

Chemistry Newsletter

University of North Dakota

Fall 2013



Welcome from Dr. David Pierce, Chair of the Chemistry Department

Warmest Wishes from the Chairman's corner! As always, this newsletter highlights the many important developments within our department over the last two years. However, I also want to turn things around and invite everyone in our audience to send us a quick note to let us know what YOU are up to. E-mail and post are always welcome, but Kim Myrum in our office has now put us at the crest of the social media tsunami, so you can also keep us updated by Facebook. <https://www.facebook.com/pages/UND-Chemistry/162768837104265>

We have worked on the evaluation of our undergraduate programs and I must give a well-deserved acknowledgement to Prof. Irina Smoliakova who did an outstanding job of shepherding these evaluations as Chair of our Undergraduate Program committee. I'm particularly pleased to report that our program has been fully approved by the American Chemical Society for another six-year cycle and to note that the ACS Committee on Professional Training made a special point to commend the department for its self-evaluation procedures and effective use of the results to strengthen its program. It also praised the department for its effectiveness in expanding the diversity in its faculty members, its success with recent acquisitions of major instrumentation, and its increased number of peer-reviewed publications (particularly the substantial number with undergraduate co-authors). Certainly, these developments are a credit to both the faculty and students who made them possible.

Last time I hinted at planned renovations to our central 'Reading Room' — where students and faculty often meet for study sessions and office hours — but now I can

report that the facelift is complete and the changes are being enjoyed by students, faculty and Alumni alike. Please read on to learn what's been done and to see a nice photo collage of the results.

Other noteworthy developments that deserve mention here are the Science article published by Prof. Mark Hoffmann (along with collaborators from the University of Oslo) that describes a new form of chemical bonding, The OpenEye Outstanding Junior Faculty Award in Computational Chemistry given to Prof. Jerome Delhommelle at the Fall 2012 ACS national meeting, and the Reverend Elmer & Min West Faculty Award given to Dr. Julie Abrahamson in recognition of her outstanding teaching. We are also excited that alumnus Dr. Kathryn Uhrich (B.S. Chemistry cum laude, 1986), currently Dean of Mathematical and Physical Sciences at Rutgers University, was presented with a 2012 UND Sioux Award for her outstanding contributions in polymer research and development of PolyAspirin.

In closing, I would like to make several important acknowledgements. My first is to the tremendous help provided by our staff members — Sandie Routier, Kim Myrum, Kem Wilkerson and Dave Knittel. Their efforts often go unheralded in departmental news but their hard work touches nearly every item in this issue. I would also like to acknowledge our alumni and friends for their generous gifts over the past year. This support continues to make possible the many scholarships and awards, lectureships, equipment acquisitions, and building improvements described herein.

Dave Pierce, December 2013

2012 Homecoming Speaker
Professor Charles E. Murry



In 2012, the Chemistry Homecoming speaker was **Professor Charles E. Murry**. On October 12, Prof. Murry presented a seminar entitled “*Regenerating the Heart: A Journey from Chemistry Major to Stem Cell Biologist*”.

Charles (Chuck) Murry is Professor of Pathology and Bioengineering at the University of Washington in Seattle. Murry is Director of the Center for Cardiovascular Biology and Co-Director of the Institute for Stem Cell and Regenerative Medicine. He obtained his B.S. in Chemistry from the University of North Dakota, his Ph.D. and M.D. from Duke University and did a fellowship in vascular biology at the University of Washington under Stephen M. Schwartz, M.D., Ph.D. His awards include a Burroughs Wellcome Career Award in Biomedical Sciences in 1996, the Presidential Early Career Award in Science and Engineering in 2000 and 3 awards for outstanding teaching in basic sciences. The Murry laboratory’s research focuses on myocardial infarction and strategies to enhance the heart’s lack of intrinsic regenerative ability. Active projects explore the molecular mechanisms that underlie the heart’s normal wound healing processes and in developing molecular and cell-based approaches to improve infarct repair, with a special emphasis on adult and pluripotent stem cells. They are a multidisciplinary group, doing basic work in molecular biology and regulation of gene expression, cell biology, tissue engineering, animal models of disease and analyses of human tissues.

