IU • CHEMISTRY

Association of Indiana University Chemists Alumni Journal

Vol. 57 • College of Arts and Sciences • Fall 2012

Crystalline Glazes: Art and Chemistry

Also in this issue:

Proteomics Comes of Age at IUB

X-ray Crystallography in the Fight Against Cancer

Service Learning: Applying Chemistry to the Real World

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Students prepare for lab in the chemistry atrium.

This magazine is published annually for graduates of the IU Department of Chemistry by the Department of Chemistry to encourage alumni interest in and support for IU.

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Contents

1 CHAIR'S LETTER

2 PROTEOMICS COMES OF AGE AT INDIANA UNIVERSITY BLOOMINGTON
by Randy Arnold

4 POINTING CANCER IN THE RIGHT DIRECTION
by Charles Dann III

7 SERVICE LEARNING IN CHEMISTRY
by Steve Tait

9 CHRYSTALLINE GLAZES: ART AND CHEMISTRY
by Kate Reck

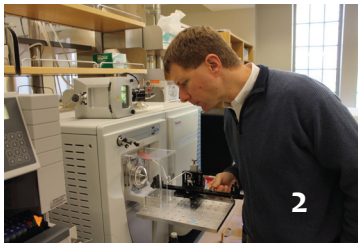
10 AROUND CHEMISTRY

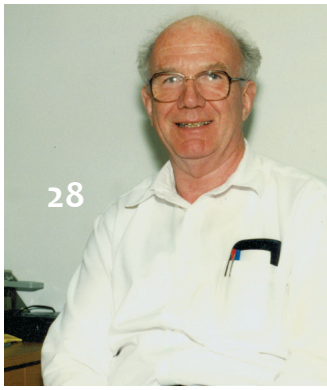
11 Faculty News
17 Conferences, Lectures, and Symposia
18 Staff Profile: Carly Friedman
19 Staff News
20 Graduate News
22 C046 Chemistry Learning Lab is Open!
23 Undergraduate News
27 Library News
28 In Memoriam: Terry Jenkins

29 ALUMNI NEWS

32 CHEMISTRY HONOR ROLL 2011

33 SUBMIT YOUR CLASS NOTE





CHAIR'S LETTER

As we arrive now well into my third year as chair of department, we take some time to look back upon the previous year as well as look forward to what the new academic year holds for new and returning students, staff and faculty. For all of the latest news, please check out our newly designed departmental website (http://www.chem.indiana.edu/) and the periodic news releases from the IU Newsroom that highlight the accomplishments of Chemistry faculty (see http://www.chem.indiana.edu/news-events/index.asp).

David Giedroc

This past summer, we were able to attract three outstanding tenured or tenure-track faculty as well as two outstanding Research Scientists to IU. These include the Joan and Marvin Carmack Chair and Professor in Bioorganic Chemistry, **Nicola Pohl** who comes to us from Iowa State University, and Assistant Professors **Megan Thielges** from Stanford University and **Yan Yu** from UC-Berkeley. Prof. Pohl is a synthetic chemist and chemical biologist with interests in glycobiology and carbohydrate chemistry. Prof. Thielges has joined the analytical division and uses sophisticated laser spectroscopy to study the origins of fast timescale protein dynamics. Professor Yu is a biomaterials chemist with interests in membrane dynamics, cell-cell communication and signaling networks. Assistant Scientist **Yi Yi** is a synthetic polymer chemist associated with our Nanocharacterization Facility, while **Jonathan Trinidad** joins us as Associate Scientist and Director of the Biological Mass Spectrometry Laboratory. We warmly welcome these new members to the department.

As in years past, our faculty have again received significant recognition for major university and national awards since our last issue of *IU Chemistry*. These include a JSPS Fellow (**Clemmer**), a Division of Analytical Chemistry Awardee in Chemical Instrumentation (**Clemmer**), an ACS Analytical Chemistry Distinguished Service Awardee (**Hieftje**), an IU Outstanding Junior Faculty Awardee (**Carlson**), a promotion to the rank of Distinguished Professor (**DiMarchi)**, a Cottrell Scholar Collaboration Awardee (**Baker**), and the Harry & Carol Mosher Awardee (**Carroll**). In addition, two of our junior faculty, **Erin Carlson** and **Sara Skrabalak**, have been named 2012 Cottrell Scholars, out of eleven total given nationwide. I am extremely proud of the accomplishments of our faculty at all ranks, which speaks volumes about the quality of science ongoing in the department.

In addition to the our third annual Watanabe Symposium in Chemical Biotechnology held September 29, the department also hosted a scientific symposium in honor of retirement of Milos Novotny on October 15, 2012. An all-star lineup of former Novotny students and scientific collaborators and acquaintances came to Bloomington from around the world to honor Milos. They included **Paul Grieco** (former Professor and Chair of IU Chemistry), Robert Kennedy, Ellen Ketterson, Milton Lee, Pat Sandra, and Danielle Whittaker. It is indeed fitting that Milos is the 2012 recipient of the Giorgio Nota Award from the Italian Chemical Society

Continued on page 19

Proteomics Comes of Age at Indiana University-Bloomington

by Randy Arnold

With the momentum created by the Human Genome Project and the first working draft of the human genome in 2000, it seemed that the next logical step would be to create a corresponding map of all the proteins in our bodies — the Human Proteome. As the technologies necessary to build such a map — liquid chromatography and mass spectrometry — continued to improve in regards to sensitivity and resolving power, such an endeavor seemed within reach. In the decade since, we've found that significant challenges still exist in mapping an accurate proteome for any organism, especially human.

> ... the genome can be viewed as a reasonably static 'blueprint' for the cell, while the cell's proteome changes dynamically over time depending on a wide range of internal and external factors ...

Consider the main challenge in mapping the human genome — 3 billion base pairs that must be sequenced. Now consider the challenges in mapping the human proteome — tens of thousands of proteins that range in concentration from one copy per cell to millions of copies per cell (or up to 10 orders of magnitude in some fluids), many of these proteins are modified with functionally determining post-translational modifications. Furthermore, the genome can be viewed as a reasonably static "blueprint" for the cell, while the cell's proteome changes dynamically over time depending on a wide range of internal and external factors. And of course, different tissues and cell types express different proteins based on their functions.

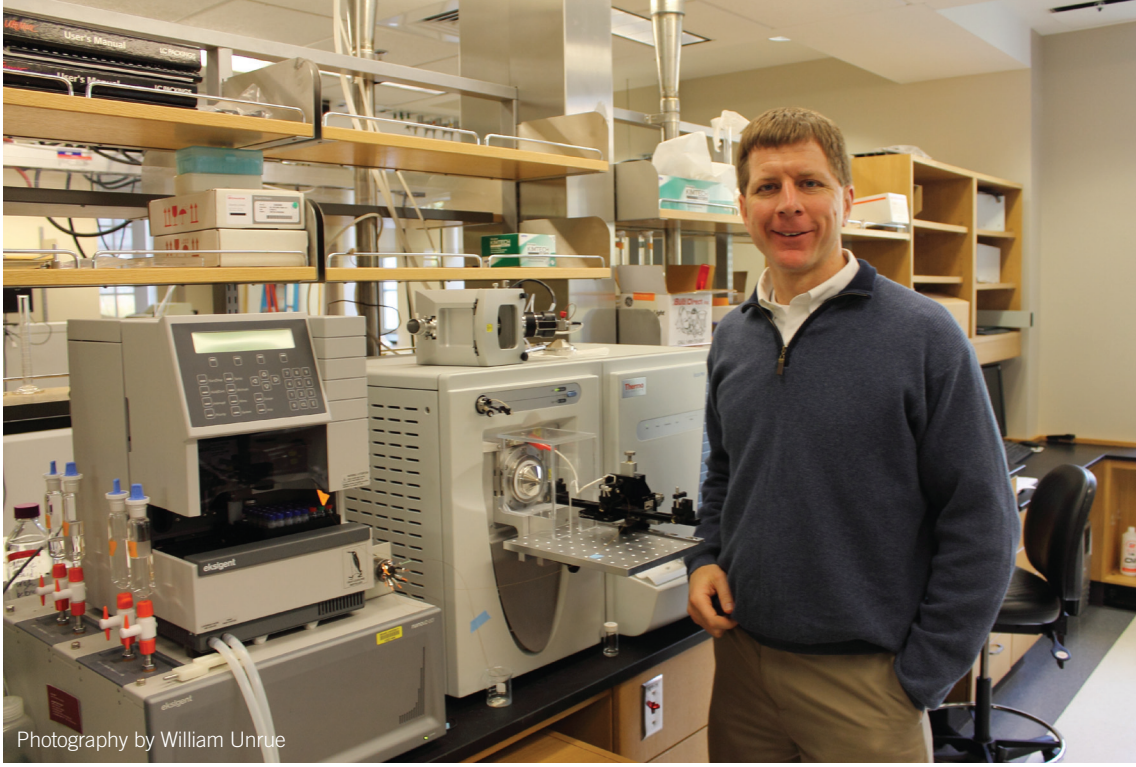
In response to these challenges, the department began to pursue with vigor research in the area known as proteomics by establishing the Proteomics Research & Development Facility in 2002. Prior to that time, there was already significant work being done by faculty members **David Clemmer**, **Milos Novotny**, and **James Reilly** to develop the technologies that would allow measurement of thousands of proteins at sub-femtomole sensitivity. The facility brought commercial technology in the form of two nanoLC-MS/MS platforms, one a fast-scanning ion-trap and the other a high-resolution quadrupole/time-of-flight mass spectrometer. Each system was equipped with a nano-flow liquid chromatograph, where the separations of peptides are carried out at 250 nanoliters per minute in 75-micron ID capillaries (4000-fold lower flow rates than standard 1 mL/min LC). I was also brought on board at the time to manage the facility and coordinate projects within and outside the department.

So what has transpired in the last decade? A wealth of research pursued by faculty, research scientists, graduate students and undergraduates. It would be pointless to try and describe all the work that has been done or even all the new equipment that is now in place, but allow me to share a few noteworthy examples.

In 2007, **David Clemmer**'s group took a break from making the world's best ion mobility measurements of gas-phase proteins and peptides to produce the most extensive profile of the human plasma proteome to date. Their work (Liu, X., Valentine, S.J., Plasencia, M.D., Trimpin, S., Naylor, S. and Clemmer, D. "Mapping the Human Plasma Proteome by SCX-LC-IMS-MS" *J. Am. Soc. Mass Spectrom.* **2007**, *18*, 1249-1264) employed immunoaffinity depletion of six abundant plasma proteins, strong-cation exchange fractionation, nanoflow reversed-phase liquid chromatography, and ion mobility coupled to time-of-flight mass spectrometry to confidently identify 2928 proteins (with 6000 more tentative proteins identified).

In 2008, **Milos Novotny**'s group, which is world-renown for the development of capillary-based separations, published their work on high-throughput permethylation of glycans (Kang, P., Mechref, Y., and Novotny, M.V. "High-throughput solid-phase permethylation of glycans prior to mass spectrometry" *Rapid Commun. Mass Spectrom.* **2008**, *22*, 721-734). This work demonstrated that glycans — the sugars attached to proteins — could be readily modified by permethylation to improve their mass spectrometric sensitivity. These types of glycome measurements had been shown previously by the Novotny group (Kyselova, Z., Mechref, Y., Al Bataineh, M. M., Dobrolecki, L. E., Hickey, R. J., Vinson, J., Sweeney, C. J. and Novotny, M. V. "Alterations in the Serum Glycome Due to Metastatic Prostate Cancer" *J. Proteome Res.* **2007**, *6*, 1822-1832) to have promise as diagnostic markers of metastatic prostate cancer.

Always looking to build the better tool for analyzing biological molecules, **James Reilly**'s group demonstrated that high-energy 157 nm photodissociation could be accomplished by modifying a commercially available time-of-flight instrument (Zhang, L. and Reilly, J. P. "Peptide photodissociation with 157 nm light in a commercial tandem time-of-flight mass spectrometer" *Anal. Chem.* **2009**, *81*, 7829-7838). His group also developed chemical labeling of molecules for protein crosslinking that enable the study of protein-protein interactions (Lauber, M.A. and Reilly, J. P., "Novel amidinating cross-linker for facilitating analyses of protein structures and interactions." *Anal. Chem.* **2010**, *82*, 7736-7743), an area of much interest to fundamental biology.


Photography by William Unrue

Randy Arnold stands in front of an Eksigent nanoLC-2D liquid chromatograph (left) coupled to a Thermo LTQ Velos ion trap mass spectrometer located in the Laboratory for Biological Mass Spectrometry in Simon Hall.

Meanwhile, the Proteomics Facility was embarking on a number of collaborative projects that spanned the areas of cancer biology, chromosome structure, viral assembly, and bioinformatics. In 2006, we worked with colleagues in the IU School of Medicine to demonstrate that a cancer-specific form of the protein PCNA (proliferating cell nuclear antigen) was heavily modified by methylation (Hoelz, D. J., Arnold, R. J., Dobrolecki, L. E., Abdel-Aziz, W., Loehrer, A. P., Novotny, M. V., Schnaper, L., Hickey, R. J. and Malkas, L. H. "The discovery of labile methyl esters on proliferating cell nuclear antigen by MS/MS" *Proteomics* **2006**, *6*, 4808-4816). At the same time, we were working with colleagues **Pedja Radivojac** and **Haixu Tang** (School of Informatics and Computing) to develop machine learning algorithms to predict peptide fragmentation patterns (Arnold, R. J., Jayasankar, N., Aggarwal, D., Tang, H. and Radivojac, P. "A Machine Learning Approach to Predicting Peptide Fragmentation Spectra" *Pacific Symposium on Biocomputing 2006*, Maui, HI, **2006**, 219-230.) and better understand why some peptides are more easily detected in proteomics experiments (Tang, H., Arnold, R. J., Alves, P., Xun, Z., Clemmer, D. E., Novotny, M. V., Reilly, J. P. and Radivojac, P. "A computational approach toward label-free protein quantification using predicted peptide detectability" *Bioinformatics* **2006**, *22*, e481-e488).

In 2009, we worked with **Martha Oakley** to determine interacting regions of the chromosomal maintenance protein MukB (Li, Y., Weitzel, C. S., Arnold, R. J. and Oakley, M. G. "Identification of interacting regions within the coiled coil of the Escherichia coli structural maintenance of chromosomes protein MukB" *J. Mol. Biol.* **2009**, *391*, 57-73) and with IU biologist **Tuli Mukhopadhyay** to look at the role of disulfide bond formation in a structural alphavirus protein (Parrott, M. M., Sitarski, S. A., Arnold, R. J., Picton, L. K., Hill, R. B. and Mukhopadhyay, S. "Role of Conserved Cysteines in The Alphavirus E3 Protein" J. Virology **2009**, 83, 2584-2591). Along the way, we have been funded by organizations such as the Indiana 21st Century fund, the Office of the Vice President for Research, the Lilly Endowment, and the National Institutes of Health.

So where do we go from here? From the relatively humble beginnings of two proteomics instruments, the capabilities for proteomics at IU-Bloomington have expanded to include ten mass spectrometers, including two ion traps, two commercial ion mobility/time-of-flight instruments, two FTMS systems, one time-of-flight instrument, one MALDI instrument, one triple-quadrupole, and one orbitrap. The two original instruments are now replaced with updated technology that is faster (8x faster ion trap) and has higher resolution (2x better quadrupole/time-of-flight).

Our facility, now called the Laboratory for Biological Mass Spectrometry, is led by recent hire **Jon Trinidad**, an expert in quantitative proteomics and phosphoproteomics. We've recently been recognized as a Center of Innovation by Waters Corporation. We are also energized by the recent hiring of young faculty such as **Erin Carlson** and **Nikki Pohl** who will both utilize our facility and push us to develop the technology their groups will need to move forward in their research. In the coming decade, we anticipate our facility to be as productive as it has been in its first 10 years. Check back and we will keep you posted! ■

Randy Arnold earned his Ph.D. in Analytical Chemistry from Indiana University in 1999 under the direction of Professor James Reilly. His research focused on the application of matrix-assisted laser desorption ionization (MALDI) time-of-flight mass spectrometry to the analysis of biomolecules. Dr. Arnold spent three years as Assistant Professor of Chemistry at Huntingdon College in Montgomery, Alabama where he was awarded the Dr. & Mrs. John N. Todd Award for Excellence in Teaching before returning to IU in 2002. While at IU, Dr. Arnold has published over 30 research articles in a wide range of research areas including bioinformatics, targeted and untargeted proteomics, cancer proteomics, virus assembly, combinatorial peptide library synthesis, and chemistry education.

Pointing Cancer in the Right Direction

by Charles Dann III

Photo courtesy Jocelyn Bowie

The **Dann** research group has determined multiple atomic resolution models of key proteins via X-ray crystallography to guide the development of a new generation of anti-cancer drugs with widespread applicability and minimal therapeutic side effects.

Challenges in the Fight Against Cancer

While it is common to hear that researchers are looking for the cure for cancer, the simple truth remains that cancer arises from myriad causes and thus all cancer types cannot be treated with one or even a handful of highly successful therapeutics. Generally speaking, metastatic cancer arises from a cell in which changes allow for:

1) unchecked cell proliferation;
2) evasion of normal checkpoints that normally lead to programmed cell death (apoptosis); and
3) growth in an anchorage-independent manner.

