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A Word from the Chair

By George McBane

As we start the fall 2016 semester, the department is enjoying six newly renovated teaching labs, improved support spaces for those labs, and substantially increased research space. These gains are an indirect effect of the opening of a new building on the other side of Campus Drive.

Kindschi Hall of Science opened in August 2015. The Biology and Cell and Molecular Biology departments moved from Padnos and Henry Halls into the new building. The Chemistry, Physics, Geology, and Biomedical Sciences departments worked together with the Dean's office to allocate the vacated spaces among themselves. Necessary renovations took place in two phases, largely during the summers of 2015 and 2016. Chemistry now occupies essentially all of the third floor of Padnos and a substantial part of the second floor.

Last fall our full-year General Chemistry students began using two roomy, pleasant labs on the second floor with a common space between them for computers and printers. A new satellite stockroom on the second floor supports both those CHM 115/116 labs and the new lab for our organic/biochemistry survey course, also on that floor.

This fall we moved into a new specialized teaching lab for upper-level synthetic chemistry, two renovated analytical chemistry labs with a dedicated instrumentation annex, and a renovated biochemistry lab. The stockroom was expanded and reorganized and a new space for instrument repair and maintenance was created. The stockroom and repair spaces host staff and students who are supporting 164 sections of lab classes each week.

Our available research space increased by about 50%. A big shared space that

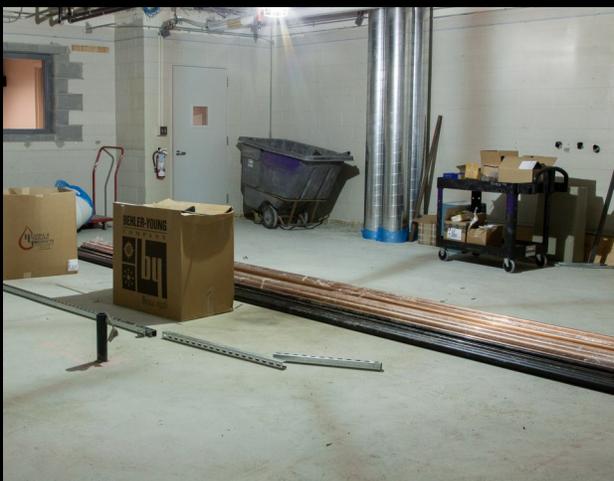
previously supported faculty and students from several different departments is now essentially devoted to Chemistry and was renovated to include several more bays with hoods and equipment for synthetic chemistry. This new space is reducing crowding in our existing synthetic spaces and we hope will be a big draw as we recruit a new organic chemistry professor this year. We gained new access to several small single-group labs that now house one organic and two analytical chemistry groups. The computational chemistry faculty, who had been working principally in the computational teaching lab associated with the physical chemistry curriculum, gained dedicated space on the second floor. Finally several of the chemistry education faculty have moved their research efforts into a space managed by the Integrated Science programs that has facilities for interviews, eye-tracking equipment, and similar operations.

Not all the dust has settled, and as of the beginning of September we still have a "punch list" of minor tasks remaining to be completed. We remain somewhat tight on space with respect to the activity level of both our research and teaching efforts. Nonetheless, things are substantially improved and we're excited about the new facilities. We are grateful for the long-term efforts of the department's Facilities Committee, the faculty and staff working groups who helped design the individual renovated spaces, the people in the Dean's office who listened carefully to our needs and advocated for us, and finally to Professor Blair Miller who knows more about Chemistry's space and its possibilities than anyone else. We look forward to the benefits these improved facilities will extend to our students and faculty.



PADNOS HALL BUILDING RENOVATIONS

Advanced Synthesis Laboratory



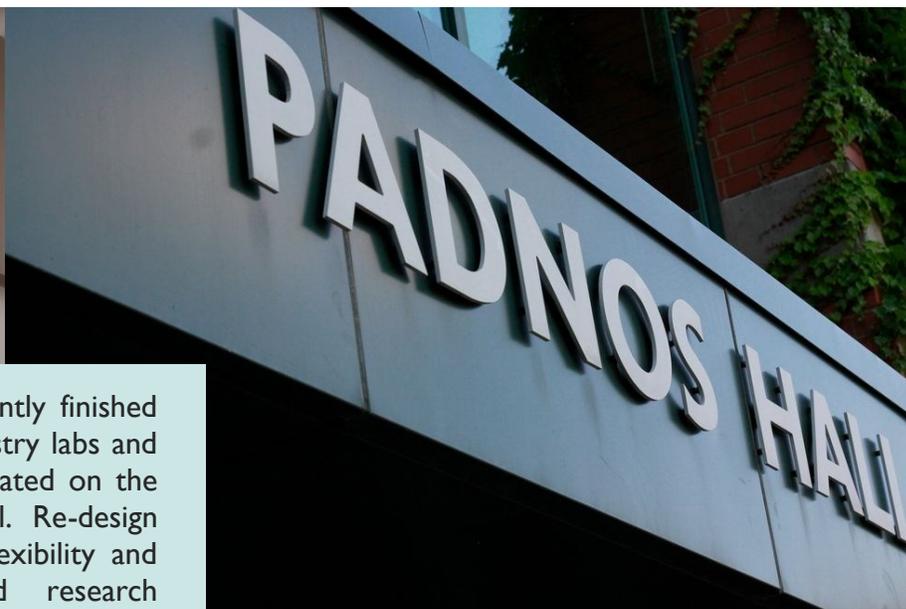
Expanded Stockroom



Expanded Research Space



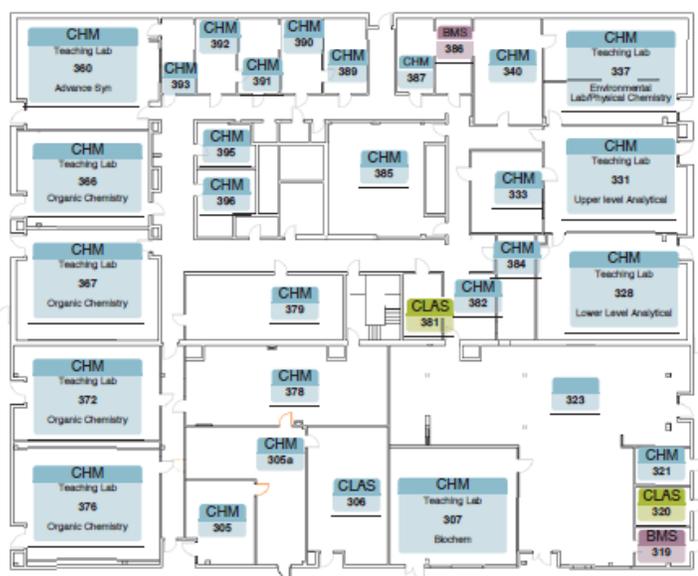
Instrumentation Suite



The Department of Chemistry recently finished renovating three instructional chemistry labs and an associated shared prep room located on the third floor of the Padnos Science Hall. Re-design of the interior spaces has added flexibility and capability to the teaching and research laboratories.