2013 Abbott Lectures



The 2013 Abbott Lectures were given by **Debra R. Rolison** of U.S. Naval Research Laboratory. Dr. Rolison heads the Advanced Electrochemical Materials section at the NRL, where her research focuses on multifunctional nanoarchitectures for such rate critical applications as catalysis, energy storage and conversion, and sensors. She is also an Adjunct Professor of Chemistry at the University of Utah (2000–present). She was a Faculty Scholar at Florida Atlantic University (1972–1975) and received a Ph.D. in Chemistry (UNC–CH, 1980). Rolison is a Fellow of the American Association for the Advancement of Science, the Association for Women in Science, the Materials Research Society (Inaugural Class), and the American Chemical Society and received the 2011 ACS Award in the Chemistry of Materials, the 2011 Hillebrand Prize of the Chemical Society of Washington, and the 2012 C.N. Reilly Award of the Society for Electroanalytical Chemistry. Her editorial advisory board service includes Analytical Chemistry, Langmuir, Journal of Electroanalytical Chemistry, Advanced Energy Materials, Nano Letters, the Encyclopedia of Nanoscience and Nanotechnology, and Annual Review in Analytical Chemistry. When not otherwise bringing the importance of nothing and disorder to materials chemistry, Rolison writes and lectures widely on issues affecting women (and men!) in science, including proposing Title IX assessments of science and engineering departments. She is the author of over 200 articles and holds 24 patents.

2012 Abbott Lectures



The 2012 Abbott Lectures were presented on April 26 and 27 by **Professor Michael D. Ward**, with seminars “*The Rapidly Changing Face of Scientific Publication*” and “*Pathological Crystallization: Kidney Stones and Pathways to Therapies by Molecular Design.*”

Michael D. Ward is a Silver Professor and Chair at chemistry department at the New York University, creator the Molecular Design Institute, Director of NSF-supported NYU Materials Research Science and Engineering Center, Editor for the ACS journal Chemistry of Materials, and Fellow of the Materials Research Society, the American Chemical Society, and the American Association for the Advancement of Science. Prior to 2006, he also was the faculty of the Department of Chemical Engineering and Materials Science at the University of Minnesota, and the Director of the University of Minnesota Materials Research Science and Engineering Center (MRSEC) from.

His current research interests include organic solid-state chemistry, crystal engineering, functional organic materials, crystallization, polymorphism, the role of biominerals in biomedicine and disease, organic epitaxy, and atomic force microscopy.

Joint Chemistry/Chemical Engineering REU Site



2011 REU Participants with Dr. Yun Ji (Chem. E., Summer Coordinator) and Dr. Evgenii Kozliak, REU PI

The Research Experience for Undergraduates (REU) renewal was granted by NSF. The joint REU site under SUNRISE group has been run continuously at UND Chemistry and Chemical Engineering since 2003 (four 3-year funding cycles), which makes it one of the few, if any, REU sites that enjoyed continuous NSF funding for such a long time period. For all these year, Dr. Evgenii Kozliak has been the program's PI. The co-PI is Dr. Wayne S. Seames from Chemical Engineering.

8 students per year are supported by NSF providing stipends, room and board and travel funding. Supplemental funding for 2-10 more students per summer has been provided by UND Graduate School, DOE and faculty mentors. For 10 weeks, students conduct research and attend weekly program sessions, with an emphasis on publication-quality research projects and the improvement of oral and written communications skills. SUNRISE faculty are committed to student-centered research on advancement of sustainable energy technologies. The continued success of the REU site is due to hard work of faculty mentors and summer coordinators (Drs. Irina Smoliakova, Chemistry and Yun Ji, Chem. E.).

Among student participants, 1/4 to 1/3 are outstanding minority students, e.g., Native American and Hispanic. Other participants are recruited, on a competitive basis, from both

UND and non-research colleges in the upper Midwest. Over 10 years, REU students co-authored more than 40 peer reviewed articles. Most of these students went on to continue their education in graduate school; they praise the program for its contribution to making this decision.

Among the specific features of our REU site are multidisciplinary projects and the ethics component, whose goal is to motivate participants to learn, and more importantly, to practice ethics in science. Four weekly sessions focus heavily on motivating students to think about the ethical impacts of their actions and instilling in them the desire to make the right decisions in ethical situations.

