



GROVE CITY COLLEGE
CHEMISTRY
eNEWSLETTER
SPRING 2017



Departmental News

From Dr. Tim Homan, Chair

The 2016-17 year has been an especially busy one for us in the Grove City College Chemistry Department. Our search to replace Dr. Harold Conder after his retirement last year was unsuccessful. We have been fortunate to have Dr. Mary Sisak, a retired chemistry professor from Slippery Rock University, be willing to serve as an adjunct professor to help us by teaching a lecture section and a lab for both Chem 101 and 102. She's done a great job.

But we are pleased to announce that Dr. Holly Guevara will be joining our department in the Fall. Holly has completed her PhD in organic chemistry at the University of New Hampshire. She will be teaching Chem 101 in the Fall, and Chem 453 (Advanced Molecular Spectroscopy) and Chem 458 (Advanced Synthesis Lab) in the Spring. We'll have a full profile on her in next Fall's eNewsletter.

Our new 400 MHZ JEOL NMR was delivered and installed in September. You can read about it in full on the next page.

Student research this year has been particularly fruitful. We are very pleased that one of our juniors, Matt Genzink (CHEM, '18), was chosen to participate in the Euroscholars Research Abroad program. As the name says, instead of study abroad, this program enables undergraduates from the States to spend a semester abroad doing research. Danielle Hiener (CHEM, '18), Jordan Herder (BIOC, '17), and Emily Tharnish (CHEM, '17) all presented poster of their research at the ACS national Meeting.

We are teaching two new classes this Spring. First, Dr. Kriley is teaching Chem 231, Descriptive Inorganic/Bioinorganic Chemistry, which is a sophomore level introduction to Inorganic Chemistry. He has been teaching a one-credit course on Group Theory since 2003, and this new course will combine some topics from our senior Inorganic course and his Group Theory course, so that we will be introducing Inorganic Chemistry earlier. The chemistry majors will then take an advanced Inorganic course their senior year.

Dr. Augspurger and Dr. Falcetta began offering an elective Computational Chemistry course in 2009, but we also wanted to expose our students to computational tools earlier, as well. So Dr. Falcetta is teaching Chem 245, Introduction to Molecular Modeling, for the first time this semester. It is a required course and taught each year to the sophomores. Dr. Augspurger will continue to offer as an elective every other year the Advanced Computational Chemistry course. Finally, we are preparing to say goodbye to another large class, although not quite as large as last year's class of 29. We'll graduate 21 students this year. Three of them graduated early, after the Fall semester. We continue to be blessed to have excellent students that we are privileged to help train for their future careers.

Our new NMR is installed and running!

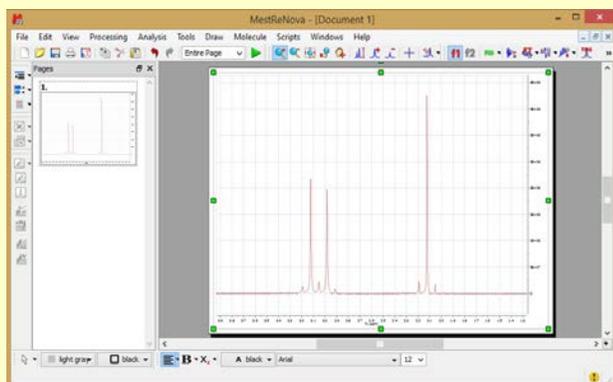
Last September, our new JEOL 400YH 400 MHz NMR spectrometer was delivered. We decided to locate it on the first floor of STEM Hall, in a room directly off the delivery area, so that we no longer have to wheel the liquid nitrogen tanks up and down an elevator. One technician from JEOL spent several days over a two week period setting it up, filling the magnet with liquid nitrogen, and then liquid helium.

Once the magnet was cooled to the superconductor state, the current to the magnet was charged. After waiting several days for the magnet to equilibrate, final shimming and setup was completed. At that point a second technician arrived to provide an initial training, and it was then available for use.



One of the main advantages of the new NMR is the software and the modern interface. The large black box in the bottom left of the picture actually controls the spectrometer, and it is connected to the PC tower under the table on the right. It was used in the Fall semester by the CHEM 422 Inorganic lab class and research students.