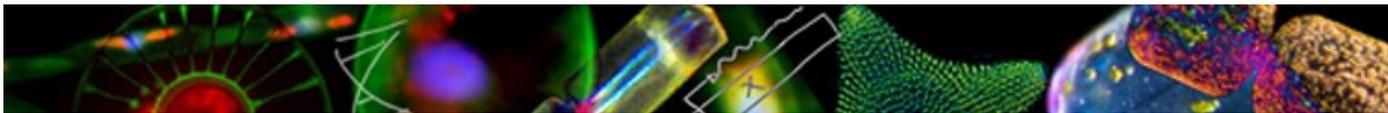
Some of the most impacted spaces were:

- converted what was once an analytical lab space into a new advanced synthesis laboratory
- converted a biochemistry laboratory into to a new analytical classroom with a new adjacent instrumentation suite
- expanded the stockroom to nearly double its size and added an instrumentation repair room
- expanded research capacity by nearly 50%




**GRAND VALLEY
STATE UNIVERSITY**
DEPARTMENT OF CHEMISTRY

Arnold C. Ott Lectureship in Chemistry for the 2015-2016 School Year



The Ott Lectureship remains a Grand Valley Chemistry Department tradition that honors the legacy of Dr. Arnold Ott, who was one of the co-founders of Grand Valley and served on the Board of Trustees for almost three decades. The Ott Lectureship was created and endowed by a gift from Arnold C. Ott and Marion Ott. Our Ott Lecturers, for the 2015-2016 school year, were Professors Sara Skrabalak and Geraldine Richmond.

Dr. Sara Skrabalak received her B.A. degree in chemistry from Washington University in St. Louis in 2002 where she conducted research with Professor William E. Buhro. She was the recipient of the Sowden Award in undergraduate research from the Department of Chemistry. She then moved to the University of Illinois at Urbana-Champaign where she completed her Ph.D. degree in chemistry in the fall of 2006 under the tutelage of Professor Kenneth S. Suslick. There, she was the recipient of the T.S. Piper Thesis Award for her work on porous materials. She then conducted postdoctoral research at the University of Washington – Seattle with Professors Younan Xia and Xingde Li, designing nanomaterials for biomedical applications.

She is the James H. Rudy Associate Professor of Chemistry at Indiana University – Bloomington and a recipient of both NSF CAREER and DOE Early Career Awards. She is a 2012 Research Corporation Cottrell Scholar, a 2013 Sloan Research Fellow, a 2014 Camille Dreyfus Teacher-Scholar, and recipient of the 2014 ACS Award in Pure Chemistry and 2015 Baekeland Award. Her research group focuses on nanomaterial design and synthesis.

Two lectures were scheduled on Thursday, April 14 and Friday, April 15, at the Robert C. Pew Grand Rapids campus and Allendale campus, respectively. The evening lecture on Thursday, April 14, was titled “From Honeycombs, Spider Webs and Snowflakes to Stellated Metals: Symmetry in Nature and Nanomaterials”. The afternoon lecture on the following day at the Pere Marquette Room, was titled “Shaping the Synthesis of Bimetallic Nanocrystals.”



Professor Sara Skrabalak & Professor George McBane

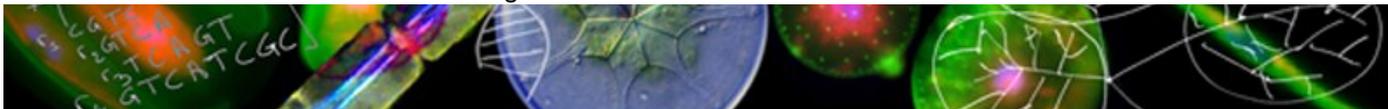
Geraldine Richmond, Ph.D., is the presidential chair and professor of chemistry at the University of Oregon. Her research focuses on nonlinear optical spectroscopy and computational methods applied to understanding the chemistry that occurs at complex surfaces and interfaces that have relevance to important problems in energy production, environmental remediation, atmospheric chemistry, and biomolecular surfaces.

Her scientific accomplishments include the Olin-Garvan Medal, the Spectrochemical Analysis Award, and the Joel Henry Hildebrand Award in the Theoretical and Experimental Chemistry of Liquids from the American Chemical Society. She also received the Oregon Scientist of the Year by the Oregon Academy of Science, the Spiers Medal of the Royal Society of Chemistry, the Bomem-Michaelson Award, and the American Physical Society Davisson-Germer Prize for Atomic or Surface Physics. Professor Richmond has served on many science boards and advisory panels, and is currently serving the U.S. State Department as the 2015-2016 science envoy for the Mekong River countries, as a presidential appointee to the National Science Board, and as the president of the American Association for the Advancement of Science (AAAS). She is also the founder and chair of COACH, a grass-roots organization assisting in the advancement of women scientists in both the U.S. and developing countries.

The public lecture was presented on Tuesday, October 20 at the Grand River Room of the Russel H. Kirkhof Center on the Allendale campus and was titled “Surf, Sink, or Swim: Understanding How Environmentally Important Molecules Behave at Water Surfaces.” The second seminar, “Going Nonlinear to Study Molecular Assembly at Oil-Water Interfaces,” was held on Wednesday, October 21, at 1:00 pm at the Grand River Room, Russel H. Kirkhof Center. This was followed by a special student and faculty discussion session on STEM careers and women as leaders in science that was put as part of the Women in Chemistry week.



Professor Geraldine Richmond

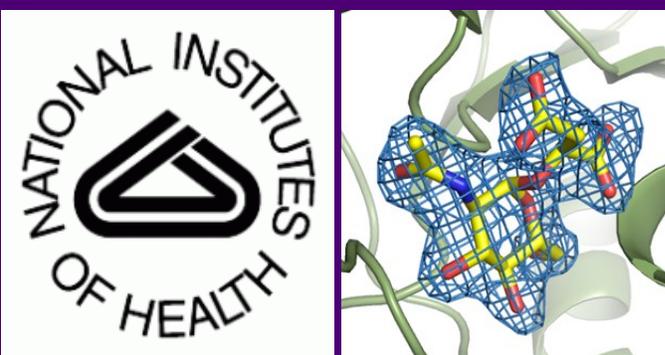


FACULTY COLLOQUIA RECAP

For the last 23 years, the Chemistry department has been holding faculty colloquia for the purpose of keeping up with each other's research. Additionally, these events serve as a venue for participants to showcase what they accomplished during their sabbatical leaves.

In the Fall colloquium, Dr. Julie Henderleiter presented her sabbatical work in a talk entitled "What Happens in K-8 Science?". During her leave, Professor Henderleiter worked with science instructors at all levels in the Otsego Public Schools district. Her activities included efforts to map the science K-8 curriculum, assess continuity within and between elementary schools, and to design curriculum materials as needs were identified. Henderleiter notes that this work has made an impact on her teaching at GVSU: "I can now offer GVSU preservice science teachers a better understanding of how science is really taught in schools. Additionally, my experience will help me adjust the activities and products of SCI 319 and CHM 201 to more accurately reflect what future teachers will need to do in their classrooms."

For the Winter colloquium, Dr. Shannon Biros discussed her sabbatical activities at GVSU, Michigan State University and Institut Catala d'Investigacio Quimica in Tarragona, Spain. Biros's successful research program generating molecules that specifically bind lanthanide and actinide elements may lead to better medical imaging agents or more efficient nuclear water remediation techniques. In her talk entitled "A Sabbatical in X-Ray Crystallography", she described her successful efforts to learn a new technique that would allow students in her lab to directly characterize all of the molecules they were generating.



PAUL COOK AWARDED NIH AREA GRANT

Dr. Paul Cook received an Academic Research Enhancement Award (AREA) from the National Institutes of Health (NIH) to support his research efforts for 2016-2019. The \$392,000 grant titled "Structural and Functional Studies of the Bacillithiol Biosynthesis Enzymes" will enable Dr. Cook and his undergraduate students to study an important enzymatic pathway involved in resistance to the antibiotic fosfomycin.

