets is delighted to join the Department in a more formal manner. She particularly enjoys teaching biochemistry to juniors and seniors. Erin loves working with the graduate and undergraduate students in her group and seeing them thrive post-UMD. Erin is the founding advisor for the Society of Chemists and Biochemists (SCB), which focuses on the professional development of our undergraduate and graduate students and creates a community within the Department. She is currently serving on the Executive Council of the Biophysical Society. Erin and her husband, Ahmed Heikal, enjoy exploring Duluth and its surroundings, spoiling their two cats, and hosting SCB dinners at their home.

Congratulations To:



Brian Gute has been selected as the first director of the Center for Excellence in Teaching and Learning. Brian has been teaching at UMD for eight years. During that time he served as an Instructional Development Service Faculty Fellow for STEM Education, organized summer workshops for high school science teachers, and is currently providing leadership in the Swenson College of Science and Engineering initiative to integrate active learning into courses across the college. In addition, he is just completing a year-long research project comparing a flipped (active) classroom format to more traditional teaching methods, with plans to publish his results in journals focused on the scholarship of teaching and learning. Prior to teaching chemistry, Brian published extensively as part of a research group at the Natural Resources Research Institute and planned and coordinated numerous international scientific workshops.

Faculty & Staff Updates, cont.

Congratulations To, cont.:



Ahmed Heikal received a 2016 UMD Outstanding Academic Advisor Award for his work with students during the 2015-2016 academic year. Dr. Heikal earned his Ph.D. in 1995 from the California Institute of Technology, where he worked on ultrafast laser spectroscopy and molecular dynamics. Prior to coming to UMD in 2009, he was an Associate Professor of Bioengineering at Pennsylvania State University. Ahmed will teach general and physical chemistry courses in the upcoming academic year, while also directing an active research lab.



Romesh Lakhan received a 2016 Outstanding Student Organization Advisor Award for his work with the Chemistry and Biochemistry Club during the 2015-2016 academic year. Since joining the department in 2011, Romesh has been very active in community outreach, including several highly successful events intended to increase awareness of the importance of STEM education. Romesh will teach general chemistry in the upcoming academic year.



Venkatram Mereddy, known familiarly as “Reddy,” was promoted to Full Professor in March 2016. Dr. Mereddy received his Ph.D. in 1996 from the Indian Institute of Technology in Kanpur, India, for work on asymmetric synthesis via chiral acetals. He spent three years as a research associate at Purdue University and an additional four years at the Herbert C. Brown Center for Borane Research, also at Purdue, prior to his arrival at UMD in 2004. Dr. Mereddy teaches higher-level courses in organic synthesis and medicinal agents and directs a research program in therapeutics development for cancer and neurodegenerative diseases.

Viktor Nemykin received the 2016 UMD Chancellor’s Award for Distinguished Research/Creative Activity. This award honors excellence in research or creative activity, scholarly or artistic contributions to individual disciplines, and dedication to student research. Viktor obtained his Ph.D. from the Institute of General and Inorganic Chemistry, National Academy of Sciences, Ukraine. After spending several years at Tohoku University in Japan and Duquesne University in Pittsburgh, he came to UMD in 2004. Viktor is co-author of more than 170 peer-reviewed research papers and three book chapters, and currently is among the top five most cited researchers at UMD. His research in the field of functional materials attracted more than \$2.1 million dollars in funding over the last 10 years.



Thank You To:

The department would like to thank **Gregory Rohde** (inorganic chemistry) and **Elizabeth Weberg** (general chemistry) for their teaching contributions to the 2015-2016 academic year. We look forward to working with you again in the future.



<https://www.facebook.com/UmdDepartmentOfChemistryAndBiochemistry>

Looking Back: UMD Graduate Education in Chemistry



Pictured: James C. Nichol, Donald Harriss, Vincent Magnuson, Larry Thompson, Robert Carlson, Ron Caple

UMD has its historical roots in the Duluth Normal School which was established in 1895 and later became the Duluth State Teachers College (DSTC) in 1921. In 1947, DSTC became the University of Minnesota Duluth, the second campus of the University of Minnesota (UM) system after the Twin Cities campus. Professor Francis (Red) B. Moore served as the department head of the Department of Chemistry from 1952 to 1972, a two-decade long period of significant growth in student enrollment, faculty hiring, and new academic programs at UMD.

Early in his headship, Prof. Moore sought ways to strengthen the department by securing ACS certification for its undergraduate chemistry degrees and, later offering a graduate degree. These goals would require additional faculty hires to expand course offerings and to increase

research activities, capabilities, and equipment. For an eleven-year period starting in 1957, seven new faculty members were hired. This group was successful in establishing strong research programs, securing grant funding and new instrumentation, and acquiring a core collection of chemistry journals. With strong support from UMD Provost Ray Darland and Science Division Head Bill McEwen, Dr. Moore and his colleagues developed a strong proposal for an M.S. Chemistry degree. Despite local support, Dr. Moore and the UMD Chemistry faculty encountered strong resistance from the UM system concerning the development of a new graduate program at UMD. However, two individuals on the Twin Cities campus were particularly strategic and supportive. They were Dr. Stuart Fenton, the Head of the Chemistry Department and Dr. Bryce Crawford, Professor and Department Head of Chemistry and, later, Dean of the Graduate School. After eight years of planning, persistence, and convincing evidence of research productivity, the M.S. in Chemistry at UMD was approved in February 1964. It was the first master's degree in the sciences at UMD, and the first to offer a Plan A research-based M.S. The program was approved in 1964 in the areas of inorganic and physical chemistry. As additional faculty were hired with expertise in organic and analytical chemistry, graduate students were able to specialize in all of the sub-disciplines of chemistry. The first graduate students started in Fall 1964 with the first student completing his M.S. in 1967 in organic chemistry. Two years later, a biochemist was hired to bring the number of sub-disciplines to five.

