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IU•CHEMISTRY

Association of Indiana University Chemists Alumni Journal

Chemistry in a Computer

Chasing Cyanide

Remembering Professor Marvin Carmack

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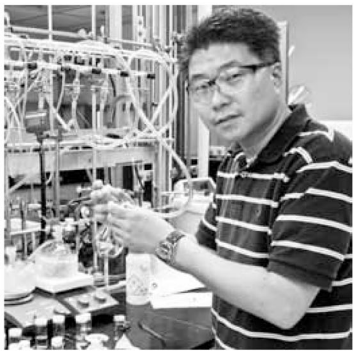

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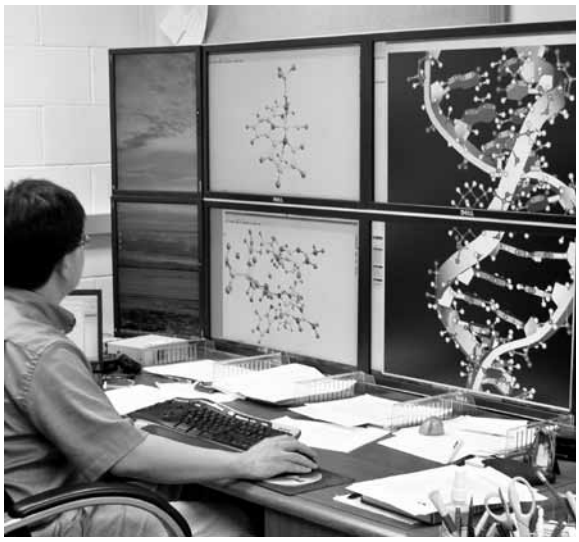
Front cover: *Prayer wheels are spiritual devices used by Buddhists and Tibetans to spread great blessings, positive wishes and good karma to all beings. Prayer wheels have thousands of prayers written and placed inside which exponentially increases the blessing each time the wheel is turned. The outside of the wheel has the prayer* Om Mani Padme Hum *written in Tibetan script. Its meaning cannot be accurately translated in English, but this phrase is intended to awaken compassion and loving-kindness for welfare of all beings. The earliest known mention of prayer wheels is in an account written by a Chinese pilgrim, in 400 AD, while traveling through the area now known as Ladakh (northern India). These large prayer wheels are found on the property of the Tibet Tibetan-Mongolian Buddhist Cultural Center in Bloomington, Indiana.*

Photography: *Cover photo: Kate Reck. Unless otherwise noted, Charles Parmenter supplied the photography for this issue.*

Simulating chemistry in a computer

by Mu-Hyun "Mookie" Baik



Mookie Baik

What does it take to make carbon-based fuel out of useless carbon dioxide? Green plants figured out millions of years ago how to convert solar energy into chemical energy and biomass: photosynthesis. In the simplest of terms, we need to take carbon dioxide and push electrons and protons onto the carbon atom until it lets go of the oxygen atoms and starts to make C–H and C–C bonds. This process will require energy and lots of it — so, we better choose an abundant source: solar energy.

Where are the electrons and protons going to come from? Let's split water to generate electrons, protons, and molecular oxygen. To develop artificial photosynthesis technology, we need three components: (i) solar energy, harvesting devices, (ii) water oxidation catalysts that will provide electrons and protons, and (iii) carbon dioxide reduction catalysts that will put the harvested light, protons and electrons to use and convert CO_2 into fuel.

If, or should I say, when we are successful in developing an effective artificial photosynthesis apparatus, we will never have to worry about energy again—there is enough solar energy for all of us. Perhaps the most overlooked aspect of why artificial photosynthesis is such a desirable technology among the many potential solutions to the energy crisis is the fact that our economy relies on carbon-based fuels.

If we discovered an inexhaustible source for hydrogen, nuclear power, or geothermal energy tomorrow, it would take decades and trillions of dollars to restructure our economy and build a new infrastructure that does not rely on carbon-based fuel. We would have to figure out how to transport, store, and utilize the new, hopefully plentiful energy form. In addition, fossil fuels are not only just energy carriers, but are used as valuable feedstock for chemicals. How will we replace this important feedstock if we run out of fossil fuels?

All these tantalizing questions about what our future world will look like disappear if we simply solved the supply problem of fossil fuels. Release of carbon dioxide during consumption of the carbon-based fuel produced by artificial photosynthesis would no longer increase the global carbon dioxide concentration, as that carbon dioxide was taken out of the atmosphere during production.

Since my arrival at the IU Department of Chemistry in 2003, my students and I have taken up the challenge of contributing to the global effort towards developing the key ingredients of artificial photosynthesis. Despite enormous efforts, our fundamental understanding of how to design effective water oxidation and CO_2 reduction catalysts remains poor.

Whereas we have several promising leads, and rate of progress has been increasing rapidly in the last few years, there was no rational strategy or a systematically improvable approach that would lead to a cheap, sustainable, and technically exploitable solution when we began our work. Our approach was to embrace the incredible computing infrastructure already in place at IU to make gigantic computer models of water oxidation catalysis performed by the mother of all H_2O oxidation catalysts, a diruthenium complex known as the blue dimer.