Chemistry Department has been very active in outreach and recruiting

We actively participated in ND State Science Fair organizing on-site tours with hands-on demonstrations on X-ray crystallography, nanoscience, chromatography, protein databank, and computational chemistry. A number of faculty and students participated also as judges on both regional and state science fairs.



We have over 140 students (out of 5 high schools) regularly coming to our 5th Annual Air Pollution Workshop (for more information see its web page <http://und.edu/conferences/air-pollution/index.cfm>) and learning about atmospheric research through lecture style presentations, performing hands on

demonstration and, last but not least, visiting the local airport to show to students the Citation aircraft used for atmospheric studies. We had also a couple of smaller workshops organized with hands-on demonstrations including that for 8 students from Fort Berthold college and 15 high school juniors from Hope-Page.



Through the US MASTER (Undergraduate Scholarships with Mathematics and Science Training in Environmental Research) program awarded last year by National Science Foundation we have recruited three new chemistry students - whom we would like to welcome:

James Sullivan, Elk River, MN
Jordan Grosz, Hazen, ND
Alexis Rodriguez, Grafton, ND



Laboratory Safety training. Each Chemistry department deals with and is concerned with Laboratory Safety. This year we were able to

get in place a new online training, thanks to the dedicated work of Nenny Fahrudin, an undergraduate student designing and installing it as part of her degree in education but going way beyond the routine requirements. We would like to thank her for dedicated Work on Design and Setup of the Online Chemistry Safety Training.

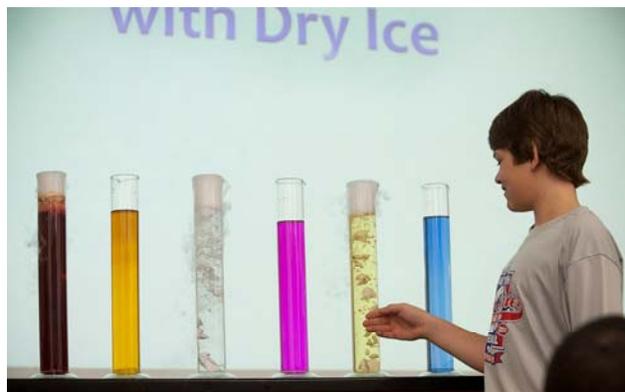
Undergraduate Chemistry Club Outreach Activities



An enthusiastic group of undergraduates from various majors (including chemistry) has brought the fun of chemistry to people and places around Grand Forks several times in the past year. In November 2011, a group brought demonstrations to the Century Elementary School Science Fair night. The elementary school students thoroughly enjoyed the dry ice balloons, liquid nitrogen frozen balloons, crushing pop cans, and acid-base testing with purple cabbage indicator. A group will go again to this year's event October 30.

In March, the Middle School Chemistry Fun Day brought more than 30 students to Abbott Hall for an afternoon of hands-on experiments in the teaching labs. Ten UND students worked with groups of 3-4 students as they learned about acids and bases using the Chemistry Rainbow kits from the ACS, and made slime. The UND students began and concluded the event with favorite demonstrations in the lecture hall, including the Bloody Hand, the Whoosh Bottle, Acid-base Indicators in solutions with dry ice, and the thermite reaction. Support from the Red River

Valley Section of the ACS allowed the purchase of chemistry items to send home with each participant.



For Earth Day, April 22, the group joined efforts with the Chemistry Graduate Student Association (CGSA) to bring demonstrations to the Purpur Arena for the annual Super Science Day, coordinated by Dakota Science Center. Our tables were easily among the more popular stations for the youngsters in attendance. Copies of the ACS magazine Celebrating Chemistry: Chemists Celebrate Earth Day were given to interested persons.

For Mole Day, October 23, 2012, the graduate students invited the Undergraduate Chemistry Club to join forces for an evening of "molerrific" chemistry demonstrations in the main lecture hall, Abbott 101. Fourteen undergraduate students, six graduate students and two faculty members presented more 75 minutes of chemistry excitement to a mixed audience of UND students and families with young children. It is hoped that this becomes an annual celebration.



Advisor Dr. Julie Abrahamson has enjoyed working with the undergraduates, and watching their eagerness as they explain the chemistry on a level that young people can begin to understand. The UND students find they have at least as much fun as the youngsters with whom they are working. The rewards are evident in the smiles after each event.