Since its inception, there have been 308 M.S. Chemistry graduates, including 287 Plan A research-based degrees. Currently, there are 33 graduate students in the program. Recent graduates are going to medical school (e.g. University of Minnesota-Duluth, University of Washington School of Medicine), law school (University of St. Thomas), veterinary school (Iowa State), Ph. D research programs (e.g. Stanford, University of California-Irvine, Purdue, University of Michigan, University of Iowa, Washington University, Dartmouth, University of Minnesota Twin Cities, University of Utah) and into the workforce (e.g. Waters Corporation, Ecolab, Sigma-Aldrich) and include researchers at government labs (EPA) and teachers (at K-12 schools, community colleges, and 4-year colleges and universities).

SCSE Academy of Science & Engineering



The Academy of Science and Engineering was established in 2002 to recognize alumni and special friends of the Swenson College of Science and Engineering who have distinguished themselves through their participation, commitment, and leadership in their chosen professions. Our 2015 inductee to the Academy is Dr. Mengtao He, Senior Research Fellow, Henkel Consumer Goods.

Dr. Mengtao He came to UMD as an international exchange student from China. Mengtao received a M.S. degree in Chemistry from UMD in 1989 and his Ph.D. from the U of M Twin Cities in 1993. He is currently a Senior Research Fellow at the Dial Corporation/Henkel Consumer Goods Inc. and focuses on corporate sustainability interests in North America. Over the years, he has received many corporate diversity and sustainability awards. "My commitment to helping other people is something I took from my time at UMD into my career," said Mengtao He.

Alumni Spotlight: Dr. Rolf T. Weberg

Executive Director, UMD Natural Resources Research Institute

Dr. Weberg grew up in Mankato, Minnesota and attended the University of Minnesota Duluth where he graduated with a B.S. degree in Chemistry (1982). He received a Ph.D. in Inorganic/Organometallic Chemistry from the University of Colorado, Boulder (1986). After two post-doctoral appointments, he embarked upon a 25-year career in the R&D division of the DuPont Company. He left DuPont in 2014 as the Global Technology Manager for DuPont's Building Innovations Business – Surfaces Division.

Dr. Weberg assumed leadership of the University of Minnesota Duluth's Natural Resources Research Institute in March 2014. As Executive Director, he is responsible for the operation, integration and performance of the Institute and its 130 full time and 40+ part time and student employees in fulfilling the University of Minnesota's applied research role in natural resource and economic development as chartered by the Minnesota Legislature in 1983.

Today, NRRI is recognized as a model for bridging between the University of Minnesota and state stakeholders to define, develop and deliver research solutions that balance economic development and entrepreneurial support with natural resource and environmental management. Dr. Weberg works to build productive relationships with Institute constituents including industry, business, agency partners, environmental leaders and Minnesota communities.



Active Learning Cohort and Workshops

SCSE Dean, Joshua Hamilton, has called for all faculty within the college to begin incorporating more active learning in their classes. At its heart, active learning is any in-class activity that requires students to do more than passively listen to a lecture and take notes. When it is done well, active learning gets students excited and engaged with the material they are studying. Active learning is not a new concept, but despite its proven effectiveness in increasing student success; especially among women and underrepresented groups in the fields of math, the sciences, and engineering; it has not been widely adopted at the college-level.

As part of this initiative, Dean Hamilton created the first Active Learning Cohort during the spring of 2015 that included himself and seven faculty members from departments across the college: Chemical Engineering, Chemistry & Biochemistry, Civil Engineering, Computer Science, Mechanical & Industrial Engineering, and Mathematics & Statistics. This facilitated-group met throughout the spring with a faculty development professional from the Center for Educational Innovation (CEI), reading and discussing the book *How Learning Works*, by Ambrose, et al, and discussing strategies to increase student success in STEM coursework.

During the 2015-16 academic year, the original cohort continued to meet, organized four workshops on Active Learning facilitated by Kris Gorman from CEI, and initiated the second group of Active Learning Cohorts in the spring of 2016. The response by SCSE faculty to the call for participants in this second generation of cohorts was fantastic. Thirty-eight faculty (including seven from Chemistry & Biochemistry) from across SCSE were divided into six cohorts, each facilitated by a member of the original Active Learning Cohort. These new groups followed the same format as the original group and will continue to meet throughout the fall of 2016. A third round of Active Learning Cohorts will start in the spring of 2017.

New Graduate Education Initiative at the Large Lakes Observatory

As part of a National Science Foundation funded effort, professors at the Large Lakes Observatory (LLO), led by Dr. Kathryn Schreiner of the Department of Chemistry and Biochemistry, are rethinking and reworking first year curriculum for graduate students at LLO. While significant work has been done in recent years on integrating active learning, capstone projects, and community partnerships into undergraduate classrooms in the Swenson College, this represents one of the first coordinated efforts to integrate these education techniques into the graduate level classroom.

The new course sequence (Limnology I and II and Limnology Practice I and II) will introduce graduate students from a variety of undergraduate backgrounds to the interdisciplinary science of Limnology, the study of inland waters. These courses will be a one-year sequence, with laboratory/practice and lecture sections each semester. Laboratory and field activities will be fully integrated into lectures so students can learn how the science is done and get hands on experience collecting data and field samples while they use this raw data and data sets from the literature in classroom analyses and discussions. Both the laboratory and lecture sections will be taught using an active learning framework, with students accessing course material outside of class via a course website, leaving class time to apply that knowledge to various individual and group projects, data analysis, and discussions. This will allow students to combine their scientific knowledge with applicable scientific skills in the classroom, with input from classmates and instructors.

