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A Word from the Chair

By George McBane

Modern chemistry uses a wide range of instruments to examine, characterize, and separate chemical samples. They range from small, simple devices like thermometers that might cost just a few dollars to sophisticated spectrometers with prices in the hundreds of thousands.

Our students, in both teaching labs and research projects, need access to modern, well-functioning instrumentation so they can become well prepared for jobs or further study. The department maintains, upgrades, replaces, and expands its stable of instruments with that need in mind. Our Facilities Committee, which includes several faculty as well as our Chemical Instrumentation Specialist Jim Krikke and our Lead Lab Supervisor Michelle DeWitt, keeps a close eye on instrumentation needs and priorities and helps us communicate those needs to others.

New instruments can come from several different sources. Routine replacements of small instruments used in teaching labs can often be handled within the department's annual budget. Instrumentation of moderate cost – say, up to \$20,000 – that will be used by substantial numbers of students is well supported by the College and the University. Examples of new equipment obtained with College support in the last few years include several IR spectrometers, an inert-atmosphere glove box for air-sensitive synthesis, a high-performance liquid chromatograph for analytical chemistry, an ion chromatograph for environmental chemistry, and a fluorimeter that is used in several courses and by several research groups.

The department occasionally receives donations of equipment from local companies. One of our two nuclear magnetic resonance spectrometers came from Pfizer. We have a

mass spectrometer with an inductively coupled plasma ion source just coming on line for metals analysis, donated by Honeywell.

More specialized equipment can sometimes be funded with external grants. Rachel Powers obtained a Leica autozoom stereomicroscope, used by the experimental biochemistry faculty to examine and prepare crystals for X-ray diffraction studies, with NIH funding. Paul Cook recently received an NIH grant that provided a new Agilent HPLC for his work at the Center for Health Sciences downtown. Jessica VandenPlas and Debbie Herrington have just placed an order for a Tobii eye tracker for their studies in chemical education, funded by the National Science Foundation.

Our JEOL 300 MHz nuclear magnetic resonance spectrometer was purchased with a Major Research Instrumentation grant from the NSF about seventeen years ago. Last fall Shannon Biros led development of a new MRI proposal seeking funding to replace that productive but aging instrument. The investigators include not only GVSU faculty but also representatives from nearby Aquinas College and Grand Rapids Community College. We learned in late summer that this proposal had succeeded, providing nearly \$300,000 for a replacement. We are currently soliciting bids for a new 400 MHz NMR to replace the JEOL. We expect the new instrument to be installed next summer.

The department pursues all the avenues just described to meet its instrumentation needs. Some needs still go unmet for substantial periods of time. At present two stand out. One is a preparatory-scale liquid



chromatograph, needed by the peptide synthesis groups of Laura Hawk and Laurie Witucki and likely to be useful to several other synthetic groups. The second is an LC-MS, a mass spectrometer coupled to a liquid chromatograph source, for separation and identification of nonvolatile organic compounds. Despite several attempts, we have so far not found funding for these two needs.

Recognizing this gap, Dr. William Schroeder, longtime collaborator and friend of the department, recently established an endowed fund at the University called the Chemistry Support Fund. Its purpose is "to ensure the Chemistry Department's ability to purchase and maintain excellent instrumentation for the long term." Our goal is for this fund to reach an endowment level of at least \$100,000 within a few years, so that the income from the endowment can substantially supplement the funding sources described above. Dr. Schroeder made a founding gift, has pledged annual contributions of his own, and has helped us solicit contributions from other members of the West Michigan chemistry community. With this generous start the fund has already exceeded the \$30,000 level needed for permanent endowment, but has a way to go to reach its target.

In late summer, Prof. Robert Smart and his wife Dr. Sara Kane-Smart informed us of a very generous

offer: they will match all gifts to the Chemistry Support Fund from alumni and faculty up to a total of \$10,000. This matching offer is particularly valuable, because Prof. Smart's donations will *themselves* be matched by the University, as all faculty and staff gifts to endowed funds are matched. This means that every \$100 donated to the fund by alumni will produce a \$300 increase in the endowment balance. If faculty and alumni together earn the entire \$10,000 match offered by the Smart family, the Chemistry Support Fund will be more than halfway to its target level.

A second fund, the Chemistry Instruments and Infrastructure fund, has similar goals but a shorter-term focus. It is non-endowed ("annual") so all the money in the fund is available for department needs immediately, in contrast to an endowed fund from which only the earnings can be spent. Other worthy funds that benefit the department and its students are described in the summary later in this newsletter.

We are extremely grateful to both Dr. Schroeder and the Smart family. We hope you'll consider joining their generous efforts and directing at least part of a gift to the Chemistry Support Fund this fall.

PLEASE DONATE TO *THE CHEMISTRY SUPPORT FUND*

WWW.GVSU.EDU/GIVE

ALUMNI NEWS

Jody Wycech (BS, Magna Cum Laude, 2012) recently graduated with a PhD in Geoscience from the University of Wisconsin-Madison. Her research utilized novel instrumental techniques and approaches to measure the geochemistry of calcareous marine microfossils and ultimately enhance the fidelity of the reconstructed paleoclimate records. In her tenure as a graduate student, Jody received the Schlanger Fellowship from the International Ocean Discovery Program and several departmental awards including the Tyler Award for Excellence in Teaching and Graduate Student of the Year. Jody is now completing a post-doctoral fellowship through the Cooperative Institute for Research in Environmental Science (CIRES) in Boulder, Colorado.

Jake Lindale graduated in April 2017. He received the Collaborative Achievement Award for his GVSU Honors Senior project, for research that he did with Stephanie Schaertel and Dalila Kovacs. He has begun a Ph.D. program in chemical physics at Duke University as a James B. Duke Fellow, working with Professor Warren Warren on high-Tesla spin transfer methodologies for NMR and MRI. Jake's latest pulse sequence, DARTH-SABRE, allows for a 1500-fold enhancement of heteronuclear NMR signals, which is a 10x increase over previous techniques. He will start migrating his enhancement technique to MRI over the next year, so that high resolution chemical and physiological information may be collected efficiently and in vivo. This will help circumvent the need for expensive, high-field MRIs and may allow the technology to be unilaterally incorporated in clinics, family practices, and emergency vehicles.

New Faculty 2017-2018

Brittland K. DeKorver has joined the faculty as an Assistant Professor of Chemistry. She graduated from Grand Valley State University with a B.A. in Chemistry (Education) in 2007 and earned a Ph.D. in Chemistry from Purdue University 2016. After earning her doctoral degree, Brittland was an Instructor at Michigan State University within Lyman Briggs College. Brittland's research focuses on chemistry students' laboratory experiences and the use of chemical demonstrations. This academic year, Brittland will be teaching General Chemistry I. Outside of teaching and research, Brittland enjoys textile crafts and home improvement projects.