Furthermore, for each of the changes required for cancer progression, only one of many possible cellular signaling networks may be altered. For example, a cancer cell can activate or shut down one of a several pathways with the result being increased cell proliferation. While strides have been made to develop diagnostics to detect changes in cellular signaling indicative of cancer — most often methods that identify proteins not present in normal tissues — drugs that target each of the various signaling pathways required for cancer cell survival are lacking.

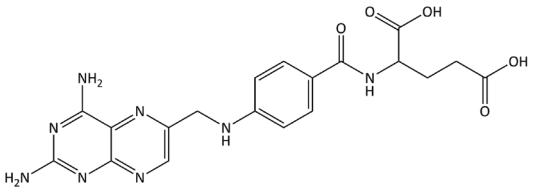
The future for cancer treatment will rely on personalized medicine in which the specific treatment regimen will be based on analysis of the signaling pathways that have been in altered in a particular individual. We are working to develop a series of drugs that specifically target cancer cells that upregulate a protein receptor responsible for folate uptake. The folate receptor has a very limited presence in normal tissues while being prevalent in many cancers of lymphatic and epithelial origin including leukemic, breast, lung and ovarian cancer. Many of these cancer types, particularly ovarian cancer, have high mortality rates due to lack of effective, targeted therapeutics. The goal of our cancer research program is to develop drugs that kill cells via inhibition of nucleotide precursor synthesis specifically in cancer cells.

Fighting Cancer with Antifolates — A Short History

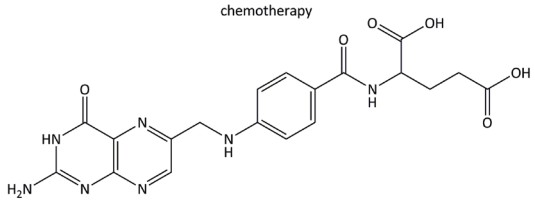
With rare exceptions, patients diagnosed with cancer sixty years ago were effectively told they were going to die. The best chemotherapeutic drugs to fight cancer, derivatives of mustard gases developed for warfare, were not very effective and caused numerous side effects during treatment. However, a major breakthrough in cancer therapy happened in the late 1940's with the approval of the first of many so-called antifolate drugs, aminopterin. Aminopterin, like other antifolates, is a molecule that resembles the essential vitamin, folic acid (Figure 1 on the next page).

To explain the mode of action for antifolates, the role of folic acid in cellular growth and metabolism must first be understood. Under normal circumstances, folic acid is converted in cells to folate derivatives that serve as enzyme cofactors in methyl and formyl group transfer reactions. Most notably, folates are required for the *de novo* production of purine and pyrimidine nucleobases in the production of DNA, RNA and many key nucleotide metabolites in cells. Most antifolates share high structural similarity to folic acid and all act by inhibiting vital cellular enzymes.

Figure 1. Aminopterin and Folic acid

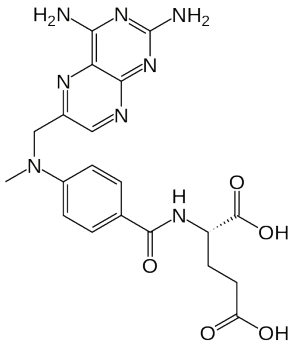


Aminopterin - an antineoplastic drug with immunosuppressive properties used in chemotherapy



Folic acid - vitamin B_9

Since the approval of aminopterin, hundreds of new antifolate derivatives — defined primarily by their ability to inhibit a folate-utilizing enzyme *in vitro* — have been designed empirically and reported in the literature as possible next generation anti-cancer drugs. Of these potential therapeutics, methotrexate (MTX) and pemetrexed (PMX, branded as Alimta® by Eli Lilly) are widely used, with very few antifolates approved by the FDA for clinical use overall.



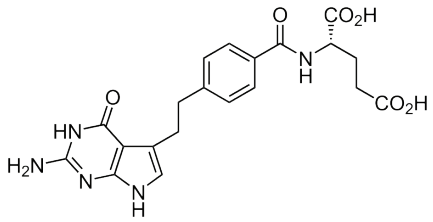
MTX is a first generation antifolate approved for clinical use over fifty years ago whereas PMX met with FDA approval in 2004 (Figure 2). While these two drugs have certainly saved the lives of many cancer patients, dose-limiting toxicity in normal cells remains a key limitation for their use. Antifolates presently in clinical use are trafficked to normal and cancerous cells similarly and kill cells that are rapidly dividing — that is, cells with an increased requirement for folate — preferentially. As many normal tissues are comprised of rapidly dividing cells, the overall utility of antifolates for cancer treatment is limited.

Trafficking of Folates and Antifolates into Cells

To design antifolates that are cancer-cell specific with minimal toxicity to normal cells, our group is studying the three major systems for folate uptake in human cells (Figure 3 on page 6). The primary means of folate uptake in normal cells is via the reduced folate carrier (RFC), a multi-pass transmembrane transporter that uses an anion gradient to drive folate transport. A second membrane transporter, the Proton-Coupled Folate Transporter (PCFT) is also expressed in normal tissue, but is only active in an acidic environment (e.g., the digestive tract or intracellular vesicles). As these are human membrane proteins, they represent the most challenging class of protein for which to obtain atomic level structures. Nonetheless, we are advancing technologies in the area of expression and purification of eukaryotic membrane proteins to facilitate our structural work on folate transporters.

The final avenue for folate transport into cells relies on the human folate receptors (hFRs), high affinity receptors that are not membrane proteins but rather anchored to the cell membrane via a lipid anchor. We remain the only lab in the world that has been able to purify hFRs in high yield with the purity required for biophysical and structural characterization studies. Our overall goal is to understand the binding, trafficking and release properties of natural folate metabolites and antifolate drugs in all folate transport systems. However, we have focused initially on hFR as this class of protein is

Figure 2. Methotrexate (MTX) and Pemetrexed (PMX, branded as Alimta® by Eli Lilly)



present at high levels on cancer and autoinflammatory cells and may provide a means to specifically target diseased cells.

Structure-based Drug Design for Specific Targeting of Cancer Cells

In an effort to target new antifolates to cancer cells via hFR, we have determined a series of human folate receptor structures alone or in complex with folates and antifolates. Using these structures as a guide, we are able to design a new series of molecules that should exhibit specificity for transport into cells by hFR present on cancer cells over either the RFC or PCFT membrane transporters displayed on normal cells. Currently, working with collaborators at Duquesne and Wayne State University, we have a number of molecules that enter cells preferentially via hFRs, inhibit cellular

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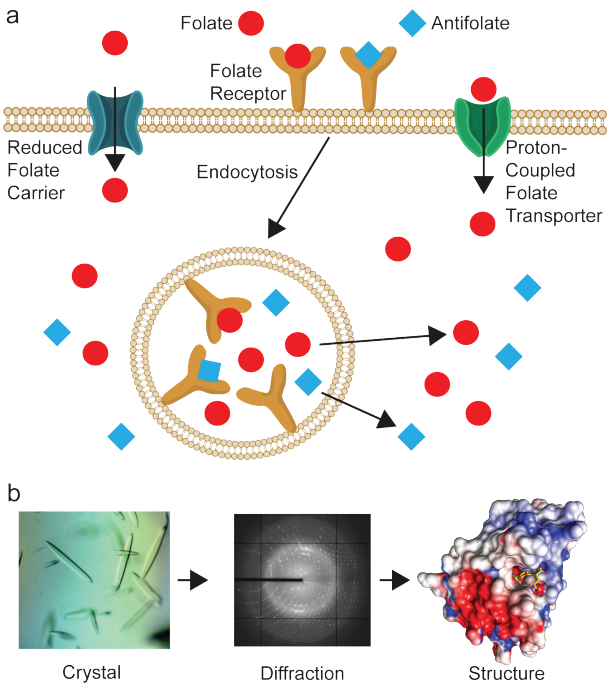


Figure 3. Stragegy for development of cancer-specific drugs.

(a) Three uptake pathways for folate uptake in human cells are shown. The reduced folate carrier and proton-couple folate transporter are membrane proteins responsible for uptake of folate in normal and cancerous cells. The Dann group is developing new anti-cancer therapeutics that are trafficked solely via the membrane-anchored folate receptor present at high levels in many cancer cell types with extremely limited expression in normal tissue. Unlike the membrane transporters, the folate receptor delivers molecules to the cell via receptor-mediated endocytosis. (b) Rational design of new molecules is based on our ability to obtain crystals and diffraction data that ultimately leads to an atomic level description of folate receptor:drug complexes.

enzymes responsible for purine synthesis, and show cytoxicity to cancer cells in a xenograft mouse model of disease. While our new molecules show much promise, researchers in my group are continually proposing novel molecules to synthesize based on the enzyme inhibition profiles and crystallographic structures of complexes with either the folate receptors or their enzyme targets. Collectively, we are iteratively designing molecules based on structural insight, synthesizing these molecules, and testing their activities in both *in vitro* and *in vivo*. In this manner, we anticipate a growing number of small molecules with potential therapeutic applicability.

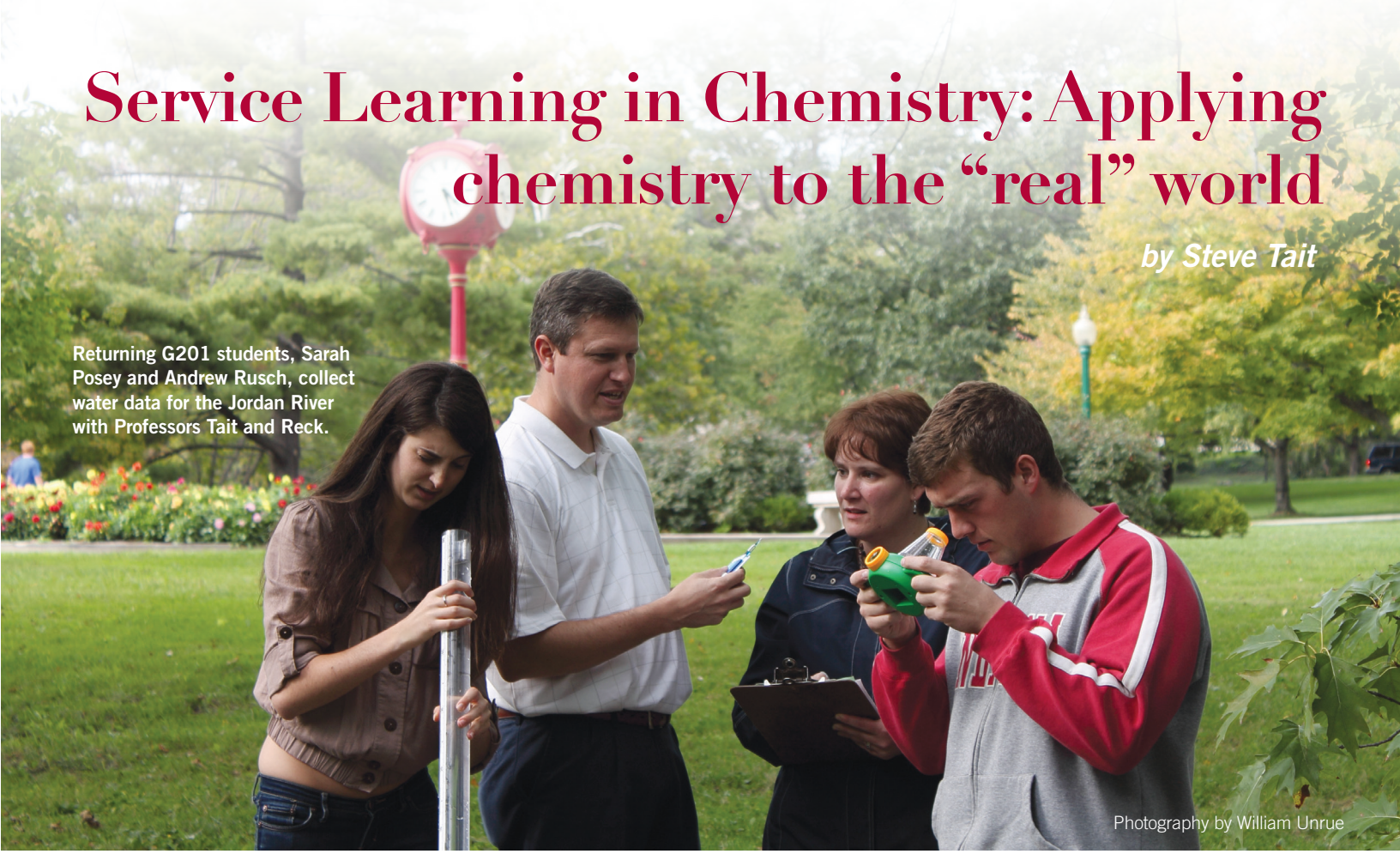
A Final Note on Macromolecular Structure Determination at IUB

Given the challenge associated the structural targets in our current research program and the general need for enhanced structural facilities at IUB, a longstanding goal since my arrival at IUB has been to acquire funds for the establishment of a high throughput macromolecular structural biology center that benefits research programs both in the Chemistry department and across the IUB campus. I am pleased to announce that funds were awarded this year from METACyt and the new Crystallization Automation Facility (CAF), part of the IU Macromolecular Crystallography Facility (IUMCF) of which I serve as the director, has been in operation since the beginning of June. Instrumentation in the CAF allows for automated screening of crystallization conditions through the use of a series of robots and start-of-the-art imaging. The practical result is less time and effort spent on the empirical tasks associated with crystallization, which is otherwise a major bottleneck in the process of structure determination. Additionally, this facility, coupled with the existing computational and data collection resources in place in the IUMSC, provide easy access to crystallography for virtually any lab on campus with no need for prior crystallographic training. At this point, we have a facility that compares favorably to any academic facility in the world and approaches the capacity of the world's best structural genomics centers. I would like to extend a special thank you to METACyt and all faculty across the IUB campus that supported the efforts on this project! For more information, contact the facility manager, **Soca Wibowo** (aswibowo@indiana.edu) or visit the IUMCF website (http://www.indiana.edu/~iumcf). ■

Charles E. Dann III was awarded a B.S., ACS, degree in chemistry from Millsaps College in Jackson, Mississippi, in 1996. He received his Ph.D. from the Department of Biophysics & Biophysical Chemistry at Johns Hopkins University School of Medicine in Baltimore, Maryland, while working in the laboratory of Daniel Leahy. In 2002, Dr. Dann was invited to continue his studies at the University of Texas Southwestern Medical Center at Dallas as a postdoctoral fellow under the supervision of Nobel Laureate Johann Deisenhofer. After a year in this position, he received the Sara and Frank McKnight Fellowship to work as an independent fellow. Dr. Dann held this position until joining the faculty in the Department of Chemistry at Indiana University in August 2008. The research in Dr. Dann's laboratory focuses on determining atomic resolution structures of RNA and protein macromolecules by X-ray crystallography. Projects in the laboratory afford the researcher opportunities to learn computational modeling, structural and biophysical techniques as well as general biochemistry and molecular biology in both RNA and protein systems.

Service Learning in Chemistry: Applying chemistry to the "real" world

by Steve Tait



Returning G201 students, Sarah Posey and Andrew Rusch, collect water data for the Jordan River with Professors Tait and Reck.

Photography by William Unrue

Chemistry education researchers have noted a problem of capable students choosing to not major in chemistry ("voting with their feet")[1] and have commented that part of what we are missing as educators is to connect the chemistry we teach in the classroom with real chemistry in scientific research, i.e., to make chemistry, particularly chemistry as a potential career, seem less abstract.[2] To many incoming freshman, a decision about pursuing a science degree must be based solely on classroom experience from high school, since very few of these students have been personally acquainted with a professional scientist. One challenge to students considering a chemistry major (and there are several others) is that it may be difficult for them to visualize themselves "doing chemistry" outside of the classroom environment.

In Spring 2011, Prof. **Kate Reck** piloted a new service learning course related to water quality monitoring, which involved a partnership with Kriste Lindeberg from the City of Bloomington and the Hoosier Riverwatch program[3] of the Indiana Department of Natural Resources. In Fall 2011 and Spring 2012, I collaborated with Kate on the further development of that course, especially on the development of a classroom discussion curriculum to teach background material and give the students a forum to discuss their experiences with the water monitoring program. The major activity of this course was that students would test water quality in the Jordan River and Clear Creek in Bloomington.

The Clear Creek has a distinct significance as being the major water shed for the city of Bloomington, which lies along the newly formed B-line Trail. The B-line Trail is a 10-mile foot-traffic trail that runs north-south from the heart of Bloomington along the old railroad switchyards and past an old creosote plant. Specific concern to the city is that creosotes, in addition to regular farm run-off, are large pollutants in the water that feeds into the Clear Creek Water Shed and the Bloomington City water supply.

The intent of this service-learning course was to design a water quality testing program at local creeks and rivers that would provide incoming university students with an engaging and educational science experience. We identified four primary objectives of the course: (1) engage lower-division students from diverse backgrounds in meaningful applications of science, (2) enable students to use science to serve the community, (3) enable student learning of chemistry that has a direct connection to real world issues through discussion and reflection on their service, and (4) provide early training in communication and presentation skills.