Another unique aspect of this course is the formal community partnerships that the instructors have set up with local community groups, including private environmental consulting firms, government labs, and nonprofits. The goal with these partnerships is twofold: first, to foster career networking connections between our graduate students and local partners, and second, to help our students learn career-applicable skills and knowledge that as academics we would not necessarily be able to teach them. Community partners will bring our students a project or issue they are currently working on, and in order to solve this issue or complete the project students will have to perform fieldwork, laboratory analytical work, and/or online data mining work. After that, they will be required to produce various deliverables for the partner, which could include a study report, a formal presentation, an organized data set, or anything else the partner requests. Our goal is to introduce our students to the wide range of non-academic career options available to them and give them the skills and formal network of colleagues necessary to succeed in careers outside of the academy.

This effort is funded by the National Science Foundation for three years, and at the conclusion of the project, we will make our online content in the form of stand-alone learning modules, classroom activities, and data sets available on a public website for other educators to use. Additionally, we are partnering with University of Minnesota Duluth education professors who are experts in student assessment to help us determine the success of our program and our students' learning outcomes. This data will be made available through peer-reviewed literature after the conclusion of this project.

A Day in the Life of a SURP Student

by Katelyn Koval, 2015 SURP Participant

Before receiving my SURP, or Summer Undergraduate Research Program, scholarship, I really had no idea how to go about applying for a program or even how to work in one of the many Professors' labs scattered throughout the Chemistry & Biochemistry department. A graduate student presented me with the information and I was able to find the application and requirements on the department's website. Truth is: the process was pretty painless and I am delighted to say I have had the opportunity. I worked in a biochemistry-focused lab with Dr. Joseph Johnson as my research advisor. A typical day in the lab for me is outlined below:

7 am: I wake up to my alarm and check the weather; since I walk to campus each day, I want to be aware of any rain showers. Next, I check my e-mail and schedule to ensure that I am aware of any meetings with my research advisor or the graduate students I work with.

8 am: I arrive at the lab and immerse myself in the technique I am preparing for. Today, I will perform a transformation procedure to replicate my plasmid/template. For this, I need to retrieve ice from the common store room, locate the correct materials, and follow one of our lab's procedures. Although the full amplification of our stock occurs in multiple steps, they are performed over the course of three days.

10:30 am: With the transformation complete, I prepare to image the PCR products that I finished the previous day. By using gel electrophoresis and imaging the resulting gel, I can analyze how well the reaction worked.

12 pm: I head out of the lab to eat the lunch that I brought from home.

12:30 pm: Back in the lab, I begin researching how to improve the PCR reactions that I have been working to improve for the last week. The reactions have many intervals and temperatures that I can adjust which always makes it hard to pick just one. In this time, I also work on organizing the data I have already collected for better comparison of the PCR trials.

3 pm: After the analysis of the previous PCR reactions, I pick one parameter to adjust and try again to optimize the band I want to see. After thawing all of the reagents on ice, I combine them in a specific ratio and add them to the PCR machine, which runs for about three hours.

5:30 pm: After popping the PCR reaction into the machine, I leave the lab thinking about how to improve my research results for the next day.

A Summer of Research

by Gage Sachs, 2015 SURP Participant

The atmosphere of the University of Minnesota Duluth campus has a curious feeling as the spring semester ends. The halls have emptied until one has the vague impression of a recently deserted city. Instead of the typical uneasiness that accompanies passing through seemingly empty buildings, there is a sense of belonging knowing that there is a community of fellow researchers tucked away and that you are there for a challenging, yet rewarding, purpose. Participating in the Summer Undergraduate Research Program (SURP) was one of the pivotal opportunities of my college career, but I realized it was more than just the lab work that influenced me and many of my fellow students.

Research projects have their challenges, but that is one of their attractions as there is a sense of satisfaction and accomplishment that comes with developing a well-planned research project. What made SURP different than laboratory classes, or even small research projects during the main academic year, was the involvement from beginning to end. Being able to ask targeted questions, and then think, read, and plan a way to solve a problem with the available tools and apply the lessons taught in class to see everything come together was what made the long days and long nights worthwhile. Though not every issue that arises comes with the luxury of being foreseen and prepared for, being able to think on your feet and modify set plans or devise contingency plans to face the unexpected problems is one of the greatest abilities to learn. Because of this independent, hands-on, perhaps even on-the-fly, learning, some of the greatest academic strides are made during the summer months as students, free from classes, have the opportunity to explore their curiosities and follow threads of ideas down side avenues and alleyways.

The summer is not just filled with hours in the lab and reading journal articles, though. Duluth provides ample escapes and the community of researchers has a culture that appears as dedicated to outdoor pursuits as it is to research. Outside of the lab, lunch hour on the patio is one of the best learning opportunities. The sense of community brings lab groups together to enjoy the sun and share ideas. Table talk includes everything from cooking recipes to lab techniques, books to weekend camping adventures.

The full days spent at the laboratory working alongside students and professors build relationships and an enriching culture. A culture that, a new researcher quickly learns, asks far more questions than originally imagined. This quality of people creates an atmosphere of curiosity and encouragement, and the sheer enjoyment that comes from everyone loving what they do is what made a summer of research an opportunity to become refreshed and truly excited about learning and future possibilities.

UMD Large Lakes Observatory's Science On Deck: Sharing the Science of the Great Lakes with the Twin Ports Community

Outreach to the greater Duluth, MN community is an important part of our job in the Department of Chemistry and Biochemistry. It helps us to engage community members, share our cutting-edge research with local citizens, and excite students about studying chemistry and the physical sciences. One important way that two of our chemistry professors do this is through Large Lakes Observatory-sponsored summer events called "Science on Deck."

