

GROVE CITY COLLEGE

CHEMISTRY eNEWSLETTER

Spring 2012



Departmental News

By Dr. Timothy Homan, Chair

The first thing you notice as you approach Rockwell these days is the construction of the new Science, Engineering and Mathematics building. We had the mildest winter I've seen in my twenty-one years in Grove City, and it has allowed the construction to proceed on schedule toward completion in August, 2013. The steel skeleton was finished as the New Year began. The cement floors have been poured, they are beginning to erect the external walls, and mechanicals are being installed.

The new chemistry labs will be located on the second floor (it will have a basement, first, second, and third floor). The new General Chemistry lab will be located in the center of the second floor, and the organic lab will be on the north (Harker facing) side, also on the second floor.

In the Fall, 2010, eNewsLetter we told you about our curriculum review. This past year, the Biology department completed their review. A result of their review is impacting our biochemistry major. Currently, biochemistry majors are required to take

General Biology I and Cellular & Molecular Biology ("CellMolec"); as a result of the Biology curriculum review, beginning next year CellMolec can only be taken after General Biology I & II and Genetics. To keep the number of hours of chemistry/biology credits at 52, we have eliminated 4 hours of additional biology electives from the requirements, and are also eliminating Chem 264, Chemical Applications of Math Methods (or PCP as the students affectionately refer to it – Physical Chemistry Practice). Dr. Falcetta created this class several years ago, to replace Calc III. The intent was to focus more specifically on the math our majors would need.

In our last curriculum review, we reduced the biochemistry major physical chemistry requirement to one semester (thermodynamics and kinetics) from the entire year required of the chemistry majors. Now that 264 is being eliminated, Dr. Falcetta is creating a one semester Physical Chemistry of Biological Systems for the biochem majors. It will include quantum mechanics along with thermo and kinetics, which will be a significant improvement. If you want to look at our major requirements in more



The white beam being installed was the final piece of the steel skeleton. Before it was installed, it was setup in the grassy area between Rockwell, Hoyt, and the Breen Student Union, and students, staff, and faculty were given the opportunity to sign it. It ended up being completely covered in signatures before it was installed.

To see more construction photos, go to http://www.gcc.edu/News_Media.php

detail, you can see all of the specific requirements at the Registrar's site:

http://www2.gcc.edu/registrar/advising/adv_default.htm

We're also excited with how summer research at Grove City is growing. In the past, our students have been very active in obtaining opportunities to do research at other universities. As we've described in previous newsletters, Grove City has provided the resources for us to offer our students the opportunity to do research right here. This summer, Drs. Augspurger, Falcetta, and Kriley will be directing a total of nine of our majors (including some freshmen), which will be described fully later in the newsletter.

It is difficult to believe that we have celebrated graduation again. Several years ago we began a new tradition of hosting a breakfast for the graduates and their families the morning of graduation. While it is a real treat for us to meet the parents, brothers, sisters, and grandparents of our majors with whom we've spent the last four years, it is also a little sad to say goodbye after those four years. We'll highlight the graduating seniors in the Fall eNewsletter.



This picture shows how the mechanical systems are underway, with piping for utilities being installed. The cement block wall shown will house the elevator shaft.

The picture on the left below shows the current status of the new building, where you can see that the roof decking and gables are installed. The drawing on the right depicts how the building will look upon completion. These views are from the east, looking at Rockwell from the Union. You can see that the Rockwell tower will still be visible over the new building. If you are interested in information about how to give to the new SEM building, please call or email Grove City College Advancement office at 724-458-2156 or ejwinner@gcc.edu.

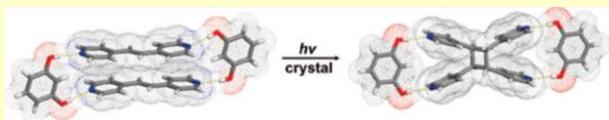


Summer Research at GCC

Nine of our chemistry and biochemistry majors are preparing to spend eight to ten weeks at Grove City doing research on several different projects. Grove City is providing housing for the students in the Colonial Apartments which are located on lower campus, next to Carnegie.

The research will be directed by Dr. Falcetta, Dr. Kriley, and Dr. Augspurger. Funding to provide the stipends to the student researchers is coming from a grant from the II-VI Foundation and the college's Swezey Fund for Scientific Research and instrumentation.

Dr. Augspurger will be directing two students, Jonathan Wood (CHEM, '14) and Peter Foster (CHEM/PHYS/MATH '13), as they investigate the conformational flexibility of crystalized substituted alkenes. A guest speaker during the Fall semester told of his work where it was demonstrated that when alkenes have ringed substituents, which include a pyridine ring, and they are crystalized along with resorcinol (1,3 di-hydroxy benzene), the hydrogen bonds between the resorcinol and the pyridine rings can cause the alkene double bonds to be aligned in such a way that when exposed to ultraviolet radiation they undergo 2 + 2 cyclization:



For the reaction to occur, the double bond must be aligned in a parallel orientation. It has been shown in some cases that even crystals where the double bonds are crossed still undergo reaction. It is thought that this can only happen if the double bonds can undergo a "pedal motion" whereby the double bonds go from the crossed to parallel orientation and back. We will use computational tools to determine the energy barriers to such a motion and to use these tools to characterize this pedal motion. This project is funded by the II-VI Foundation grant.