Chemistry Department Honors Students

In April of 2016, the Chemistry Department honored many of its most outstanding students for the 2015-2016 academic year. A total of 26 awards in various categories were given. The award winners in the different categories were as follows:

General Chemistry Award: The general chemistry awards recognize students who show excellence in general chemistry. Every instructor who teaches CHM 115 and CHM 116 (both Fall and Winter sections) during the academic year has the opportunity to nominate three students per section for this award. The Scholarship and Development Committee chooses any students whose names appear on both the CHM 115 list and the CHM 116 list and give awards to those students. Names submitted from Winter CHM 115 are used with the following Fall CHM 116 courses. The award winners were, **Haley C. Haasch, Caleb D. Huizenga, Samantha L. Law, Joshua D. Morse, Lauren A. Robb, Luke R. Rozema.**

Organic Chemistry Award: This award recognizes the top students from the CHM 241/242 sequence. Instructors teaching CHM 241 and CHM 242 (both Fall and Winter) during the academic year have the opportunity to nominate up to two students per section for this award. The Scholarship and Development Committee chooses any students whose names appear on both the CHM 241 and CHM 242 lists. Names submitted from winter CHM 241 are used with the following fall CHM 242 courses. The award winners were, **Omar Adaba, Alyssa R. Echelberger, Chelsea L. Lula, Emily R. Noordyke, Andrea L. Norman, Luke T. Pardy, Grace E. Peterson, Kaylee L. Smith, Tyler V. Van Velsen.**

Organic Chemist Award (ACS Poly-Ed Award): The recipient of this award was **Brandon Wackerle**. This award recognizes a student that excels in the majors organic chemistry sequence (CHM 245/246/247/248). The student must be a declared chemistry major and have completed the CHM 245-248 sequence by the end of the academic year. The instructors for these courses select the student.

Analytical Chemist Award: **Sara J. Barlow** was the recipient of this award, which is given to a declared chemistry major that is outstanding in CHM 222 and CHM 225. The student must have completed CHM 225 by the end of the current academic year. The Analytical Chemistry faculty selects the awardee from the best students meeting the above criteria based upon chemistry GPA.

ACS Division of Inorganic Chemistry Award: **Andrew I. Vanderweide** was the recipient of this award, which is given to a chemistry major that has excelled in CHM 471. In the event that more than one student has been identified, performance in CHM 372 is also considered. The Inorganic Chemistry faculty selects the awardee based on the above criteria.

Physical Chemist Award: **Emma C. Schroder** was the recipient of this award, which recognizes a student who has shown excellence in physical chemistry. The winner of this award is a student who has shown high performance in terms of grades and dedication in CHM 356, CHM 358, CHM 353, and either CHM 355 or CHM 455.

Senior Organic Chemistry Award (ACS): For this award, the departments selects a top graduating senior student majoring in either chemistry or biochemistry who has demonstrated excellence in organic chemistry based on a combination of research experience, coursework and a desire to pursue a career in chemistry. The nominee is then recognized by the American Chemical Society (Organic Chemistry Division). The recipient of this award was **Alan R. Lear**.

Biochemistry Award: The recipient of this award was **Josie Werner**. The award is given to a chemistry major who has excelled in CHM 461,

CHM 462 and CHM 463. The student must have completed CHM 463 by the end of the current academic year. The Biochemistry faculty selects the awardee based on the above criteria.

Senior Chemical Education Award: This award is given to a Chemical Education major, typically a graduating senior. The Chemical Education faculty selects the awardee, and this year the recipient was **Cassie Miles**.

American Institute of Chemists Award: **Kelsey Winchell** was the recipient of this award, which is given to the senior chemistry major who meets all or most of the criteria for the Outstanding Senior Award, and who demonstrates ability, leadership, and professional promise. The Chemistry faculty selects the awardee from the eligible students.



Outstanding Senior Chemistry Award: In order to be eligible, a senior, presenting in CHM 491 of the current academic year, must be a declared chemistry major and have an overall GPA of 3.5 or greater. The Chemistry faculty selects the awardee from the eligible students based upon the following criteria: research participation; service to the department; extracurricular activities; and general attitude. The award recipient was **Heidi Conrad**.

Outstanding Senior Biochemistry Award: In order to be eligible, a senior, presenting in CHM 491 of the current academic year, must be a declared biochemistry major or chemistry major with a biochemistry emphasis, and have an overall GPA of 3.5 or greater. The Biochemistry faculty selects the awardee from the eligible students based upon the following criteria: research participation; service to the department; extracurricular activities; and general attitude. The award recipient was **Emma Schroder**.



Outstanding Undergraduate Research Award: In order to be eligible, a chemistry major must show outstanding skills, motivation, and progress in undergraduate research. This award is reserved for students that display exceptional abilities to (a) thoroughly understand their research project, (b) think critically and creatively in the research processes, (c) work independently, and (d) make significant progress in their research. In addition to participating in multiple CHM 499 and/or summer research opportunities, the awardee should also demonstrate the ability to disseminate research work to the scientific community either at regional/national conferences or through publications. Nominations for the award are to be submitted by the student's research advisors in the form of a written research activity summary. The Scholarship and Development Committee then selects the award winner(s). The award recipient was **Kelsey Winchell**.

Outstanding Service Award: This award is given to a chemistry major that has made significant contributions in service to the department. Nominations for the award are solicited from the department and other service related areas, and includes a summary statement of the student's service record. Service obligations may include stockroom duties, tutoring, serving as an SLA, Chemistry Club involvement, community outreach, etc. The Student Affairs Committee then selects the award winner(s). The award recipient was **Tyler Cooley**.

Tom Pentecost: University Outstanding Teaching Award

The University Outstanding Teaching Award, the university's highest honor for teaching, is given to a single professor each year who best demonstrates commitment to student learning as an instructor, role model, and for positive influence on career development of students. Additionally, recipients are noted for the use of pedagogies that are designed to "maximize students' engagement in their learning and to provide exemplary support so that all students can be successful". Professor Pentecost, who joined GVSU in 2009, also oversees an active research program specializing in the development of assessment tools that measure student understanding.

Jessica VandenPlas: Pew Teaching Excellence Award

Dr. Jessica VandenPlas was selected as a GVSU 2015 Pew Teaching Excellence Award winner. Prof. VandenPlas, who has taught at GVSU since 2010, was honored for her active engagement of students in the classroom, her clear communication skills and her dedication to students.

Shannon Biros: Distinguished Undergraduate Mentoring Award

The Distinguished Undergraduate Mentoring Award, presented by the GVSU Center for Scholarly and Creative Excellence, recognizes Professor Biros' excellent track record introducing students to chemistry research experiences, and her success in publishing the studies that have resulted from those collaborative efforts

Stephanie Schaertel: Maxine Swanson Award

The Maxine Swanson award, sponsored by the GVSU Women's Commission, is presented to an individual who has provided leadership in support of the rights of women at Grand Valley State University. Professor Schaertel in particular was recognized for her outstanding work mentoring both women students and fellow women faculty members. Additionally, Stephanie is recognized for her service work with science education in the Grand Rapids Public Schools.

Laurie Witucki: CLAS Lifetime Service Award

In being chosen for the CLAS Lifetime Service Award, Dr. Witucki was honored for her extensive work encouraging young women and girls to pursue careers in science. She served for seven years as the director of the Women in Science and Engineering program at GVSU, and participated in the successful efforts to secure funding from the National Science Foundation supporting retention of science majors.

Felix Ngassa: CLAS Annual Faculty Service Award

Dr. Ngassa was honored for his extensive service to the University as a member of the Faculty Senate where he has served on the Executive Committee and currently holds the post of Vice Chair of the Senate. He has been noted for his ability to "see multiple perspectives and to be an advocate and strong voice for faculty." Among many other activities, Professor Ngassa serves as the Chair of the Public Safety Liaison committee, as a grader for AP Chemistry exams and as a regular volunteer at the regional Science Olympiad tournament.