Reading room renovations

Renovation to reading room area was completed last year with the generous support of alumni donations to our general fund. In addition to new paint and new, more collaborative furnishings, the room now has glass cabinets to prominently display Scholarship Award plaques as well as graduate theses and dissertation. This room has become a very popular space for students to work on projects and to meet with faculty for extra help.



*Mark Hoffmann publishes
ground-breaking article in
the prestigious journal
Science*



Mark Hoffmann, Chester Fritz Distinguished Professor and computational chemist in the Department of Chemistry of the University of North Dakota has teamed with colleagues from the University of Oslo, Norway, to discover a new type of chemical bonding, distinct from the well-known covalent and ionic bonding.

Hoffmann and Tryve Helgaker, a well-known Norwegian scientist, and co-authors E.I. Tellgren and K. Lange have discovered a molecular-level interaction that science has puzzled over for decades but has never seen. In an article published recently in the internationally respected journal *Science*, *A Paramagnetic Bonding Mechanism for Diatomics in Strong Magnetic Fields*, *Science* 20 July 2012: Vol. 337 no. 6092 pp. 327-331. [DOI: 10.1126/science.1219703](https://doi.org/10.1126/science.1219703), Hoffmann and his colleagues describe their use of quantum chemical simulations to model the bonding in

diatomic hydrogen and also diatomic helium in extreme magnetic fields – extremes that are only attainable (at present) in stars near the end of their life.

Ordinary covalent or ionic bonds would fall apart under these conditions. However, within magnetic fields approaching half a million Tesla (versus the thousandth of one Tesla of a fridge magnet), the research team has shown that a net attraction could develop between two adjacent atoms when their spin states align. They have called this interaction ‘perpendicular paramagnetic bonding’ and have made predictions about the light emissions of these oddly bonded species. Perpendicular paramagnetic bonding is the stabilization of the anti-bonding σ_u orbital in the presence of a magnetic field. This stabilization occurs because a magnetic field lowers the energy of orbitals that correspond to counter-clockwise rotation. Normally, one would not think of an anti-bonding σ_u orbital as having the favored rotation (angular momentum), but a detailed analysis shows that it in fact it does in the presence of a magnetic field, provided that the orientation of the molecule is perpendicular to the field.

It is now up to astronomers and astrophysicists to see if the spectral signatures of these species can be detected in the emissions of white dwarf and other aged stars. “We computationally modeled [a bonding] behavior that we theorized, based on universally applicable physical principles,” said Hoffmann, an internationally recognized expert in the theory and computational methods used for elucidating molecular electronic structure. “We discovered a new type of chemical bonding. That’s a pretty bold statement, but I’m not kidding you! It’s a brand new type of chemical bonding, not previously known to science.” “Our discovery addresses one of the mysteries in astrophysics about the spectrum of white dwarf stars,” Hoffmann said. “White dwarfs have an unusual spectrum that has been thought to result from polymerized hydrogen and helium, which of course do not occur on Earth.”

*Dr. Jerome Delhommelle
selected for the ACS
Outstanding Junior Faculty
Award in Computational
Chemistry.*



The Computers in Chemistry Division of the American Chemical Society has awarded Dr. Jerome Delhommelle the ACS COMP OpenEye Outstanding Junior Faculty Award for his work presented at the 2012 Fall ACS meeting titled "Unraveling the mechanisms of crystal nucleation and growth at the nanoscale". The award is presented to up to four outstanding tenure-track junior faculty members based on the novelty and importance of their research. The award is designed to recognize the work of and assist rising new faculty members in gaining visibility within the COMP community.

*Collaborative Research grant
for Dakota BioCon from
National Science Foundation*