Dr. Kriley will be working with four students on two independent projects. The first project is being funded by the II-VI Foundation and involves the continuation of the monitoring of the chemical and physical properties of water and soil located near several Marcellus drilling sites. There are currently only a few systematic studies of the properties of well water in the vicinity of Marcellus wells pre- and post-drilling to quantify the effects of drilling on water quality and contaminants. Kyle Emili (CHEM, '15) and Joey Kriley (CHEM, '15) will be taught the current techniques for water analysis and will investigate whether the chemicals that might be present in the fracking fluid begin to be detected at each site. The second project is being funded by the Swezey Fund. Michael Grennek (CHEM, '13) and A. J. Motta (BIOC, '14) will be isolating and characterizing various novel tungsten and nickel phosphine complexes that have been isolated in the lab. A primary goal of this research is to look at the possible catalytic activity of these complexes, specifically C-H bond activation, hydrogenation catalysts and polymerization catalysts.

Dr. Falcetta will be overseeing two projects. The first is a GC/MS study of trace organics in water in support of Dr. Kriley's Marcellus shale environmental study. Aaron Sircy (CHEM, '13) will be working on this. The second project continues the computational studies of metastable anions, with particular focus on CO_2^- . The CO_2^- anion is important for CO_2 recycling technologies, in which CO_2 must be reduced, and thus, CO_2^- is an expected intermediate. CO_2^- is also an excellent test case molecule because it is small enough to enable accurate calculation of its properties, structure, and energetics, and has both bond lengths and angles that can be changed to tune the properties of the anion. Two students, Erin Eperthener (CHEM '15) and Joe Winklebauer (CHEM '15) will be on this project. Funding for this project is being provided by the Swezey Fund.

Alumni Highlight

Mike Roland CHEM, '74

Mike Roland graduated from Grove City College with his BS (magna cum laude) in chemistry in 1974. He earned a PhD from Penn State in 1980 with his thesis entitled "*Coherent Anti-Stokes Raman Scattering from simple Fluids.*" After completing grad school, he worked for the Central Research Lab of Firestone Tire & Rubber Co. in Akron.

In 1986, he joined the Chemistry Division of the Naval Research Lab (NRL) in Washington, DC, where he has had a distinguished career. His research involves experimental study of the viscoelastic, mechanical, and dielectric properties of materials. He earned the first of his fifteen patents in 1988 for "Cured Rubber Compositions of High Modulus." In 1989, he was named head of the Polymer Physics Section of NRL. He served as the technical editor of *Rubber Chemistry & Technology* from 1991 – 1999, and associate editor from 2000 to present. In 1998, he authored a review article on the use of latex for HIV prophylaxis in *RubberWorld*, the chronicle of events and technological changes in the rubber industry.

Mike received the NRL Edison award for his patented method of using rubber to measure ambient ozone concentrations in 2000. In 2002 he was awarded the Pure Science Award by Sigma Xi, the international honor society of science and engineering (*Grove City has had a Sigma Xi chapter since 1997, as a result of then President John Moore's initiative – ed.*). His article, "Relaxation Phenomena in Vitriifying Polymers and Molecular Liquids" was published in *Macromolecules* as a cover article in 2010. That same year he received the E.O Hulburt Science Award, which is the highest award the NRL commanding officer can confer on a civilian employee. Last year he authored a book, "*Viscoelastic Behavior of Rubbery Materials*", published by Oxford University Press.

This year, he was awarded the 2012 Charles Goodyear Medal, the most prestigious award given by the American Chemical Society Rubber division. He has given 103 invited lectures, and authored a total of 359 publications in his very productive career.



Mike married Carol Anne Procopio in 1978, and they are expecting their third granddaughter in May. Besides his many professional accomplishments, he is active in the Charles County, MD, chapter of the *Gideons*, and was elected to serve as their president in 2009.

What have been the most satisfying achievements of your very productive career?

In basic research, our discovery that relaxation times and viscosities for any temperature, pressure, and density are a function of T/ρ^γ , where the exponent γ on the density is a material constant, which can be related to the steepness of the intermolecular potential. Thus, we have a simple means to categorize relaxation properties that span many decades of time or frequency, and connect them directly to the forces between molecules.

In applied research, it was the development of elastomer coatings that improve the ballistic penetration resistance of steel armor. This has obvious practical significance, foremost protecting our soldiers. One of our designs has been licensed by a private company and will be used to protect (e.g., from snipers) nuclear missiles off-loaded from submarines, during their transport on public roads for maintenance.

Did your interest in polymers begin at Grove City?

No. Grove City offered no classes in polymers at that time (*We do now – ed.*). My only exposure to large molecules was in first-year faculty Dr. Sodergren's biochem course. In grad school, I tried to let my advisor let me use benzene as a sample in Raman measurements, but he said it had too many atoms! My first job with Firestone introduced me to polymers.

Did you ever consider academics?