Accidently discovered in the 80s by Tom Meyer of the University of North Carolina at Chapel Hill, this catalyst was one of the few systems for which the structure was known precisely. Unfortunately, the catalyst is far from being technically exploitable, as it only turns over a few tens of times per day and deactivates within two to three days. The details of how it manages to catalytically split water and how it loses reactivity were complete mysteries for decades. Computer models were considered too big and too complex for a thorough computational study, and nobody had attempted to design them to better understand the mechanism. We set out to do so and answer these questions: What is so special about this ruthenium complex that it can oxidize water? Which features must be maintained to replicate catalytic activity, and which must be eliminated to prevent deactivation?

IU's supercomputing facilities were and remain among the very best available to academic researchers in the world. Currently, our machine pool gives access to more than 7,000 high-performance CPU-cores, including Big Red, a supercomputer purchased two years ago for nearly $13 million. Using this awesome resource, we were able to test hundreds of possible reaction channels

"All these tantalizing questions about what our future world will look like disappear if we simply solved the supply problem of fossil fuels."

Simulating chemistry

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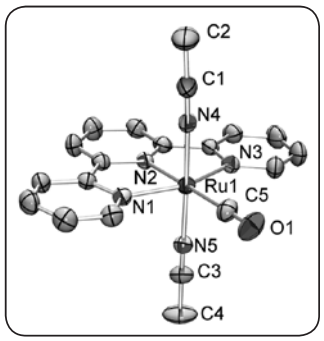


Figure 1: The bpy-free carbon dioxide reduction catalyst prepared in the Baik group

and thousands of potential reaction intermediates to derive an unprecedentedly detailed mechanism for the entire catalytic cycle, which we published in 2006.[1]

We proposed a novel mechanism with atomistic details for each step of the catalytic cycle, identified the reason for chemical activity in a unifying concept, and predicted the existence of a key intermediate that had not been detected before. Initially greeted with much skepticism, our mechanism and principle of catalysis has now been fully embraced by the community. Gratifyingly, our proposed intermediate has recently been detected spectroscopically, proving key support for the validity of our mechanism and new catalysts that were designed by optimizing the features we identified to be important have emerged.

One of the tremendous opportunities that computational chemistry provides is the flexibility of inquiry and breadth of problems that can be studied. Whereas the equipment and available instrumentation can often limit the variety of research topics that are investigated in a typical experimental group, computational researchers are generally much more flexible.

Over the years, my students and I have pursued various collaborative and noncollaborative projects that include studies of the mode of action of DNA-binding anticancer drugs with Steve Lippard of MIT, remarkable reactivities of transition metal complexes with **Dan Mindiola** and **Ken Caulton** in our department, stereoselective C–C bond activation catalysis by Rh-complexes, mechanical coupling of nano-scale molecular sensors with **Dongwhan Lee** and the properties of potential photodynamic chemotherapeutics with **Jeff Zaleski**.

Encouraged by the predictive power and conceptual simplicity of our mechanistic work, recently my students and I have embarked upon a new adventure. Addressing the second half of the artificial photosynthesis apparatus, we began studying the mechanism of CO_2 reduction catalysis. Among the catalytic systems we were interested in was one again based on ruthenium that was initially discovered by Koji Tanaka.

To our complete disappointment, we were unable to find a plausible mechanism, despite excruciatingly thorough scans of all possible reaction channels conceived.

A painfully detailed analysis of the implausible reaction pathways that was born out of complete desperation revealed a stunning result: Our computer simulations suggested that the ubiquitous ligand 2,2'-bipyridine (bpy), which was long thought to be critically important for catalysis, was actually inhibiting activity. The conclusion from this observation was that the catalysis may be performed by a decomposition product where the original catalyst must first lose the bpy ligand to form the catalytically competent intermediate.

To prove this unsettling hypothesis and streamline future incorporation of theory and experiment, we decided to build an experimental arm within our own group, instead of searching for an experimental collaborator. After some struggle, we were able to independently prepare and characterize the proposed intermediate with solvent molecules occupying the coordination sites where the bpy ligand was originally bound. When exposed to the original electrocatalytic conditions, this new complex showed significantly improved catalytic activity towards CO_2 reduction.

The seamless and even-handed integration of computational and experimental inquiries into the catalytic mechanisms relevant to artificial photosynthesis is tremendously promising. Within a relatively short amount of time, my students were able to discover insights that I could not have imagined possible. As I look into the bright future of IU's chemistry department with all the energy and excitement that our new colleagues have brought to the department, while the senior colleagues continue to provide steady leadership through these turbulent times of shrinking national science funding budgets and crises, I can't help feeling a joy of anticipation of the new chemistry that my students will discover in the future. Stay tuned!

[1] "Cis,cis-[$(bpy)_2RuVO)_2O^{4+}$ Catalyzes Water Oxidation formally via in situ Generation of radicaloid RuIV-O(dot)" Xiaofan Yang and Mu-Hyun Baik, *J. Am. Chem. Soc.* 2006, 128, 7476-7485