Laura Hawk has joined the faculty as an Assistant Professor of



Dr. Brittland DeKorver

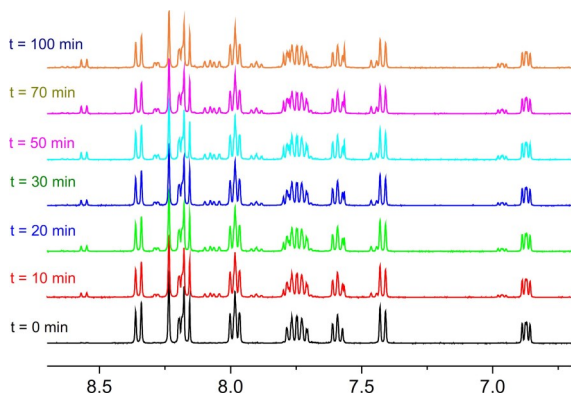


Dr. Laura Hawk

Chemistry. Laura graduated from University of Wisconsin-Madison in 2005 with a B.S. in Chemistry, and received her Ph.D. in Chemistry from the University of Chicago in 2013. After graduate school, Laura did postdoctoral work at the University of Minnesota-Twin Cities. During her postdoc, Laura taught organic chemistry both at Minnesota and at Augsburg College, and she will be teaching organic chemistry at GVSU this year. Her research involves work at the interface of chemistry and biology, including developing small molecules that bind to proteins important to the bacteria that cause tuberculosis and studying protein aggregation. In her spare time, Laura enjoys spending time outside and exploring chemistry in her kitchen by baking and cooking.

GVSU Chemistry awarded NSF-MRI grant for 400 MHz NMR Spectrometer

The GVSU chemistry department received a NSF Major Research Instrumentation (MRI) award in the amount of \$289,990 to fund the acquisition of a new 400 MHz NMR Spectrometer for research and training at GVSU, Grand Rapids Community College and Aquinas College. The new NMR will be used by GVSU



students in both the sophomore organic sequence as well as the new upper level synthesis courses. Eleven GVSU faculty members in the areas of organic, inorganic and biochemistry, along with their students, will also use the new NMR to further their research programs. Students from GRCC will use the new NMR to acquire data on compounds from their sophomore organic laboratory course, and Prof. Fritz and his students will use the new NMR to further their research program at Aquinas College. Contributors to the proposal were Shannon Biros, John Bender, David Leonard, Felix Ngassa, Randy Winchester, Thomas Neils (GRCC) and Jonathan Fritz (Aquinas College).

2017 Arnold C. Ott Lectureship in Chemistry



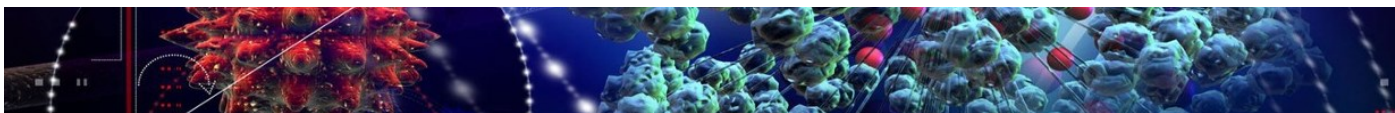
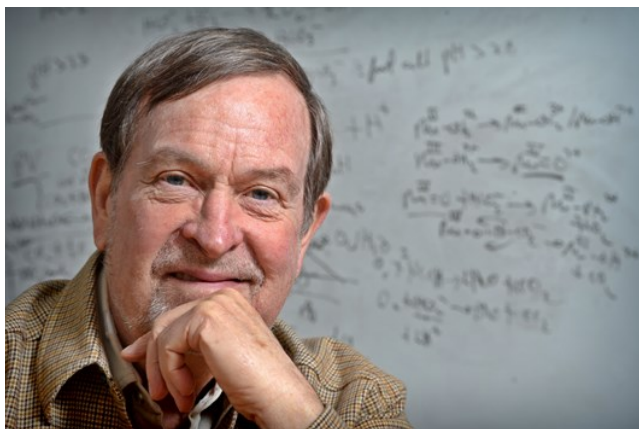
On March 23rd and 24th, the department hosted Prof. Thomas J. Meyer as the 2017 Ott Lecturer. The evening public lecture was titled: "Our Energy Future. Science and Technology Challenges of the 21st Century" which focused on energy sources in today's world economy. Prof. Meyer also gave a seminar "Making Oxygen from Sunlight and Water" that highlighted his research group's latest scientific discoveries.

Dr. Meyer rejoined the faculty of the University of North Carolina at Chapel Hill as Arey Professor of Chemistry on July 1, 2005. He is Director of the UNC Energy Frontier Research Center on Solar Fuels. In 2000 he was named Associate Director for Strategic Research at the Los Alamos National Laboratory in New Mexico. In that position, he oversaw research in support of nuclear weapons, threat reduction, and energy and environmental programs and was the LANL lead for economic development, intellectual property, and DOE programs in Science, Energy Efficiency and Renewables, and Nuclear Energy. He also served as the LANL liaison in these areas to the US Department of Energy and to the US Congress. From 1994 to 1999, he was Vice Chancellor for Graduate Studies and Research at UNC-CH where he oversaw a graduate and professional student program of over 8000 students and a research portfolio of > \$300 million. He led planning efforts that resulted in campus wide initiatives in genomics and bioinformatics, Arts Carolina, The Center for the Study of the American South, and others. As a UNC liaison with the North Carolina Legislature he initiated efforts that led to \$12 M in enhanced graduate tuition student support, return of overhead to the campuses from the NC General Fund, and initiated planning for construction that ultimately led to a bond issue passed by the citizens of North Carolina in 2000.

After receiving a BS from Ohio University in 1963 Meyer received a Ph.D. from Stanford in 1966 with Henry Taube, who

won the Nobel Prize for Chemistry in 1983, as his research mentor. He was a NATO postdoctoral fellow at University College, London in 1967 with Sir Ronald Nyholm, joined the faculty at UNC in 1968, was promoted to Associate Professor in 1972, Full Professor in 1975, Smith Professor in 1982 and Kenan Professor in 1987. He was the Head of Chemistry from 1985 to 1990, Chair of the Curriculum in Applied Sciences from 1991 to 1994 and Vice Chancellor/Vice Provost for Graduate Studies and Research from 1994 to 1999. He served on the North Carolina Board of Science and Technology, the Executive Committees of the North Carolina Biotechnology Center, the Research Triangle Institute, the Triangle University Center for Advanced Study Inc., and on the Board of Associated Universities Inc. He has served on the Boards of the Mind Institute, the International Informatics Society, the National Center for Genome Research, the Coronado Ventures Forum, the Science and Technology External Advisory Committee for Sandia National Laboratory and the Commission on Higher Education for the State of New Mexico and Chair of the Scientific Advisory Board for the Center for Revolutionary Solar Photoconversion (Colorado). He was awarded the Order of the Long Leaf Pine for service to the State of North Carolina in 1999, the Porter Medal in 2012, the Honda-Fujishima Lectureship Award in 2013, and most recently the 2014 Samson Prime Minister's Prize for Innovation in Alternative Fuels for Transportation.