Drs. Elizabeth Austin-Minor and Kathryn Schreiner are both professors jointly appointed between the Large Lakes Observatory and the Department of Chemistry and Biochemistry, and their research focuses on the chemistry of aquatic systems. The Large Lakes Observatory (LLO) is dedicated to the study of large lakes all over the world, and as such is the only research institution of its kind. The Observatory is made up of

professors from many different departments at UMD, all connected by their focus on the study of the physics, chemistry, ecology, and geology of large lake systems worldwide.

One important way that Drs. Minor and Schreiner and the rest of LLO do their work is on a research vessel owned by UMD, the R/V Blue Heron. This ship allows LLO scientists to make measurements and collect samples all over Lake Superior and the rest of the Laurentian Great Lakes and is integral to LLO's research program.

The Large Lakes Observatory and the crew of the R/V Blue Heron open up the ship one Friday afternoon every month in the summertime for ship tours and a science talk by an aquatic scientist from the greater Duluth, MN area. The ship is docked between the Duluth Great Lakes Aquarium and the Duluth Entertainment and Convention Center. Crew and scientists (professors and graduate students) are available to give free tours of where aquatic scientists live and work for up to weeks at a time while they are out on the lakes, and there is also a short talk by a local aquatic scientist about the lake research they are currently pursuing.

Previous talks have focused on the geologic history of the Great Lakes, the effects of the 2012 flood on Lake Superior chemistry and ecology, and the use of microscopic organisms, preserved in sediment cores, to reconstruct the ecologic history of the lake, among many other topics.

For residents of the Twin Ports community, or visitors to the area, the summer 2016 Science On Deck dates are Friday, July 22; Friday, August 26; and Friday, September 23 from 12:00pm to 4:00pm. Hope to see you there!



Diamond Jubilee Celebration of Chemistry at UMD



Saturday, October 8, 2016

Beginning with the hiring of Assistant Professor J.C. Nichol and continuing for twelve years, the UMD Department of Chemistry experienced a period of considerable faculty hiring, enrollment growth, development of the MS-Chemistry program, and ACS certification for our bachelor's degree. The faculty hired in the 1950's and 1960's created a strong foundation for dedication to teaching, high-quality undergraduate and graduate research, meaningful and varied international collaborations, and a commitment to social justice.

In May 2016, one of the faculty members hired during this period, Professor Robert M. Carlson, retired after a distinguished 50-year career on the UMD faculty. To honor this occasion, the UMD Department of Chemistry and Biochemistry invites you to celebrate the legacy and contributions of UMD retired Chemistry faculty and their students over the last sixty years and to recognize the achievements of current Chemistry and Biochemistry faculty.

A program of presentations highlighting the history of the Department, the legacy of dedication to teaching, the focus on high-quality undergraduate and graduate research, and the impact of international collaborations will be followed by a scientific poster session and evening dinner. This will be a great opportunity to reconnect with former and current faculty, students, and colleagues.

More information can be found at: <http://d.umn.edu/chem/event.html>

Spotlight on Students

The Chemistry and Biochemistry department has over 400 undergraduate majors and over 30 MS Chemistry graduate students each year. Collectively, they are a very impressive group and we would like to introduce some of them to you.

Undergraduate



James Lyon (left), **Megan Strehlke** (center), and **Kathryn Peterson** (right) were awarded Casmir Ilenda Awards for Outstanding Undergraduate Research during the 2016 Symposium. The award was named after Dr. Casmir Ilenda (BS-Chemistry, Class of 1969). Dr. Ilenda received an excellence in research award from his long time employer, Rohm and Haas Pharmaceutical, and then gave this award to the department to recognize excellence in undergraduate research.

Sheila Paintsil (BS-BMB, Class of 2017), an undergraduate researcher in the Sheets Group, was chosen to participate in the highly selective Summer Research Program in Biophysics. This program will be held at the University of North Carolina at Chapel Hill from May to July of this year.

Katherine McMahon (BS-BMB, BA-Chemistry, and BA-Hispanic Studies, Class of 2016), **Caitlin Pederson** (BS-Chemistry, Class of 2016), **Kathryn Peterson** (Pictured, BS-BMB and BA-Chemistry, Class of 2016), and **Megan Strehlke** (BS-BMB, Class of 2016) presented in the 2016 University Honors Capstone Project. University Honors students commit hundreds of hours of work to expand their undergraduate experience.



Chemistry & Biochemistry Club officers **Matt Iverson**, **Jasmin Mellesmoen**, **Cyrina Ostgaard**, and **Kaelt Simpson** received the UMD Arrowhead Award for their exemplary service to the Twin Ports community.

UMD varsity soccer players **Katherine McMahon** (BS-BMB, BA-Chemistry, and BA-Hispanic Studies, Class of 2016) and **Kathryn Peterson** (BS-BMB and BA-Chemistry, Class of 2016) received the seventh annual NSIC Myles Brand All-Academic with Distinction Award. The honor, named for the late NCAA President Dr. Myles Brand, is bestowed to senior NSIC student-athletes who have a cumulative grade point average of 3.75 or higher, are exhausting their eligibility and are on track to graduate.

Graduate



The teaching contributions of our graduate students are essential in our ability to deliver lecture and lab courses to so many UMD science, engineering, and education students. We thank all of them. MS students **Hannah Rhoda** (left), **Hyojung Kim** (center), and **Megan Currie** (right) were selected to receive SCSE Outstanding GTA Awards.

In addition, MS students **Ben Horn**, **Cody Tennant**, and **Yimo Wang** were the recipients of the departmental outstanding teaching awards.

Profile of Faculty with Distinguished Scholarly Achievements: Paul Siders



Dr. Paul Siders is an instructor and advisor whose scientific talents and personal qualities create a content-rich, positive and supportive educational experience for our students. He is known to create a community of learners in the classroom and instructional laboratory by communicating his own scientific curiosity and enthusiasm for knowledge.