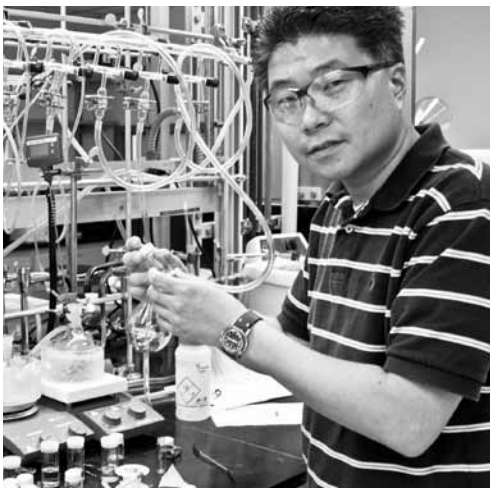
Professor Baik received his Vordiplom (BS) in chemistry from the Heinrich-Heine-Universität in Düsseldorf, Germany, and his PhD in theoretical inorganic chemistry from the University of North Carolina at Chapel Hill as a Cray graduate research fellow with Professor Cynthia K. Schauer in 2000. Before coming to IU in 2003, Baik was a postdoctoral research fellow at Columbia University with Professor Richard A. Friesner. The Baik group is broadly interested in transition metal chemistry with a heavy emphasis on catalysis. Based on large-scale computer simulations, mechanisms of how transition metal systems can activate small molecules are investigated in detail. Of particular interest are water oxidation, carbon dioxide reduction, and C–C/C–H bond activation in small organic molecules. The Baik group is mainly computational, but has recently begun to carry out experiments to confirm the theoretical predictions towards improving the behavior of catalytic systems in an iterative loop between theory and experiment.

Chasing cyanide

by Dongwhan Lee

Cyanide (CN-) ion is a frequent byproduct from many industrial manufacturing processes that often ends up in public ground water. Cyanide is poisonous to humans because it binds to an enzyme called cytochrome-c oxidase and stops its aerobic respiration in the cell, which is the key to converting ATP to energy in the body. In 2003, the World Health Organization (WHO) reported that cyanide-contaminated drinking water was a major problem in developing countries and, surprisingly, in some developed countries. Most cases of cyanide poisoning are low enough that the health effects go almost undiagnosed in large populations. Chronic low-level cyanide poisoning may simply present symptoms as general weakness and lethargy, anemia, or an inability to maintain healthy vitamin-B12 levels. A fatal dose of cyanide in humans can be as little as 90 mg (for a 60 kg- or 132-pound body). U.S. Environmental Protection Agency guidelines suggest chronic minor health problems can result from a daily exposure to cyanide as low as 6.0 ng/kg (2.7 ng/lb). Both the U.S. Environmental Protection Agency (EPA) and the WHO set a daily threshold of concern at ca. 12 ng/kg (2 ng/lb).

For an inorganic chemist, cyanide is a strong-field ligand that sits next to CO in the spectrochemical series. As a negatively charged small ion, it readily forms high coordination number complexes of early transition metals. As a soft ligand and π-acceptor, it can also bind electron-rich, late-transition metals. Such structural and electronic versatility of this useful ligand, however, can bring fatal consequences if it binds metals participating in critical metabolic pathways.



Dongwhan Lee

Toxic effects of cyanide ion are primarily ascribed to its irreversible binding to heme iron centers of cytochrome-c oxidase in the mitochondrial electron transport system, and hemoglobin for dioxygen (O_2) uptake and transport. Inhibition of antioxidant defense systems is another mechanism of cyanide toxicity. Each year, about 1.5 million tons of cyanide are used in various industrial processes including chemical synthesis, mining, and electroplating. In addition to industrial accidents and occupational exposures, combustion of plastic materials is another source of cyanide. Many polymeric materials, in particular polyurethane, polyacrylonitrile, and nylon fibers, release toxic HCN upon structural disintegration.

Cyanide can function as a Lewis base as well as a nucleophile. Understandably, both properties have been exploited by chemists in the rational design of molecular sensors and probes that target this toxic chemical. Ideally, these systems should selectively bind cyanide ion in the presence of other potentially competing species, and efficiently couple such recognition event to changes in physical properties that can be measured with relative ease. Within this context, fluorescent molecular probes have recently emerged as ideal structural platforms to integrate both the "binding" component and the "reporting" component into a single functional unit. A rapid screening of solution samples could be carried out with hand-held light sources, without complications associated with elaborate spectroscopic, chromatographic, or mass-spectrometric devices.

The rich structural chemistry of transition metal cyano complexes intuitively suggests that strong metal–ligand interaction could be used to craft such molecular sensors. Unfortunately, many transition metal ions function as internal quenchers to make the complex non-emissive. Existing strategies to detect CN^- using transition metals, in fact, take a conceptually "reverse design," in which binding of cyanide dissociates loosely-held metals from a luminescent matrix (such as fluorescent polymers or quantum dots), and thereby restores their inherent emissive properties. Interestingly, what can be considered as an "inorganic" approach to detect cyanide has been more successful in main group chemistry. In particular, trivalent boron centers can effectively couple coordination of CN^- to optical signal responses. As schematically shown above, the empty p_z-orbital of the boron can participate in a strong Lewis acid–base interaction with the incoming CN^- to form a stable adduct. A subsequent disengagement of the boron *p*-orbital from direct conjugation with the chromogenic π-system can elicit changes in light absorption or emission.