Dr. Meyer is a member of the National Academy of Sciences and the American Academy of Arts and Sciences and has won many prizes for chemical research. His research has been notable for pioneering, innovative discoveries in chemical reactivity and applications to important problems in chemistry and energy conversion. He has published over 700 papers, holds five patents, and is one of the most highly cited chemists in the world.



2016-2017 FACULTY COLLOQUIA

For the last 3-4 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. Min Qi** presented her research in a talk entitled "Determination of Human and Veterinary Antibiotics in Beijing Miyun Reservoir Using SPE/LC/MS/MS". For her sabbatical, Dr. Qi spent a semester in China collecting and analyzing water samples from the Miyun Reservoir located near Beijing. This body of water supplies 90% of water to the capital city, but is increasingly threatened by pollution. Her work, in collaboration with Dr. Tong Zhang, Professor in the Department of Civil Engineering at the University of Hong Kong and the Beijing Water Group in Miyun County (WGM), sought to establish baseline concentration levels of antibiotics in water, sediment, and fish in the reservoir.

For the Winter colloquium, **Dr. John Bender** discussed his sabbatical work carried out in the Chemistry Department at Babes-Bolyai University in Cluj Romania, along with follow-up work he carried out with his students at GVSU. The title of his talk, "A Phosphine for All Seasons", refers to his efforts to develop methods to improve battery efficiency using phosphorous. Bender also discussed his experiences teaching a graduate class to students at Babes-Bolyai, and his observations of similarities and differences between the American and Romanian higher education systems.



CHARLIE KNOP REMEMBERED

We are saddened to report that Charles P. Knop, the first Chair of the Chemistry Department, died on May 24, 2017, a few days before his ninetieth birthday.

Charlie earned his BS in mathematics from Aquinas College, and his PhD in inorganic chemistry from Michigan State. He worked for Monsanto and Ford before coming to GVSU as Assistant Professor in 1965. In 1969, as the former Division of Science was separated into independent departments, he was selected as department chair for Chemistry. He served in that role until 1977. Under his leadership the department received program approval from the American Chemical Society.

Charlie's influence is still visible in many places in our department. He heavily influenced our curriculum, and some parts of our laboratory instruction remain essentially as he designed them. For example, a CHM 116 chemical kinetics lab we continue to use was carefully designed by Charlie to bring home the concept of reaction order in a very clear way to students. He was a strong believer in community outreach, both to students and in the professional world. He worked and consulted with the Grand Rapids water treatment system for several years. He enthusiastically supported Science Olympiad and its long history of success at GVSU owes a lot to his efforts. Charlie continued to volunteer with Science Olympiad for many years after his retirement.

Donations in Charlie's honor may be made to the Professor Charles Knop Chemistry Scholarship Endowment at GVSU, which provides a scholarship for an outstanding chemistry major and has a particular focus on chemical education.

(Above: Charlie Knop, with Gary Richmond behind him, grades student work for Science Olympiad.)

Annual Student Awards

In April of 2017, the Chemistry Department honored many of its most outstanding students for the 2016-2017 academic year. A total of 56 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, **Sarah M. Battiston, Daniel S. Gritters, Breanna K. Kooinga, Jarod D. Nickel, Ryan Schipper.**

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, **Kacie A. Klott, Michael R. Garnaat, Michael I. McCabe, Benjamin M. Howard, Stefanos D. Apostle, Caroline B. Brereton, Jessica M. Hoover, Samantha L. Law, Jenna L. Seymour**

Organic Chemist Award (ACS Poly-Ed Award): The recipient of this award was **Alanna K. Kenny**. 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 has completed the CHM 245-248 sequence by the end of the academic year. The instructors for these courses select the student.

Analytical Chemist Award: **Daniel J. Tjapkes** 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: **Evan L. Christoffersen** 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: **Betsy K. Trinklein** 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 **Evan L. Christoffersen**.

Biochemistry Award: The recipient of this award was **Aron Rottier**. 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.

American Institute of Chemists Award: **Alexander J. Wong** 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 **Jenae J. Linville**.

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 **Dayne A. Martinez**.



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 submitted by the students 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 **Jacob R. Lindale**.

Outstanding Service Award: This award is given to 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 **C'arra C. Miller**.

Chemistry Department Instrumentation Update

Acquiring up to date equipment remains a challenge for our department but with help from the Dean's office and support via donations we continue to obtain new instruments. A special fund, the Chemistry Instruments and Infrastructure fund, is a non-endowed fund that has been established in order to build up funding for new instrumentation. Donations from our graduates are encouraged and of course much appreciated!

Existing equipment is being maintained as long as parts are available but this becomes challenging as the instruments reach an age where the manufacturer no longer supports them. An update about newer acquisitions follows.

UHPLC

A WPS-3000SL auto sampler and TCC-3000SD column heater were installed on the Thermo Dionex UHPLC. Other modules that complete the system are an LPG-3400SD pump and a VWD-3100 variable wavelength detector. The complete system is now stationed in one of our remodeled analytical laboratories and can be used for both laboratory teaching and for research. The system runs Chromeleon 7 software like most of our other chromatography systems and reduces the learning curve for operation.

GC/MS

A second GC/MS was purchased for the department due to the high use of the existing system by both lab classes and researchers. The newly acquired system is a rebuilt, used system of the same make and model number as the existing system. The same software runs either instrument so method transfer is simple. The newer GC/MS adds the capability of being able to do chemical ionization, a feature the other system does not have. Both instruments are in use and running well.

FTIR

With funds recently received from the Deans' office, the department has purchased a second Thermos Nicolet iS-5 FTIR with a diamond ATR cell. Having the additional FTIR will mean not having to move the other unit from lab to lab. This new FTIR will prove to be very useful for both teaching labs and research.

Laboratory Renovations

With the opening of the Kindschi Hall of Science, additional laboratory space was made available on the second and third floors of Padnos. Much remodeling was undertaken in order to give additional space for the stockroom, instrument repair, analytical labs and advanced synthesis. A photo of part of the analytical space renovation is pictured to the right. The photo is of the analytical chromatography suite which currently houses four of our gas chromatographs, the newer GC/MS and the ion chromatograph.



Thermo Ultimate 3000
UHPLC System



Thermo Focus/DSO II
GC/MS System



Thermo Nicolet iS5 FTIR
with ATR cell



Analytical Chromatography
Suite

Support New Instrumentation Through:

Chemistry Instruments and Infrastructure Fund: A non-endowed fund to supplement the maintenance and purchase of instrumentation and other infrastructure for the chemistry department. It is particularly intended to allow the department to bank money for the purchase of large equipment and instrumentation items. Funded mainly through donations.

Chemistry Support Fund: An endowed fund used to provide long-term support for department supplies, equipment, and consumables for undergraduate teaching and research activities. Since this is an endowed fund, only the gains on the account are usable each year. It will be a smaller but more consistent source of funds for supplies and equipment for the department compared to the non-endowed account. We are currently banking money from donations here to increase the account balance before withdrawing any gains.