Jim Krikke: CLAS Administrative and Professional Service Award

The 2016 CLAS Administrative and Professional Service Award was awarded to Professor Jim Krikke. Krikke was honored for his extensive service contributions to the Chemistry Department, GVSU and the community. Jim has served on the executive committee of the local section as chair (an elected position) for a number of years, and helped to reinvigorate the activities of this group. Members of the Chemistry faculty note that he regularly goes beyond his job duties in helping them set up equipment for their research labs, and also in mentoring several undergraduate research students.

Faculty & Staff Awards

Tom Pentecost



Jessica VandenPlas



Shannon Biros



Stephanie Schaertel



Laurie Witucki



Felix Ngassa



Jim Krikke

Departmental Research Update



The Department of Chemistry has maintained high level of scholarly activity during the 2015-2016 academic year. As in previous years, many faculty and their research groups attended regional and national meetings and published numerous scholarly works, many of which contain student co-authors.

Dave Leonard and his research group continue to investigate structure/function relationships in class D β -lactamase enzymes. In the past year, they published a manuscript in the *Journal of Antibiotics* and presented a poster at Microbe 2016 (Boston). The Leonard group bid farewell to Chemistry majors Emma Schroder and Taylor Muckenthaler.

Felix Ngassa continues research in synthetic organic and computational chemistry. Six undergraduates worked in the Ngassa lab in the 2015-2016 school year. A synthetic project on "Sulfonate Synthesis and Application" resulted in five peer-reviewed publications. A new computational project on "Predicting the Secondary Structures of Proteins by Circular Dichroism" resulted in two external presentations and a peer-reviewed journal article.

Scott Thorgaard During 2015 and 2016, my research group has included three students working along two main research threads. Austin Ronspees continued his work on a project using ultramicroelectrodes for the detection of *E. coli* bacteria individually in time, with correlated observation of the experiment using fluorescence microscopy. Austin presented findings from his project at the 251st National ACS meeting in March, 2016, as well as at the West Michigan Regional Undergraduate Science Research Conference (WMRUGS) in November, 2015. Chris Peruzzi and Aaron Capps are working on related projects focused on electrochemical observations of single metal nanoparticles using electrocatalytic amplification. Chris Peruzzi presented preliminary findings for this project at the WMRUGS conference in November, 2015, and will present additional findings later this summer at the 252nd National ACS meeting in August, 2016. For the summer of 2016, Chris is conducting research in my group as a

McNair Scholar. Aaron Capps is the newest student in my group, and we were able to obtain an external MSGC Undergraduate Research Fellowship to fund his work for the summer of 2016. Aaron also successfully applied to GVSU's S3 program, and was awarded one of the Ott-Stiner Fellowships.

Stephanie Schaertel co-authored an entry titled "What is the pKa of water?" in the UC Davis ChemWiki <http://chemwiki.ucdavis.edu>

Andy Lantz In the past year our lab has worked on two research projects: 1) the development of organic redox electrolytes for energy storage (e.g. flow cells and pseudocapacitors), in collaboration with Vinazene, Inc. (supported by DOE and NSF), 2) the development of a capillary electrophoresis based methods for the enantioseparation of chiral silanes. We will also be collaborating with Cynthia Thompson in the Biology department on the development of in-field methods for analysis of primate olfactory compounds using portable gas chromatography-mass spectrometry instrumentation.

Andy Lantz received two grants for his research: Rassmussen, P. (Co-Principal), Lantz, A. (Co-Principal), Schroeder, W. (Supporting), "High Energy Density Non-aqueous Pseudocapacitors," Sponsored by National Science Foundation, Federal, \$225,000.00. (\$67,892 for GVSU). (January 1, 2015 – June 30, 2016). Thompson, C. L. (Principal), Vinyard, C. (Co-Principal), Lantz, A. (Supporting), Grant, "Breaking the smell barrier: Development of in-field methods for analysis of primate olfactory compounds", National Science Foundation, High-risk Research in Biological Anthropology, Federal, \$26,498.00, Funded.



Randy Winchester continues to investigate the synthesis of chiral silanes and the preparation of theoretically interesting silicon compounds. In June he presented a poster at the Silicon Chemistry Symposium in Portland, Oregon on Resonance and the sila-allylanion. Eva Gulotty, a member of the Winchester group, presented at the VAI Undergraduate Research Symposium and at the ACS National Meeting in August. This year Eva Gulotty graduated from the group and chose

to attend the University of Notre Dame. Eva and Ckat Duke made great progress on the sila-allyl anion and I am writing papers this summer. In addition Professor Winchester is presenting at the BCCE this summer on a collaboration with Professor Kovacs on the incorporation of a research project in second semester organic chemistry for increasing student engagement.

Shannon Biros and **John Bender** worked this past summer with five students: Erin Leach (GVSU); Anthony Spyker (GRCC - GVSU) Troy Luster (GRCC - MSU) C'arra Miller (GVSU) Alan Lear (GVSU) on novel, selective ligands for lanthanide and actinide complexation and have made considerable progress in terms of compound discovery, and confirmation by multi-nuclear NMR and x-ray crystallography. Each student recently presented their research at the ACS Reaction Mechanisms Conference in St. Louis (June 25 - 29), and all of them presented again at the end of July in either Cincinnati (REU students) or Buffalo (McNair).



Julie Henderleiter had two presentations at the 206 BCCE in Greeley, CO this past August: Barrows, N., Henderleiter, J. & Kovacs, D. 24th Biennial Conference on Chemical Education, University of Northern Colorado, Greeley, CO, "Curriculum redesign: From needs-based education to rollout" (August 2016); Henderleiter, J. 24th Biennial Conference on Chemical Education, University of Northern Colorado, Greeley, CO, "Sustainable science and math outreach to elementary schools" (August 2016).

Julie Henderleiter published a research article titled "Seasonal analytics: A 5E lesson on Michigan weather and the 'reason for the seasons'". *MSTA Journal*, (2015) 20(2), 70-78.

Stephanie Schaertel worked with several students on several projects over the 2015 year. Some students worked to measure pressure-broadening coefficients in gas phase samples. Some students worked on physical chemistry laboratory development projects

Richard Lord and collaborators published four papers: "Coordination and Electronic Characteristics of a Nitrogen Heterocycle Pincer Ligand" Brian J. Cook, Chun-Hsing

Chen, Maren Pink, Richard L. Lord, Kenneth G. Caulton. *Inorg. Chim. Acta* 2016, 451, 82-91. "Synthesis and Characterization of a Stable High-Valent Cobalt Carbene Complex" James A. Bellow, Sebastian A. Stoian, Johan Van Tol, Andrew Ozarowski, Richard L. Lord, Stanislav Groysman. *J. Am. Chem. Soc.* 2016, 138, 5531-5534. "Synthesis of a mononuclear, non-square-planar chromium(II) bis(alkoxide) complex and its reactivity toward organic carbonyls and CO₂" Maryam Yousif, Alyssa C. Cabelof, Philip D. Martin, Richard L. Lord, Stanislav Groysman. *Dalton Trans.* 2016, 45, 9794-9804. "Catalytic Formation of Asymmetric

Carbodiimides at Mononuclear Chromium(II/IV) Bis(alkoxide) Complexes" Maryam Yousif, Daniel J. Tjapkes, Richard L. Lord, Stanislav Groysman. *Organometallics* 2015, 34, 5119-5128.

Richard Lord had an article selected for back cover art in the "New Talent: Americas" issue of *Dalton Transactions*.