Chasing cyanide

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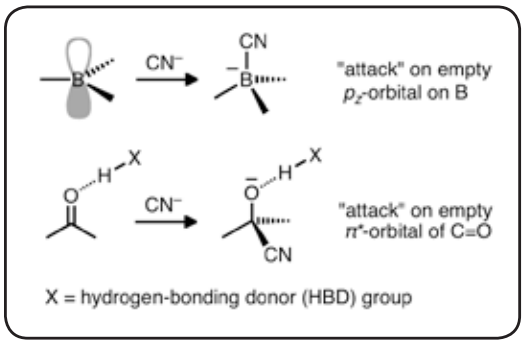

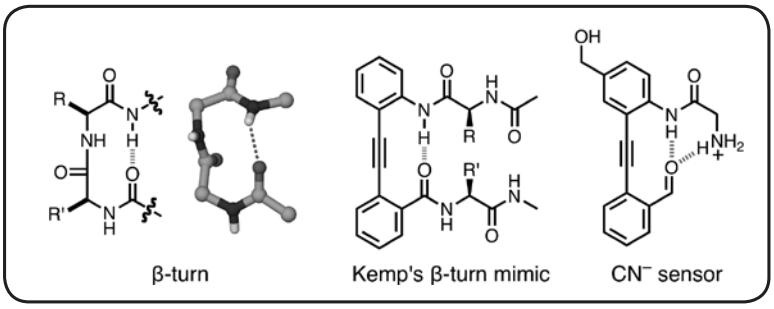

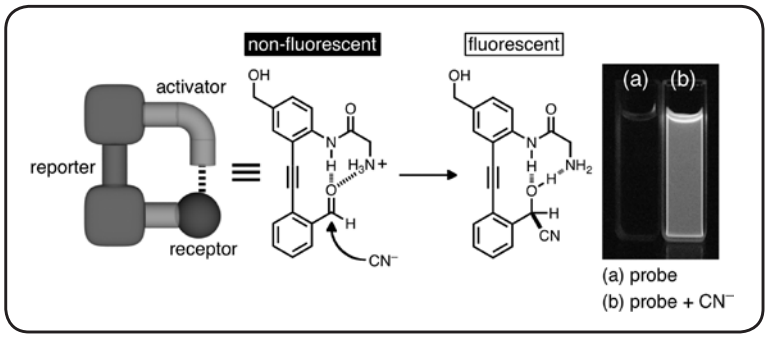

In direct analogy to the Lewis acid-base adduct formation, one can also conceive of an electrophilic organic fragment such as carbonyl group that can capture CN– by making a covalent C–C bond. Here, the "burden" of dispensing the developing negative charge of the cyanide adduct is shared by a hydrogen-bonding donor (HBD) group, which can direct (at least part of) the electron density onto the antibonding orbital through a tight O•••H–X (X = HBD group) contact. A conceptual linkage can thus be drawn between "inorganic" and "organic" modes of operation in cyanide detection. Covalent capture of cyanide, as shown above, requires appropriate secondary interactions to enhance the reactivity of the electrophilic carbonyl group. Coupling of this initial recognition event to the eventual reporting event poses yet another level of design challenge.

At the beginning of this intellectually stimulating game, we decided to search for robust chemical scaffolds that can direct multiple hydrogen-bonding donor groups to converge at the carbonyl group to promote its reactivity. We thought that it would be even better if such a chemical skeleton had luminescent properties of its own, which could be modulated by formation of the cyanide adduct. In the 1990s, Dan Kemp at MIT published a series of intriguing papers on the use of diphenylacetylene as a good synthetic surrogate of a peptide-turn (see above). Since then, a few follow-up studies appeared in the literature, in particular by research groups working on synthetic foldamers. However, no one seems to have noticed the practical utility of this conformationally preorganized "turn motif" as a foundation to build chemical sensors.

Taking leads from photophysics of small organic molecules, we postulated that an aldehyde group attached directly to diphenylacetylene would make the compound nonfluorescent, but its conversion to cyanohydrin could light up the molecule. We thus installed a simple glycine amide fragment onto one phenyl ring in order to direct its two N–H groups toward the carbonyl group on the other ring across the turn motif. A cartoon-type representation shown below highlights the highly modular architecture of this functional "triad," which is made up of the receptor, activator, and reporter components.

We carefully designed this structure so that each of its functional modules could be modified in an essentially orthogonal manner for future elaboration. Our first-generation molecular probe, prepared in a straightforward manner in six-step synthesis from known material, indeed reacts exclusively with CN– and gives rise to blue emission upon excitation. Notably, this chemistry operates in water at pH window of 6–8, with the current detection limit of 2.5 μM comparable to the 70 ppb (= 2.7 μM) set by the WHO for drinking water. Our detailed mechanistic studies also unveiled the functional importance of charge-assisted hydrogen bonds, which not only accelerate the reaction kinetics but also help rigidify the cyanide adduct to further enhance the fluorescence (Jo, J.; Lee, D. "Turn-On Fluorescence Detection of Cyanide in Water: Activation of Latent Fluorophores through Remote Hydrogen Bonds That Mimic Peptide-Turn Motif" *J. Am. Chem. Soc.* 2009, 131, 16283–16291).

As was aptly and also quite straightforwardly put forth by one of the leading experts in chemical sensing, "It isn't the shape of the molecules that kills you—it's their reactivity." (*C&EN News*, 2003, 81, 12). In this exciting journey, we took architectural inspirations from biology and turned them into the design of reactivity-based probes for cyanide detection.

Of course, the story is far from being complete. Building on this initial discovery, we are currently working on second- and third-generation systems, having improved photophysical properties (such as brighter emission at longer wavelengths to avoid background light absorption in biological and environmental samples), as well as higher sensitivity and faster response kinetics.