Dr. Siders earned his B.S. in Chemistry, Mathematics, and Physics from the University of Wisconsin–Whitewater followed by a Ph.D. degree from the California Institute of Technology in 1983 working with Professor Rudy A. Marcus, Nobel Laureate in Chemistry (1992) for his work on the theory of electron transfer in chemical reactions. He joined UMD after postdoctoral research experience at the Radiation Laboratory, University of Notre Dame (1983-1985) and teaching at Florida Atlantic University in the beautiful, winterless Boca Raton (1985-1986).

Since joining UMD in 1986, Paul and his family have enjoyed the more bracing beauty of Duluth. Paul has been recognized for his high academic standards coupled with compassionate assistance and encouragement to students. Dr. Siders has taught many undergraduate courses including Aspects of Chemistry, General

Chemistry, Introductory Environmental Chemistry, and Physical Chemistry. He also taught Physical Chemistry to graduate students.

While his courses are considered challenging, Paul has been successful in motivating and encouraging his students to work hard, be persistent, and to think critically. As students discover early in his courses, Paul is a patient and caring instructor. This is reflected in the number of students who fill his office during (and often outside of) his office hours. He also brings considerable curricular innovation to the classroom, especially in the physical chemistry and computational lab courses, such as designing new experiments, integration with current research published in peer-reviewed journals, and incorporating computational methods into our courses.

In addition to his outstanding teaching and service records, Dr. Paul Siders is a fine theoretical and computational chemist who is interested in a wide range of research areas, including statistical thermodynamics. He has published 22 papers while advising and mentoring several MS graduate and undergraduate students in his laboratory, an experience he considers to be “an honor and pleasure.”

Dr. Paul Siders is an earnest teacher and lifelong learner who values clear thinking, intellectual discipline, and hard work. “Excellent students and colleagues have made teaching a happy career for me here at UMD.” Paul said. In this student-centered university, Dr. Siders sets a very high standard for all of us to follow.

Update on Brian Gute's "Flipped" Classroom Approach



The 2015-16 academic year was a busy one for Brian Gute, who conducted a side-by-side quantitative study of the effectiveness of a traditional lecture approach versus a "flipped" classroom approach on student learning in second-semester General Chemistry. For those of you not familiar with the term, a "flipped" class is one in which students access the course content through readings

or videos prior to scheduled meetings, while class time is devoted to small group work focused on applying concepts and problem-solving techniques. This approach allows students to spend more time practicing the course material with the instructor and teaching assistants available to help work through any issues.

The flipped class met four days per week, like the traditional lecture course, but instead of a small group discussion section on the fifth day, students in the flipped class had the option of coming to class on the fifth day if their group has fallen behind on in-class work. On a typical day, students would complete their pre-class work before coming to class, spend class time working through assigned conceptual and quantitative problem sets, and then have a short follow-up homework assignment on the material due the following day.

Pre-class work consisted of one to three short video lectures followed by a short multiple choice quiz. The intent of the videos was to provide all of the foundational knowledge that students would need to tackle the assigned problems in class. During class, the students worked on the assigned problems in groups of three or four. When needed, Brian provided short lectures to cover additional information that was not covered in the videos or "just in time" spontaneous lectures to address common misunderstandings that several of the groups were struggling with.

For purposes of the comparative study, students in both sections worked the same homework problems and took the same quizzes and exams. Results from fall semester showed that, on average, students in the flipped class performed 3.88% higher on identical exams and their final grades were 5.45% higher (half a letter grade). Additionally, overall student success (based on the percentage of students who received D's, F's or withdrew from the course) increased. The percentage of students in the flipped course earning D's, F's, or withdrawing from the course (16%) was half that of the lecture course (32%). Perhaps more importantly, students were more engaged in the flipped class and reported enjoying the course more and having a stronger interest in chemistry as a result of the course.

Some of the positive feedback from students in the flipped class included:

"Compared to Chem I, I love this teaching system. In class I enjoy chemistry!"

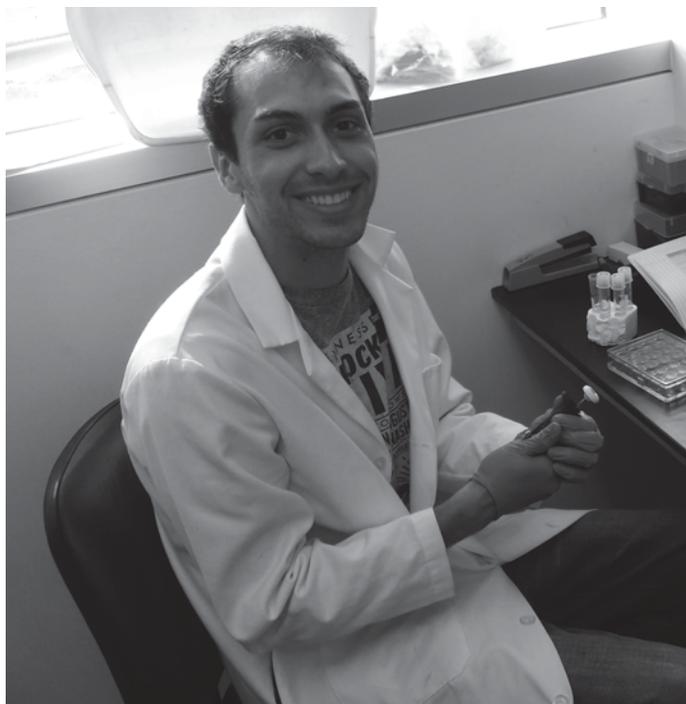
"I really enjoy the class. I love that I can come to class and work out problems instead of coming to a lecture."

While preparing the course was a huge amount of work, Brian says that he doesn't regret a minute of the time spent. When asked about the class, he said:

"...teaching the flipped course was the most fun I've had in my eight years of teaching. Instead of lecturing to students, I spent my time talking with students and answering their questions. And it seemed like any time the work was getting to me, something happened in class that just made day and reminded me why I was putting so much effort into this new class format."