Andrew Korich and **Richard Lord** published a collaborative article featuring two student co-authors: "Ether Cleavage Re-Investigated: Elucidating the Mechanism of BBr₃-Facilitated Demethylation of Aryl

Methyl Ethers" Talon M. Kosak, Heidi A. Conrad, Andrew L. Korich, Richard L. Lord. *Eur. J. Org. Chem.* 2015, 34, 7460-7467.

Andrew Korich and collaborators published two articles: "Harnessing a Mobile Social Media App To Reinforce Course Content" Andrew Korich, *J. Chem. Educ.*, 2016, 93 (6), pp 1134-1136. "Fast colorimetric titration protocol for quantification of boron tribromide" Brianna N. Barbu, Talon M. Kosak, Amber J. Prins, Jason G. Gillmore, Andrew L. Korich *Tetrahedron Letter.* 2016 57(33), 3746

Chemistry Department Participates in International Partnership

By Felix Ngassa



This summer I made my first trip to South East Asia as part of a GVSU Padnos International Center Partnership Delegation to Japan. It should be noted that Japan is an island nation in the Pacific Ocean with cities characterized by high-rise buildings, imperial palaces,

numerous mountainous national parks, world heritage sights, as well as shrines and temples. Our port of entry in Japan was the Narita airport in Tokyo. Tokyo is the very crowded capital city, known for its pop culture and neon skyscrapers. After purchasing our transportation passes from the airport, we were ready to explore Japan! From the airport, there are trains that run directly to most of the popular districts in Tokyo, such as the city center and Shinjuku. I was in awe when we got to the Shinjuku train station. Shinjuku train station is the busiest train station in the world! It has about a dozen different routes plying through it and serves millions of people daily. After 13 hours of flight time and lugging our entire luggage around, we were exhausted and ready to check out our hotel. Finally, we made it to our hotel. There was free in-room Internet access (Wi-Fi) and Japanese robes that we could wear, rather than the usual bathrobes.

As part of a delegation of six, we visited three of our partner institutions: International Christian University (ICU) in Tokyo, Ritsumeikan Asia Pacific University (APU) in Beppu, and the Japan Center for Michigan Universities (JCMU) in Hikone, Shiga Prefecture. Using the very efficient train transportation system in Japan, we visited cities like Tokyo, Beppu, Hiroshima, Kyoto, and Hikone in ten days. Kyoto is a popular tourist destination and is known for the numerous Buddhist temples, Shinto shrines, gardens and cherry blossoms. Beppu is known for the popular hot springs that can be found everywhere in the city; something I highly recommend for anyone to try. In Tokyo, we visited the International Christian University, where I had the opportunity to interact with colleagues in the Chemistry Department and other

science disciplines. I shared with our colleagues the curriculum for a major in chemistry at GVSU and learned from them what courses could be taken by GVSU students who decide to study at ICU. Although ICU offers many courses in English, most of the core courses in chemistry are offered in Japanese. In Beppu, we visited APU, where I met with colleagues in the Environmental Management Program. APU does not have a traditional chemistry department or any department in the basic sciences. However, they have a College of International Management that is home to the Environmental Management Program. The Environmental Management Program offers courses that could be used for our Green Chemistry Certificate Program. Therefore, I could see our students who choose to study at APU take courses in the Environmental Management Program that would count towards the courses required for the Green Chemistry Certificate at GVSU. Similarly, a student from APU that comes to GVSU can take courses in the Green Chemistry Certificate Program that will count towards their degree in the Environmental Management Program at APU. APU has the advantage of a more global focus and many courses are taught in English. It struck me that APU basically represents a "global village"; with 5,959 total students, a staggering 48.9% of them are international students. In Hikone, we visited JCMU, where we had a tour of the center and listened to the center director, who explained how the center operates and how the students from MI who come to JCMU are educated in Japanese culture.

Looking back at the trip and based on lessons learned, I would plan for the trip differently and be more intentional in the experiences I would seek. When I make a personal trip in the future or for anyone interested in visiting Japan, here is my list of top 10 things I would recommend:

1. Take a bath at the Japanese hot springs (onsen)
2. Witness a tea ceremony
3. Visit temples and world heritage sights
4. Visit a Karaoke bar and sing Karaoke
5. Take the bullet train
6. Try the famous Japanese sake drink
7. Stay at a Japanese Inn (Ryokan)
8. Take a picture of Mt. Fuji
9. Visit the Museum of Peace in Hiroshima
10. Shop for suits (men) or shop for cosmetics (women)

Faculty News

Aysegul Saral, a PhD student from Artvin Coruh University in Artvin, Turkey, spent six months working in the laboratory of **Dr. Dave Leonard** (May-October 2015). She used this time to learn how to measure kinetic parameters for a clinically-relevant β -lactamase enzyme that she isolated in her home country as part of her PhD thesis project. This work, entitled *Kinetic characterization of GES-22 β -lactamase harboring the M169L clinical mutation* was recently accepted for publication in the Journal of Antibiotics.

Felix Ngassa was promoted to full professor. He also won the CLAS Annual Faculty Service Award and was part of a GVSU Partnership Delegation to Japan in June.

Two of **John Bender's** former students have finished their Ph.D.s: **Anthony Montoya** (U of Iowa) and **Ben Thome** (Akron State).

Jessica VandenPlas earned tenure and was promoted to Associate Professor.



Dr. David Leonard & Aysegul Saral

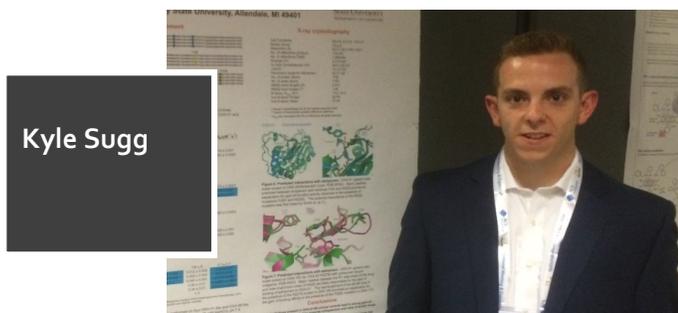
Fall 2015 Boston National Meeting & Exposition



Several GVSU faculty and students attended the 250th National Meeting of the American Chemical Society in Boston, MA from August 16-20, 2015. The contributions of the GVSU chemistry department are highlighted below:

Student **Eva Gulotty** presented the poster: "Where is the Lone Pair: Resonance and the Sila - Allyl Anion" in collaboration with **Randy Winchester**.

Dr. Shannon Biros and her research group collaborated on several poster presentations. GVSU students **Erin Leach** and **Alyssa Kulesza** presented the poster "Influence of the aryl carbonyl group in CMPO ligands for the sensitization of lanthanide luminescence", which was featured in SciMix. Student **Jeremy Cunningham** gave a poster presentation titled "Series of rigid, bidentate ligands with varying degrees of hardness for the selective extraction of actinides from aqueous solutions". Student **Alan Lear** also presented a poster, titled "Synthesis and characterization of multidentate CMPO ligands for use in the complexation and extraction of f-elements".



The biochemistry division made two poster presentations at the meeting. Student **Thomas Harper** presented the poster "Triple-substitution clinical variant of the OXA-23 carbapenemase from *Acinetobacter baumannii* shows increased activity toward cephalosporins and aztreonam" co-authored by professors **Rachel Powers** and **Dave Leonard** and laboratory technician **Cynthia June**. Student **Kyle Sugg** also presented a poster, titled "Structure of OXA-51, the native carbapenemase of *Acinetobacter baumannii*, reveals insights into gain-of-function clinical variants" with professors **Rachel Powers** and **Dave Leonard** and laboratory technician **Cynthia June**.