Feedback from the students was requested in written form at the end of the semester and allowed us to learn what they enjoyed about the course. Their comments did not perfectly align with our intended objectives, but do show several parallels. A sampling of typical comments:[4]

- "I like the feeling that I am actually actively participating / helping the community."
- "It offers a unique, hands-on experience."
- "I like the small class size and direct interaction with professors."
- "It has reiterated the importance of community service to me, which I will continue to do."
- "It is a good way to see how water quality affects everyday life."
- "I definitely believe that I am more likely to engage in this type of community service."
- "This class helps me with my presentations."

Continued on page 8

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- "I have always enjoyed being involved in voluntary community service, and I still do!"
- "It is easy to fit in with tough classes since its only once a week and you learn how to be involved in the community in a new way."
- "This course made me have to work in groups and I enjoyed it."
- "I enjoyed this so much. It got me out and involved."
- "I have been recommending it so the students get more involved with the instructors as well as doing field work."
- "The class is small so attention [from the professors] is greater. Also, one gains a better appreciation for chemistry because of the real-world application."
- "I think this course has allowed me to meet new people and to show me how good it feels to use science in a helpful manner."

The health of the Jordan River is indicated by its creatures, such as its abundance of crayfish.

And my favorite: "Reck is Awesome!! Tait Rocks!!!"

We were pleased to see that the students valued this "hands-on" experience and being involved in "field work." Several commented on the value of a small class size and close interaction with the instructor. (Note that each of our classes was a fairly uniform mix of freshman, sophomores, juniors, and seniors. The freshmen may be comparing their experience in this class of 13 students and two professors to general chemistry with over 600 students!) It was also interesting to note that this course appealed to some students particularly because they already valued the ideas of community service and/or environmental conservation and were glad to have an opportunity to merge their academic interests with service to the community and the environment.

Generally the feedback was positive and showed that the experience was valued. Negative comments tended to focus on the need to streamline training and simplify data entry of test results. The positive response was not too surprising, considering the class met only once per week (several of those were outdoor meetings) and the major "homework" involved doing chemical measurements in local streams (typically in good weather) in a small group. Academic rigor came with short writing exercises, relevant weekly readings, classroom discussions, guest speakers, and group presentations (mostly absent in the above comments). The students earned one credit hour if they fully participated in the course, which involved a total time commitment of about 3-6 hours per week (some weeks busier when they were testing water samples).

Enrichment to the water testing experience was done during the weekly class meeting. During each semester, Prof. Reck and I selected a theme. Fall 2011 focused on the chemistry of water. We used the text *Elements of Environmental Chemistry* by Indiana University Professor **Ronald Hites** for our weekly readings and discussions of water chemistry. At the end of the semester the students gave group reports on water chemistry topics: "Nitrates," "Phosphates," "Metal cations," and "Biological Oxygen Demand." During Spring 2012, the theme we chose for the semester was "Regulation and Water Quality." We discuss the role of government regulation in water quality and had a guest speaker from the law school lead a discussion on environmental law. We also discussed advanced analysis methods, including AAS and GCMS, through presentations by experienced users (**Dr. Jon Karty** and graduate student **Yan Cheung**) and facility

G201 student, Sarah Posey, and Professors Reck and Tait count macroinvertebrates on the bottom of rocks while Andrew Rusch collects a turbidity sample. (Photography by William Unrue)

tours and demonstrations. End of semester group presentations each focused on a specific body of water (selected by the student group) and discussed water quality and regulation in that lake or river.

The long-term impact of this course is yet to be determined. Scheduling the course is a major challenge, especially since the target audience (freshman and sophomores) may already have a demanding schedule of required coursework and long lab sessions. Future iterations of this project could possibly take the form of a student club, as was done in Spring 2011, but the structure (and academic credit) of a course appealed to some of the students. Our data so far indicate that this experience was valued by the students who participated and may provide an opportunity for them to see the role of chemistry and their potential as chemists in the world around them. ■

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4. In addition to standard university course evaluations, we conducted a more in-depth assessment to gauge the effectiveness of the course through a short-answer questionnaire. These were conducted at the beginning and at the end of each semester. Due to the small class size and our familiarity with each student (and their handwriting), no pretense of anonymity was made, but helpful suggestions were collected (including some negative feedback) that allowed us to tweak the course. It was also very useful to learn what the students valued most in the course, as illustrated here.

Steven Tait obtained a BS degree in Honors Physics and University Honors from Brigham Young University in 2000. His graduate studies were done at the University of Washington, co-supervised by Charlie Campbell in Chemistry and Sam Fain in Physics, in conjunction with Bruce Kay at Pacific Northwest National Laboratory in eastern Washington State through a graduate fellowship program in Nanoscience co-sponsored by UW and PNNL. His doctoral work explored the desorption kinetics of small alkanes from solid surfaces, methane dissociation on Pd nanoparticles and the growth and sintering kinetics of Pd nanoparticles on aluminum oxide (PhD, 2005). His postdoctoral work was pursued in the department of Prof. Klaus Kern at the Max Planck Institute for Solid State Research (Stuttgart, Germany) where he studied the self-organization of supramolecular nanometer-scale structures at surfaces, especially systems formed by metal-organic coordination. Professor Tait joined the faculty at Indiana University in 2008.

Crystalline Glazes: Art and Chemistry

by Kate Reck

Crystalline glazes invoke images of frost or snow and this feature comes from the intentionally crystalline material dissolved in the glaze in combination with the highly technical and specific set of recipes and firing schedules. For a potter to know their glazes and when to use the right one (or combination of glazes), requires skill, research, and experimentation! *It kind of sounds like chemistry!*

Since coming to Bloomington, I have become a collector of the 3-dimensional art pieces of Adam Egenolf, a local Bloomington potter who specializes in crystalline pottery. I will not admit to you how many pieces of his I own but I have given many as gifts. If the connection to chemistry is not obvious, the crystals grow within the glaze and this interests me as a chemist. Chemists and non-chemists alike are drawn to his pieces at local art shows, and he has garnered a large group of fans since he made his home in Bloomington.

Several pieces of crystalline pottery by Blooming potter, Adam Egenolf. (Photography by Kate Reck)

Crystalline Glazes: A Brief History

Crystalline pottery was first invented during the Sung Dynasty (AD 960-1279). The glaze used then contained very small crystals that produced crystallites that were believed to arise unintentionally. Historians suggest that the potters were trying to prolong the cooling process in the kiln and the crystals developed accidentally.

This pottery was well guarded in the East until the early 1800's when the first pieces of crystalline pottery found their way to Europe. Enamored by the glazes, all the large pottery houses desired to produce crystalline pottery until they found that the pottery boasted a 30-50% success rate; unsuccessful pieces either have poor color, no crystals, or break while cooling. After the large pottery manufacturers had too high of failures it turned out that only the wealthy could afford to purchase the final products, becoming solely an early art form to the wealthy in Europe.[1]

Potters had known for years that high amounts of zinc oxide in the glazes would produce crystals; these were thought to be accidents and initially were of little interest to artists. In 1885, Charles Lauth and G. Dutailly donated a cup to the Sèvres Pottery Factory in France and these crystal deposits in the glaze were made from zinc silicate or titanium dioxide. They published their findings as a "problem" and warned potters against this.[2] By 1898, a factory chemist at Royal Copenhagen Porcelain Manufacturing, Adolphe Clement, ignored this warning and started successfully experimenting with zinc silicates. Clement's successor, a chemist named Valdemar Engelhardt, developed the glaze into an art form and they became internationally known for their work in this art form.[3]

The Art Nouveau movement witnessed an elevation in interest in crystalline pottery when oriental glazes started being imitated. Chemists in several countries tried to reproduce the East Asian glazes. Articles on crystalline glazes started being widely published in 1904 and artists were encouraged to experiment with these new glazes and share their findings. In spring 1909 a well-known French potter, Taxile Doat, was brought over to head the School of Ceramic Art in St. Louis, bringing with him the crystalline pottery technique. Doat was known for providing practical instructions and formulas for clays and glazes for successful crystalline pottery, reminiscent of the evocative pottery of the East.

Continued on page 10

Continued from page 9

Crystalline Glazes: The Technique

A fine balance of several components goes into making a crystalline glazed piece: *clay*, *glaze*, *temperature*, *time*, and *shape*. If any one of these five parts of the process is not controlled in the intended way by the artist, the results will change. Because of this delicate balance, every variable possible must be addressed to give the best opportunity to make a successful piece.

Porcelain provides the best, most brilliant results due to its whiteness and translucency, containing the least amount of impurities, yielding a smooth, white unblemished surface for the most controlled nucleation. Next, the *glaze* is a careful composition of three basic ingredients necessary for crystal growth. A common combination might consist of 25% zinc oxide, 25% silica (or ground quartz) and a 50% frit (i.e. fused glass) that is ground to a fine powder. Using frit in the mixture ensures that the mixture will be homogeneous and melts at a lower temperature. These three ingredients are mixed with water to form a thick suspension (glaze) which is then applied to the pot. Various metallic oxides such as oxides of copper, cobalt, iron, manganese or nickel are added alone or in combination to give combinations of colors ranging from white to blue, green, gold, purple, and orange.[4]

Crystalline glazes are special ceramic glazes in which crystals actually grow inside the glaze while it is very hot, but cooling slowly. Growth starts at a nucleation point and spreads out in an orderly manner. These microscopic spots in the glaze, called "seed crystals," form spontaneously in random numbers and random locations. "Seeds" can be added to the glaze in ca. 0.5% to help ensure crystallization occurs. These ingredients need not be the same as the glaze and can remain undissolved at firing temperatures. Most artists find that natural dust from the kiln works well enough for sites of nucleation as seeding the glazes can cause over-nucleation and excessive crystallization.

Crystallization occurs by firing the glazed piece at ca. 2400-2500°F until all the glaze ingredients are thoroughly melted. The kiln is cooled quickly and then held at 1800-2000°F for several hours (6 to 12 h) to allow the crystals to grow. The glaze is akin to a superstaturated solution that, upon cooling, cannot continue to contain the excess material and the most crystalline compounds crystallize. When the temperature is held constant, the crystallization occurs most regularly. The longer the glaze is held at that temperature, the larger the crystals form. The crystalline process contains so many variables that consistent or predictable results are difficult to obtain.

Alternatively, a piece could be brought up to about 2400-2500°F initially and then cooled down in stages to afford rings of crystals. If the piece is cooled in succession, the potter is ultimately painting the crystals onto the piece by deliberate and careful control of the temperature. Consequently, this process delivers crystallites that look like rings in a tree or the pattern of dropping a pebble in water. Artists can play with the temperature profiles in order to obtain the desired results and new outcomes.

In order for the crystals to grow well, the glaze must be very fluid and much of it runs down the side of each piece. By contrast, traditional glazes are stiff and do not run off the piece when molten; alumina is added to increase the viscosity. Crystalline glazes contain very little alumina and higher amounts of zinc oxide and silica that form zinc silicate crystals (Zn_2SiO_4). Zinc silicate formed in nature is known as willemite, which is highly fluorescent (green) under shortwave ultraviolet light.

During glazing, each piece sits in its own trough (glaze catcher) to ensure the kiln is not ruined as the glaze runs is molten. Finally, the piece is cut from the base (after firing it is actually stuck to this trough), and then the piece has to be ground flat with a diamond plated grinding disk.

New technology today uses a computer-assisted kiln that controls both the temperature and gas composition. Gas composition has been shown to be equally important as temperature. Controlling the atmosphere could allow one to starve the kiln of oxygen, burning the excess oxygen out of the glazes, leading to new hues and colors blends. The manipulation of this technology is still evolving.

Each glaze has its own unique fusion point based on its composition, but zinc silicate has the same rather small temperature window (130°F) in which it grows crystals. Crystalline artists must keep highly accurate and detailed notes to try hard to reproduce their successful pieces.

The inherently unique and unpredictable nature of crystalline glazes yields a wide range of colors, surface patterns, and textures that enables artists to produce a diverse body of ceramics but usually from a limited number of shapes. Understanding what crystals are, how they grow, the ingredients that go into a crystalline glaze and how each ingredient reacts in the melt requires research, time and sensitivity. Every piece that comes out of the kiln is completely different, making it a unique and exciting art form.

You can find current work by Adam Egenolf at Adam's website (http://egenolfceramics.com), at the Venue Fine Arts and Gifts (114 S. Grant; 812-339-4200), or at the local art fairs. ■

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Cathrine "Kate" Reck, Ph.D. is Clinical Professor and Director of Undergraduate Studies in the Department of Chemistry at Indiana University. She earned a B.A. in chemistry from Kalamazoo College (Kalamazoo, MI). Her Ph.D. is in inorganic/organometallic chemistry, specifically the synthesis of highly metalated aromatic compounds (Wayne State University; Professor Charles H. Winter). Her postdoctoral work in the synthesis of highly electrophilic olefin polymerization catalysts (The University of Iowa and The University of Chicago; Professor Richard F. Jordan). After teaching at Michigan Technological University (Houghton, MI) for one year, she accepted a teaching faculty position here at IU in 2001. She teaches courses within the areas of freshmen chemistry, non-majors chemistry, inorganic chemistry and organic chemistry.

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FACULTY NEWS

Welcome our new faculty among our ranks

Professor **Nicola (Nikki) Pohl** joined our faculty in July of 2012 as the Joan and Marvin Carmack Chair of Bioorganic Chemistry. Nikki grew up in Georgia and South Carolina before heading to Harvard for her undergraduate studies. Although officially majoring in English and American Literature and Languages with the Comparative Study of Religions, she also took classes in chemistry and worked in a lab doing gas-phase ion chemistry and mass spectrometry. She then came to the Midwest for her graduate studies and received her Ph.D. for work in synthetic organic chemistry in 1997 from the University of Wisconsin in Madison. After three years as an NIH postdoctoral scholar in the chemical engineering department at Stanford, she started her independent career at Iowa State University in 2000. She was the Wilkinson Professor of Interdisciplinary Engineering and a professor of chemistry and of chemical and biological engineering there before moving to Bloomington.

Research in the Pohl labs focuses on the development of synthetic methods to make carbohydrate-containing structures. Carbohydrates — from the sugars on red blood cells that determine blood groups A/B/O to the many other sugars that serve as a kind of fingerprint of cells from bacteria to cancer cells — are a major structure encountered by the immune system. However, the study of this class of biomolecules has lacked the tools to progress as quickly as related protein and nucleic acid studies. The Pohl group has developed a unique solution-phase automated method to string together sugar building blocks into more complex oligosaccharides and is now working with a range of collaborators to probe the rules needed to incorporate sugars into structures that either 1) boost an immune response to make better vaccines and adjuvants or 2) avoid an immune response to make bio-inert materials for implanted therapies.

Professor **Megan Thielges** joined our faculty in July of 2012. She was born and raised in Bismarck, ND. In 2003 she received her B.S. in biochemistry at Arizona State University in Tempe, AZ. She was awarded a National Science Foundation Graduate Fellowship for training in biophysics at The Scripps Research Institute in La Jolla, CA where she earned a Ph.D. in 2009. She went on to a Ruth L. Kirschstein National Institutes of Health funded postdoctoral fellowship in the chemistry department at Stanford University.

Continued on page 12

FACULTY NEWS

Continued from page 11

At IU the Thielges research group is developing nonlinear infrared spectroscopy as a tool for the measurement of protein flexibility in order to understand how it might impact protein function. To generate a picture of the structural fluctuations of proteins with both high spatial and temporal resolution, ultrafast spectroscopic experiments are combined with methods of biochemistry and chemical biology for placing vibrational probe groups at specific sites throughout proteins. With the newly developed tools, the Thielges group aims to understand the function of many proteins that play key roles in biology and the onset of disease, but are currently difficult to study because of their high mobility.

Professor **Yan Yu** joined our faculty as an assistant professor in July 2012. Prior to moving to Bloomington, Yan received her Ph.D. degree in the Department of Materials Science and Engineering at the University of Illinois-Urbana Champaign in 2009 and subsequently completed her postdoctoral studies on immune cells at the University of California at Berkeley.

Research in the Yu laboratory focuses on understanding cell-cell and cell-materials interactions, and development of biomaterials as novel therapeutic tools to control cell behavior. The major challenge in biotechnology, from biomedicine development to microbial fuel cell designs, is to understand and precisely control how cells communicate. With multidisciplinary approaches from chemistry, materials engineering, and biophysics, the Yu research program will: (1) apply a combination of optical imaging, spectroscopy, and analytical tools to quantitatively understand how cells send and receive signals across the cell membrane; and (2) to design bio-inspired materials that mimic the real cell membranes to manipulate how cells communicate, particularly in disease processes, as novel approaches for treating cancer and infectious diseases. Research in the Yu laboratory will bring multidisciplinary approaches from materials engineering, biophysics, and cell biology to modern chemistry. ■

In other faculty news ...