If you'd like to know more, Brian's final report to the Center for Educational Innovation can be found online, along with reports on all of the other ELI projects, at: <http://cei.umn.edu/initiatives-grants/experiments-learning-innovation>.

Featured Graduate Student: Anthony Meger



It is our pleasure to introduce Anthony Meger (first year Chemistry MS student) of New Prague, MN.

Anthony graduated from New Prague High School in 2011. He then attended UMD and in 2015 completed his undergraduate degree in Biochemistry and Molecular Biology, with a minor in math. Anthony has a great deal of interest in biochemistry and math, even completing graduate level courses as an undergraduate. He performed undergraduate research with Dr. Steven Berry during his senior year. His research project entailed using protein crystallography to determine structural differences amongst a series copper proteins that have sequentially varied reduction potentials. Anthony applied to the Chemistry MS program to not only continue this work, but to add computational analysis to the systems he studied. Anthony envisioned and independently initiated a collaborative project between Dr. Alessandro Cembran and Dr. Berry, where he coupled his experimentally derived protein crystal structures, of which he has now obtained two, with computational study to help quantify the roles of protein structure and dynamics, polarity, and solvent accessibility on the copper protein's reduction potential. Anthony has learned extensive computational methods, using supercomputing time at the Minnesota Supercomputing Institute to perform molecular dynamics simulations and sophisticated quantum mechanical calculations on the protein. Anthony's creativity and hard work was rewarded this spring when he was awarded a prize for his poster presentation at the Minnesota Supercomputing Institute Research Exhibition on April 26, 2016, entitled "Molecular Dynamics Simulations of Azurin Variants." Anthony won the prize which included \$1K travel award to attend a conference of his choice. The enthusiasm and expertise that Anthony brings to the lab is reflected on his lab mates, for which he is both an example and a reference. The same passion, competence, and accessibility make him a great teaching assistant, capable of showing the students that chemistry does not end with the lab report, and that broader open ended questions wait just outside the door. Upon completing his MS project, Anthony plans on pursuing a Ph.D. degree. Congratulations to Anthony on his excellent work combining computation with experimental work on proteins! We wish him all the best as he applies to Ph.D. programs around the country.

Featured Undergraduate Student: Jasmin Mellesmoen

We are pleased to introduce Jasmin Mellesmoen (President, UMD Chemistry and Biochemistry Club, 2015-2016) of Bloomington, MN.



Jasmin has served as both an officer and president of the Chemistry and Biochemistry Club during her time at UMD. These roles required her to organize several community outreach events that included experiments meant for public consumption, as well as social opportunities for UMD students and faculty.

Due to the success of these educational events, Jasmin was awarded the Undergraduate Bulldog Award for the 2015-2016 academic year. This award recognizes students who have served in at least one area where outstanding service has positively affected the University community within the past calendar year.

In addition to her duties with the Chemistry and Biochemistry Club, Jasmin is the vice president of the UMD Pre-Dental Club where she assists students applying to dental school, recruits dental professionals to speak to the club, and secures shadowing opportunities for club members. She has also served as a traveling officer for Students Today Leaders Forever, where she organized multiple short-term community service events and an eight-day volunteer bus trip to Atlanta, GA. In total, Jasmin has volunteered more than 1500 hours since her start at UMD.

When Jasmin is not assisting others with learning and outreach opportunities, she can be found in the UMD dormitories helping students adjust to life away from home as a Residential Advisor. Additionally, she has served the Chemistry and Biochemistry Department as a Stockroom and Lab Coordinator Assistant.

Jasmin's hard work and enthusiasm has been greatly appreciated by the department and we look forward to seeing what she will accomplish next.

Outreach and Community Engagement

The UMD Department of Chemistry & Biochemistry Club has been very active this year. In addition to weekly meetings where students explore topics in chemistry and engage in social activities, the club has gone out into the community to share their passion for learning and science. One highlight was the STEM (Science, Technology, Engineering, and Mathematics) "Science Spooktacular" that the club organized for the Duluth community. Members of the Chemistry and Biochemistry Club, as well as Biology, Integrated Biosciences, and Physics students were joined by Swenson College of Science and Engineering faculty in conducting mini hands-on experiments for the more than 500 elementary school students and their families. Participants explored concepts in density, gas laws, solubility, electromagnetism, inertia and conservation of energy, fluorescence, symbiosis, and human anatomy. Females have historically been underrepresented in the STEM disciplines, so it was especially exciting to see the large number of young women participating in the event. Jasmin Mellesmoen, featured above, told a FOX 21 reporter covering the event, "Maybe the cure for cancer could be in one of these children's heads and our job is to ignite that spark." See the full article at <http://m.fox21online.com/news/science-spooktacular/36020802>