Student **Andrew Vanderweide** also collaborated with **Dr. Biros** and **Dr. Richard Lord** to present "Experimental and computational study of lanthanide-CMPO ligand complexes".

Dr. Lord's work was featured in five additional presentations: "Alimine effect in (bis)iminopyridine complexes: Nonplanar nickel(I) complexes of a bis(aldimino)pyridine ligand", "Group transfer catalysts utilizing a pyrazolate-bridged CO₂ system", "Cooperative activation of carbon dioxide by a nucleophilic ligand backbone of an oxophilic metal", and "Reactivity of the low-coordinate bis(alkoxide) metal complexes in N-N and C-N bond formation reactions". Student **Samantha Bidwell's** work was also featured in collaboration with **Dr. Lord** in the presentation "Threefold symmetric zerovalent cobalt is a potent reductant of N₂".

Student Scholars Day 2016

The 2016 Student Scholar's Day hosted by the Office of Undergraduate Research at GVSU featured 33 posters from 40 students and 18 faculty.

Sonny Haskins, Daniel Tjapkes A Computational Exploration of Redox Induced Electron Transfer. Sponsor: Richard Lord

Jacob Lindale An Inexpensive Two-Dimensional Infrared Spectrometer for Reaction Monitoring. Sponsor: Dalila Kovacs

Erin Leach, Brandon Wackerle Antimony, Bismuth, and Phosphorous Based Compounds for Nuclear Waste Remediation. Sponsor: John Bender, Shannon Biros

Ryan Zahran Assessing Working Memory Load During Logical Thinking by Measuring the Task-evoked Pupillary Response. Sponsor: Nathan Barrows, Jessica VandenPlas

Talon Kosak BBr_3 -Initiated Cyclization of *o*-alkynylanisoles to Form Benzofurans. Sponsor: Andrew Korich, Richard Lord

Emma Schroder Biochemical Analysis of Enzymes Responsible for Increased Antibiotic Resistance in *Acinetobacter baumannii*. Sponsor: David Leonard

Tyler Cooley Boron-Silicon Exchange of Trimethylsilylarenes with BBr_3 : Why Do Heterocycles Shut Down the Desired Reactivity? Sponsor: Andrew Korich, Richard Lord

Joshua Berwanger BshB and BshB2: Crystallization and Analysis. Sponsor: Paul Cook

Connor Radecki Chiral Separation of Silanes via Capillary Micellar Electrokinetic Chromatography. Sponsor: Andrew Lantz

Aaron Hillsamer Design and Development of Novel Organic Pseudocapacitors. Sponsor: Andrew Lantz

Alyssa Cabelof Design of Low-Coordinate Transition Metal Alkoxides for the Activation of Small Molecules. Sponsor: Richard Lord

Christopher Peruzzi Detecting Single Platinum Nanoparticles Using Ultramicroelectrodes and Investigations of Modified Electrode Surfaces by Cyclic Voltammetry. Sponsor: Scott Thorgaard

Austin Ronspees Electrochemical Monitoring and Correlated Fluorescence Imaging of Single *Escherichia Coli* Using Ultramicroelectrodes. Sponsor: Scott Thorgaard

Marissa Biesbrock, Dena Warren Examination of Student Use of Screencasts and Simulations for Learning About Solubility. Sponsor: Deborah Herrington, Jessica VandenPlas

Heidi Conrad Expanding the Scope: Demethylation Reactions with Boron Trihalides. Sponsor: Andrew Korich, Richard Lord

Aaron Rosenberg Fluorescence Analysis of BshC Ligand Binding Interaction. Sponsor: Paul Cook

C'arra Miller Fragment-Based Drug Discovery of a Novel Inhibitor of OXA-24 β -Lactamase. Sponsor: Rachel Powers

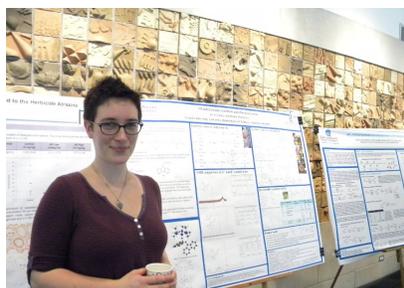
Emily McGuffie Isolation of 6-Gingerol from Ginger Root and the Synthesis of Major Metabolites, 6-gingerdiols. Sponsor: Dalila Kovacs

Luke Jackson Molecular Dynamics Explorations of BshC, an Enzyme Important in Drug Resistance. Sponsor: Paul Cook, Mary Karpen

Emily David Mutagenic Studies of a Unique Cysteine Ligase Enzyme. Sponsor: Paul Cook

Kayla Lockmiller, Nicholas Woldyk Presence and Distribution of Polycyclic Aromatic Hydrocarbons in Sediment Contaminated with Tar Sands Crude Oil. Sponsor: Tara Kneeshaw, Min Qi

Michael Hudson Recovery and Recycling of Lanthanides and Actinides in Spent Nuclear Fuel for Sustainment of Nuclear Reactors. Sponsor: Shannon Biros

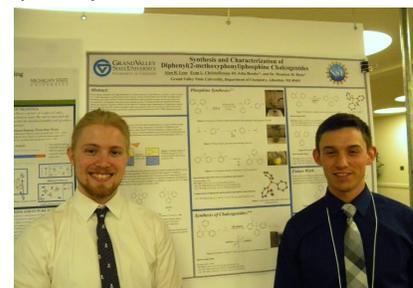


Eva Gulotty Silaallyl Anions: Synthesis and Characterization. Sponsor: Randy Winchester

Alexander Wong Stereoelectronic Effects in the Nucleophilic Ring Opening of Phenyl Aziridines. Sponsor: Matthew Hart

Emily Ingalls Synthesis and Activity Analysis of Potential FAK Substrate and Inhibitor Peptides Based on the Protein p130cas. Sponsor: Laurie Witucki

Evan Christoffersen, Alan Lear Synthesis and Characterization of Diphenyl (2-methoxyphenyl)phosphine Chalcogenides. Sponsor: John Bender, Shannon Biros



Jennifer Jess Synthesis and Comparison of p130cas Peptide Sequences For Potential Effective FAK Substrates and Inhibitors. Sponsor: Laurie Witucki

Roxana Dumitrache, Stephanie Tanis Target Inquiry: Changing the Way Teachers Think About Science Instruction in Their Classrooms. Sponsor: Deborah Herrington

Kelsie Nauta The Antibiotic Potential of Diphenylureas. Sponsor: Matthew Hart

Jane DeCoeur, Alyssa Nardone What is Your Success Based on in Chemistry 115? Sponsor: John Gabrosek, Thomas Pentecost

Joel Francis Pd/C and Ru/C-catalyzed Conversion of 5-Hydroxymethylfurfural (HMF) to Fuel Additives. Sponsor: Dalila Kovacs

Joel Francis Purification and Characterization of BstA, a Bacillithiol-Dependent Transferase. Sponsor: Paul Cook

Katelyn Mulder AtomAction: A Pedagogical Tool. Sponsor: Mary Karpen, Gregory Wolffe



Parting Shots

Students from the class of 2016 share their thoughts and reflect on their time at GVSU. They were asked: (1) Where are you from?; (2) Where are you going after graduation?; (3) What are the fun memories you have during your time here at GVSU?; (4) If there is one famous chemist/scientist you admire (not your professors), who will that be?; (5) One fun fact that only your peers and classmates may know about?; (6) Where do you see yourself 10 years from now?; (7) Anything else you would like to share?