This year has been eventful for Professor **Erin Carlson** and her research group! The Carlson research program is focused on the development and application of advanced chemical biology and systems biology technologies to define the mechanisms of bacterial pathogenesis and identify potential therapeutic agents. This year, Dr. Carlson presented this research at ten national conferences and universities including an invited talk at the Chemical Biology and Novel Tools in Pharmacology Keystone Conference in Santa Fe, NM. Her group has published several manuscripts describing their recent work and additional papers are in the pipeline and will be submitted for publication soon!

Dr. Carlson's research has received many accolades over the past year being funded by a National Science Foundation CAREER Award and a National Institutes of Health Director's New Innovator Award. The NIH Director's New Innovator Award addresses two important goals: stimulating highly innovative research and supporting promising new investigators. Dr. Carlson was also named one of five IU Outstanding Junior Faculty. Finally, she was named a Cottrell Research Scholar, funded by the Research Corporation for Science Advancement, which is given to faculty members who have both excellent research programs and excellent approaches to student learning at the undergraduate level.

Over the past year, the **Flood Group** has seen its first four graduate students, **Kumar Parimal**, **Andrew Share**, **Eddie Witlicki** and **Yuran Hua**, successfully defend their theses and move forwards to professional employment or postdoctoral studies. The Flood Group has been recognized at the international level with the inaugural *Cram Lehn Pedersen Prize in Supramolecular Chemistry* and the *Award for Early Excellence in Physical Organic Chemistry*, which also allowed them to secure cover art for submissions related to these distinctions in Chemical Communications and the Journal of Physical Organic Chemistry. Locally, current graduate students **Kevin McDonald** and **Semin Lee** were awarded fellowships in the year ahead to pursue their research. These recognitions reflect efforts that continue with the theme of anion binding in the Flood Group. New areas of application of this knowledge are emerging for the group in the development of novel macrocycles, foldamers and supramolecular structures that self-assemble into 2D patterns on graphitic surfaces.

The **Giedroc Laboratory** continues to work toward understanding how bacteria control the intracellular availability of first-row transition metal ions. They have moved much of this project into the human respiratory pathogen, *Streptococcus pneumoniae*. In this organism, the high affinity zinc and manganese uptake systems are virulence determinants, which suggests that in the transition from commennsal inhibitant of the upper respiratory tract to invasive pathogen, zinc and manganese become limiting. The Giedroc group, in collaboration with **Dr. Charles Dann III,** Assistant Professor of Chemistry, reported the crystallographic structure and solution NMR characterization of a novel zinc uptake regulator from pneumococcus, adhesin competence repressor (AdcR) in the zinc bound, DNA-binding competent state (Guerra *et al.*, *J. Am. Chem. Soc.* **2011** *133*, 19614). This work was featured in a Spotlight on Recent *JACS* Publications (http://pubs.acs.org/doi/abs/10.1021/ja212036w). This project was recently (2012) renewed for another four-year period by NIGMS.

The **Hieftje Group** is collaborating with Chris Enke, an adjunct faculty member at IU Chemistry, in developing new methods for mass-spectrometric analysis. The first goal is the design, construction, and evaluation of an instrument for Distance-Of-Flight Mass Spectrometry (DOFMS). In principle, DOFMS is somewhat similar to Time-Of-Flight MS (TOFMS), and shares with it several architectural features. However, DOFMS is for scientists who are less patient. In TOFMS, all ions are given a mass-dependent velocity and then travel down a field-free flight tube; their time of arrival at a detector stationed at the end of the tube is then used to obtain a mass spectrum. In contrast, in DOFMS the ions are not allowed to escape the end of the flight tube but instead are directed perpendicularly onto an array of detection channels. Lighter ions, which fly faster, are detected by the farthest detector channels, and progressively heavier ions strike nearer channels.

DOFMS has many of the same strengths as TOFMS: unlimited mass range, high speed (more than 20,000 spectra/sec), architectural simplicity, simultaneous ion detection, and compatibility with most existing ion sources. However, it boasts high dynamic range, simpler electronic detection circuitry, and greater freedom from noise. A prototype DOFMS instrument has already been evaluated and described in the open literature; even higher performance is expected from modifications that are underway.

The 2011-2012 academic period has been exciting for the **Skrabalak Laboratory**. New synthetic strategies to shape- and architecturally-controlled particles — such as seed-mediated co-reduction, ligand-controlled nanoparticle assembly, and aerosol-assisted molten salt syntheses — have been validated and communicated in recent manuscripts. These new chemical methods are providing novel nanomaterials with controlled sizes, shape, three-dimensional structures and properties. Collaboration with the **Novotny Laboratory** has introduced graduate student **Amanda Peterson Mann** to lectin-affinity chromatography as she designs new porous materials with higher binding capacity for biomolecules and works with industrial partners to scale-up her synthesis. Students working on these projects presented their work at national and regional conferences, including the Noble Metal Nanoparticle Gordon Research Conference where Professor Skrabalak gave a well-received presentation and graduate student **Chris DeSantis** was selected as vice-chair for the associated 2014 Gordon Research Seminar.

Professor Skrabalak also spoke to an international community about their research at the International Conference for Young Researchers in Advanced Materials sponsored by the International Union of Materials Research Societies and hosted in Singapore. Travel support was provided by the NSF sponsored — International Materials Institute for Solar Energy and the Environment. Graduate student **Nancy Ortiz** also presented her research internationally at Seoul National University as part of IU-AGEP Professional Development Workshop. Finally, the Skrablab's Science Ambassadors program has been expanded to include undergraduate researchers working on nanoscience projects, with **Matthew Bower** visiting his former high school in the spring — this effort is made possible by Research Corporation, who selected Professor Skrabalak as a 2012 Cottrell Scholar.

At the Electrochemical Society meeting in Seattle, Washington in May, 2012, **Dennis Peters** received the 10th Manuel M. Baizer Award in Organic Electrochemistry for his career achievements in studying the electrochemical behavior of organic halides. A two-day special symposium featured a retrospective talk by Dennis, research presentations by attendees from around the world, and a late-afternoon award ceremony and reception. At the same symposium, oral papers were presented by three of Dennis' present research students (**Nathan Buehler**, **Kent Griffith**, and **Erick Pasciak**) and by a former doctoral student (**Chang Ji**, now Associate Professor at Texas State University).

Angela Peverly and Dennis Peters have published a paper in *Analytical Chemistry* describing an electrochemical procedure for the determination of the total trihalomethane content of water; trihalomethanes constitute the most important class of harmful disinfection by-products that arise from municipal chlorination of drinking water. **Elizabeth Wagoner** and Dennis Peters, together with **Jack Hayes** (a former graduate student, now teaching chemistry at State Fair Community College in Sedalia, Missouri) and **Jonathan Karty** (Director of the IU Mass Spectrometry Facility) have published a paper in the Journal *of Electroanalytical Chemistry* that describes the direct and catalytic electrochemical reductive dechlorination of 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113), a now-banned chlorofluorocarbon involved in the destruction of the Earth's ozone layer; CFC-113 remains stored globally at a level near 0.25 megaton, so there is interest in converting it electrochemically into useful feedstock for chemical industry. ■

Professor Milos Novotny Retires from Teaching but Never Stops Pursuing Science

A native of Brno (Czech Republic), **Milos V. Novotny** received his undergraduate education and a doctorate in biochemistry at the University of Brno. He received his further scientific training at the Czechoslovak Academy of Sciences and the Royal Karolinska Institute (Sweden). When the Soviet troops occupied Czechoslovakia in 1968, Dr. Novotny decided to remain abroad and immigrate to the U.S. accepting another postdoctoral position at the University of Houston. It took a number of years before he could again visit his relatives in Brno.

Dr. Novotny joined the IU Chemistry faculty in 1971, became full professor in 1978, James H. Rudy Professor in 1988, Distinguished Professor in 1999, and the Lilly Chemistry Alumni Chair in 2000. He rapidly built a strong research program and directed the centers of excellence at IU.

Professor Novotny has been a pivotal figure in the development of analytical separation methods for more than 30 years. His highly acclaimed efforts in microcolumn separation techniques of liquid chromatography, supercritical fluid chromatography, and capillary electrophoresis represent important innovations in modern analytical chemistry. He has made seminal contributions to the fields of glycomics and glycoproteomics. Professor Novotny and his associates are also known for structural identification of the first definitive mammalian pheromones. He participated in designing the system analyzing for organics on the planet of Mars (Viking 1975 Mission).

His laboratory has long been involved with developing new high-resolution and ultra-sensitive bioanalytical separation techniques. Current research focuses on substantial improvement in resolution of complex biological mixtures and identification of the separated compounds through techniques such as electrospray mass

Continued on page 14

Continued from page 13

Milos Novotny as the recipient of honorary doctorate at Charles University (Prague) in 2007.

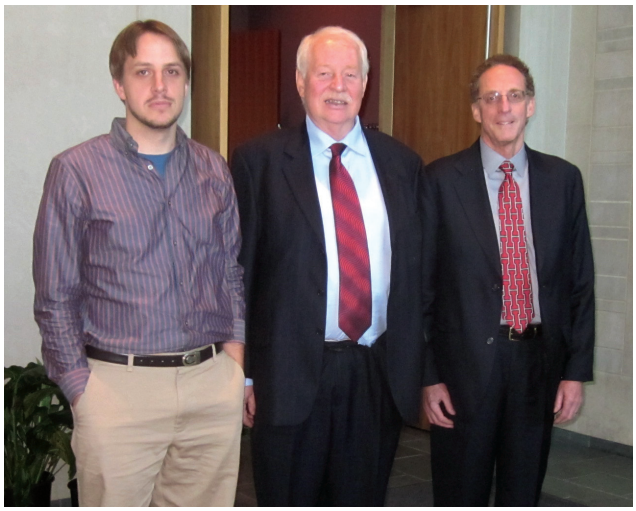
spectrometry and matrix-assisted laser desorption/ionization mass spectrometry. His most recent work includes the preparation of highly efficient microcolumns for various forms of chromatography and capillary electrophoresis, new detectors based on the laser technologies, imaging detectors, and other measurement principles. In particular, capillary electrophoresis and electrochromatography combined with laser-induced fluorescence offer highly sensitive measurements at less than attomole (10^{-18} mole) levels. To facilitate ultrasensitive analyses of biological compounds by this technique, his group has synthesized unique fluorogenic reagents that permit a spectral match with laser characteristics. Highly sensitive determinations of carbohydrates in complex mixtures are among the most pressing problems of glycobiology, a field now often referred to as the last great frontier of biochemistry. The analytical systems under development in his laboratory involve enzyme microreactors, unique fluorescent tags, and sophisticated instrumentation for proteomics and carbohydrate analysis, including various forms of mass spectrometry for sequencing, linkage analysis and a site of posttranslational modification.

Biochemically related investigations concern lipid peroxidation and its connection to the molecular mechanisms of aging and certain human diseases. For several years, his laboratory has also been active in the identification of mammalian pheromones and the biochemical aspects of olfaction. Olfactorily receptive proteins have now been isolated from mammalian tissues, and we are currently pursuing their structures, binding sites for pheromones, and the relevant molecular dynamic aspects. The membrane-bound receptor proteins are being probed for their interaction with pheromones and the consequent transmembrane signaling.

Milos Novotny has authored more than 500 journal articles, reviews, books and patents. He has received over 40 awards, medals, and distinctions, including for majors awards by the American Chemical Society and three honorary doctorates at European universities. He was elected to two foreign academies: the Swedish Royal Society for Sciences (1999) and the Learned Society of Czech Republic (2004). After 40 years on the chemistry faculty, Milos Novotny has retired from active teaching and service, but not from his research. As a Distinguished Professor Emeritus and the Lilly Chemistry Alumni Chair, he receives federal grants and retains an active research laboratory. Congratulations and best wishes, Milos! We are glad to know you will not be far from our department.

To celebrate Professor Novotny's scientific contributions, a symposium was held in his honor on October 15, 2012 at the Neal Marshall Black Cultural Center at Indiana University. Speakers included distinguished colleagues:

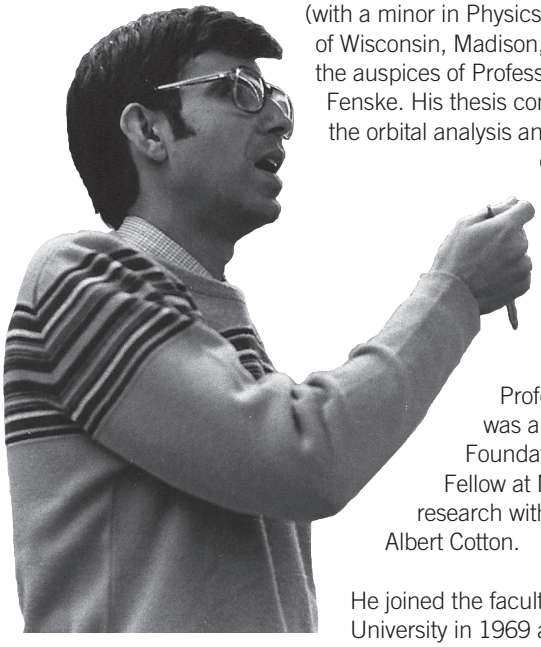
- **Paul Greico**, Regents' Professor of Chemistry, Montana State University, *"Zwitterioninc Fluorescent Dyes for Use in Proteomics: An Update."*
- **Mark Wightman**, W. R. Kenan, Jr. Professor of Chemistry, Director of Undergraduate Studies, University of Carolina, *"Capillary Liquid Chromatography at Ultra-high Purity"* (replacing **James W. Jorgenson**, W. R. Kenan, Jr. Professor of Chemistry, University of Carolina who could not attend for personal reasons).
- **Robert T. Kennedy,** Hobart H. Willard Collegiate Professor of Chemistry, University of Michigan, *"The Nanoliter Lab: Miniaturized Methods for High Throughput Chemical Analysis."*
- **Ellen D. Ketterson**, Distinguished Professor of Biology, Indiana University, and Dannielle J. Whittaker, Managing Director of the Beacon Center, Michigan State University, *"Dispelling Myths about Birds and Odor: Chemical Communications in the Dark-Eyed Junco."*
- **Milton L. Lee**, H. Tracy Hall Professor of Chemistry, Brigham Young University, *"Exploring the Limits of Resolution in Liquid Chromatography and Capillary Electrophoresis."*
- **Pat J. Sandra**, Emeritus Professor, Ghent University, Belgium, *"Innovations in Separation Science and the Belgian Dioxin Crisis."* ■



Taken at the Novotny Symposium October 15, Milos (center) with his first Ph.D. student **Milton L. Lee** (H. Tracy Hall Professor of Chemistry, Brigham Young University, Provo, UT) who graduated 1975, and the last Ph.D. student **Benjamin F. Mann** (left) to be graduated later in 2012. (Photo by Helena Soini)

Professor Kenneth Caulton Celebrates his 70th Birthday and 43 Years in the Department

Kenneth G. Caulton was born in Chicago, Illinois, May 24, 1941. He obtained a B.A. degree (cum laude) from Carleton College in Northfield, Minnesota in 1962. As an undergraduate student, Caulton performed research and published two papers under the guidance of Professor James E. Finholt. As a National Science Foundation Predoctoral Fellow he then obtained a Ph.D. in chemistry (with a minor in Physics) at the University of Wisconsin, Madison, in 1968 under the auspices of Professor Richard F. Fenske. His thesis concentrated on the orbital analysis and elucidation on of the electronic structure of classical metal complexes having π-donors and π–acceptor ligands. From 1967–1969, Professor Caulton was a National Science Foundation Postdoctoral Fellow at MIT, conducting research with Professor F. Albert Cotton.



He joined the faculty at Indiana University in 1969 and rapidly moved through the ranks to become Full Professor. Professor Caulton has remained at Indiana his entire, fruitful career as an independent scientist. In 1994 he was appointed Distinguished Professor of Chemistry. Since 1962, Professor Caulton has carried on research in coordination and organometallic chemistry publishing well over 500 research articles in peer-reviewed journals. In his independent career, Professor Caulton has supervised over 55 doctoral students and 44 postdoctoral fellows, many of whom hold academic or industrial positions in chemistry.

Since 1967 he has received many awards and honors including Eastman Kodak Award (1967), Aguirre-Basualdo Award for Sciences, Sorbonne (France, 1996), SPIE scholarship in Optical Science and Engineering (2000), and the CaRLa Fellow (University of Heidelberg, 2010) among other distinctions. Apart from serving on many committees at the departmental, college and university level, Professor Caulton has been an active participant in the American Chemical Society (ACS) and the Division of Inorganic Chemistry. He has also held many Editorial Advisory Boards for prestigious chemical journals.

One of the many notable achievements of Professor Caulton's career would be his prolific involvement with numerous institutions and faculty outside of IU during his many sabbatical leaves. These would comprise both foreign and domestic totaling nine, and included the countries of France, Germany and Japan.

Prior to 1975, his research was involved with synthesis and characterization of molecules containing ligands in unusual bonding situations (multiple metal-metal bonds, linear and bent nitrosyls), non-rigid molecules (studied by dynamic NMR and computer simulation techniques) and coordinated intermolecular migration of nitric oxide. A detailed ^{31}P NMR examination of the solution equilibria of the catalytic molecule $RuCl_2(PPh_3)_3$ heightened his interest in the fundamental science behind catalytic transformation of relevance to the petrochemical industry. Subsequent research has been along the themes of organometallic photochemistry, particularly photogeneration of catalytically active polyhydride complexes; mechanistic studies of the catalyzed hydrogenation of carbon monoxide; activation, by electron transfer or protonation, of polyhydride complexes; synthesis and reactivity of mixed halide/pi-donor ligand compounds; the study of H_2 complexes; quantum exchange coupling.