Graduating Seniors: 2015-2016



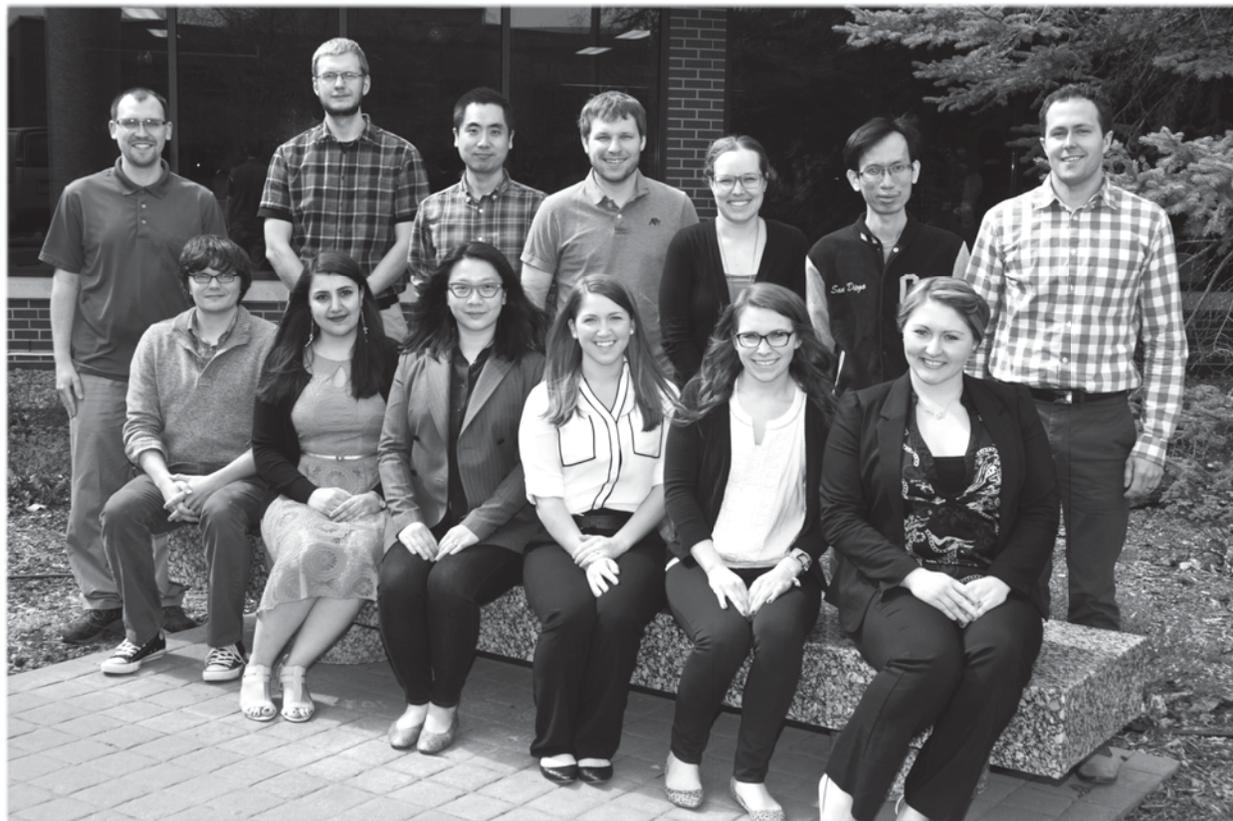
DivineMercy Bakare, BA-Biochem
 Grant Balaich, BS-BMB
 Brenden Berry, BS-Chem*
 Michelle Botts, BS-BMB*
 Jason Bugbee, BS-BMB
 Alexander Carlberg, BA-Chem
 Brooke Carlson, BS-BMB
 Jessica Christensen, BA-Chem
 Rachel Cook, BS-BMB
 Nicholas Dalton, BS-BMB
 Paul Degeneffe, BS-Chem
 Katherine Dennison, BS-BMB
 Brittany Diep, BS-Chem
 Elliott Eckhoff, BS-BMB
 Hannah Feldhacker, BS-BMB*
 Nicolette Fisher, BA-Biochem
 Jared Gailey, BS-BMB*
 Zachary Gardner, BS-BMB
 Jake Gibbons, BS-BMB
 Salam Girmay, BS-BMB
 Daniele Grathwohl, BA-Biochem
 Elliott Haapoja, BS-Chem

Jared Harm, BA-Biochem
 Samuel Headlee, BS-Chem
 Hillary Heiling, BA-Biochem*
 Zachary Her, BS-BMB
 Trevor Hilk, BA-Biochem
 Skyler Hubbard, BS-Chem*
 Shahzaad Jahangier, BS-BMB*
 Dustin Johantgen, BS-BMB
 Alexander King, BS-Chem
 Mohamud Kodah, BS-Chem
 Austin Koepf, BS-Chem
 Jeanine Kotnik, BA-Biochem
 Katelyn Koval, BS-BMB
 Cody Kunzman, BS-BMB
 Katrina Lau, BS-BMB
 Dakota Lundstrom, BS-BMB*
 Dillon Lundstrom, BS-BMB*
 Alec Lutz, BS-BMB
 James Lyon, BS-Chem*
 Elizabeth Marshall, BS-BMB
 Brady McGuire, BS-BMB
 Katherine McMahan, BS-BMB*

Chad Miller, BA-Biochem
 Sarah Moe, BS-BMB
 Noah Nagle, BS-BMB
 Kabamba Ngoyi, BA-Chem
 Haley Noeldner, BS-BMB
 Sheila Paintsil, BS-BMB
 Alexandra Paulson, BA-Biochem
 Colin Pearson, BS-Chem*
 Caitlin Pederson, BS-Chem*
 Bryant Pepin, BS-Chem
 Kathryn Peterson, BS-BMB*
 William Renier, BS-Chem
 Nick Ruha, BS-BMB
 Gage Sachs, BS-BMB*
 Mariah Scharf, BS-BMB
 Tanner Schumacher, BS-BMB
 Jesse Skogstad, BS-Chem
 Seth Stafki, BS-BMB
 Megan Strehlke, BS-BMB*
 Micah VandeWege, BS-Chem
 Taylor Ward, BS-BMB*
 Meghan Wicklund, BS-BMB
 Christopher Wojciehowski, BS-BMB

Master of Science in Chemistry Program Graduates: 2015-2016

The Master of Science in Chemistry degree program at UMD provides an excellent opportunity to acquire and develop advanced technical expertise and problem-solving skills expected of today's chemical and biochemical professionals. Coursework is designed to provide a firm fundamental basis for students going into a variety of chemical specialties in both professional and academic settings. Following is a list of students who are completing their Master's degree over the 2015-2016 academic year:



Top Row: Justin Hines, Benjamin Orpen, Hyojung Kim, Shawn Stafki, Megan Currie, Khiem Chau Nguyen, Benjamin Horn

Bottom Row: Cole Holstrom, Mahtab Fathi Rasekh, Yimo Wang, Stephanie Kobany, Hannah Rhoda, Amber Nelson-Porter

Not pictured: Kaila Hanson, Cody Tennant

Student Awards

Our department is fortunate to be able to recognize our outstanding and deserving students. Former students, faculty, and friends of the department established some of these awards; others are from organizations in the field. Award details can be viewed at <http://www.d.umn.edu/chem/undergraduates/awards.html> and <http://www.d.umn.edu/chem/graduates/awards.html>

UNDERGRADUATE AWARDS:

Swenson Family Foundation Scholarships for Academic Excellence

2015/2016: Molly Connor, Delaney Coy, Matthew Danley, Micaela Den Hartog, Jacob Kluver, Jacob Martin, Morgan Tinquist, Jace Wagner

Achievement in Organic Chemistry (ACS) Award

2015/2016: Tanner Schumacher

Achievement in Inorganic Chemistry (ACS) Award

2015/2016: Alexander King

Achievement in Organic Chemistry (POLYED) Award

2015/2016: Allan Omete

HyperCube Scholar Award

2015/2016: Abby Quinnell

Peterson Memorial Scholarship

2015/2016: Kevin Wielenberg

Lake Superior Section of ACS Outstanding Senior

2015/2016: Gage Sachs, Mariah Scharf

The American Institute of Chemists Outstanding Senior

2015/2016: Brenden Berry

F. B. Moore Academic and Leadership Award

2015/2016: Michelle Botts, Skyler Hubbard, Kathryn Peterson, Gage Sachs

General Chemistry Award for Excellence

2015/2016: Anthony Goelz, Christin Libal, Bryan Reutzel, Alyssa Zachow

Warren F. Davis Award for Excellence in Biochemistry

2015/2016: Danica Grover, Vitaliy Goncharov, Kaleigh Nelles, Kaelt Simpson

Catherine E. Cox Scholarship for Chemistry & Biochemistry

2015/2016: Tana O'Keefe, Kayla Schabacker

James H. Maguire Scholarship

2015/2016: Shawn Bourgeois, Ellen Monzo, Kaelt Simpson, Yishu Zhang

Undergraduate Analytical Chemistry Award

2015/2016: Kaelt Simpson

Robert Bayer Memorial Scholarship

2015/2016: Ntsang Anye, Robert Miller

Larry C. Thompson Inorganic Chemistry Award

2015/2016: Caitlin Pederson

James C. Nichol Scholarship

2015/2016: James Lyon

Casmir Ilenda Award for Outstanding Undergraduate Research

2015/2016: James Lyon, Kathryn Peterson, Megan Strehlke

Dr. Nathan and Elaine Ballou Scholarship

2015/2016: Mackenzie Liebl, Luke McCutcheon, Faith Murphy, Scott VonBank

Departmental Honors

2015/2016: Brenden Berry, Michelle Botts, Hannah Feldhacker, Jared Gailey, Hillary Heiling, Skyler Hubbard, Shahzaad Jahangier, Dakota Lundstrom, Dillon Lundstrom, James Lyon, Katherine McMahan, Colin Pearson, Caitlin Pederson, Kathryn Peterson, Gage Sachs, Taylor Ward

Student Awards, cont.

Departmental Outstanding Service Award

2015/2016: Elizabeth Marshall, Jasmin Mellesmoen, Kathryn Peterson

Chemistry and Biochemistry Outstanding Undergraduate Teaching Assistant

2015/2016: Sarah Moe, Kaelt Simpson, Alexandra Theis

GRADUATE AWARDS:

John C. Cothran Memorial Fellowship

2015/2016: Megan Currie, Erica Lueth, Amber Nelson-Porter, Hannah Rhoda, Yimo Wang, Shane Wilson

Moses Passer Graduate Fellowship

2015/2016: Khiem Chau Nguyen, Jonathan Fuchs, Benjamin Horn, Hannah Leopold, Conor Ronanye, Cody Tennant

UMD Siders Chemistry Graduate Fellowship

2015/2016: Tanner Blesener, Cole Holstrom

SCSE Outstanding Graduate Teaching Assistant

2015/2016: Megan Currie, Hyojung Kim, Hannah Rhoda

Chemistry and Biochemistry Outstanding Graduate Teaching Assistant

2015/2016: Benjamin Horn, Cody Tennant, Yimo Wang

CAMPUS AWARDS:

University Honors

2015/2016: Katherine McMahon, Caitlin Pederson, Kathryn Peterson, Gage Sachs, Megan Strehlke



2015-2016 Award Recipients

Research Publications

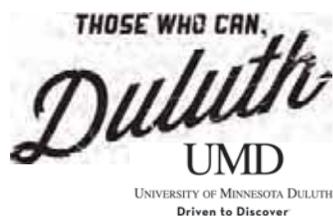
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- Belosludov, R.V., Rhoda, H.M., Zhdanov, R.K., Belosludov, V.R., Kawazoe, Y., **Nemykin, V.N.** "Conceptual Design of Tetraazaporphyrin- and Subtetraazaporphyrin-based Functional Nanocarbon Materials: Electronic Structures, Topologies, Optical Properties, and Methane Storage Capacities" *Phys. Chem. Chem. Phys.* 2016, 18, 13503-13518.
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- Li, Y., Rhoda, H.M., Wertish, A.M., **Nemykin, V.N.** "Organometallic Pyrene-containing Porphyrins: Synthesis, Characterization, and Non-covalent Interactions with C₆₀ Fullerenes" *J. Porphyrins Phthalocyanines*, 2016, accepted (invited paper for special issue).
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