David Buck - (1) Traverse City, MI (2) Taking a year off and applying for medical school. (3) I really enjoyed the opportunity of conducting research with Dr. Korich (6) Back in my hometown of Traverse City, as a physician, possibly with a couple kids

Alyssa Cabelof - (1) Pittsburgh, PA (2) I am going to graduate school at Indiana University to study inorganic chemistry after graduation doing both synthetic and computational work (3) my favorite memory of GVSU was margarita Monday's (5) one thing my peers might only know about me is that I'm obsessive about my note-taking and school supplies (6) in ten years I hope to be working at an undergraduate institute like Grand Valley as a professor and doing research

Heidi Conrand - (1) Coloma, MI (2) I plan to work in industry for a few years and then go on to obtain a PhD. (3) Getting to know and hangout with all of the really cool people in the inner hallway of Padnos. Also, getting to do undergraduate research. (4) Marie Curie and Rosalind Franklin. (5) I use to be a pole vaulter and I love to go rock climbing. (6) Doing research in organic synthesis.

David Dykhuis - (1) Portland, MI (2) New location undetermined (3) Humorous times spent in conversation with fellow chemistry students and professors. (6) As a professional living a well balanced life. I will choose to live well below my means financially to pay off my home / invest appropriately for eventual retirement.

Monica Elliott - (1) Jenison, MI (2) Ferris State College of Pharmacy (3) I went to the rock-climbing center on Wednesdays one semester, that was neat. (4) Sheldon

Cooper. Realistically, perhaps Theodosius Dobzhansky. There was a book I had a long time ago, it may have been my first biology book in college, the first page had a quote from Dobzhansky, "nothing in biology makes sense except in the light of evolution" which I guess stuck with me. (5) That Mackinac Hall connects to Manitou without having to walk outside. Also, there are new study rooms in Manitou that are actually quiet and no one seems to know about them! (6) I'm working to be a clinical pharmacist working part-time to be a semi-stay-at-home mom with the income of an average paying full-time career. I'd like to live somewhere where I can have a large yard that can accommodate a greenhouse, a chicken coop, and a few peach trees. Of course I'd like to have found a deep happiness and better manage stress for wherever I am and for what I've worked so hard for.

Kelsey Hodge - (1) Zion, IL (3) I have many fun memories but I am especially thankful for how warm and welcoming many of the professors and students have been here. (4) I admire anyone who is passionate about what they do and unpretentious about their success. (5) I color coordinate all my notes. (6) I don't know where I will be in two weeks so 10 years from now is extremely hard to predict.

April Kaneshiro - (1) East Lansing, MI (2) I will be going to the University of Michigan (in Ann Arbor) for the PIBS PhD program (3) Becoming friends with a lot of my classmates as we went through the same courses together. (i.e. working on lab reports/homework together, hanging out after class was done, supporting each other when times were hard and stressful, etc) (4) Marie Curie (5) I'm not sure. My birthday is not in April and I'm a third degree black belt in Tae Kwon Do (some professors may know these though). (6) I would like to be a professor at a teaching university like GVSU, so hopefully I'll be close to that goal. Or I may have chosen something completely different by then. (7) Thank you to all the professors I have had and who have helped me get to where I am today. You are all amazing teachers and I really appreciate all that you do to help your students.

Cassie Miles - (1) Lowell, MI (2) Salt Lake City, Utah, Space and an Ice Cream Shop (3) Humpday Hallway Hangman (4) Bill Nye; his bow ties are spectacular (5) I host Dancing Thursdays at the GVSU Climbing Center; brought to you by Whitney Houston and Beyonce and various 80s influenced artists (6) I see myself either back in Michigan applying to be an astronaut while teaching/mothering or training to be an astronaut.

Talon Kosak - (1) Grand Rapids, MI (2) After graduation I'm attending Notre Dame for organic chemistry (3) The fun memories were research, meeting new friends, and summer research (6) Working in Industry making new pharmaceuticals or working at a university (7) Thanks to GVSU for the great education and experience.

Alina Morales - (1) Belleville, MI (2) I will be continuing research with Dr. Powers for a while and hopefully applying for graduate school within the next year. (3) I liked attending the group exercise classes a lot. Those were always a great workout and a good time. (4) Alice Augusta Ball for sure. (5) There is a small bouncy ball stuck in the wall on the third floor of the library (6) 10 years older in a building somewhere.

Kristi Ruvina (1) Albania (2) I will be working somewhere, but my future goal is to get to medical school (3) Tutoring chemistry was one great experience. I got to know many people who were passionate for chemistry and were willing to try hard to get good results (4) Dmitri Mendeleev (5) Sometimes I ask tricky questions that I already know the answer (6) Wearing a white Doctor's coat (7) Organic synthesis and biochemistry is my jam.

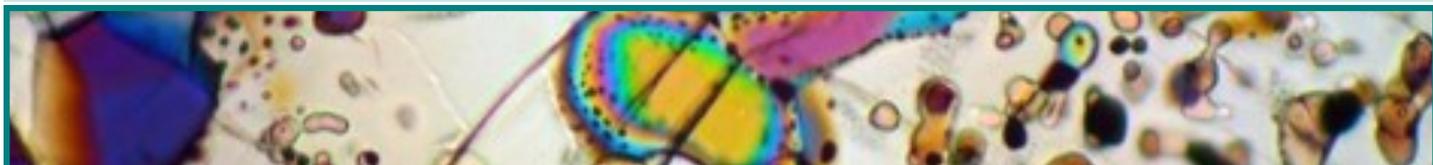
Emma Schroder - (1) Rockford, MI (2) Feinberg School of Medicine (?) (3) Watching "Wreckingball" on the news.... I still giggle every time I walk by the pendulum. Also, "You have to ask yourself, 'What the heck is X?' " (-Dr. Matchett) (4) Drew Berry, who makes incredible animations of biochemical processes. (5) D-amino acids makes left-handed α -helices! (6) I hope I'm either (a) giving someone a vaccine or (b) at a party celebrating the end of a disease. (Goodbye

lymphatic filariasis?!) (7) To the chemistry & BMS faculty -- thank you for making Grand Valley such a great place to go to school.

Stacie Stuut - (1) Kalamazoo, MI (2) University of New Hampshire (3) Is Margarita Monday appropriate? If not, then just put down hanging out with all of the chemistry students and professors in the inner hallway. (4) Ms. Frizzle (5) I was born deaf in my right ear and it was not fixed until my sophomore year in high school. (6) Working at a pharmaceutical company designing new drugs.

Andrew Vanderweide - (1) Byron Center MI (2) After graduation I'm attending the University of Rochester for inorganic chemistry (3) As far as memories there are far to many great memories I've had here to even begin to recount. But if I have to say one thing it would probably be playing "The Agents" in the comp lab with Dr Lord and his research group this summer. (4) As far as the scientist I'd have to say Richard Fyenman because he chose to take on some of the hardest scientific challenges of his day, but still managed to live life to the fullest and have fun while he was doing it. (5) As far as the fun fact, when I was in high school I spent a couple weeks one summer traveling Europe playing my trumpet, which was pretty cool. (6) 10 years from now I'd like to be looking to get a job as a chemistry professor

Josephine Werner (1) Sault Ste. Marie, MI (2) After graduation, I am going to be attending Michigan State University College of Osteopathic Medicine. (3) Fun memories would include playing volleyball, meeting friends in the Chemistry department, doing summer research, and just being part of such a close-knit department. (4) I admire my dad, Marshall Werner. He is a chemistry professor at Lake Superior State University. (5) Hmm... Can't think of anything for this one. (6) In 10 years, I hope to be married with several kids. I would like to be working as a family physician while still finding the time to do the things I love: oil painting, horseback riding, jewelry making, and being outdoors. (7) Thank you to the Chemistry department for making my experience at GVSU unforgettable.