During the late 80's and most of the 90's, the synthesis of mixed metal alkoxides was pursued for the purpose of subsequently converting these to solid state materials useful due to their mechanical, optical, magnetic or electrically conductive properties. This has led to studies of bulk solid thermolysis reactivity and chemical reactivity of solids with gases, including chemical sensors. Recent work has been on several pincer-type ligands, leading to unprecedented high spin Ru(II), Re species capable of converting alkanes to carbenes or carbynes, and finally to carbene ligands carrying two electron withdrawing ligands. Alkane conversion to metal alkyls and to olefins (i.e. net dehydrogenation) has been effected using a unique new geometrically constrained tripyridine macrocycle on Pt(II), and this ligand type on Cu catalyzes the functionalization of alkanes to aziridines and amines. These recent studies have focused on unsaturated late-metal frameworks, in particular some redox-active ligands, that provide access to unusual electronic structure and reactivity. Professor Caulton's energy and enthusiasm for chemistry is one of a kind, and we wish him continued success as he explores new regimes in inorganic chemistry.

Professor Caulton was honored at the 21st Annual Inorganic Alumni Symposium on October 22, 2011. Over 100 friends and colleagues joined in the celebration to honor his contributions to the department and to the discipline of chemistry nationally. ■

Continued on page 16

Continued from page 15

Professor Dennis Peters Celebrates his 75th Birthday and 50 Years in the Department

Born in Los Angeles, California on April 17, 1937, Professor **Dennis Peters** received the B.S. degree (cum laude) from the California Institute of Technology in 1958 (where he did undergraduate research for three years under the direction of Professor Ernest H. Swift) and the Ph.D. degree from Harvard University in 1962 (with the mentorship of Professor James J. Lingane).

Beginning his appointment at Indiana University as an Instructor in 1962, Professor Peters became the Herman T. Briscoe Professor of Chemistry in 1975.

Professor Peters is a member of the American Chemical Society, the Electrochemical Society, the Society for Electroanalytical Chemistry, and the International Society of Electrochemistry. For the Electrochemical Society, he is a member of the executive committee of the division of Organic and Biological Electrochemistry and has served as Secretary-Treasurer, Vice Chairman, and Chairman of that division.

Professor Peters received the *Ulysses G. Weatherly Award* for distinguished teaching at Indiana University in 1969, and a Distinguished Teaching Award from the College of Arts and Sciences-Graduate School Alumni Association in 1984. He presented approximately 35 lectures in analytical chemistry during a two-month period in 1975 at the University of Natal in Pietermaritzburg, South Africa under the sponsorship of the Students' Visiting Lecturers Trust Fund. For two months in 1980, he was a Visiting Fellow of the Japan Society for the Promotion of Science, during which time he gave research lectures on electroorganic chemistry at 13 universities throughout Japan. In 1988 he received a Chemical Manufacturers Association National Catalyst Award for outstanding teaching, and in 1990 he was recipient of the American Chemical Society Division of Analytical Chemistry Award for Excellence in Teaching. In 1995 and 2000, he received an outstanding teaching award from the Indiana University chapter of Alpha Lambda Delta.

In 1997, 1999, and 2000, he received *Teaching Excellence Recognition Awards* from the Indiana University Board of Trustees. In 2001, he received the *James Flack Norris Award* for Outstanding Achievement in the Teaching of Chemistry from the Northeastern Section of the American Chemical Society. For 2002, Dr. Peters was the recipient of the *Brown Derby Award*, presented to an Outstanding and Popular Faculty Member by the Indiana University School of Professional Journalists, and he received the *Henry B. Linford Award* for Distinguished Teaching, presented by The Electrochemical Society. The year 2002 also marked Dr. Peters' 40th year of teaching at Indiana University, and an undergraduate scholarship fund has been created in his honor. In 2003, 2005, 2007, and 2010, he received Trustees Teaching Awards from Indiana University. From Indiana University he received a *Distinguished Service Award* in 2005 and the *W. George Pinnell Award* for Outstanding Service in 2006. In 2007, Dr. Peters was elected as a Fellow of The Electrochemical Society, and he was the 2012 recipient of the *Manuel M. Baizer Award* in Organic Electrochemistry from The Electrochemical Society.

Dennis Peters with Past and Present Undergraduate Researchers. (Left to Right): **Kyle Knust**, **Joseph Rheinhardt**, **Ian Walker**, **Ryan Clodfelter**, **Dennis Peters**, **Kent Griffith**, **Tyler Koss**, **Clark Baumberger**, **Sonja Skljarevski**, and **Nathan Buehler**

Professor Peters is coauthor of five textbooks on analytical chemistry (published by W. B. Saunders Company): *Quantitative Chemical Analysis*, third edition, 1968 (with **R. B. Fischer**); *A Brief Introduction to Quantitative Chemical Analysis*, 1969 (with **R. B. Fischer**); *Chemical Equilibrium*, 1970 (with **R. B. Fischer)**; *Chemical Separations and Measurements*, 1974 (with **J. M. Hayes** and **G. M. Hieftje**); and *A Brief Introduction to Modern Chemical Analysis*, 1976 (with **J. M. Hayes** and **G. M. Hieftje**).

Over the past 40 years, Professor Peters' research has focused principally on the electrochemical behavior of halogenated organic compounds, especially alkyl halides, acetylenic halides, and acyl halides. In particular, compounds such as trihalomethanes (THMs) and haloacetic acids (HAAs) are contaminants in drinking water and the Peters group has interest in the quantification and remediation of these pollutants in aqueous environments using electrochemical means.

More recently, he and his group have been investigating the use of transition-metal complexes as homogeneous-phase and polymer-bound catalysts for the reduction and oxidation of organic species. Many modern organic syntheses still require harsh conditions and toxic reagents; one goal of organic electrochemistry, congruent with green chemistry, is to eliminate the necessity of these undesirable features. In conjunction with developing mild and efficient methods for electrosynthesis of useful organic products, his group hopes to elucidate mechanistic pathways and reaction kinetics using electroanalytical methods. His focus is on halogenated organic compounds that, upon electrochemical reduction, can undergo intramolecular cyclization, ring-expansion, and other useful organic reactions. Present research extends into exploration of nickel and cobalt salen as solution-phase and polymer-bound catalysts, employing ionic liquids as solvent-electrolyte, and the use of silver as a catalytic cathode material.

Furthermore, his research has aimed at examining biologically-relevant compounds by electrochemical means to gain knowledge of their behavior. For example, by examination of the electrochemical

behavior of piperazinyl amidrazones and the effect of various substituents, they have been working to illuminate if there is a correlation between the electrochemistry and anticancer activity. For example, they study the electrooxidation of histamine which is a biogenic amine and is present in many food products as well as in the body. Dennis Peters' group continues to thrive and be a home to graduate and undergraduate students.

For Dennis Peters, service to Indiana University is so intertwined with his commitment to students, he is widely considered the "heart and soul" of the chemistry department. ■

CONFERENCES, SPECIAL LECTURES AND SYMPOSIA

IU Chemistry had 160 seminar speakers present their research efforts in our department over the last calendar year. These speakers represented many levels of experience in chemistry and biochemistry: fifth-year graduate students and defending Ph.D. students, present IU faculty and staff, including faculty visiting IU from around the world. Several named lectures and symposia are provided below.

October 15, 2011: *Watanabe Symposium in Biotechnology*
The Watanabe Symposium honors the late August "Gus" Watanabe, a renowned physician, researcher and professor who led research and development at Eli Lilly and Company for nearly a decade, and who was a pioneer in the study of the cellular mechanics of the heart. IN 1994, Watanabe assumed the role as President of Lilly Research Laboratories and is responsible for launching eleven new and pivotal pharmaceutical products. IU hosted the 2nd annual Watanabe on October 15, 2011, and the list of speakers is below.

- Dr. **Andrea Cochran**, Genentech, *"A Common Mechanism of Wnt Signaling Inhibition by Sclerostin and Dickkopf Proteins."*
- Professor **Silas Cook**, Department of Chemistry, Indiana University, Bloomington, IN. *"An Overlooked Approach to the Malaria Problem: A Practical Synthesis of Artemisinin."*
- Professor **Jon Clardy**, Department of Biological Chemistry and Molecular Pharmacology, Harvard University, Boston, MA. *"Bacterial Conversations."*
- Professor **Martha Oakley**, Department of Chemistry, Indiana University, Bloomington, IN. *"Structure and Interactions of Bacterial Condensins."*
- Professor **Nicola Pohl**, Department of Chemistry, Iowa State University, Ames, IA. "*Automated Oligosaccharide Synthesis and Glycoimmunology."*
- Professor **Doug Rees**, Department of Chemistry, California Institute of Technology, Pasadena CA. *"The Structural Basis of Biological Nitrogen Fixation."*
- Professor **Michael Van Nieuwenhze**, Department of Chemistry, Indiana University, Bloomington, IN. *"The Study of Peptide Antibiotics that Inhibit Peptidoglycan Biosynthesis."*

The 2011 Inorganic Annual Alumni Symposium was held on October 22, 2011 and dedicated to Professor **Kenneth G. Caulton** in celebration of his 70th birthday (i.e. renamed ***"Kenfest 2011"***). Several of Ken's past students, postdocs and colleagues returned to honor him and join in the celebration.

- Dr. **Larry N. Lewis** (Ph.D. 1976-1980; Principal Chemist — GE Global Research, Niskayuna, NY) *"How Ken Caulton Inspired an Industrial Career."*
- Professor **Lori Watson** (Ph.D. 1999-2004; Associate Professor of Chemistry, Earlham College, Richmond, IN) *"Hydrogen Bonding of the Uranyl Oxo Group and Other Adventures in Teaching and Research."*
- Dr. **Eric G. Lundquist** (Ph.D. 1984-1988; Global Research Director for Dow Plastics Additives, The Dow Chemical Company, Spring House Research Laboratories, Spring House, PA) *"A Ph.D. in Inorganic Chemistry = a Career in Polymers."*
- Dr. **Björn Borup** (Ph.D. 1991-1997; Director Marketing Coatings, Evonik Industries, Hanau-Wolfgang, Germany) *"Sol-Gel Chemistry for Specialty Chemicals, or How the PhD is Relevant to the Life in Industry."*
- Professor **Andrei N. Vedernikov** (Postdoc 2001-2003; Associate Professor, Department of Chemistry and Biochemistry, University of Maryland, College Park, MD) *"Direct Functionalization of M—C (M = Pt^{II}, Pd^{II}) Bonds Using Environmentally Benign Oxidants, O_2 and H_2O_2."*
- Professor **Masamichi Ogasawara** (Postdoc 1994-1996; Associate Professor, Catalysis Research Center, Hokkaido University, Sapporo, Japan) *"Catalytic Asymmetric Synthesis of Planar-Chiral Transition-Metal Complexes."*
- Dr. **Todd Johnson** (Ph.D. 1988-1992; Chief Operating Officer, KemPharm Inc., North Liberty, IA) "From Ken's Office to Wall Street Road Shows."
- Professor **Dejian Huang** (Ph.D. 1994-1999; Associate Professor, National University of Singapore, Singapore) *"Ru- and Fe-Based Molecular and Nano Probes for Detection of Small Molecules of Biological Importance."*
- Dr. **Grigorii Soloveichik** (Visiting Scholar 1991; Senior Staff Chemist, GE Global Research, Niskayuna, NY) *"From Metal Hydride Complexes to Virtual Hydrogen Storage."*
- Dr. **Roger L. Kuhlman** (Ph.D. 1991-1996; Senior Chemist, The Dow Chemical Company, Freeport, TX) *"New Polyolefins from Chain Shuttling."*
- Dr. **Jack Coalter** (Ph.D. 1996-2001; Lead R&D Manager, The Dow Chemical Company, Freeport, TX) *"Development of a 6th Generation Ziegler —Natta Polypropylene Catalyst."*
- Professor **Oleg V. Ozerov** (Postdoc 2000-2002; Professor of Chemistry, Texas A&M University, College Station, TX) *"Exciting Chemistry of Unsaturated Pincer Complexes."*

Continued on page 26

STAFF PROFILE

by Kate Reck

Carly Friedman, Chemistry Advisor

The success of an undergraduate program can often hinge on a good academic advisor. **Carly Friedman** was hired as the new Chemistry Advisor in 2009, and she is solely responsible for advising the almost 500 biochemistry and chemistry majors our department has over all four years. Twice a year, all majors make an appointment for one-on-one counseling to ensure that they are on track and following a course of action that is in their best interest toward their career goals. She communicates constantly with other departments and offices on campus to ensure that information is up to date and that our requirements are understood across campus and the state.

Her duties do not end with solely advising. She meets with prospective students (and parents) to discuss the strengths of our chemistry program. Although not having a chemistry background, Carly does a good job of quickly picking up the complex requirements for our four degrees. When questions arise, she asks and retains the information well. She does an excellent job maintaining the rigor and integrity of our degrees while helping students attain their ultimate goals in the most efficient ways.

Working with **Amanda Ellis** in the Chemistry Undergraduate Office, she has been responsible for making our last three departmental graduations successful. Likewise, she helps with the *Chemistry Honors Banquet* every spring and anything else in the office that needs attention. She is a team player and a consummate professional.

Although she did not know it, she was born to be an advisor. While in grade school, she took a "career exam" (like most of us do) that indicated that her skill set and interests would make her a good counselor. After a few career diversions and a great deal of great job opportunities, her career trajectory finally brought her to that point.

Originally from Albany, NY, Carly wanted to attend a large university for her undergraduate education. She chose Ohio State University where she completed a degree in Communication and a minor in Sociology. She loved her business classes and thought to pursue a career in marketing and advertising. After working for a sports marketing company for a few years and the lack of job satisfaction, she sought to change her career direction.

She attended Marymount University in Arlington, Va., where she liked the smaller school population and living in the DC area. She earned an M. Ed. in Secondary Education in English, allowing her to teach grades 7-12. She taught high school in New Jersey and middle school in Virginia and Indiana. After teaching in grades 7-12 for five years, she gained valuable experience working with students early on in the education process. Her largest challenge came when trying to get apathetic students to do what they did not feel like doing. She realized that she liked the interactions with students outside of class more than the in-class instructional component.

Carly learned through all these experiences that her one-on-one interactions gave her the most satisfaction. Although no course or decision in college would have gotten her to this career sooner, she has since determined that being an academic advisor uses her talents best and gives her the greatest satisfaction.

"None of these career diversions were a waste of time because they helped me figure out what I wanted to do in life," she comments. "This is the best job I've ever had."

We are fortunate that she landed in our department because her skills and experiences have provided her the skills necessary to make her a good advisor, working equally well with both capable and struggling students along their unique paths. She enjoys best watching students prepare for their future careers through academic, social, and professional development, and she gains some satisfaction from knowing she has an impact in their success. For the most part, our chemistry and biochemistry students are well motivated, already knowing that they want to do when they come to see her. Sometimes they are so focused that they don't realize they need guidance or that they have alternatives once they have focused in on their goals.

Likewise, it's challenging to help students find new career paths when they decide that biochemistry or chemistry does not suit their skill set. Oftentimes, students feel like they have failed when they switch away from this major, but she works hard to explain to them we all need to figure out what we are good at and pursue that rather than forcing a career or major that does not fit. She can speak from experience about not wanting to be caught in an unsatisfying career. She aspires to help students find their correct path and find themselves along the way.

Carly has made a permanent home in Bloomington with her husband, Seth, and her two sons, Leo (age 7) and Clark (age 4). She loves the size of the city, the diversity of restaurants, social interests and opportunities for all ages. She has been a strong asset to our department and the success of our undergraduate program. *We hope we can convince her that this is her last career move!* ■

STAFF NEWS

by Cheryl Johnson and Erin Edwards

Oscar Judd was hired as a Lecture Demo Technician in the undergraduate teaching labs (replacing Kylie McFarland).

Christina DiMarchi was hired as an Office Assistant working under the direction of Dr. Jay Levy. Christina is from Carmel, Indiana. She graduated from Academy Plus High School in 2004 and then attended Ivy Tech Community College (majoring in Education).

Cynthia Banks was hired as the Office Services Assistant Senior in the Chair's Office (replacing Kathy Fisher). Cynthia has experience working in administrative offices both during and since her service with the Navy, from which she received an Honorable Discharge.

Kelly Clark was hired as the departmental Grant Specialist. This is a new position that was created to assist Chemistry academics in proposal development and submissions. Kelly formerly worked at eLearning firm Wisdom Tools Enterprises Inc. in Bloomington for over 5 years as a Lead Writer, Editor, and Project Manager. Her duties included writing and editing grant proposals submitted annually to the NIH and project management for various federally funded efforts.

Erin Edwards was hired as the Assistant Director of Business for the department in January 2012. She aids the Director of Business (**Amy Van Pelt**) with account management. Erin also assists with underwrites and project time extensions, provides projections on account expenditures, and oversees Chemistry Requisitioning, Receiving and Chemistry Scientific Stores. She previously served as a departmental Research Secretary.