Dongwhan Lee received a BS and MS with honors from Seoul National University, Korea, and was awarded his Ph.D. (2001) from Massachusetts Institute of Technology (MIT) under the guidance of Professor Stephen J. Lippard. Prior to joining Indiana University in 2003, he was a postdoctoral associate in the laboratory of Professor Timothy M. Swager at MIT. Professor Lee's research program is broadly based on synthetic inorganic and organic chemistry of functional molecules and materials, with current focus on long-range mechanical coupling of artificial receptors, self-assembly and photophysics of discotic fluorophores, and conformational dynamics of shape-adaptive chemical architectures for molecular switching and sensing. The common theme threading through the group's ongoing research is designing and implementing cooperative mechanical coupling schemes that can amplify local structural distortions of small molecules to "readable" large-scale conformational changes at the molecular and supramolecular level.


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Choosing the right materials for the job

by Amar Flood, Liang-shi Li, Sara Skrabalak, and Steven Tait

The field of chemistry is expanding its research directions and becoming more interdisciplinary every decade.

The Indiana University Department of Chemistry remains current in its approaches in graduate education, and an example of this is its new graduate degree in Material Chemistry. The dynamic area of Materials Chemistry creates an extraordinary opportunity for stimulating graduate research at the interface of materials science and analytical, inorganic, organic, and physical chemistry.

Society's desire for modern technologies stimulates the need for new materials and improving on existing ones for a broad range of applications: computers, electronics, communication, energy storage, solar cells, machine tools, biomaterials, and sensors to be utilized in areas such as information technologies, health care, energy and sustainability. Our department anticipates being at the forefront of these technologies, and the current interest from graduate students shows we are heading in the right direction.

Amar Flood

Materials Chemistry is a new graduate division within the Department of Chemistry. This interdisciplinary field investigates fundamental properties and characteristics of materials, probing the relationship between the structure of materials at the atomic or molecular scales and their macroscopic properties. The vision for this division involves the creation and study of new materials with novel and advanced functionality. At present there are four assistant professors in materials chemistry: **Amar Flood**, **Liang-shi Li**, **Sara Skrabalak**, and **Steven Tait**, as well as 10 affiliated faculty. As the "young" division in our department, its members are dedicated to growing excellence in the graduate program and enhancing the visibility for the materials research conducted at IU.

Amar Flood came to IU in 2005, at the time materials chemistry started. His group focuses on the design, synthesis, and application of molecular machines that can function as anion receptors, molecular muscles, and sensor elements. Interest in molecules that can act as machines originates from nanotechnology and is inspired by biology leading to synthetic molecules that are envisioned to serve as small functional devices. The field is still in its infancy, with exciting proof-of-principle demonstrations of molecular electronics, artificial muscles, and nanovalves for drug delivery. Beyond these possibilities, there is a lot of fundamental science being investigated in Flood's laboratory that extends beyond beakers to include the science behind interfacing molecules with the outside world.

In the realm of anion-receptor chemistry, Flood has created a new class of receptors that bind anions tightly. These compounds, called triazolophanes, are macrocycles that hold onto anions (e.g., chloride), by using unusually strong CH hydrogen bonds rather than the typical NH or OH hydrogen bonding groups. The triazolophanes are also easy to make and modify, and a lot of variations have been created to understand the reasons for the tight binding. The receptors are also being incorporated into ion-selective electrodes that have shown excellent selectivity towards bromide in blood serum as related to the disease epilepsy. Flood is developing these receptors further to respond to light for possible applications in the environmental remediation of toxic anions, e.g., pertechnetate from nuclear power production.

Of a more fundamental nature, Flood is making molecular machines as a means to understand the rules that govern controllable molecular movements. The long-term goal is to create synthetic molecular muscles that can be incorporated into more relevant assemblies.

To aid with such interfaces, Flood is also investigating the science and methodology behind anchoring molecules to surfaces. Taken together, these research endeavors bring students into contact with synthesis and characterizations of their molecular materials as well as the critical evaluations of function necessary to facilitate the transfer

of materials from laboratory to industry.

Liang-shi Li's group is developing new carbon materials for renewable energy and neuroimaging. Carbon materials are special in our society, as they are the basis of many important technologies that include pencils, adsorbents, metal strengtheners, batteries, and many others. Unfortunately, by far the largest use of carbon today is to burn it for energy supplies. This not only depletes fossil fuels, but also releases CO_2 and other wastes, affecting the global climate and environment. The Li group develops sustainable ways to use carbon for energy—to use them for solar cells. Many carbon materials are black and great for light harvesting. However, common carbon materials contain chunks at least hundreds of nanometers in size, and are full of defects; not good for getting electrons out. The Li group has made a new class of carbon material—colloidal graphene quantum dots (QDs)—which are essentially small particles containing a single atomic layer of graphite. A few nanometers across, the QDs appear black and are soluble in various solvents, which is crucial for making low-cost solar cells. The QDs also have some unique properties that could potentially overcome fundamental limits on the efficiency of current solar cells. The researchers hope that, one day, carbon could replace the silicon and other dyes made of rare or toxic metals in thin-film solar cells.

Besides having excellent light-absorbing properties, the graphene QDs can emit light under UV or the sun's light, with tunable colors from visible to infrared, depending on the size of the QD particles. Because infrared light can penetrate human tissues, the QDs can potentially be used as optical labels for biological imaging. The Li group is modifying them so that their emission intensity can be controlled by electrical voltage. Such sensitivity can be used to detect the electrical signals employed by nerve systems to propagate and process information for *in situ* studies of nerve cells. These activities represent multidisciplinary opportunities for graduate students to see the real-world applications of their research.