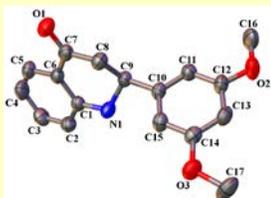
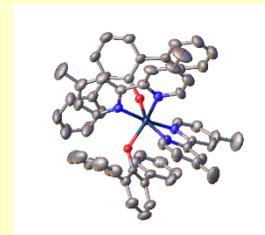
Another huge upgrade is the 24-chamber autosampler. This spring, the students in the majors section of the Organic Lab have been learning how to use the NMR. With the autosampler, an entire class's samples can be setup to run overnight. We're still working out the details, but so far, for classes with a large number of students like Organic, Dr. Cramer gets the raw data off of the NMR computer onto a thumb drive, and then the students copy their data onto their own computer.



Once the students have their raw data, they will continue to use the MestreNova software that we have been using for several years to process the raw data and generate spectra to include in the lab reports.

Research Highlights for This Year

Jordan Herder (BIOC, '17), under the direction of Dr. Kriley, synthesized three tungsten aryl oxide pyridine complexes, including one (in the picture to the right) new compound, $W(OAr)_2(4,4\text{-Me-}2,2\text{-bipy})_2$. The structure pictured was determined using our Rigaku x-ray diffractometer.



Emily Tharnish (CHEM, '17), also under the direction of Dr. Kriley, has been working on synthesizing derivatives of quercetin, a naturally occurring compound with some anti-cancer effects. One derivative which has been reported, antioxidant 2-(3,5-dimethoxyphenyl)-2,3-dihydroquinolin-4(1H)-one, relies on expensive catalysts and harsh conditions. Emily developed an alternative reaction scheme which avoided the expensive catalysts and harsh conditions.

Dr. Falcetta supervised two students, Nate Reilly (BIOC, '17) and Danielle Hiener (CHEM, '18), who used computational tools to study the stabilization energies and lifetimes of short-lived negative anions. Some of this work resulted in a paper published in *Chemical Physics* with Nathan as a co-author:

M.F. Falcetta, N. D. Reilly and K.D. Jordan; "Stabilization calculations of the low-lying temporary anions states of Be, Mg, and Ca", *Chemical Physics*, 482, 239 (2017).

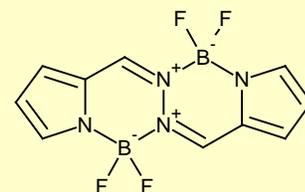
Danielle, Jordan, and Emily presented their results at the ACS National Meeting.



Drs. Kriley and Falcetta took three students to the National ACS Meeting in San Francisco in March. They are pictured here with a couple of alumni. Front row: Dr. Evonne (Marasco) Baldauff (BIOC, '00, Chair of Chemistry and Forensics Science, Waynesburg U.), Emily Tharnish (CHEM, '17), Danielle Hiener (CHEM, '18) and Dr. Falcetta. Back row: Dr. Kriley, Dr. Max Majireck (BIOC, '05, Asst. Professor, Hamilton College), and Jordan Herder (BIOC, '17)

Dr. Wong has begun a new research project which is focused on characterizing and understanding polymeric systems as they bind to biomolecular species, including DNA, bacteria, and viruses. It will utilize optical, titrimetric, and imaging instrumentation to determine the mechanism of how these complexes bind. An example of these types of systems is polyethyleneimine (PEI), which is a nanopolymer that is positively charged and binds to negatively charged DNA and also kills bacteria (*E. coli*) and viruses (influenza).

Matt Genzink (CHEM, '18) spent the Fall semester at KU Leuven University in Belgium as a Euroscholars student. [Euroscholars](#) is a program for undergraduates to do research (not just take classes) abroad. Matt synthesized novel derivatives of BOPHY (pictured on the right), a recently discovered fluorescent dye that is proving to be important in biological systems.



2016 Graduates

29 of the freshmen who started at GCC in August, 2012, graduated in 2016, the largest number of graduates from the Chemistry department that any of us are aware of (and Dr. Homan has been here 26 years). This class was outstanding not only for its numbers, but also its quality. Five of the graduates have started PhD programs (at Notre Dame, Wisconsin, Akron, George Washington, and Washington), four are in medical school (Michigan, West Virginia, Lake Erie College of Medicine, and Virginia), and one is in the Temple MD-PhD program. Two of our students were accepted into National Institutes of Health research internships, two are at dental school, one in a Physician's Assistant program, one is in an EMT program, and one is in pharmacy school.

But not everyone went off to grad school or the medical professions. Four are working in various industrial positions. A couple of grads are at work in research labs, considering their future direction. We are so proud of this group, and wait to see the great things they will accomplish in the years ahead!