Shelly J Dodson was hired as the Student Services Assistant for the Chemistry Undergraduate Office. Shelly received her B.S. in Community Health Education from Portland State University in Portland, Oregon and also has experience as a nonprofit program manager, anti-violence advocate and in providing support and resources to folks with disabilities. Originally from Indiana, Shelly, her husband Tom and their 12 y/o dog Bela recently relocated back to be closer to her family.

Retirement

Kathy Fisher retired from the University at the end of June after 37 years of service. Kathy began her long career at Indiana University in the Office of the Registrar and in late 1977 took a position in the Chemistry Graduate Office. In 1985, Kathy began working as a research secretary for **Paul Grieco** and stayed in that position until his departure in 1997. She then became the research secretary for **David Clemmer** and in 2000 transferred to the Chair's Office to serve as the Administrative Secretary, where she remained until her retirement. Thank you for your many years of dedicated service, Kathy. Best wishes and much happiness in your retirement!

Service Recognition

10 years – **Rose Burchfield**, **Scott Harrington**
15 years – **Angela Hansen**
25 years – **Andy Alexander**
35 years – **Robin Nordstrom**

2012 Staff Award Recipient

Becky Wilson, Undergraduate Office

Leaving the Department

Kylie McFarland, Lecture Demo Tech
Amanda Posto, Lab Tech (Novotny)
Abdullah Mohammed, Sr. Electronics Engineer
Amanda Ellis, Student Services Coordinator— Undergraduate Office

In Memoriam

Angela Monts, a 2009 Staff Award Recipient

This past spring, Chemistry lost a good friend and valued staff member, **Angela Monts**, after a two-year battle with atypical carcinoid neuroendocrine cancer. Angie joined the Chemistry Department in 2003 as a Research Secretary for Profs. **deSouza**, **Ewing**, **Iyengar, C. Jarrold**, **M. Jarrold** and **Raghavachari**. She quickly adapted to working in academia after employment at the Bloomington Hospital and the Monroe Public Library and served as a mentor to many colleagues in the department. In early 2008, Angie began fully dedicating her time to the **DiMarchi** Group as their Administrative Assistant. Angie enjoyed learning about her faculty members' research projects and getting to know Chemistry personnel from all walks of life. Her love of people and her job was evident in her genuine, bright smile and uplifting words. Angie will always be remembered as a treasured member of the Chemistry Family. Team "IU Chemistry-Angie Monts" participated in the Hoosiers Outrun Cancer Walk again this year on September 29, to keep Angie's memory close and support cancer research. ■

Chair's Letter

Continued from page 1

recipient of the Giorgio Nota Award from the Italian Chemical Society given in recognition of his pioneering work and lifetime achievements in capillary liquid chromatography. This award, sponsored by the Waters Corporation, was received at the 36th International Symposium on Capillary Chromatography (ISCC), in Riva del Garda, Italy. While there, Milos delivered the opening lecture on the role of glycobiology in cancer research and emphasized the role of chromatographic methodologies in biomedical science.

In closing, let me express my gratitude for your continued support of the department. Please stop by during your next trip to Bloomington — you're always welcome.

—David Giedroc

GRADUATE NEWS

by Toni Lady

During the 2011-2012 school year, Professor **Caroline C. Jarrold**, was the Director of Graduate Studies. Serving with her on the Standards Committee were professors **Richard DiMarchi**, **Srinivasan Iyengar**, **Amar Flood**, **Dennis Peters**, **Michael Van Nieuwenhze**, and **Mu-Hyun Baik**.

Daniel Mindiola chaired the Graduate Admissions Committee. Evaluating the hundreds of dossiers submitted to the department were professors **Mu-Hyun Baik**, **Lane Baker**, **Kevin Brown**, **Erin Carlson**, **Silas Cook**, **Charles Dann III**, **Sarah Skrabalak**, and **Steven Tait**.

Fellowship Award Winners for 2011-2012

Christopher DeSantis was awarded the Chester Davis Inorganic Fellowship. Chris joined the lab of Dr. Sara Skrabalak in the fall 2009.

Kevin McDonald was awarded the Chester Davis Organic Fellowship. Kevin joined the lab of Dr. Amar Flood in the fall 2008.

Raghu Ramabhadran was awarded the Richard Slagle Fellowship. Raghu joined the lab of Dr. Krishnan Raghavachari in the fall 2008.

Semin Lee was awarded the Raymond Siedle Materials Fellowship. Semin joined the lab of Dr. Amar Flood in the fall 2009.

Elizabeth Wagoner was awarded the E.M. Kratz Fellowship. Elizabeth joined the lab of Dr. Dennis Peters in the fall 2009.

Shivnath Mazumder was awarded the Raymond Siedle Inorganic Fellowship. Shivnath joined the lab of Dr. Mu-Hyun Baik in the fall of 2008.

Ozden Kocaoglu was awarded the Marvin Carmack Fellowship. Ozden joined the lab of Dr. Erin Carlson in the summer of 2010

Sarah Waller was awarded the Kraft Fellowship. Sarah joined the lab of Dr. Caroline Jarrold in the fall of 2009.

Akshay Shah was awarded the Paget Organic Fellowship. Akshay joined the lab of Dr. David Williams in the fall of 2008.

Alexander Graham was awarded the ACS Analytical Fellowship through the Division of Analytical Chemistry (DAC) of the ACS. Alex joined the lab of Dr. Gary Hieftje in the fall 2008.

Other Fellowship Recipients:

Chiao-Chen Chen, ChemGRC Travel Grant Fellowship; Women In Science Travel Grant Fellowship
Jonathan Dilger, Crane Fellowship
Frank Hardin, Gates Fellowship
Zachary Harms, QCB Training Grant Fellowship
Rachel Lecker, Baxter Fellowship
John Lisher, QCB Training Grant Fellowship
Andrey Malyutin, QCB Training Grant Fellowship
Amanda Mann, Women In Science Travel Grant Fellowship
Keevan Marion, Mays Fellowship
Indranil Mitra, ChemGRC Travel Grant Fellowship
Fese Mokube, NIH-Pre-doctoral Fellowship
Celeste Morris, Women In Science Travel Grant Fellowship
Kirstin Morton, Women In Science Travel Grant Fellowship
Elizabeth Siegel, QCB Training Grant Fellowship
Alison Smith, Crane Fellowship
Jonathan Snider, Paget add-on Organic Fellowship
Mitchell Stadler, Lanterman Fellowship
Darci Trader, McCormick Science Fellowship; Women In Science Travel Grant Fellowship
Kaelyn Wilke, QCB Training Grant Fellowship; Wichem Travel Award


Christopher DeSantis

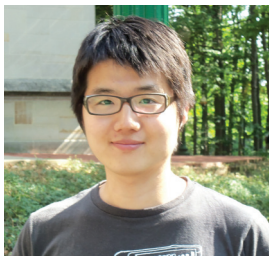

Alexander Graham


Kevin McDonald


Ozden Kocaoglu


Elizabeth Wagoner


Akshay Shah


Semin Lee


Raghu Ramabhadran


Shivnath Mazumder


Kaelyn Wilke


Sarah Waller


Singha Roy Abhishek

Benjamin Gamoke

Ashley Sidebottom

Paul Gladen

Deven Shinholt

Zach Harms

Elizabeth Siegel

Daniel Skomski

Lauren Kacz

Annual Chemistry Department Award Winners

E. Campaigne C500 Award: **Daniel Skomski**, Professor Steven Tait lab

Jack K. Crandall Award: **Paul Gladen**, Professor David Williams lab

Wendell P. Metzner Memorial Award: **Kevin McDonald**, Professor Amar Flood lab

William H. Nebergall Memorial Award: **Shivnath Mazumder**, Professor Mu-Hyun Baik lab

Felix Haurowitz Award: **Zachary Harms**, Professor Stephen Jacobson lab

Felix Haurowitz Award: **Benjamin Gamoke**, Professor Krishnan Raghavachari lab

Henry R. Mahler Award: **Kaelyn Wilke**, Professor Erin Carlson lab

David A Rothrock Award: **Singha Roy Abhishek**, Professor Peter Ortoleva lab

Associate Instructor Awards:
Lauren Kacz, Professor Stephen Jacobson lab
Deven Shinholt, Professor Martin Jarrold lab
Ashley Sidebottom, Professor Erin Carlson lab
Elizabeth Siegel, Professor Martin Jarrold lab

Congratulations to recent graduates!

Ph.D. Degree Recipients

Leigh Boerner - Inorganic, August 2011, Professor Jeff Zaleski

Seth Carmody - Organic, September 2011, Professor Michael VanNieuwenhze

Joseph Chabenne - Chemical Biology, October 2011, Professor Richard DiMarchi

Yi He - Analytical, December 2011, Professor James Reilly

Michelle Hoffman – Analytical, August 2012, Professor Stephen Jacobson

Ekram Hossain – Physical, January 2012, Professor Caroline Jarrold

Sunyoung Lee – Physical, February 2012, Professor David Clemmer

Elizabeth Opsitnick – Organic, August 2011, Professor Dongwhan Lee

James Patterson – Chemical Biology, October 2011, Professor Richard DiMarchi

Joseph Pinchman – Organic, February 2012, Professor David Williams

Nathan Rawlinson – Analytical, May 2012, Professor Stephen Jacobson

David Rothgeb – Physical, August 2011, Professor Caroline Jarrold

Andrew Share – Organic, December 2011, Professor Amar Flood

Mario Vieweger – Physical, November 2011, Professor Bogdan Dragnea

Vincent Waldman – Chemical Biology, December 2011, Professor Martha Oakley

Ardian Wibowo – Chemical Biology, December 2011, Professor Charles Dann III

Edward Witlicki – Materials, December 2011, Professor Amar Flood

Xin Yan – Materials, May 2012, Professor Liang-shi Li

M.S. Degree Recipients

Scott Dietrick – Chemical Physics, December 2011, Professor Srinivasan Iyengar

Deblina De Ghosh – Chemical Biology, August 2011, Professor Charles Dann III

Elif Karacan – Materials, August 2011, Professor Bogdan Dragnea

Daniel Meyers – Organic, November 2011, Professor Michael VanNieuwenhze

Michael Rudolph – Physical, December 2011, Professor Romualdo de Souza

Mallory Mueller – Physical, April 2012, Professor Liang-shi Li

Jeffrey Everett – Analytical, May 2012, Professor David Clemmer

Zachary Gosser – Physical, May 2012, Professor Romualdo de Souza

MAT Degree Recipients

Daniel Meyers – Organic, May 2012

Lesley Sevcik – Analytical, May 2012

Continued on page 22

GRADUATE NEWS

Continued from page 21

Alicia Friedman (Lane Baker's group) was selected for a NSF Travel Award to attend the IUMRS International Conference of Young Researchers on Advanced Materials (CYRAM) in Singapore. Alicia Friedman (Lane Baker's group) won first place in the Women In Science Poster competition.

Alexander Gundlach-Graham (Gary Hieftje's group) is the recipient of the ACS Division of Analytical Chemistry Graduate Fellowship Award sponsored by Agilent Technologies for the 2012-2013 academic year. Alex was selected by the committee for his excellent multiple scientific dimensions.

Celeste Morris (Lane Baker's group) received a 2012 Electrochemical Society Summer Research Fellowship. This is a prestigious award administered by the ECS. Doctoral students from all over the world compete for this honor. Celeste was one of the five successful recipients from a very strong pool of applicants.

Kristin Morton (Lane Baker's group) was granted an NSF East Asia and Pacific Summer Institute Fellowship (EAPSI) to study in Japan this summer at AIST, Tskuba, Japan. The primary goals of EAPSI are to introduce students to East Asia and Pacific science and engineering in the context of a research setting, and to help students initiate scientific relationships that will better enable future collaboration with foreign counterparts.

Jake Shelley (Gary Hieftje's group) is the recipient of a Gordon Kirkbright Bursary 2012 Award. His scientific contributions and associated activities, etc, were considered by the review committee as excellent and thoroughly deserving of this international award. The Gordon F. Kirkbright Bursary Award is a prestigious annual award that enables a promising student/non-tenured young scientist of any nation to attend a recognized scientific meeting or visit a place of learning.

Darci Trader (Erin Carlson's group) is the recipient of the McCormick Science Grant for 2012. Charles O. McCormick III, M.D., established the McCormick Science Grant Fund to honor his father and grandfather and to support basic science research. This award was given to support Darci's research in collaboration with Professor Carlson.

Undergraduate News: The C046 Chemistry Learning Lab is Open!

When students returned to class this fall, they noticed that the Chemistry Resource Center transformed into a new C046: Chemistry Learning Lab. The IU architect's office has designed work areas to provide for more focused office hours, small-group, and individualized study. Counters along the sides of the room provide expanded study spaces, inviting more long-term study. Students have plenty of outlets to plug in their computers and extra routers help ensure students stay connected. Students fill the space on most days until midnight. Although it's not entirely done, comfy sofas and chairs, tables and a plethora of white boards and computers have been installed into the new space.

The last phases will be benches in the hallways and a few more odds and ends, but it's close to being done. We hope to provide a positive, inviting and relaxing learning environment where students can be successful working together in this innovative and stimulating atmosphere. So far, it looks like it's working. ■

Professor Ben Burlingham in office hours for organic chemistry.

Photography by Kate Reck

UNDERGRADUATE NEWS

by Carly Friedman

We are pleased to add 94 new alumni to the department after December 2011 and May 2012 commencements, as 18 chemistry BS degrees, 15 biochemistry BS degrees, 46 chemistry BA degrees, and 15 biochemistry BA degrees were awarded to our students. Our graduates went to diverse places such as industry, graduate school in chemistry and biochemistry, dental school, pharmacy school, law school, and even teaching English in China!

In the Chemistry Undergraduate Office, we are always excited when our students take it upon themselves to supplement their education with departmental opportunities that are not required for degree completion. Two of our May graduates consistently sought out such opportunities and, in their own words, describe the impact it had on their undergraduate experience.

Zachary Hallberg graduated in May with a Biochemistry BS. Zach explains, "Like many students entering Indiana University to major my original career goal — made without much thought — was to enter a medical profession. Strong support from a high school biology teacher, however, convinced me to begin my career at IU through the IFLE program, which matches incoming freshmen with research labs the summer before classes start. I was lucky enough to land myself a position in the lab of Professor **David Giedroc**, where I had the opportunity to research transcription factors involved in oxidative stress. Being exposed to the open and friendly academic environment of his research group whet my scientific appetite and showed me that there were many options I hadn't yet considered which would be better career choices for me than medicine, including research.

As my undergraduate education progressed, I was drawn to interesting research topics in the fields of organic and biological chemistry, and wanted more exposure to both fields before I committed to one in graduate school. By pursuing research on bacterial chromosome segregation in **Martha Oakley**'s lab, I gained experience in major biochemical techniques and benefited from a supportive advisor who has been instrumental in giving me the confidence to succeed as a scientist. Through graduate courses in organometallic chemistry, physical organic chemistry, and chemical biology with Professors **Cook**, **K. Brown**, and **VanNieuwenhze**, I had the chance to receive more personal attention as a student than I would have been able to in a large lecture class and became friends with many of the graduate students — students who were always happy to 'talk chemistry' and help me through the graduate applications process they were already familiar with. Being exposed to both fields helped me to find research groups which use synthetic organic chemistry techniques to solve biological problems and gave me the skill set and academic support required to gain admittance to UC-Berkeley, where I will be starting a PhD program."

After graduating in May with a Chemistry BS, **Quinn Easter** describes his experience: "Looking back on my undergraduate career, the decision to apply for an undergraduate associate instructor (UAI) position was definitely one of the best decisions I made during my time at IU. I applied for the position to both challenge myself to master the knowledge I had already learned and to pass on this knowledge to other students. At first, it was slightly intimidating knowing I would be at the front of the room teaching students, but after a couple of sections I was completely comfortable in my position. During my three semesters as a UAI, I gained a lot more confidence speaking in front of others and in my abilities to teach chemistry to others. Additionally, it was critical for me to manage my time wisely due to grading and lesson planning responsibilities, and I was able to prioritize tasks in a much more efficient manner than I had before. Finally, perhaps most importantly, I was able to see my students succeed, which was very rewarding for me as a UAI."

Student Groups Impact

With all of the teaching and learning occurring in the chemistry labs and classrooms at Indiana University, we must not forget about the invaluable experiences our majors gain from the student groups on campus. Included on the list of organizations that provide social and intellectual opportunities for chemistry and biochemistry majors are *The Indiana University Bloomington – Minority Association for Premedical Students* (IUB-MAPS), *Student Affiliates of the American Chemical Society* (SAACS), *Alpha Chi Sigma* (AXE), and *National Association of Black Chemists and Chemical Engineers* (NOBCChE).

AXE is the pre-professional chemistry fraternity at Indiana University. With more than 100 active members, their brothers participate in social, service, and professional events throughout the year. Social activities range from cookouts and Frisbee games to trips to Cedar Point, and many members spend time with brothers outside of organized events. AXE offers its members a variety of volunteer opportunities and they encourage brothers to share their own service experiences with the rest of chapter.