A group of scientists from both North Dakota (UND and NDSU) and South Dakota (SDSU and SDSMT) was awarded a National Science Foundation three-year grant for Dakota Bioprocessing Consortium "Dakota BioCon" to develop new methods for lignin conversion (UND Co-PIs P. Johnson and M. Hoffmann). The UND funded with \$1,500,000 research team includes Drs. A. Kubatova (lead scientist), M. Hoffmann, E. Kozliak, I. Smoliakova (Chemistry) and W. Seames, B. Tande and Y. Ji (Chemical Engineering). The most resilient yet abundant part of crop biomass is targeted, which is called lignin. This three-dimensional polymer is not amenable to common biomass treatment methods, so currently it ends up being burned as a heat source. Yet, lignin chemical structure suggests that in the presence of a specifically designed catalyst it may be thermally treated with highly pressurized water to yield chemicals that are currently produced from petroleum. If this task is accomplished, all of the major components of plant biomass could be converted into renewable biofuels and valuable chemical products, sources of plastics, pharmaceuticals and other by-products that the modern industry needs. The problem's ultimate complexity necessitates the development of integrated interdisciplinary collaboration spanning across the state borders; this is envisioned by the group. In addition to technical tasks, the group will tackle multiple educational activities, such as undergraduate and graduate research as well as science-promoting outreach targeting high school and tribal college students.



The Sioux Award goes to Kathryn Uhrich



Kathryn Uhrich, a 1986 UND chemistry department graduate and Homecoming speaker in 2008, wins The Sioux Award.

As a high-schooler at Grand Forks Central, Kathryn's chemistry teacher connected her with a research internship at the USDA Human Nutrition Research Center in Grand Forks. She continued that research through high school and college, and would go on to graduate cum laude from UND with a Bachelor of Science in Chemistry. "Math, Chemistry, German — there wasn't a class at UND I didn't like," she said. Her positive experience and interaction with her professors inspired her to continue her education at Cornell University, where she earned her Master of Science (1989) and Ph.D. in Organic Chemistry/Polymers (1992). She completed her post-doctoral research at the Massachusetts Institute of Technology and AT&T Bell Laboratories.

As founder of the Polymerix Corporation, her continued research has focused on polymerized drugs that more efficiently deliver treatment to targeted areas such as orthopedic implants, coronary stents and arthritic joints. In 1997, she patented PolyAspirin, which is now undergoing clinical trials as a material for a new type of cardiac stent, and co-founded Polymer Therapeutics, which focuses on using PolyAspirin for wound care. In addition, she is serves as Dean of Mathematical and Physical Sciences at Rutgers University in New Jersey,

where she oversees six departments and 300 faculty members.

"Being a woman scientist, people often say 'Are you sure you should do this?'" Kathryn said. "Just because I'm a woman doesn't mean I can't run a machine or do cool science." That prompted her to establish the Jeanette M. and Herbert W.A. Kroll Scholarship Endowment at UND, which is named in honor of her grandparents, who always encouraged her to do what she thought was best for her and is aimed at young women who are interested in science and engineering.

Her scientific honors include being named to the New Jersey's Technology Council Hall of Fame (2006), Outstanding New Jersey Scientist by the New Jersey Association for Biomedical Research (2004), and the Thomas Alva Edison Patent Award (2003). In February, New Jersey's Star Ledger newspaper named her one of "Jersey's 20 Biggest Brains." "Someone forwarded me the story, and I was reading through saying 'I know him, I know her ... wait, that's me!'" she said. "I still think of myself as some kid from North Dakota." In her scant free time, Kathryn enjoys traveling the world and hunting for the world's "10 Best Hikes." She lives with her husband, Jeff Holmes, another Grand Forks native, in Plainfield, N.J.

Richard Cochran, Chemistry graduate student, received a prestigious travel award to the meeting of Nobel Laureates in Lindau Germany



in the summer of 2013. Rich traveled, along with nearly 550 other young researchers from about 78 countries, to attend this elite

gathering in Lindau to discuss topics on an array of chemistry topics. Students and researchers alike used the forum to voice their ideas and discuss various projects all while building international networks. Rich's accomplishments go beyond research focusing also on outreach, not only within the department working on steering committee for Air Pollution workshop, but also completing impressive work in Turtle

Mountain Tribal College within ACS funded program CERAIS (Rich is a co-PI), on a setup of the analytical lab and providing research experiences for the American Indian students.