Because I was married with a son when I finished grad school, moving to a low-paying, temporary post-doc position didn't appeal to me.

Having worked in both the private and government sectors, what are their advantages and disadvantages?

Some of the advantages in the private sector are a greater urgency: "let's get it done today", resources are made available, and reporting is not onerous. A disadvantage is that everything has to lead to profit, so there's little room for merely satisfying your scientific interest. And there's less opportunity to share your results outside the company.

In the government, there's more freedom to pursue whatever you want, as long as a program manager approves it, and publish results in open literature. The downside includes mandatory and often useless training, with lots of reporting that can seem purposeless.

In both places, I've had the fun of doing research and being paid for it. While neither allows much chance to teach, I've satisfied my desires in that area by teaching courses at Calvary Christian College (which is affiliated with my church) on

cosmology, evolution/intelligent design, English grammar, etc. I also teach adult Sunday School.

What advice would you give our majors as they consider career paths?

If science excites them, "makes them want to get out of bed in the morning," they should pursue a PhD. It will give them broader opportunities for interesting work. Jobs in industry can be in research, business, or sales; academia entails teaching and research; government work can vary widely.

What qualities do you see as being crucial for new graduates to master to be successful?

Be very openminded about the type of work they get involved with, avoiding any preconceptions. Until you experience a job for an extended period, it's not possible to predict whether you'll like it. They should expect to learn much more through their employment experiences than their college course work. And it really helps to be mobile - willing to relocate.

What memories from your days at Grove City College stand out?

Mr. Chab, Physical Chemistry professor, declaring on the first day of class that he hadn't given any A's in many years and didn't intend to give any to our class. He really threw down the gauntlet! I got an A the first semester, but the second semester's final exam was a standardized test, including many areas we'd never covered (e.g., quantum mechanics); thus, the grading for the final exam was subjective and he gave me a B for the semester :-(. Notwithstanding, he was my favorite teacher and p-chem was my favorite subject.

Elizabeth Michael (Chem '10), currently pursuing a PhD at Penn State, has been awarded both a Fulbright Fellowship and a National Science Foundation Graduate Fellowship. She has accepted the NSF fellowship to continue her research on piezoelectric material.

If you are aware of any other accomplishments or noteworthy happenings concerning Grove City College Chemistry alumni, please send an email to Dr. Augspurger (jdaugspurger@gcc.edu) so that it can be included in future editions of our Chemistry Department eNewsletter.

Faculty Spotlight

Mike Falcetta

Dr. Michael Falcetta joined the faculty of Grove City College in the Fall of 2003. He had previously taught at Anderson University (Anderson, IN) and Roberts Wesleyan University (Rochester, NY). He earned his PhD from the University of Pittsburgh, working under Ken Jordan. His graduate studies combined both experimental and computational work on metastable anion states of organic molecules.

When Mike arrived, his main teaching responsibilities were Chem 227, Analytical Chemistry, and Chem 105, the one-semester General Chemistry course for engineering and physics majors. He has created three new courses in his nine years at Grove City College: Chem 264 (Mathematical Methods for Chemistry), Chem 406 (Instrumental Analysis), and Chem 445 (Chemical Modeling/Computational Chemistry) along with Dr. Augspurger.

Chem 264 was created to correct an imbalance between the chemistry major and the biochemistry major. At the time, chemistry majors were required to take Calc III and biochemistry majors were not, which lead to difficulties when the biochem majors reached PChem. So he created this course which was required for all our majors to better prepare them mathematically for PChem.

He created Chem 406 in part to fulfill a requirement of the ACS curriculum guidelines, so that we will be prepared to apply for ACS accreditation. As we wrote about two years ago, he has partnered with alum Collin Moore (CHEM, '93) at BASF, to provide the students with a "real-world" experience of working on a real project as a significant part of the course. One year the students worked on the problem of using HPLC to analyze the indole-3-acetic acid content of corn plants, for Dr. Dudt in biology. This year, they are working on developing a protocol for measuring water contaminants at the ppm or ppb level for Dr. Kriley's analysis of ground water potentially impacted by fracking.



Chem 445 is another new elective to introduce our students to the computational tools that have become common to the modern chemist. This was a natural extension of his research. Currently he is working on calculations to model photocatalysis of CO₂ on titanium dioxide surfaces in collaboration with Dr. Mark Fair from the Grove City physics department. Calculations that attempt to model macroscopic systems are extremely challenging. This work has focused on developing a realistic model that is still computationally tractable. Another project involves the calculation of the energies and lifetimes of metastable anions. These short-lived species are of import in several technologies and have been implicated as major intermediates in radiation damage of biological systems. Additional projects include modeling organometallic compounds in collaboration with Dr. Kriley and modeling ion-molecule reactions and complexes.

Mike brings a diverse background to the Chemistry department. After finishing his PhD and post-doc at Pitt, he worked at a church in Pittsburgh for a year and then attended seminary for two years in Nyack, NY, before taking his first chemistry teaching position. He continues to explore his interest in the development of Old Testament themes in the New Testament.

Mike is married to Esther, and they have one daughter, Tessa.