Professor Sara Skrabalak joined the faculty in the fall of 2008. Her research group is focused on the development of new chemical methods towards the creation of nanomaterials in which their size, shape, and 3D structure are precisely controlled. Interest in nanomaterials has been steadily increasing because of their fascinating and often tunable properties. By harnessing these unique properties, pioneering technologies are emerging. Yet, as these platforms come to full fruition, increasingly complex nanomaterials are required and their properties must be predictably controlled through their composition, size, shape, and assembly. These needs require advances in synthesis. Students in the Skrabalak laboratory are currently applying their synthetic skills toward the preparation of catalysts and photocatalysts for energy applications.

Multiple synthetic techniques are being used to prepare a diverse set of materials. For example, ultrasonic spray pyrolysis—an aerosol synthetic technique—is being used to prepare porous and shape-controlled metal oxide particles for photocatalytic applications. Electrospinning is also being used to prepare materials for photocatalytic applications; in this case, nanostructured composite fibers. Regardless of the synthetic approach or specific material being synthesized, the objective is always to study their photocatalytic performance as a function of their structure. With the information garnered from this work, better photocatalysts can be rationally designed, including those that are promising platforms for splitting water using sunlight and the generation of H_2 for use as a clean fuel. Additionally, the Skrabalak laboratory is using solution-based methods to prepare metal nanocrystals with defined features so that their catalytic properties can be evaluated as a function of their structure. As this brief research description illustrates, students working on these projects are required to fuse and apply concepts from many areas of chemical study (inorganic, physical, and analytical), reflecting the interdisciplinary nature of materials chemistry.

Sara Skrabalak

Professor Steven Tait and his research group are studying the self-assembly of organic molecules at surfaces. Their surface analysis experiments in ultra-high vacuum have led to a better understanding of intermolecular interactions and adsorbate-substrate bonding in systems of organic ligands at metal surfaces. Scanning tunneling microscopy (STM) studies of terephthalic acid on copper surfaces have revealed structural transitions in the crystalline first layer with increasing areal densities of molecules. These studies have been correlated with high-resolution electron energy loss spectroscopy experiments, in collaboration with Professor **Larry Kesmodel** of the Physics Department. That experiment provides spectral data similar to that obtained from an IR experiment, with the added advantages of being able to measure low-energy modes and to make measurements that are extremely sensitive to the surface layer. This collaboration has led to a new understanding of the intermolecular forces which drive the self-assembly of terephthalic acid, an important ligand in metal-organic frameworks and as a binding layer in organic photovoltaic devices.

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Choosing the right materials

(continued from page 7)

The STM experiments in the Tait laboratory have also produced molecular resolution imaging of novel supramolecular architectures at surfaces, including self-assembled one-dimensional chains of azopyridine. Those chains show a significantly different interaction mode compared to their cousin, azobenzene, and provide a model system for the control of nanometer scale structure based on ligand design in small molecular building blocks.

Recent studies have also developed organic/inorganic mixtures at surfaces leading to new surface structures and compounds. STM results are correlated with x-ray photoelectron spectroscopy, which provides integral compositional and chemical state information to complement the local structural results. Ongoing analysis of these and other systems is leading to a greater understanding of organic film interfaces to solid surfaces and how they can be effectively utilized in new materials and technologies, including self-assembled nanostructured surfaces and organic photovoltaic materials.

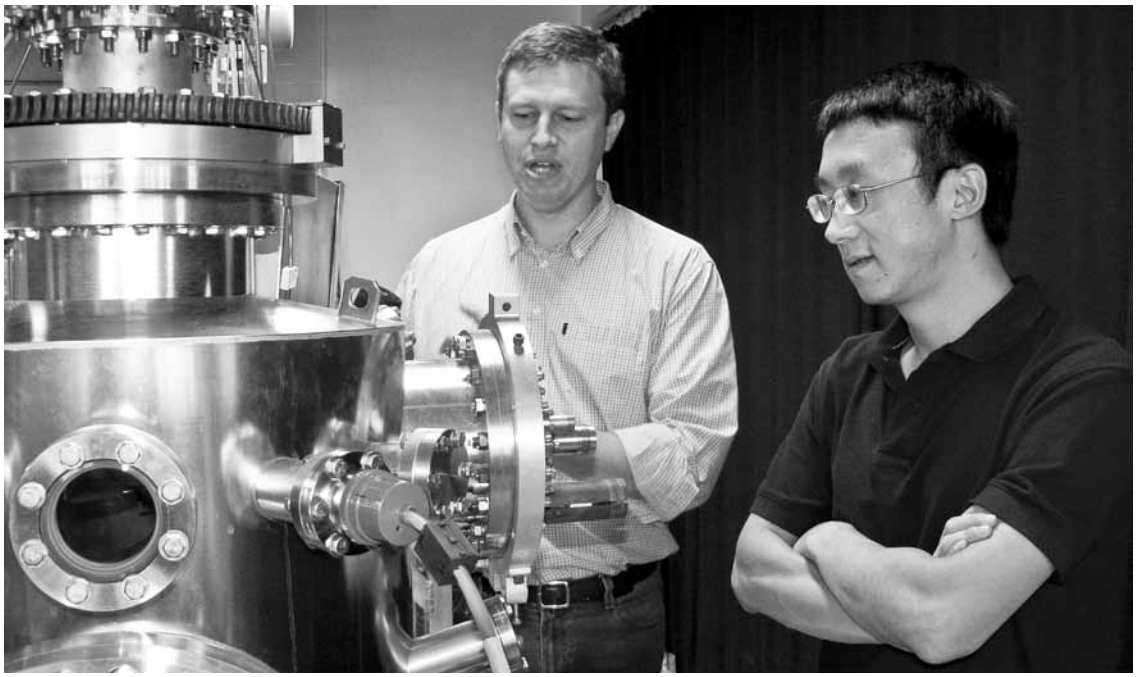
The graduate curriculum in Materials Chemistry has been running for four years, with the first Ph.D. student set to graduate in 2011. Materials chemistry is intrinsically multidisciplinary, yet there are some fundamental elements in this field of study. As a consequence, graduate students take two common classes and are then able to choose from a broad array of courses to complement their specific research program, from analytical and physical to organic and inorganic chemistry. The two core classes, Fundamentals of Materials I and II, cover the properties and underlying principles of hard and soft matter as well as their synthesis and characterization. There are currently 19 students enrolled in the program, and students from other divisions regularly take these graduate courses, attesting to the growing success of this new division.