Faculty & Staff Awards

Andy Lantz: Pew Teaching Excellence Award

Dr. Andrew Lantz was recently selected as a GVSU 2016 Pew Teaching Excellence Award winner. Prof. Lantz, who has taught at GVSU since 2007, was honored for his ability to "blend knowledge of technical issues with real-life challenges to assist students in moving beyond their initial understanding of the subject. His teaching efforts have been focused in the area of analytical chemistry, including Quantitative Analysis, Instrumental Analysis and Survey of Analytical Chemistry.

Paul Cook: Early Career Scholar Award

Dr. Paul Cook was selected as a 2016 Distinguished Early Career Scholar Award winner. Cook was honored for his success setting up an active research lab focusing on the enzymes involved with resistance to the antibiotic fosfomycin. A recent manuscript was selected as a "Rapid Report" by the journal Biochemistry, a designation reserved for "timely papers on topics of unusual importance". He has also recently secured a \$400,000 grant from the National Institutes of Health to continue this research with students for the next three years.

Tom Pentecost: Oliver Wilson Academy Teaching Award

Dr. Tom Pentecost has been selected for the 2016-17 Outstanding Faculty Award from the Oliver Wilson Freshman Academy. The student-nominated award is presented to a faculty member who is committed to helping Freshman Academy students succeed. The Freshman Academy Program works to increase retention and promote academic performance among its participants. In nominating Professor Pentecost, students noted his availability for help, his above-and-beyond efforts to help them succeed and his involvement in Freshman orientation.



Alumni Spotlight

We caught up with one of our recent alumni, Kyle Schneider, and asked him about his time at GVSU. Here is what he had to say:

1. What year did you graduate and why did you choose GVSU? Class of '09. I can't say there was any one reason I chose GVSU -- I had visited several universities and I just felt the most at home on Grand Valley's campus.

2. What do you most remember from your time at GVSU? I have so many great memories from my time at GV, that it's impossible to pick one! Whether it's driving through the night with friends to watch the football team win a national title in Alabama, going to Laker-Late-Night at Kleiner with my then-girlfriend-now-wife to eat a pile of chili cheese fries (oh how I wish I could still do that!), or winning one of those sought after intramural champion T-shirts in basketball.

But I guess if I had to pick one, it'd be going to Argonne National Lab with Prof. Leonard and Powers to 'shoot' our protein crystals with X-rays to advance our understanding of bacterial antibiotic resistance mechanisms. I mean, how could you beat staying up all night using millions of dollars worth of scientific equipment -- just to focus all that power onto a tiny frozen protein crystal too small to see by eye -- and then watch the data come to life as a 3-D protein model. That's a pretty unique experience most college students don't get a chance to have.

3. What are you doing today and how did your education at GVSU help prepare you for what you are doing today? Today, I'm working as a scientist at a small biotech company in Kalamazoo called Vestaron. We specialize in taking spider venom, identifying the toxin component(s) responsible for killing insects but are safe against mammals, then work to design bio-insecticides based on these toxins. Among various responsibilities, I lead a small metabolic engineering team that modifies the eukaryotic expression host we use to produce these toxins, and I also work to engineer these protein toxins to have more desirable physical properties.

I think it's pretty safe to say I wouldn't be in this position without the research I did with Prof. Leonard while at GVSU. It was during this time that I developed my passion for science and learned how to think like a scientist. And besides, I'm still doing protein structure and function everyday just like I did during my research at GV!

4. What is one lesson you learned from your time at GVSU that you have been able to apply to your career? Since I'm fortunate to be working in the career that I

trained for at GV, I get to use my degree nearly every day. But the one experience I probably learned the most from was actually as a result of a failing project. I had spent an entire semester working to grow protein crystals of a bacterial enzyme called OXA-24/40 using published protocols -- to no avail. I was ready to put my head down and keep working to make subtle tweaks to the protocol the following semester, but Prof. Leonard had a different idea; perhaps there was a flaw in our experimental design and we should reassess our approach. So instead of tweaking known conditions the following semester, we restarted the screen from scratch searching for entirely new conditions, which allowed us to score a hit that led to some exciting antibiotic co-crystal structures.

The lesson here was that perseverance in science, though an essential trait, needs to be wielded carefully to avoid becoming a detriment to your project. If it didn't work last time, what makes you think it will this time? Knowing when to step back and reevaluate the direction of a project is essential to be successful in this field, and it's probably the most difficult skill to master for any scientist. For me, that one experience shifted my paradigm for how quality science is done.

5. What advice do you have for GVSU alumni and students interested in pursuing your profession? My advice to for other students pursuing this profession would be to start doing some undergraduate research. Don't worry if some aspects of your first project feels overwhelming, because believe it or not, it was that way for all of us. Nobody walks into lab on their first day and is automatically a great scientist. Just keep working at your project, one experiment at a time, and over time you will see you have a nice scientific story to be proud of (and something none of your relatives will understand!).



Senior Parting Shots

Students from the class of 2017 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?

Dayne Martinez: 1) I grew up in Tontogany, a small town in northwest Ohio. 2) I am applying to MD/PhD dual degree programs. I will be working in the lab of Dr. Merritt Taylor at GVSU over the summer. 3) I enjoyed traveling to conferences with the pre-MD/PhD club as well as my research group. I also enjoyed the time I spent tutoring in the Chemistry Success Center. 5) My dad has played in a rock band for over thirty years, and as a consequence I have always been a fan of rock music. One of my favorite pastimes is going to rock concerts with my friends and family. 6) My current plans would have me entering the residency phase of my medical training. I am interested in the research and treatment of neurodegenerative diseases. 7) NA

Jenae Linville: 1) Canton, Ohio 2) Ohio State University (Ph. D. in organic chemistry) 3) My favorite memory at Grand Valley was competing in the NCAA national track meet. I have a couple favorite memory with the chemistry department; one is the tremendous support of everyone in the department from the front office, to the students, to the professors the other memory I have are the long days sitting in the inner hall working on homework everyday, but doing it with my friends along side me. 4) I would say Otto Diels because of how sweet the Diels-Alder reaction is. 5) People probably know that I was on the track team, but they might not know I also was a tutor in the tutoring center, tutor in the CSC, PASS instructor, lab instructor, and researched all while in school. 6) In 10 years from now I would like to be teaching organic chemistry at a university similar to Grand Valley. 7) The chemistry department has done a very good job at turning me from a hesitant questioning freshman to graduate who was accepted to and now has the confidence to go to graduate school.

Alex Wong: 1) From- Bloomfield Hills 2) Will be around grand rapids next year and then hopefully graduate school for a degree in polymers. 3) One of my best memories is competing as a diver for Grand Valley. 4) I admire Enrico Fermi and his pioneering work in nuclear energy. 5) A fun fact is that I learned English after Cantonese regardless of being born in Michigan. 6) I see my self working in industry trying to become an astronaut to go to mars. 7) I would just like to say thank you to everyone that helped me along the way!

Sarah Lelli: 1) Howell, MI 2) Hopefully working around the Grand Rapids area 3) Spending the week over spring break volunteering at an animal shelter in Florida last year 6) Hopefully living somewhere warmer than Michigan, having a job I enjoy, and having one (or two) awesome dog(s).