Awards to Chemistry Graduate and Undergraduate Students

- In 2012 and 2013 Dr. Roland G. Severson Graduate Research Awards were given to **Jiao Chen, Richard Cochran, and Steve Xu Wu**. In 2013 Dr. Roland G. Severson Graduate Teaching Awards were given to **Erica Ann Hicks & Mathew Etang Otang** Matilda M. Severson, along with the family and friends of Dr. Roland G. Severson, established the Roland G. Severson Chemistry Award Endowment in honor of her husband. By establishing this endowment, the outstanding contributions of Dr. Severson as a leader, scholar, educator, advisor and friend are recognized.
- The 2012 and 2013 Walter H. Moran Scholarship was given to **Kari Ann Kusler, Anastasia Lindahl, and Andrew N. Owen**, the undergraduate chemistry majors with highest scholastic achievements. Dr. Walter H. Moran, was a member of the UND Chemistry Department for some 45 years.
- The 2012 and 2013 Gustafson Scholarship, given to an outstanding junior majoring in chemistry, were awarded to **Kirsten J. McCullough and Leo Patrick O'Day**. The Ben G. Gustafson Chemistry Scholarship was established by Emil and Audrey Stoltz of Juliet, Illinois, in 1980 in honor of their long-time friend Ben. G. Gustafson.
- The Dr. D.A. Wardner Scholarship was awarded to **Laura Rae Elsbernd**. The Dr. D.A. Wardner scholarship endowment was established through memorial gifts from Mrs. C.A. Wardner, Joy Wardner Bostrom, Carl Arthur Wardner, Jr., family and friends. This endowment honors Dr. C.A. Wardner by providing scholarship assistance for students majoring in chemistry.
- The 2012 Dr. Charles Hurley Scholarship was awarded to **Tara Maria Boland**.
- In 2013, the Jeanette M. & Herbert W. A. Kroll Scholarship was given to **Katelyn M.**

Johnson. Dr. Edward J. O'Reilly Scholarship was given to **Andrew N. Owen**. Dr. Harold W. Haugan Scholarship was given to **Patrick William Olson** and the US Master Scholarship was given to **Nicole Blagoue & Cole Stevens**

Other News from the Department

- Baby Alexander Chu finally arrived 15 days late on December 20th at 12:47 AM from Jen and Rick Chu . He was 7.8 lbs and 19.5 inches. Both mommy and the baby are doing well.



News From Alumni

- **Dr. Felix Ngassa** (currently Associate Professor at Grand Valley State University in Allendale, Michigan) received the Center for Scholarly and Creative Excellence (CSCE) "Distinguished Undergraduate Mentoring Award" in February 2012.
- **Dr. Rashel Mokambe Sumpter** was offered an Assistant Professor of Chemistry position at Mohave Community College in Bullhead City, Arizona.
- **Dr. Yvonne Bongfen** was offered an Assistant Professor of Physical Chemistry position at Oklahoma Baptist University in Shawnee, Oklahoma.
- **Jeff Banning** employment changes that caused a move to Cedar Rapids, Iowa.
- **Dr. Michelle Ward** will be getting a promotion at the University of Pittsburgh
- **Katie Collette** (currently a graduate student at the Department of Pharmacology and

Physiology) wins National Institutes of Health NIGMS travel award.

- **Dr. Divine Dugah** has a new baby. Lena Nahnyonga Dugah (8 lbs 11.9 oz, and 19 inches long), born on 12/17/13 at York Hospital, Pennsylvania, United States.



The UND Chemistry Department is now on Facebook. To find us there, search for "UND Chemistry."

Thank you!

The Chemistry Department would like to express sincere appreciation to the following alumni and friends who supported the Chemistry Department during the last two academic years.

Bradley & Gayle Aafedt, Mr. & Mrs. Richard Baltisberger, Julie & Jeffery Banning, Mary & Douglas Carlson, Diana Deats-O'Reilly, Howard Efner, Darryl Fahey, Mary Margaret Frank, Sharon Giannetto, David Hampton, C. James Haug, Lisa Hesse, Phyllis Johnson, Michael Kemen, Shirley Kulevsky, Bette & Lynn Larsen, Chien-Wei & Kam Wei Liao, Walter Moran Jr., James & Renee Morley, Ali Navid, Chien-Hua & Susie Niu, Arlan Norman, Richard & Sandra Paur, Clark Rundell, Carol Sorum, Leon Stadtherr, Audrey Stoltz, Owen Webster, Curt White

Chemistry Alumni Newsletter
c/o Julia Zhao
UND Department of Chemistry
Abbott Hall Room 236
151 Cornell Street Stop 9024
Grand Forks, ND 58202-9024

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