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251st American Chemical Society National Meeting & Exposition

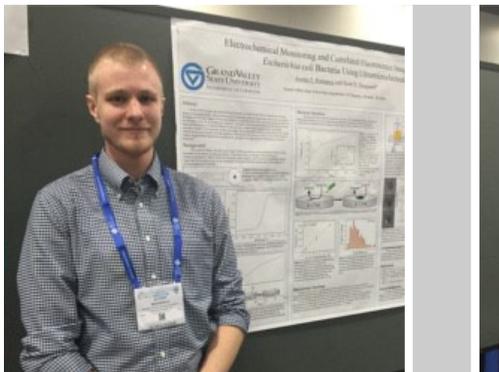
Computers in Chemistry

Several GVSU Chemistry faculty and students attended the 251st National Meeting of the American Chemical Society in San Diego, CA (March 3-5, 2016).

Student talks and posters:

Joel Francis (mentor, **Dalila Kovacs**): Pd/C and Ru/C-catalyzed conversion of 5-hydroxymethylfurfural (HMF) to fuel additives.

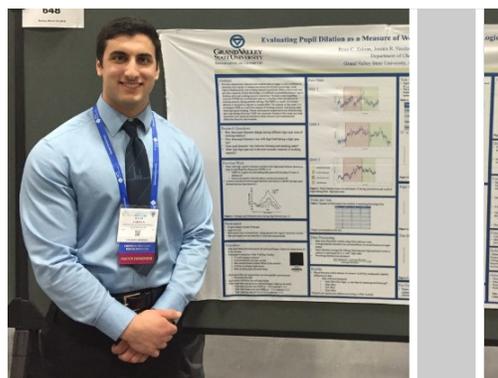
Roxana Dumitrache and **Stephanie Tanis** (mentor, **Debbie Herrington**): Target Inquiry: Changing the way teachers think about science instruction in their classrooms.



Austin T. Ronspees (mentor, **Scott Thorgaard**): Electrochemical Monitoring and Correlated Fluorescence Imaging of Single Escherichia coli Bacteria Using Ultramicroelectrodes.

Tommy Weiss and **Serafina Vitale** (mentor, **Jessica VandenPlas**): Translation among multiple representations in chemistry: Examining student ability and response time.

Talon Kosak and **Matthew Barylski** (mentors, **Andrew Korich**, **Richard Lord**): BBr₃-Initiated cyclization of O-alkynylanisoles to form benzofurans.



Ryan Zahran (mentors, **Jessica VandenPlas**, **Nate Barrows**): Assessing working memory load during logical thinking by measuring the task-evoked pupillary response.

Faculty talks and posters:

Debbie Herrington and **Jessica VandenPlas** (Poster): Student understanding of atomic interactions: Impact of simulation vs. screencast use.

Debbie Herrington: (Invited talk): Teachers as species: Survive, interact, adapt, and thrive.

Debbie Herrington: (Invited talk): Target Inquiry: Transforming teachers' ideas about laboratory instruction.

Other activity:

Tom Pentecost chaired the meeting of the ACS 2017 General Chemistry Second Semester Exam Committee.

Jessica VandenPlas chaired the ACS General Chemistry Paired-Question Exam Committee. **Dalila Kovacs** attended a meeting of representatives of the 30 schools that have co-signed the Green Chemistry Commitment.

Kyle Schneider ('09) received his PhD in Biochemistry from Northwestern University in July 2015. He is currently a post-doctoral fellow at Genentech (San Francisco) under the mentorship of Dr. Christoph Spiess where he is working to engineer antibodies with unique physical properties such that they may overcome current therapeutic limitations.

Lisa Mondie has three degrees. A B.S. in chemistry from GVSU (1998), a B.S. in Pharmacy from Ferris State (2001) and a PharmD from Midwestern University, Chicago College of Pharmacy (2007). She was recently accepted into the Emerging Leader Program for CVS and has to go for training in Rhode Island for three days in August and is very excited. Lisa is currently a pharmacy manager and has been for the last four years. She was promoted to pharmacy manager after only having worked for CVS for three months. She was a district Paragon Award winner in 2015 and also received an award for Talent Management in early 2015. Lisa recently sold her pharmacy in Chicago after having owned it for the last nine years. She has two beautiful daughters, Briana, 21 a 3rd year student at University of North Carolina, Greensboro, NC and Sanai, 10, a rising 4th grader. She relocated to NC in 2012 and is married to her wonderful husband, Earnest, nine years.

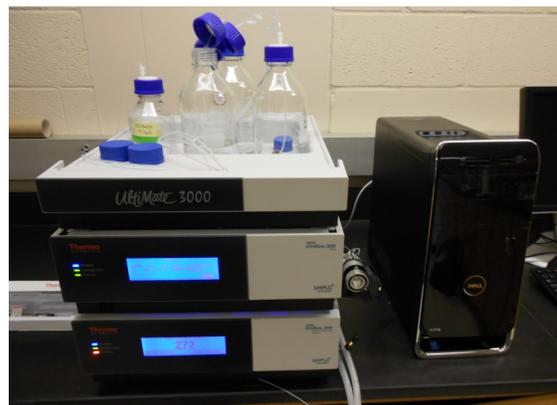
Chemistry Department Instrumentation Update

Last year the Chemistry department purchased an HPLC system capable of doing HPLC at higher pressures than our current units. The Thermo Dionex unit included an LPG-3400SD pump and a VWD-3100 variable wavelength detector. With funding provided from the Dean's office we have added a WPS-3000SL auto sampler and TCC-3000SD column heater. This simplifies operation and allows for more efficient use in teaching labs and for research. The system also runs Chromeleon 7 software like many of other chromatography systems and reduces the learning curve for operation.

Our four Jasco FTIRs have served us well over the years but are beginning to show signs of age. The department decided to try a new vendor and recently purchased a Thermo Nicolet iS-5 FTIR with a diamond ATR cell. The unit has a small footprint and should prove to be very useful for both teaching labs and research.

Installation of the Perkin Elmer Elan 6000 ICP-MS from Honeywell Burdick and Jackson in Muskegon occurred this year after it was initially delayed due to remodeling construction last summer. Additional remodeling will take place this summer but electrical and ventilation requirements have been made. So the unit should be ready to go online soon.

Preventive maintenance and repairs have kept most of the chemistry department's instrumentation up and running. Older pieces that are no longer supported by the vendors remain the biggest challenge.



Thermo HPLC
(autosampler not pictured)



Thermo Nicolet iS5 with ATR Cell

Support the Chemistry Department: New Fund 2016

The chemistry facilities committee is pleased to announce a new opportunity to support students called the **Chemistry Instruments and Infrastructure Fund**. The purpose of this fund is to provide long term development and maintenance of instrumentation and other infrastructure for the chemistry department. As our NMRs are aging and more and more grants are looking for department matching funds we came to realize we needed a location to place donations and build funds over time. If you gained valuable experience using NMRs during your years studying at GVSU consider giving to this fund so others will have the same opportunities. The facilities committee strives to provide the latest instrumentation for use in classes and research which gives our students an advantage when competing for jobs and graduate school opportunities. Help us continue our tradition of excellence by giving to the Chemistry Instruments and Infrastructure fund, or another chemistry fund that fits your interest today at www.gvsu.edu/give.





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STATE UNIVERSITY**

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Professional Growth

Our students travel to professional meetings to present research findings and network with other researchers.



Hands-on Laboratories

Students gain extensive experience conducting experiments and operating advanced research-quality instruments.



Research Experiences

Students contribute to scientific research projects while receiving one-on-one mentoring from faculty members.



Faculty Attention

Our courses highlight student-faculty interactions in and out of the classroom.