Mitchell Haynes: 1) Grand Rapids, MI, 2) UNC Eshelman School of Pharmacy - Chapel Hill, NC. 3) Watching the whole wrecking ball fad unfold, and then riding the wrecking ball. Any of the hundreds of weird conversations that always seem to happen during a lab. Ordering Jimmy Johns at 11:30 pm during exam week and no one can study because we have all been awake for 20+ hours. My favorite will always be the week before classes began as a freshman. That was my first experience with freedom and I know my best friends because of everything that happened that week. 4) In the most recent history probably Elon Musk, which feels a lot like a cop-out because he's gotten so famous recently, but I feel like he is making good strides towards the future and has a good head on his shoulders. 5) The tip of my middle finger on my left hand is shorter than my right because when I was little it got caught in a closing door and it had to be reattached. 6) 10 years from now I would like to be married and starting a family, working in something related to pharmacy. 7) I big thank you to all of the chemistry faculty. I would not be the person I am today without you, and I feel like I got a phenomenal education here at GVSU.

Emily Ingalls: 1) Mason, MI 2) I am moving to Ann Arbor to pursue a pharmD at the University of Michigan 3) Some of my best memories at GVSU are from doing research with Dr. Witucki and Jenny Jess. 6) In ten years I hope to be practicing pharmacy in a hospital.

Student Scholars Day 2017

Grand Valley hosted the annual the 21st annual Student Scholars Day on April 12, 2017, which celebrates undergraduate scholarship and creative works. This past year, students from the chemistry department presented 30 posters highlight the work of 34 students and 17 faculty.

Synthesis of Compounds with Soft Donors

Presenter: Andrew LaDuca

Mentors: John Bender, Shannon Biros, Thomas Neils

Synthesis and Characterization of Phosphine Derivatives for Complexation Studies

Presenters: Evan Christoffersen, Austin Ronspees

Mentor: John Bender

Synthesis and Characterization of Unsymmetrical Mono- and Diphosphines for use in Selective Metal Complexation

Presenters: Jonika Forbes, Betsy Trinklein

Mentor: John Bender

Synthesis and Characterization of Chalcogen Containing Phosphine Ligands

Presenters: C'arra Miller, Christopher Peruzzi

Mentor: John Bender

An Overview of Synthetic Routes and Characterization of Novel Phosphine Compounds for Use in Metal Complexation

Presenters: Marissa Biesbrock, Trey Pankratz

Mentor: John Bender

Synthesis of Tri-substituted Benzene Compounds Used in Nuclear Waste Remediation

Presenter: Brandon Wackerle

Mentor: Shannon Biros

Synthesis and Characterization of Bidentate Phosphine Ligands Containing Chalcogenides

Presenter: C'arra Miller

Mentor: Shannon Biros

The Use of Extraction and Luminescence Techniques for the Recovery and Recycling of Lanthanide and Actinide Metals from Spent Nuclear Fuel

Presenters: Michael Hudson, Hunter Pearson

Mentor: Shannon Biros

Mutagenic Analysis of BshC: the Final Enzyme of the Bacillithiol Biosynthesis Pathway

Presenter: Emily David

Mentor: Paul Cook

A Structural and Functional Analysis of BshA: The First Enzyme of the Bacillithiol Biosynthesis Pathway

Presenter: Christopher Royer

Mentor: Paul Cook

Fluorescence and Crystallographic Analysis of BshC Ligand Binding

Presenter: Aaron Rosenberg

Mentor: Paul Cook

Novel Synthesis of Antibiotic Urea Precursors

Presenter: Phillip Dietz

Mentor: Matthew Hart

Stereoelectronic Effects in the Nucleophilic Ring Opening of Phenyl Aziridines

Presenter: Alexander Wong

Mentor: Matthew Hart

Learning Biochemistry through Virtual Reality: Developing a Spectroscopic Simulation of Protein Folding

Presenter: Ryan Zahran

Mentor: Mary Karpen

Fano-Type Resonances Detected at Catalytic Surfaces with ATR-IR

Presenter: Jacob Lindale

Mentor: Dalila Kovacs

Investigating Heterogeneous Catalysis Using ATR-IR Spectroscopy

Presenter: Evan Christoffersen

Mentor: Dalila Kovacs

Extraction, Isolation, and Hydrogenation of 6-gingerol

Presenter: Connor White

Mentor: Dalila Kovacs

Chiral Separation of Silanes via Capillary Micellar Electrokinetic Chromatography

Presenter: Sydney Shavaler

Mentor: Andrew Lantz

An Investigation into the Importance of the Lysine-84 Side Chain's Nitrogen in OXA-24

Presenter: Mitchell Haynes

Mentor: David Leonard

Exploring the Reaction Mechanism and Origin of Regioselectivity in Di-Nickel Catalyzed Alkyne Cyclotrimerization

Presenter: Trey Pankratz

Mentor: Richard Lord

Analysis of the Electronic Structure and Formation Mechanism of an Iron-Tetrazene Supported by Bulky Alkoxides

Presenters: Caleb Huizenga, Elizabeth Washnack-Schmid

Mentor: Richard Lord

Synthesis of Phenoxy Acetals of α -bromo Acetaldehyde: Precursors to a New Class of Asymmetric Iron Olefin Complexes

Presenter: Christopher Peruzzi

Mentor: Stephen Matchett

Determination of Binding Affinity Between an Antibiotic Resistance Enzyme and Fragment-based Inhibitors

Presenter: Uyen Pham

Mentor: Rachel Powers

A Slow Experiment for Ultrafast Detection

Presenter: Jacob Lindale

Mentor: Stephanie Schaertel

Monitoring Collisions of Single Pd, Pt, and Rh Nanoparticles Using Hydrazine Oxidation and Proton Reduction

Presenter: Aaron Capps

Mentor: Scott Thorgaard

An Eye-tracking Study of Visual Representation Use for Problem Solving in Organic Chemistry

Presenter: Megan Plekker

Mentor: Jessica VandenPlas

Structure-function Analysis of Boronic Acid Transition State Inhibitors of Acinetobacter-derived Cephalosporinase (ADC-7)

Presenter: Kali Smolen

Mentor: Bradley Wallar

Structural Analysis of Y150F Mutant of Acinetobacter-derived Cephalosporinase (ADC-7)

Presenter: Sara Barlow

Mentor: Bradley Wallar

The Search for Resonance in Vinylsilyl Anions: Synthesis of Silyl Substituted 9-methylene urene