Professor Flood received his BS (1996) and his PhD (2001) from the University of Otago with Professor Keith C. Gordon. He was a Postdoctoral Scholar at the University of California in Los Angeles, with Sir Fraser Stoddart (2002–2005).

Professor Li received a B.S. in chemical Physics and M.S. in Theoretical Physics from the University of Science and Technology, China, and was awarded his Ph. D. (2003) in Physical Chemistry from the University of California, Berkeley under the guidance of Professor A. Paul Alivisatos. He was a postdoctoral associate with Professor Samuel I. Stupp at Northwestern University, where he worked on synthesis of organic nanostructures.

Sara Skrabalak received her B.A. in chemistry from Washington University in St. Louis (2002) and her Ph.D. from the University of Illinois at Urbana-Champaign (2006) with Professor Ken Suslick. She was a postdoctoral associate at the University of Washington–Seattle (2007) with Professors Younan Xia and Xingde Li.

Professor Tait received a B.S. in Honors Physics from Brigham Young University in 2000 and was awarded an M.S. (2002) and a Ph.D. (2005) in Physics from the University of Washington, under the direction of Professor Charles T. Campbell (chemistry) and Professor Samuel C. Fain, Jr. (physics). Professor Tait was an Alexander von Humboldt Postdoctoral Fellow at the Max Planck Institute for Solid State Research in Stuttgart, Germany, with Professor Dr. Klaus Kern until joining the IU Department of Chemistry in 2008.



Steven Tait and Liang-shi Li

Our own Little Tibet

by Kate Reck

Bloomington is not your typical college town.

Prospective students and their parents see the beauty and richness it offers in just one day on campus. A walk down Kirkwood Avenue or Fourth Street opens up a world of ethnic restaurants. Many students never get to try all the cuisines Bloomington offers.

Courtesy Kate Reck

A chorten at the Tibetan-Mongolian Buddhist Cultural Center

Often, it takes a little longer living in Bloomington to unlock the cultural diversity hidden among Bloomington's many treasures, such as the Lotus World Music & Arts Festival, the Asian Culture Center, the First Nations Educational and Cultural Center, the Latino Cultural Center (La Casa), and the Neal-Marshall Black Culture Center. Among these treasures is the Tibetan-Mongolian Buddhist Cultural Center (TMBCC), the only one of its kind in the United States. The question begs to be asked: How did this Hoosier college town become home to the TMBCC and a periodic destination for the 14th Dalai Lama, the spiritual Tibetan leader?

The Dalai Lama's eldest brother, Thubten Jigme Norbu, also referred to as Tagtser Rinpoche, was a professor of Tibetan Studies at IU. Norbu was born in 1922 in a small mountain village in Tibet, and at the age of 3 he was identified as the reincarnation of a Buddhist lama, or Tagtser Rinpoche. Shortly thereafter, he was taken from his home and given the necessary education to become a high lama. At the age of 27, he was appointed Abbot of the Kumbum Monastery in Amdo, Tibet, until China invaded Tibet in 1950. One of the highest-profile Tibetan lamas, Norbu fled Tibet and was one of the first Tibetans to settle in America. Martin Scorsese dramatized this event in his film *Kundun*, depicting Norbu's escape and struggle to work effectively against Chinese oppression from outside its borders.

Meanwhile, at 15, Norbu's younger brother, Lhamo Döndrub, was recognized to be the 14th Dalai Lama. The Chinese government tried to ally with Norbu and persuade him to work with the government to depose the Dalai Lama. The Tibetan people were strongly devoted to the Dalai Lama, and he left Tibet for Dharamsala, India, during the 1959 Tibetan uprising, creating a government in exile.

When Herman B Wells heard Norbu speak about Tibet's persecution by China, he invited Norbu to teach at the IU in 1965. Norbu accepted. By 1979, Norbu had founded the Tibetan Cultural Center, later renamed the Tibetan Mongolian Buddhist Cultural Center (TMBCC) in 1979. Norbu retired from IU in 1987 and spent the rest of his life living and practicing at the TMBCC until he died at the age of 87 in 2008.