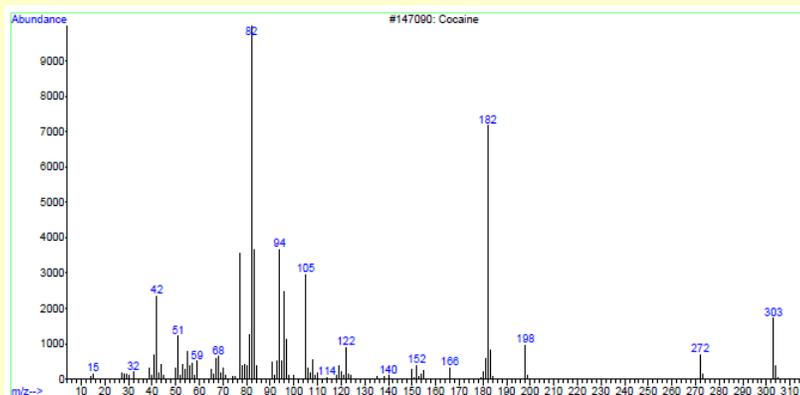
1st row: Lauren Hake, Abby Mathes, Megan Lund, Rachel Zdaniewicz. 2nd row: Rebecca McLaughlin, Jocelyn Seaton, Rachel Schmidt, Lorna Williams. 3rd row: Laruen Whitmire and Carolyn Sedmak. 4th row: Alex Abel, Chris Parry, and Dan Greenfield. 5th row: Jon Mathes, Aaron Newborn, Nate Hayes, and Jon Hoyt. 6th row: Cody Work, Matt Glasscott, Brent Veerman, and Tim Bergquist. Last row: Nathan Rutter.

Alumni Profile – Marty Lewis: CSI in real life

Marty Lewis graduated from Grove City College in 2000 with a B.S. in Chemistry, and since then has pursued a successful career in forensic science.

His first job was as a forensic scientist with the Pennsylvania State Police. His work in the drug chemistry section involved testing unknown substances (powders, pills, liquids, and plant material) for the presence or absence of controlled substances, such as cocaine, heroin, methamphetamine and marijuana. The laboratory reports generated were used in courts of law to help determine whether or not someone was guilty of violating drug laws.

While he received specialized on the job training, “my chemistry degree from GCC greatly prepared me for my work, which was very similar the content of the yearlong Practical Organic Chemistry lab course.” A major focus of the class was the use of different types of spectroscopy to identify unknown organic compounds. Classroom and laboratory instruction included using and interpreting infrared spectroscopy, mass spectrometry and NMR. At the PA State Police, the primary tools to identify organic compounds were gas chromatography, mass spectrometry (e.g., like that of cocaine, shown below) and infrared spectroscopy. They also used

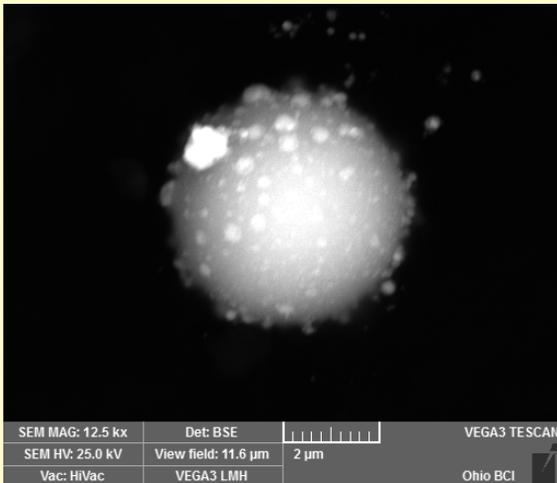


Mass spectrum of cocaine.