Presenter: Craig Fowler

Mentor: Randy Winchester

Synthesis and Study of a Vinylsilole

Presenter: Joseph Robertson

Mentor: Randy Winchester

A Study on the Synthesis of Modafinil

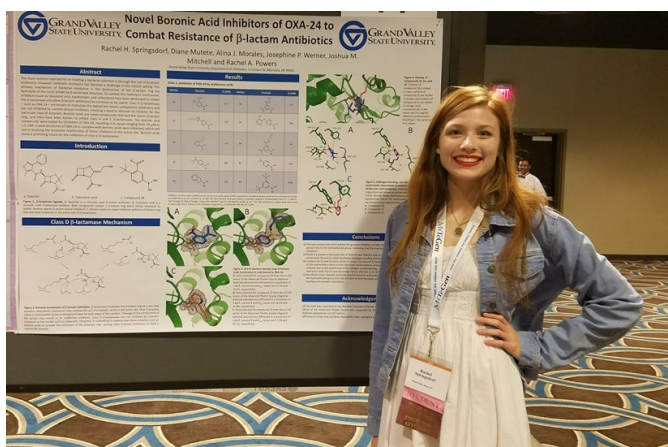
Presenter: Alexandra Williams

Mentor: Randy Winchester

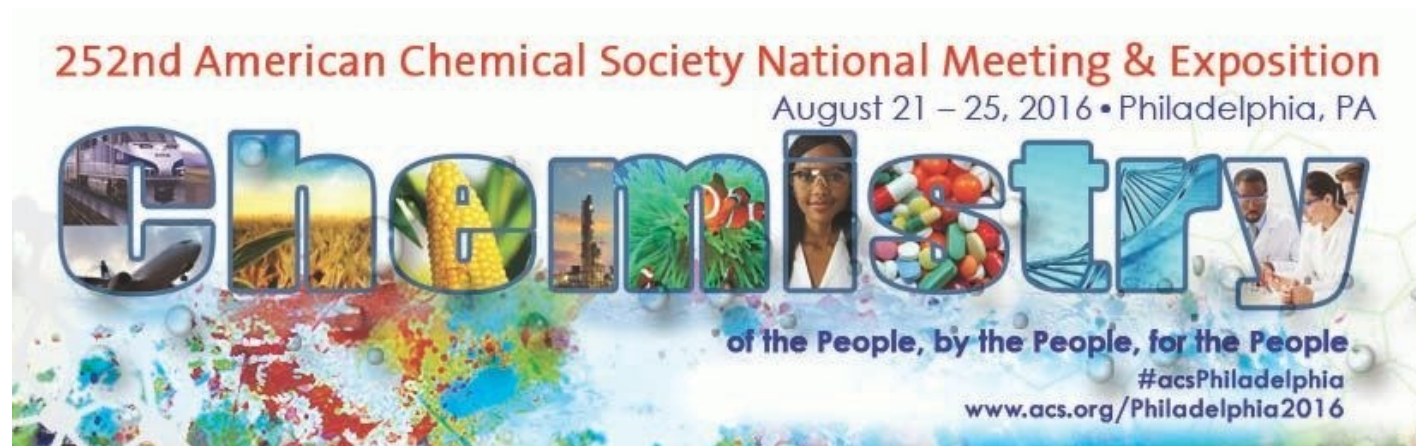
National Conference Attendance

GVSU professors and students attend the national meeting of the American Crystallographic Association

Professors **Rachel Powers** and **Paul Cook** and four of their students attended the national meeting of the American Crystallographic Association in New Orleans (May 26-30, 2017). Powers lab member **Rachel Springsdorf** (BMS) presented a poster on her research that explores boronic acids as inhibitors of class D beta-lactamases. Dr. Powers co-chaired a session with Dr. Joe Tanski (Vassar College) entitled "Engaging undergraduate students with crystallographic research". Also presenting posters were Cook lab members **Aaron Rosenberg** and **Emily David** (Crystallographic and fluorescence-based ligand binding analysis of BshC: the putative cysteine ligase in bacillithiol biosynthesis) and **Chris Royer** (Structural and Functional Analysis of the Bacillithiol Biosynthesis Enzyme BshA Supports the S_Ni-like Retaining Mechanism).



Rachel Springsdorf



Chris Peruzzi and **Professor Scott Thorgaard** presented a poster entitled *Detection of single Rh nanoparticles using an ultramicroelectrode*. This work detects the collision of individual Pt and Rh nanoparticles at the gold ultramicroelectrode using electrocatalytic amplification. Dr. Thorgaard also gave a talk on electrochemical detection of single bacterial using similar ultramicroelectrodes.

253rd American Chemical Society National Meeting & Exposition

April 2-6, 2017 • San Francisco, CA

#acsSanFran • www.acs.org/SanFran2017



Grand Valley State University was well represented in San Francisco. Students and faculty gave numerous posters and oral presentation. In all, 11 research groups which include 20 different undergraduate researchers were represented. We acknowledge the hard work and dedication of our faculty: Professors **Jim Krikke, Randy Winchester, Tom Pentecost, Dalila Kovacs, Matt Hart, Shannon Biros, Richard Lord, Andrew Korich, Deborah Herrington, Jessica VandenPlas and John Bender.**

Without question, the research presented at this and other professional conferences could not have occurred without dedicated undergraduate researchers. Many of these students spend their free time and countless hours outside of their traditional course work in the lab conducting experiments. The chemistry faculty thank all members of their research group and those who presented their work at the ACS Meeting.

The Korich Research group acknowledges: **Pauline Mansour, Victoria Kuipers and Jenae Linville**

The VandenPlas Research group acknowledges: **Megan Plekker**

The VandenPlas and Herrington groups acknowledge: **Marrissa Biesbrock**

The Hart Research group acknowledges: **Alex Wong, Justin Tarahomi**

The Biros Research group acknowledges: **Brandon Wackerle, Michael Hudson**

The Biros and Bend research groups acknowledge: **C'arra Miller, Erin Leach, Evan Christoffersen, Anthony Spyker**

The Winchester Research group acknowledges: **Craig Fowler, Joseph Roberston, and Eva Gulotty**

The Kovacs Research group acknowledges: **Evan Christoffersen and Jake Lindale**

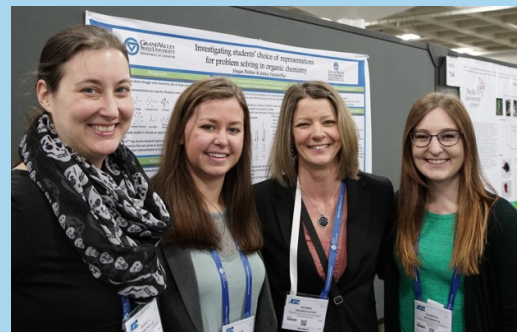
The Kovacs Research group and Jim Krikke acknowledge: **Connor White, Emily McGuffie, and Taylor Harris**



Left to Right:

Evan Christoffersen, Pauline Mansour, Brandon Wackerle, Anthony Spyker, Michael Hudson, Victoria Kuipers, Alex Wong, C'arra Miller, Dr. John Bender, Connor White, Jenae Linville, Erin Leach, and Dr. Dalila Kovacs

Left to Right:
Alex Wong,
Evan Christoffersen,
and Anthony Spyker



Left to Right: Dr. Jessica VandenPlas, Megan Plekker,
Dr. Deborah Herrington and Marrissa Biesbrock

Faculty News and Research Highlights

The Chemistry Department has consistently maintained as its priority research endeavor that involves the active participation of undergraduate researchers. Herein is provided our update of some faculty research activity.