IUB-MAPS was founded in the Fall of 2008 and is dedicated to empowering, encouraging, and retaining minority students while all populations boast membership. Since its inception, IUB-MAPS has grown to over 150 members, comprised of students with a broad range of professional interests. It has earned national recognition, being named chapter of the year in both 2010 and 2011. Each year MAPS sponsors 15-20 events that are primarily focused on exposing students to the health field as well as several community outreach incentives. IU-MAPS will be hosting the Region V Conference in January 2013 – let us know if you would like to support our efforts!

The Indiana University **NOBCChE** chapter was formed in 2007 with the goal of forming a chapter at Indiana University that could be a starting point for increasing the focus on diversity within the chemistry department as well as providing a support network for both undergraduate and graduate minorities in the physical sciences at Indiana University. The organization was very active in the 2011-2012 school year providing seminars, hands-on activities for kids, and outreach partnerships with the community.

Continued on page 24

UNDERGRADUATE NEWS

Continued from page 23

SAACS at Indiana University is an active and diverse group of approximately 40 undergraduate students. This chapter was reinstated in the spring of 2010 and has quickly grown; IU SAACS even earned an honorable mention as an outstanding chapter at the national ACS meeting in San Diego last April for its activities from the previous academic year. All group activities are designed, coordinated, and executed by the students. Their goal is to spread knowledge and excitement for chemistry around the university and the state as well as to connect undergraduates to provide a network of support and community within the department.

We continue to be proud and inspired by our students!

Chemistry Honor Roll

The following chemistry and biochemistry majors attained an overall and in-major grade point average of 3.75 or better through the fall 2011 semester.

Senior Honor Roll: Hena Ahmed, Aleksander Alavanja, Sukriti Bansal, William Berry, Kyle Brown, Kevin Chaung, Ryan Clodfelter, Matthew Colin, Drake Everson, Sidney Fletcher, Liron Ganel, Kent Griffith, Jason Guinn, Zachary Hallberg, Mary Hon, Jonathan Hourmozdi, Jacquelin Kammeyer, Neil Keshvani, Joseph King, Kyle Kleist, Mohineesh Kumar, Grant Lin, Christopher Mattson, Nicholas McColley, Priyanka Parekh, Parth Patel, Adam Richter, Rebecca Schwab, Eric Scripture, Sung Hyun Seo, Supriya Shah, Isaiah Steffen, Joseph Thomas, Yilun Wang

Junior Honor Roll: Radhika Agarwal, Clark Baumberger, Wenjing Cai, Daniel Carmody, Caleb Cooper, Alexander Elias, Adriana Giuliani, Ethan Hamer, Shannon Harvey, An Huynh, Stephanie Iden, Sangeeth Jeevan, Y-Lan Khuong, Chloe Mangas, Haley Meyer, Zachary Moon, Adam Nichols, Stephen Overcash, Jonathan Schmidt, Keith Scott, Adam Spitz, Emily Tisma, Jordan Venderley, Audrey Welklin, Anirudh Yalamanchali, Evan Yanni, Michael Zimmerman

Sophomore Honor Roll: Emily Bentley, Ian Boggs, Donald Brake, Matthew Coghlan, Carrie Cummiskey, Ryan Descamp, Ian Emmons, Joseph Eskew, Robert Gassert, Adam Given, David Haak, Olivia Hackman, Taylor Harmon, Taylor Hero, Evan Jameyfield, Madeline Jones, Mariah Killin, Nicholas Kolar, Elizabeth Krizman, Luke Kurowski, Samantha Mayhew, Keerthana Mohankumar, Laura Oehlman, Grace Park, Nicholas Petruzzi, Brooks Platt, Andjela Radmilovic, Jacob Ressler, Kristen Rinaudo, Patrick Roberts, Stephanie Rosa, Benjamin Ryan, Olivia Sanchez-Felix, Molly Scripture, Clinton Small, Sarah Stoops, Nicholas Torrance, Ian Walker, Rachel Wise

Freshman Honor Roll: Jordan Roberts

Chemistry Honors Program

The following students are BS majors in chemistry or biochemistry, have maintained a minimum grade point average of 3.3, and have completed a research project and thesis.

Rachael Al-Saadon, Kyle Brown, Zachary Hallberg, Danielle Henckel, Alexander Kovach, Kayla Mathews, Nathan Spahn, Megan Weisenberger

Phi Beta Kappa Fall and Spring Inductees

Hena Ahmed, Aleksander Alavanja, Stefanie Beidelman, Kyle Brown, Arefin Chowdhury, Omar Elsheikh, Zachary Hallberg, Hailey Holland, Neil Keshvani, Kyuwon Kim, Kyle Kleist, Mohineesh Kumar, Nicholas McColley, Eric Scripture, Sung Hyun Seo, Anja Skljarevski, Isaiah Steffen

Departmental Scholarships and Awards

C117 Award: Lily Delalande, Nicholas Kolar, Clinton Small
S117 Awards: Alexander Elias, Erin van Wesenbeeck
Organic Chemistry Course Award:: Wenjing Cai, Kenneth Danielson
American Chemical Society Awards: Kyle Brown, Eric Scripture, Sung Hyun Seo
Keith Ault Scholarship: Alexander Doran
William H. Bell Awards: Wenjing Cai, Kent Griffith
John H. Billman Summer Scholarship: Matthew Mark Bower
Harry G. Day Summer Scholarships: Clark Baumberger, Joseph Dempsey, Alexander Doran, Michelle Gray, Crystal Heim, Tyler Stanage, Yueren Wang
LeRoy Dugan Scholarship: Adam Schafer
Dr. & Mrs. Harlan English Scholarships: Matthew Mark Bower, Rebecca Schwab
Courson Greeves Scholarship: Yeiji Im
R. J. Grim Memorial Scholarships: Matthew Colin, Caleb Cooper, Evan Jameyfield, Luke Kurowski, Joseph B. Thomas, Ian Walker
Russel Leo & Trula Sidwell Hardy Scholarship: Adam Nichols
Hypercube Scholar Award: Zachary Hallberg
Ira E. Lee Memorial Fund in Chemistry: Nathan Buehler, Caleb Cooper
Eli Lilly Summer Undergraduate Research Scholarship in Organic Chemistry: Rebecca Schwab
Andrew Loh Scholarship for Analytical Chemistry: Adam Richter
Robert & Marjorie Mann Scholarships: Paige Matthews, Frank Prather, Jordan Venderley
Frank Mathers Undergraduate Summer Research Scholarships: Yeiji Im, Ian Norden John H. and **Dorothy McKenzie Scholarship:** Jordan Venderley
Merck Index Awards: Jacquelin Kammeyer, Grant Lin
Dennis G. Peters Scholarships: Clark Baumberger, Ryan Clodfelter, Crystal Heim
William G. Roessler Scholarship: Adriana Giuliani
Joseph B. Schwartzkopf Award: Zachary Hallberg
Raymond Siedle Scholarships: Patrick Gamache, Hayley Smith
Earl G. Sturdevant Summer Research Scholarship: Kent Griffith
Enola Rentschler Van Valer Trafford Scholarship Awards: Hailey Holland, Priyanka Parekh
Viola Scholarship in Nuclear Chemistry: Megan Weisenberger
Votaw Undergraduate Summer Research Scholarship: Joseph B. Thomas
Forrest L. Warner Scholarships: William Berry, Christopher Mattson
Francis & Mildred (Eckerty) Whitacre Scholarships: Lucas Berghoff, Supriya Shah
James C. White Award: Grant Lin
Mary Frechtling White Award: Jacquelin Kammeyer

GRADUATION 2012

Photograph courtesy Chadon Photography

Graduation "outline" made by William Unrue

1) Professor Dennis Peters, 2) Professor David Giedroc, 3) Professor Kenneth Caulton,
4) Anja Skljarevski, 5) Megan Brinkworth, 6) Elizabeth Schiefelbusch, 7) Crystal Ayinbode,
8) Hochie Bonhomme, 9) Parth Patel, 10) Hena Ahmed, 11) Grant Lin, 12) Dr. Lyuda Bronstein,
13) Professor Jill Robinson, 14) Stephanie Beidelman, 15) Jennifer Evancyzk, 16) Eric Scripture,
17) Stephan Kossis, 18) Quinn Easter, 19) Nathan Spahn, 20) Jacquelin Kammeyer, 21) Stacey Vosters,
22) Neil Keshvani, 23) Kyuwon Kim, 24) Professor Benjamin Burlingham, 25) Professor Todd Stone,
26) Professor Kate Reck, 27) Rachel Al-Saadon Hall, 28) Nicholas McColley, 29) William Risinger,
30) Kyle Brown, 31) Taylor Harris, 32) Chike Okolocha, 33) Zachary Hallberg, 34) Amy Fuhs,
35) Kayla Matthews, 36) Professor Norman Dean, 37) Professor Stephen Jacobson, 38) Brooke Reliford,
39) Jonathan Tiernan, 40) Nicole Richie, 41) Gregory Gumina, 42) David Gorrell,
43) Sebastain Smigielski, 44) Aleksander Alavanja, 45) Katherine Allen, 46) Megan Weisenberger,
47) Timothy Moore, 48) Danielle Henchel, 49) Alexander Kovach, 50) Professor Charles Dann III,
51) Professor Romualdo deSouza

CONFERENCES, SPECIAL LECTURES AND SYMPOSIA

Continued from page 17

Other Special Seminars

October 12, 2011:
ACS Student Selected Seminar was delivered by Professor **Michael Summers**, Department of Chemistry and Biochemistry, University of Maryland, Baltimore County, Baltimore, MD, *"Insights into the Mechanism of HIV-1 Genome Packaging and Virus Assembly."*

November 2, 2011:
Frank C. Mathers Lecture was delivered by Professor **Samuel Stupp**, Board of Trustees Professor of Materials Science, Chemistry and Medicine, Departments of Chemistry, Materials Science and Engineering, and Medicine, Northwestern University, Evanston, IL. *"Self-Assembly in Materials Chemistry."*

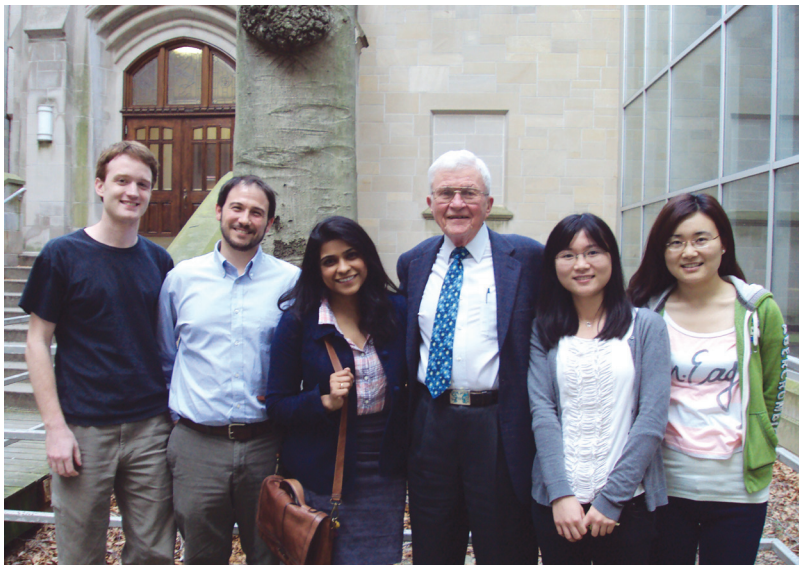
March 21, 2012:
ACS Student Selected Seminar was delivered by Professor **Fred McLafferty**, Peter J. W. Debye Professor Emeritus, Department of Chemistry and Chemical Biology, Cornell University, Ithaca, NY. *"Gas-Phase Protein Chemistry: Unfolding and New Folding Pathways in Electrosprayed Native Ubiquitin."*

April 4, 2012:
Chemistry of Everyday Life Series was delivered by Dr. **Joe Schwarcz**, Director, Office for Science and Society, Department of Chemistry, McGill University, Montreal, Quebec, Canada. "*Hey! There Are Cockroaches in my Chocolate Ice Cream."*

April 25, 2012:
Raymond Siedle Distinguished Lecture was delivered by Professor **Guy Bertrand**, Distinguished Professor of Chemistry, University of California (Riverside, CA), *"Novel Families of Carbon- and Boron-based Ligands, Novel Catalytic Reactions."*

The 2012 Raymond Siedle Distinguished Lecture was delivered by Professor Guy Bertrand. (Pictured from left to right: Professors Jeffrey Zaleski, Dongwhan Lee, Guy Bertrand, Allen R. Siedle, Daniel Mindiola, and Mookie Baik.)

ACS Student Selected Seminar, Professor Michael Summers (University of Maryland, Baltimore County) is standing with the IU students who invited him. (From left to right: Zachary Poulos, Darci Trader, Indrani Bhattacharrya, Professor Michael Summers, Amanda Peteron Mann, Angela Carrillo, Sarah Keane, and Akshay Shah).



ACS Student Selected Seminar Professor Fred McLafferty is shown here with graduate students who invited him. (From left to right Michael Ewing, Jon Dilger, Puja Ghandi, Professor McLafferty, Huilin Shi, and Feifei Zhou.)

LIBRARY NEWS

by Roger Beckman

Tiea Julian continues as our branch coordinator and takes care of the day to day operations. I split my time between the Chemistry Library and the Life Sciences Library. I recently added responsibility for collection development and some reference for the IU Optometry Library.

The Chemistry Library has an "apprenticeship" program that helps train students enrolled in the School of Library and Information Science (SLIS) in the finer points of chemical librarianship. Our current SLIS GA is **Elsa Alvaro** who started with us in January 2011. She has her PhD in chemistry and worked with John Hartwig at Illinois. Elsa is off to a good start. Elsa was awarded the 2011 Lucille Wert Award from the CINF Division of ACS. This scholarship is designed to help persons with an interest in the field of chemical information. Our previous intern, **Yuening Zhang**, was the 2010 awardee. Both of these students were also awarded the IU Davis/ Davis Fellowship that assists graduate students in the School of Library and Information Science in the study of scientific information.

Elsa started a blog for the Chemistry Library and it can be seen at https://blogs.libraries.iub.edu/libchem/. One of Elsa's interests is investigating chemistry information using mobile devices. Therefore, she was very pleased to receive an invitation to attend a week-long program sponsored by the ACS Publications Division in DC to focus on the future of scholarly communication. She got an iPad to practice on too.

Yuening Zhang worked with us about a year and a half, until the end of the 2010 fall semester. Thanks in large part to her knowledge of chemical information she obtained a position as Science Librarian at the Kelvin Smith Library at Case Western Reserve University and started in July, 2011. Yuening and I published a paper about a user survey we conducted of faculty, staff, and graduate students in the Chemistry Department and Biology Department to determine how well our library users like electronic books. You can read our article at http://www.istl.org/11-spring/article2.html.

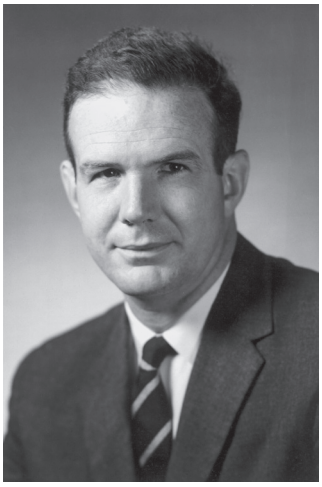
Although budgets are tight we were able to add some useful resources to the library this year. We added two new electronic reference sets: Handbook of Porphyrin Science (World Scientific, 2010) and Comprehensive Natural Products II (Elsevier, 2010). To avoid the annual "rental" fee we purchased the ACS Legacy Archives that includes all the ACS articles published from 1879 to 1995. The ACS Symposium Series titles from 1974-2008 were included in this purchase. The remaining Nature back files, 1869 to 1986, were added this spring giving us access to the whole run of this important title. Buying more e-books continues our move away from paper to electronic-only access. The IUB libraries have access to Springer e-books from 2005 to 2013, Wiley e-books from 2007 to 2010, Elsevier titles from 2008 to 2012, and RSC e-books from 1968-2011. No acceptable agreement could be reached with Wiley for 2011.

We just signed an agreement to move to the SciFinder Campus-Wide Access program which will offer unlimited seats for whole Indiana University system. Previously only 10 people at one time could use the Chemical Abstracts database. This opens up the possibility of encouraging more undergraduates and researchers in other scientific departments to use this special resource. Reaxys and SciFinder are now web-only programs and the days of loading a client software program on one's personal computer to search Chemical Abstracts, Beilstein or Gmelin are over. Library administrators are beginning to plan for the time when electronic access to journals lessens the need for each library to keep a paper copy of a journal. An initial first step happened this spring when all the Elsevier, Springer and Wiley titles that are available electronically were moved from the Chemistry Library to our remote storage facility, ALF. This is called the CIC's Shared Print Repository and IU has agreed to preserve these titles for at least 25 years so other libraries are free to withdraw their titles if shelf space is needed for other uses. ■

Terry Jenkins

by John Richardson

Although Terry Jenkins was born in Wisconsin (March 23, 1932), he grew up in the English Lake District, where his father had been assigned to supervise an American-owned evaporated milk factory. He attended the local Heversham Grammar School, and subsequently completed BA and MA degrees, in 1953 and 1956, respectively, at Magdalene College, Cambridge University. He took Part II of the Natural Science Tripos in Biochemistry. He returned to the USA for graduate work in the Department of Biology at the Massachusetts Institute of Technology, obtaining a Ph.D. in Biochemistry in 1957. After completing his degree, he stayed on at MIT for one year and then joined the faculty of the Department of Biochemistry at the University of California at Berkeley. He moved to Indiana University in 1966 where he joined the biochemistry group in the Department of Chemistry. He taught biochemistry courses to undergraduate and graduate students in the Department of Chemistry and to medical students in the Medical Sciences Program. He also served the Chemistry Department as graduate advisor and was its undergraduate advisor for several years. He retired as Professor of Chemistry in July 1996.