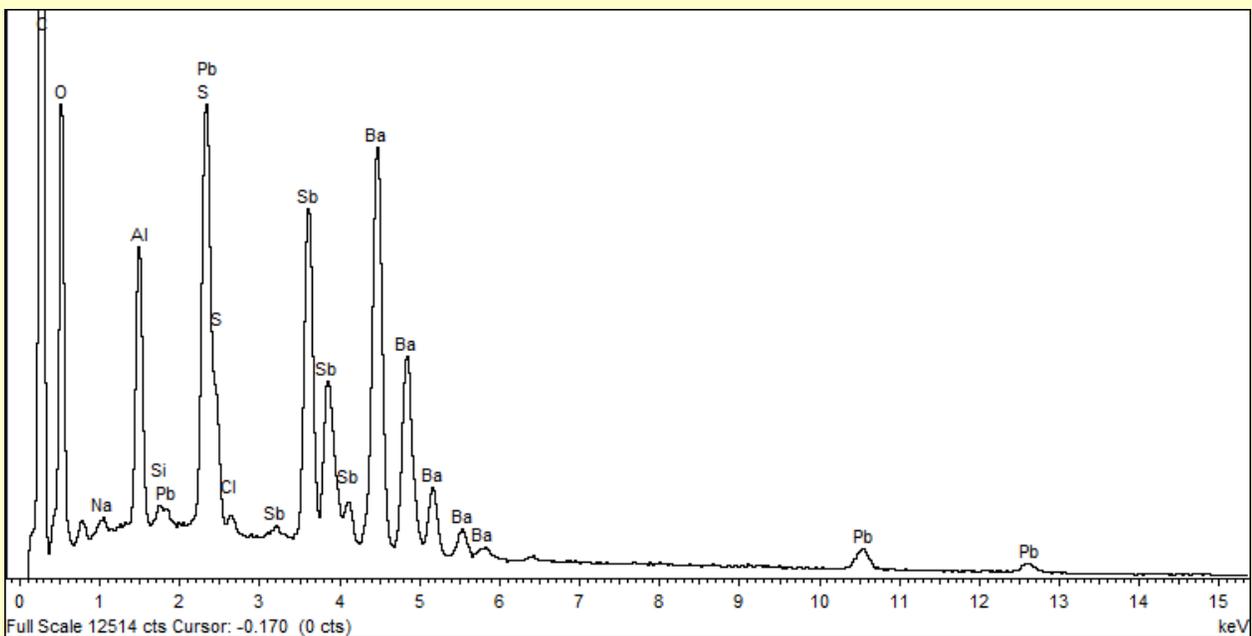
some wet chemistry, including chemical reaction color tests and acid/base extractions to isolate and purify compounds.

After working at the PA State Police for a little over a year, he moved to Cleveland, Ohio, and began work for the Ohio Attorney General's Office Bureau of Criminal Identification and Investigation (BCI), which is where he continues to work today. His job title remained Forensic Scientist, but for his first 12 years at BCI he

worked in what is called the “trace evidence” section. In this section, they analyze a variety of different types of evidence, including fibers, paint, glass, gunshot residue (see an example on the next page), pressure sensitive tapes (e.g., duct tape), shoeprints, and tire tracks. The work in the trace evidence section involved comparing materials from a crime scene to known samples that could be associated with an individual. Two examples would be comparing fibers stuck on a broken window to known clothing from a suspect or comparing a paint chip found on the clothing of a hit and run victim to known paint chips collected from a suspect vehicle. The analyses included visual examinations, microscopic examinations, measuring of physical properties and chemical analysis. The chemical analyses were primarily performed using infrared spectroscopy and scanning electron microscopy/energy dispersive x-ray spectroscopy.



This is an example of gunshot residue. The image shown at left was taken with an electron microscope, physically imaging the sample. Shown below is a chemical examination of its elemental composition using energy-dispersive x-ray spectroscopy.



One of the most interesting and difficult cases Marty worked on involved the homicide of three women whose bodies were found wrapped in multiple layers of garbage bags. The women were killed at different times and their bodies were located in different areas. Marty was assigned the task of comparing the garbage bags from the bodies to a known box of garbage bags that was collected from a suspect's house. He was also asked to compare a bed sheet from one of the victims to a set of sheets collected from the same suspect's house.

The analysis of the garbage bags and fabric from the sheet involved both physical and chemical testing. The results of the testing found that the sheet from the body was the same as the bedding from the suspect's house with respect to color, design, weave pattern and fiber content. The garbage bag analysis revealed that all but five of the garbage bags from the bodies were different than the known bags from the box that was collected from the suspect's house. The five bags that were found to be the same as the bags from the box were from the last victim. These bags were the five outermost layers of bags

wrapped around the body. When he counted the bags remaining in the known box of garbage bags, there were five bags missing! This could hardly be a coincidence. He testified in this case as an expert witness. The defendant was found guilty and received a death sentence and is currently waiting on an appeal.

As of 2013, Marty began working drug chemistry cases again, as well as continuing to test hand samples for the presence of gunshot residue. He has testified in court over two hundred times. He finds the work to be rewarding and challenging, especially with the continual emergence of new synthetic compounds of abuse and the increase in the use of opiate and opiate related compounds. He feels that his time at Grove City provided him a solid foundation in chemistry and taught him many of the skills that he uses in his career today.