Analytical

In the past year **Dr. Andrew Lantz's** laboratory has worked on several research projects: 1) the development of an organic redox electrolytes for energy storage in collaboration with Vinazene, Inc., 2) the development of a capillary electrophoresis based methods for the enantioseparation of chiral silanes, and 3) the development of in-field methods for analysis of primate olfactory compounds using portable gas chromatography-mass spectrometry instrumentation in collaboration with Dr. Cynthia Thompson in the Biology department. Dr. Lantz's research group presented two posters and is supported by a National Science Foundation, High-risk Research in Biological Anthropology grant.

Dr. Stephanie Schaertel continue working on experiment and theoretical aspects of spectroscopy including the use of noisy light for ultra-fast time resolution and collisional boarding of gas phase molecules.

Dr. Scott Thorgaard's research group is continuing its work in the areas of single nanoparticle electrochemistry, electrochemical tracking of single bacteria, and facilitated ion transfer at micro-liquid/liquid interfaces. He mentored four undergraduate students in research projects during the 2016-2017 academic year and the summer of 2017. In March of 2017, his student Aaron Capps presented findings from his summer 2016 research on single nanoparticle electrochemistry at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy in Chicago, IL. During the summer of 2017, student Zachariah Vander Tuin completed a project which used electrochemistry to study the transfer of Tb^{3+} at a water/1,2-dichloroethane interface. Zachariah worked in the lab through the S3 program as an Ott-Stiner Fellow, and will present findings from his work at the ACS National Meeting and Exposition in March 2018.

Dr. George McBane continues his work on gas-phase collisions and reactions by using both computational modeling and experiments methods. His group has a particular focus on electronically excited O_2 in the atmosphere and triatomic photodissociation.

Computer simulations remain at the forefront of **Dr. Christopher Lawrence** research group as a method to understand why water molecules can escape through aerosols

Organic

Dr. Felix Ngassa continues research in synthetic organic and computational chemistry. Four undergraduates worked in the Ngassa laboratory in the 2016-2017 school year. A synthetic project on "The Synthesis of Arylsulfonates and Its Application in S_NAr Reactions" was published in *Trends in Organic Chemistry*. The collaborative computational project on "Predicting the Secondary Structures of Proteins by Circular Dichroism" is ongoing. Dr. Ngassa was elected Chair of the Executive Committee of the University Academic Senate, ECS/UAS, for 2017-2018.

Dr. Andrew Korich graduated two research students from his laboratory this past year: Jenae Linville and Victoria Kuipers. His

group continues their work on boron-mediated cyclizations and novel catalytic organic transformations. Dr. Korich's group presented their preliminary findings on these research projects at the national ACS meeting in San Francisco and is currently made up of two undergraduates, Pauline Mansour and Jenna Burton. Dr. Korich also received tenure and promotion to Associate Professor this past year.



Korich Research Group: (Left to Right) Victoria Kuipers, Pauline Mansour and Jenae Linville

Dr. Shannon Biros continues investigating the synthesis of multidentate ligands for the coordination of lanthanides and actinides. Applications for this research can be found in the recycling of lanthanides from advanced materials as well as in nuclear waste remediation processes. Dr. Biros and her research team characterize these novel ligands with extraction studies, X-ray crystallography, and NMR spectroscopy.

Solid-phase peptide synthesis remains the cornerstone of **Dr. Laurie Witucki's** research endeavors. Her group uses this technique to synthesize both individual peptides and combinatorial peptide libraries for the purpose of identifying new inhibitors for the tyrosine kinase FAK which has been implicated in a number of cancers including skin, larynx, colon and breast cancer. A new area of research involves a chemical composition analysis of essential oils using GC-MS.

Dr. Dalila Kovacs' current research focus is breaking down biomass into commodity chemicals and various other platform molecules. Dr. Kovacs is currently on sabbatical.

Dr. Randy Winchester's group remains focused in the field of silicon chemistry. First, his group is developing a synthetic approach towards chiral silanes with the goal of using them as chiral auxiliaries for asymmetric organic transformations. Additionally, Dr. Winchester's group is interested in understanding silicon-carbon double bonds through studying sila-allyl anions. Two undergraduates in Randy's group, Joe Robertson and Craig Fowler presented last winter at ACS San Francisco meeting. This year he is supporting Chemistry major Dolly West with a Michigan Space grant.

Dr. Laura Hawk has recently joined the organic group at GVSU. Her work will focus on molecular recognition in the context of peptide-based systems. This will provide a unique scaffold for testing many questions of molecular recognition which span many fields including organic chemistry and biological systems.

Dr. Matthew Hart's Research – In the past few years our lab has been focused on the synthesis of novel diphenyl ureas. This past year we have discovered that these molecules exhibit anti-microbial activity against *E. coli* and *S. aureus*. We are currently expanding the SAR of these structures to increase their activity. Our lab has also been working on several mechanistic-application projects including one focused on the nucleophilic ring opening of aziridines.

Additionally, we have been working on novel applications of copper mediated coupling reactions in the synthesis of analogs of the antibiotic Linezolid.

Chemical Education

Dr. Thomas Pentecost's current research, *Application of Fundamental Measurement Principles in Chemical Education Research*, uses both qualitative and quantitative methods for to assess student understanding of fundamental chemistry concepts. Dr. Pentecost is currently on sabbatical.

This past year **Dr. Deborah Herrington** continued her work on the Facilitating Online-learning in Chemistry Using Simulations project in collaboration with Dr. Jessica VandenPlas (GVSU) and Dr. Ryan Sweeder (MSU). This work resulted in a publication as well as numerous presentations, including several undergraduate presentations and a keynote address at the College Chemistry Canada Conference in Toronto, ON Canada. This project was just recently funded by a collaborative National Science Foundation IUSE grant.

Dr. Herrington also continued her work with the Target Inquiry (TI) project. Though this project is now coming to an end after 13 successful years at GVSU, work with area middle and high school teachers resulted in several publications and presentations. Additionally, as an extension of this project she worked with several high school chemistry teachers this summer to incorporate many of the TI activities into a research-based high school chemistry curriculum that is aligned with the Next Generation Science Standards.

Dr. Brittland DeKorver joined the chemistry department this year. Her work focuses on Students' perceptions of laboratory coursework, student-generated visualizations to model particulate phenomena, and use of narrative tools in curriculum design.

Inorganic Chemistry

Dr. Stephen Matchett continues his work at the interface of inorganic and organometallic chemistry. His group focuses on studying the complexation of unsaturated organic molecules by transition metal complexes and the effect on their chemical reactivity.

Dr. John Bender and his group collaborates with Dr. Shannon Biros on the selective complexation of lanthanide and actinide elements. Dr. Bender's synthetic methods compliment the group research in the focus on organometallic chemistry of Group 15 and 16 elements, and combinations thereof. Recent results of this work include novel coordination isomers of phosphine oxides with lanthanides, and potential, previously undocumented antimonide complexes of lanthanides.

Dr. Richard Lord published six research articles including one with a GVSU alumni, Alyssa C. Cabelof who is a second-year graduate student in Prof. Ken Caulton's lab at Indiana University. Dr. Lord also organized the 29th MU3C Conference at the University of Illinois at Urbana-Champaign and had two students present Caleb Huizenga and Trey Pankratz. In early 2017, Dr. Lord received tenure and was promoted to associate professor. In addition to his continued success, Dr. Lord and his wife Sarah became proud parents of a baby girl, Thea Rose Lord, born 3/7/17.