Terry is best known for his important discovery of how the vitamin B_6 coenzyme (pyridoxal phosphate) functions in a class of enzymes called transaminases. These enzymes play critical roles in all cells in the synthesis and breakdown of amino acids, the building blocks of proteins. His doctoral dissertation involved the purification and characterization of two transaminases from beef heart. These proteins contain the active form of vitamin-B_6 and hence are colored. He made use of the changes in their color that occurs with changes in their interactions with their normal reactants. He found that the B_6-coenzyme is joined to the enzyme by a chemical linkage that is broken when the enzyme interacts with an amino acid reactant (a substrate). He not only could observe directly an expected enzyme-substrate complex, he also demonstrated that several intermediate states in comparable amounts were involved in the action of his transaminase.

One important generalization that emerged from his studies with enzymes was that when ionic or neutral molecules bind to enzymes, they do so by exchange processes; something has to dissociate from the enzyme when another molecule binds. Furthermore, for charged species the overall net charge change must be zero. Thus, when an anion binds, either an anion must dissociate or a cation must be concomitantly bound. Terry used this important generalization to throw light on many puzzling features of enzymatic reactions, such as the interactions between acidity and salt effects, and the coupling of heat evolving processes with heat absorbing processes in such important reactions as the formation of ATP (adenosine triphosphate) from the condensation of ADP (adenosine diphosphate) with inorganic phosphate.

One of Terry's main interests toward the end of his career was the set of reactions involving adenosine triphosphate (ATP), both enzymatic and non-enzymatic. ATP serves as an energy source for many processes in living organisms, but the details of the chemistries of its reactions are poorly understood. Terry's work helped shed light on some of its reactions, particularly the role of the divalent cations of magnesium and calcium in the hydrolysis of ATP to ADP and phosphate.

"Terry Jenkins devoted himself unstintingly to his profession and the Department of Chemistry at Indiana University. He was a knowledgeable colleague, a wise counselor and a willing helper."

Terry lived for many years with his first wife, Sally, and their three children, Christopher, Mary and Mark out in the county. While there, he served as a volunteer fireman for Bloomington Township, so often he was called away from the lab to help fight a fire somewhere in the township. Sally was always homesick for her native England, and eventually left Bloomington to return to that country. Christopher stayed in the U.S., and received a degree in accounting from the IU Kelley School of Business. A number of years later, Terry married Jeanne Martinez and after she finished her degree in Spanish they left for Phoenix, Arizona where Jeanne taught at Arizona State University. Terry died in Phoenix on November 7, 2010 after a bout with Alzheimer's disease.

Terry Jenkins devoted himself unstintingly to his profession and the Department of Chemistry at Indiana University. He was a knowledgeable colleague, a wise counselor and a willing helper. We thank him for all that he has given to the Department of Chemistry and to Indiana University. n

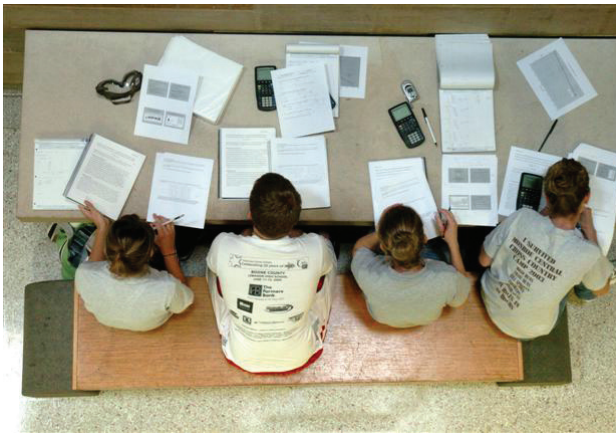
ALUMNI NEWS

Kaci M. Alexander, BA/BS'10, has been awarded a 2012–13 medical education fellowship by the Kirksville College of Osteopathic Medicine at A.T. Still University in Kirksville, Mo. She recently completed her second year of medical school.

In December 2011, **William F. Carroll Jr.**, PhD'78 (Professor Dennis Peters), a vice president at Occidental Chemical Corp. in Dallas was elected chairman of the board of directors of the American Chemical Society. He assumed the one-year chair position on Jan. 1, 2012. With more than 163,000 members, the American Chemical Society is the world's largest scientific society and a global leader in providing access to chemistry-related research through multiple databases, peer-reviewed journals, and scientific conferences. Its main offices are in Washington, D.C., and Columbus, Ohio. An ACS member since 1974, Carroll has served on and chaired numerous committees and task forces, and he served as ACS president in 2005. His areas of interest in industry have included combustion science, plastics recycling, and chemistry and the environment. In addition to his position at Occidental, Carroll is also an adjunct industrial professor of chemistry at IU Bloomington. He lives in Dallas with his wife, Mary.

In November 2010 the Office of Naval Research awarded **Bernard E. Douda**, MS'69, PhD'73, the 2010 Dr. Fred E. Saalfeld Award for his contributions to the research, development, testing, and evaluation of pyrotechnics and groundbreaking work in the field of military infrared countermeasures. Douda is senior scientist for pyrotechnics at Crane (Ind.) Naval Surface Warfare Center. During an illustrious career, he has won numerous awards; has published more than 200 technical reports, eight papers in peer-reviewed journals, a technical book; and filed 13 patents. Douda lives in Bloomfield, Ind.

Forrest L. Gager, Jr., MA'51, was pleased to see reports from Ted Largeman and Joe Leal in the Fall IU Chemistry. He reports "I, too, am still hanging on." After almost five years at Merck in Rahway, N.J., Frank moved to Philip Morris in Richmond, Va. where he retired as a Senior Scientist in 1985. He remembers seeing Joe at Indiana functions at ACS National Meetings. After retirement, he moved to Amherst, Va. and taught Organic Chemistry as a sabbatical replacement at Sweet Briar College where my first wife, **Helen McClure Gager**, MA'51, had taught before her death in 1980. Frank resumed his life-long hobby of tennis and began playing senior tournaments, when he became nationally ranked for my age groups in singles, doubles, and father-son doubles. He served on the Amherst County Board of Zoning appeals and later on the Planning Commission from which he retired as Chairman. His second wife passed in 1996, and he is now married to the third of his "three beautiful wives." They live in a full-service senior retirement center in Lynchburg, Va.



Pamela Gesellchen (Chemistry BA/Geography, BA '08) is currently in Pharmacy School at Butler University in Indianapolis, Ind. with an anticipated graduation date of May 2013!

In July 2011, **Ruth Threlkeld Hall**, MS'60, MAT'67, a retired chemistry teacher, and her husband, James, held a celebration to commemorate their 90th birthdays and their 67th wedding anniversary. The couple lives in Evansville, Ind.

Michael J. Harrell, BS'85, MLS'90, has been promoted to director of alternative fuels and resource recovery at Ash Grove Cement Co., in Overland Park, Kan. He was also elected 2012 president of the Arkansas Environmental Federation and elected 2012 technical co-chair of the Cement Kiln Recycling Coalition. Harrell lives in Olathe, Kan.

In May, **Stephen J. Helms**, BA/BS'05, received a doctorate in cell regulation from the University of Texas Southwestern Graduate School of Biomedical Science. With a research focus on evolutionary design principles of biological systems, Helms has accepted a position as a postdoctoral researcher at the Foundation for Fundamental Research on Matter at the Institute of Atomic and Molecular Physics, located in Amsterdam.

Travis B. Jenney, BS'04, and his wife, Ashley (Ferguson), BAJ'05, welcomed their first son, Parker Hayes Jenney, in November 2010. Travis is an anesthetist at Piedmont Hospital in Atlanta. Ashley, who previously worked as a senior account executive at Van Winkle & Associates in Atlanta, is currently raising the couple's child at home. The family lives in Atlanta.

Herbert M. Levetown, BA'49, and Bernice Levetown wish to report they have a granddaughter, **Lauren Linder**, who is a sophomore in the Ernie Pyle School of Journalism and they are very proud of her accomplishments. Lauren is a Hutton Honors Scholar and a Founders Scholars, as well as receiving several other honors. They are planning to visit Lauren in the coming year and will stop in to visit the chemistry building.

Continued on page 30

ALUMNI NEWS

Continued from page 29

Paul Loconto (MS '73) was acknowledged recently by the Michigan Public Health Institute for working ten years as a lab scientist specialist at the Michigan Department of Community Health, Bureau of Laboratories. Paul and his spouse, **Priscilla Loconto** (BS '73), live in Okemos, Michigan.

Professor Peter Mahaffy (PhD '79, Professor **L. Mike Montgomery**) is the recipient of the 2011 *James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry*. Within the classroom, Dr. Mahaffy is known for his highly effective and innovative teaching methods, including his commitment to help students, educators, scientists and the general public observe the intricate connections between science and their everyday lives. Dr. Mahaffy was instrumental in establishing and co-directing the King's Centre for Visualization in Science which has allowed him to continue his development of digital learning resources that help learners see and understand scientific concepts that would otherwise be difficult to visualize.

"I've come full circle," writes **Loren G. Martin**, BA'65, PhD'69. He adds, "Having grown up in rural Kingman, Ind., attended IU Bloomington for two degrees, and taught in four medical colleges, [I have] now retired after 28 years of teaching and conducting cardiovascular research to rural Big Cabin, Okla., approximately 60 miles north of Tulsa. I am enjoying the rural life once again on 20 acres with a little greenhouse and lots of animals, many adopted from being dumped on my rural gravel road. Thanks, IU, for giving everyone a chance to chase their dreams — even a farm kid with only 24 students in his rural high school graduating class!"

Dustin R. Masser, BS'10, is working on a PhD in biomedical sciences at Penn State College of Medicine in Hershey, Pa., where he lives.

In June, the White House announced that 2011 Indiana Teacher of the Year **Stacy A. McCormack**, BS'99, is the Indiana recipient of the Presidential Award for Excellence in Mathematics and Science Teaching for teaching science. The award is the highest recognition that a kindergarten through 12th-grade mathematics or science teacher may receive for outstanding teaching in the U.S. McCormack, who teaches grades 7–12 physics at Penn High School in Mishawaka, also received a $10,000 award from the National Science Foundation. She lives in Granger, Ind.

In July, golf I-Woman **Amy A. McDonald**, BA'92, MD'96, was inducted into the Monroe County (Ind.) Sports Hall of Fame. She became a member of the Bloomington City Golf Hall of Fame at age 23 after winning six women's titles. A star athlete at both Bloomington High School South and at IU, McDonald is a specialist in general surgery, trauma surgery, and surgical critical care at MetroHealth in Cleveland. She lives in Bay Village, Ohio.

In June 2011, **Andrew R. Olson**, BS'05, received a doctor of osteopathic medicine degree from Ohio University College of Osteopathic Medicine in Athens. He began an internal medicine residency at Grandview Hospital and Medical Center in Dayton, Ohio, in the summer of 2011.

Greg L. Porter, BS '91, is a partner with the international law firm of Andrews Kurth, LLP in Houston, Tx. He uses his technical skills and legal training to litigate patent and trade secret cases in technologies such oil field tools, polymers, and even computer networking. He also drafts and obtains patents in the pharmaceutical, chemical, petrochemical, and biotech fields. He has lived in Texas since 1997.

David E. Van Ryn, BA'77, MD'81, medical director of the Department of Emergency Medicine at Elkhart (Ind.) General Hospital, has been selected as the 2011 Outstanding Physician at the Indiana University School of Medicine–South Bend. The annual award honors a physician who has worked closely with IUSM–SB students and whose work in community engagement and excellence in practice exemplifies the role of physician-teacher. Van Ryn, who was honored during the annual IUSM–SB Medicine Ball on Nov. 12, 2011, has worked at Elkhart General Hospital for 28 years. He is also on the Emergency Department staff of IU Health Goshen Hospital. In both Elkhart and Goshen, he has been involved in educating physicians, nurses, paramedics, and emergency medical technicians in a wide range of subjects. Van Ryn and his wife, Alisa, live in Elkhart and have a daughter, Leigh.

Cordelia (Boersma) Running, BA '05, completed a Master's degree at Purdue in Food Science (chemistry concentration) and began a PhD program in January, 2012.

Esther Tristani (BS-Chemistry, 2005) moved to Duke University to complete a PhD in Chemistry (2011) with

a focus on inorganic and analytical chemistry. She has since moved to California and now works for The Clorox Company as a product developer.

In July 2011, **Margaret Reese Watanabe**, MS'65, PhD'80, MD'86, along with W. Quinn Buckner, BS'76; Richard L. Johnson Jr., BS'81; and Kathleen A. Ligocki, BA'78, LHD'02, were elected to the IU Foundation Board of Directors. The board provides leadership for the university's philanthropic efforts. Watanabe is a doctor of obstetrics and gynecology and clinical assistant professor emerita at the IU School of Medicine. Basketball and football I-Man Buckner, captain of both the 1976 NCAA championship winning Hoosiers basketball team and the 1976 gold-medal winning U.S. Olympic basketball team, is vice president of communications for Pacers Sports & Entertainment. Johnson is owner, president, and CEO of Johnson Ventures Inc., a Columbus, Ind., based private investment company. Ligocki is CEO of Next Autoworks Co. in San Diego.

Former two-term mayor of Evansville, Ind., **Jonathan D. Weinzapfel**, BA'88, JD'00, has joined the government team at the law firm Faegre Baker Daniels as counsel. He will practice remotely from Evansville. At the firm, Weinzapfel utilizes his experience in government to assist clients in their interactions with federal, state, and local government entities. He will help clients with their strategic planning and will design and implement public policy campaigns. In addition, Weinzapfel will counsel businesses, not-for-profits, and government clients on the development of public-private partnerships, economic development initiatives, and neighborhood revitalization programs. As mayor of Evansville from 2004 to 2011, Weinzapfel formed many economic development agreements leading to job creation, including a $22 million AT&T Indiana call center, a new $30 million American General Corporate headquarters, a $20 million Berry Plastics investment, and a $3.5 million investment from GBT USA. His development initiatives also included construction of the Ford Center, a $127.5 million multipurpose arena downtown, and an investment of more than $60 million in a new storm sewer system to address flooding problems on the southeast side of town.

Virginia Tech biochemist **Robert H. White**, BS'68, wakes up most mornings with a single question on his mind — not "What shall I eat for breakfast?" but "Was earth's first life system a very simple or a very complicated one?" His search for the answer to that question has been the driving force behind a 40-year career and the focus of a recent $1 million National Science Foundation grant. Analyzing the changes that occurred on the planet around 4.4 billion years ago, White's research led him to a present day organism called Methanocaldococcus jannaschii, or "MJ" for short. Found on the ocean floor near volcano-like vents, MJ lives in conditions similar to ancient organisms after the earth's surface cooled and formed hot liquid oceans. The NSF grant will fund the human and material resources needed to continue White's research. Grasping how MJ functions could help researchers work towards a greater understanding of the origins of life on our planet.

Ronald D. Willis, BS'02 MIS'04, is a software developer at AmerisourceBergen Technology Group in Louisville, Ky., where he lives.

"After 36 years of teaching high school chemistry," writes **Dale F. Wolfgram**, MAT'69, "I retired in June 2000." He adds, "Since then I have taught scientific inquiry to pre-service elementary teachers at Mott Community College in Flint, Mich. Those semesters when I was not teaching, I traveled. My most adventurous trip was in the fall of 2002 when I traveled in the Canadian Arctic aboard a Russian ship. Currently, I am contemplating an around the world cruise on a ship with 700 college students. I continue to enjoy camping in northern Ontario, northern Minnesota, and the Everglades, was well as around Michigan. I still love to teach and will do so as long as I'm able." Wolfgram lives in Grand Blanc, Mich.

In November 2011, **Christopher E. Wolfla**, BA'87, MD'91, professor of neurosurgery and director of the residency program in neurological surgery at the Medical College of Wisconsin in Milwaukee, was elected president of the Congress of Neurological Surgeons for 2011–12. A neurological spine specialist, Wolfla joined the Medical College faculty in 2005. He lives in Brookfield, Wis.

In July, **Jeffrey D. Zubkowski**, PhD'83, was elected treasurer of the Council of Historically Black Graduate Schools. He is associate dean of the Graduate School and professor of chemistry at Jackson State University in Jackson, Miss. Zubkowski also serves on the Faculty Awards Committee for the Conference of Southern Graduate Schools. He lives in Brandon, Miss. ■

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