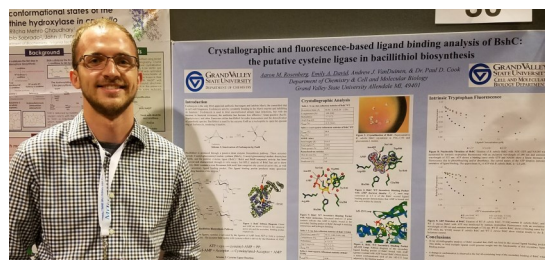
Biochemistry

Dr. Dave Leonard and his research group continue to investigate structure/function relationships in class D β -lactamase enzymes. In the past year, they published two manuscripts (*Protein Science* and *Antimicrobial Agents and Chemotherapy*) and presented two posters at the Annual Symposium of the Protein Society (Montreal). The Leonard group bid farewell to Chemistry major Mitchell Haynes and Biomedical Sciences major Irada Choudhuri.

Dr. Paul Cook and his group continue their work on structural and functional studies of the enzymes that produce and utilize bacillithiol, a molecule critical to bacterial resistance to the antibiotic fosfomycin. The group elucidated novel X-ray crystallographic structures of two important enzymes involved in these processes: BshA and BstA. The ultimate goal of this work is to find new avenues to combat antibiotic resistance in gram-positive organisms.

Dr. Rachel Powers' group looks to combat antibiotic resistance by discovering novel inhibitors for class D β -lactamases. X-ray crystal structures of several inhibitor complexes were determined, based on experiments conducted at the Advanced Photon Source at Argonne National Lab. This year, they published one paper in *Protein Science*, with GVSU students Josie Werner and Josh Mitchell as authors. On-going research efforts focus on optimization of these lead molecules to design potent inhibitors for class D enzymes.

Dr. Cook and Dr. Powers attended the national meeting of the American Crystallographic Association in New Orleans (May 26-30, 2017) where their students Emily David, Aaron Rosenberg, Rachel Springsdorf, and lab technician, Chris Royer, also presented posters on their research projects. Dr. Powers co-chaired a session with Dr. Joe Tanski (Vassar College) entitled "Engaging undergraduate students with crystallographic research".



Aaron Rosenberg

Using a combination of enzyme kinetics, site-directed mutagenesis, and X-ray crystallography **Dr. Brad Wallar** and his research team study a class of novel boronic acid inhibitors in order to identify the most effective inhibitor of the β -lactamase, *Acinetobacter*-derived cephalosporinase. This exciting project is funded by the NIH and involves research collaborations with the Prati lab (University of Modena, Italy), the Bonomo lab (Case Western Reserve University), and the Powers lab (GVSU).

Dr. Mary Karpen and her research group use computational biochemistry to study protein structure and dynamics. Her current focus is to develop 3-D virtual reality models of biomolecules, suitable for projection using 3D movie technology or viewing with virtual reality headsets. She also works with Dr. Cook to explore ligand binding modes of a series of enzymes used to synthesize bacillithiol. Understanding bacillithiol biosynthesis may lead to approaches to counteract this molecule's antibiotic resistance behavior.

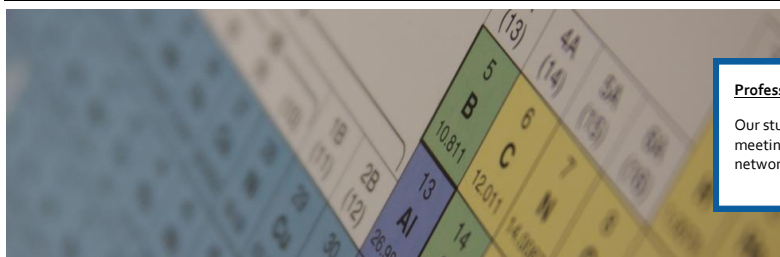




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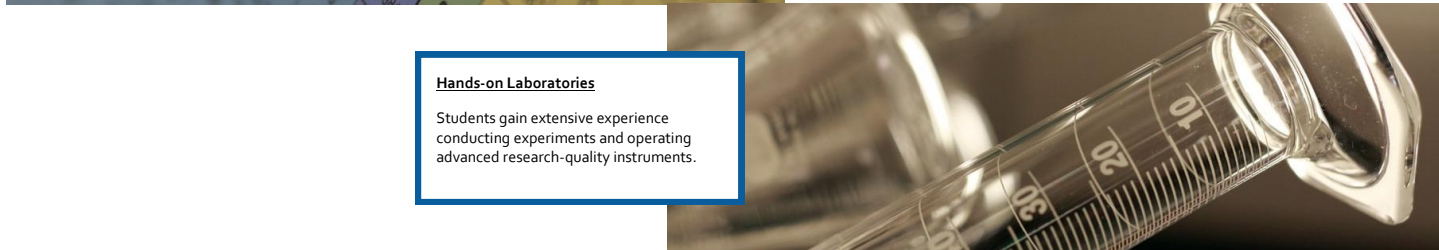
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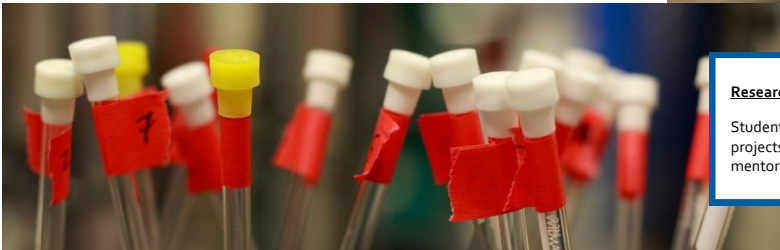
Professional Growth

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



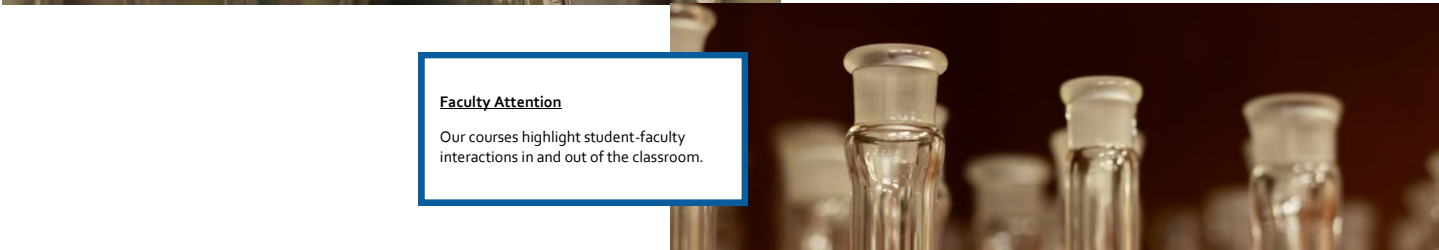
Hands-on Laboratories

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.