In 2005, Arjia Rinpoche was appointed director of the TMBCC. In 1952 at age 2, he was recognized as the 20th Arjia Danpei Gyaltsen, the Abbot of the Kumbum Monastery in Tibet. Growing up, he was trained by many Buddhist spiritual leaders, including the Dalai Lama. His years in China were filled with hiding his religion and culture. By 1958, he disrobed as a Buddhist monk and was forced to attend a Chinese school, while secretly maintaining his Buddhist beliefs. When Chinese policies eased from 1962 to 1964, he returned to studying at the Tashilhunpo monastery.

In 1979, he was reinstated as Abbot of Kumbum Monastery. By 1998, he had become a prominent official within China and was asked to become the leader of the Chinese National Buddhist Association, an organization overseen by the Communist Party of China. At this time, he decided to flee China, escaped through Guatemala, and settled in Mill Valley, Calif. There, he established the Tibetan Center for Compassion and Wisdom. In 2005 the 14th Dalai Lama asked him to become director of the TMBCC, and he accepted.

The TMBCC is located southeast of campus on Snoddy Road on 108 acres of land donated by Tom and Kathy Canada. The center is open to the public and is the only place in the U.S. with a large collection of traditional Tibetan edifices, such as two traditional Tibetan Stupas (a Buddhist shrine), 11 Mongolian gers (large round tents used by Nomadic peoples), a Kumbum Chamtse Ling Temple, Cultural Building, and Teaching Pavilion.

The Cultural Building contains a Great Hall, where one can view a permanent sand mandala of the Medicine Buddha, a traditional Tibetan Butter Sculpture, and a library of Tibetan books. Its walls are decorated with traditional paintings of Buddhas and Bodhisattvas. The center is not solely a place of worship. Its mission is to educate the public about and preserve Tibetan culture, religion, and language. It supports interfaith cooperation and dialogue among all people.

The 14th Dalai Lama returned for his sixth visit to Bloomington in May 2010 for two days of Buddhist teachings on wisdom and compassion. "All major religions traditionally all have the same potential to bring inner peace through the practice of love, compassion, forgiveness, tolerance, contentment," the Dalai Lama said. "The real source of happiness is within ourselves."

CHAIR'S LETTER

David Giedroc

I write on the cusp of my first two full months as the new chair of the Department of Chemistry. It's the first day of fall 2010 classes, and a coolish breeze of Fall may actually be in the air after a very warm and nearly rain-free summer. The good news is that the IU faculty hiring freeze that was in place over the last two years has begun to thaw, and we're again in the familiar mode of organizing a search committee to identify junior faculty candidate(s) in organic or bioorganic chemistry to join us for fall 2011.

Our past inability to hire, however, does not mean that things have been quiet over the last year. Major programmatic initiatives begun a couple of years ago in the life sciences and materials chemistry continue to mature. For example, the Nanoscience Center has now established an exciting interdepartmental seminar series and continues to acquire an amazing array of sophisticated instrumentation, including a $2 million focused ion beam instrument housed in the new Nanocharacterization Center in the basement of Simon Hall. These research activities have spurred some of our teaching faculty to engage in significant community outreach in nanoscience, which strongly promotes the central importance of chemistry in our community and everyday lives.

A new 800 MHz high field NMR spectrometer, a 300keV cryo-electron microscope for both biological and material science applications, and a major planned robotics-based enhancement to the macromolecular x-ray crystallography facility, completes a suite of instrumentation in Simon Hall that is unrivaled in the region. New research staff continue to come online to manage these important multiuser facilities. These improvements in physical infrastructure have crystallized efforts to develop an exciting new graduate training program in Quantitative and Chemical Biology that seeks to provide cutting-edge interdisciplinary training opportunities in the quantitative biomedical sciences.

It is also with great pride that I witness the successful beginnings of new careers by our flock of five assistant professors hired in 2008–2009. We have one NSF CAREER awardee, one 2010 Pew Scholar in the Biomedical Sciences, and one recipient of a major award from the National Institutes of Health. Each of these individuals has changed the face of this department in important ways. For example, two have helped to spearhead new Women in Science initiatives in chemistry that have resulted in the awarding of numerous travel grants and fellowships to female students associated with the department. Not to be outdone, two of our more "senior" assistant professors were named Cottrell and Camille Dreyfus Teacher-Scholar Awardees in 2009–2010.

Finally, I note with sadness the passing of Emeritus Professor **Marvin Carmack**, a synthetic chemist held in very high regard his entire life. He died in July at the age of 96. A memorial service celebrating Marvin's life was held on September 10 in Auer Hall (see full story, p. 31). I also note several faculty retirements from "active duty." These include Professor **Charlie Parmenter**, a physical chemist and our only current member of the National Academy of Sciences, and Professor **Jack Crandall**, who has stepped down after serving admirably as Associate Chair and Director of Graduate Studies for more than four years. I wish both Charlie and Jack all the best as they move to new chapters in their lives.

I close by thanking you for your continued support of your Department of Chemistry, and I ask that you visit when your schedule allows for a trip to Bloomington. We are living in an exciting era where chemistry solidifies its role as the central discipline in interdisciplinary efforts required to solve the many challenges that face us, from fuel cells to human disease and biotechnology. So, stay tuned!

—David Giedroc

FACULTY AWARDS

Mu-Hyun Baik has been selected to receive a 2010 Scialog Grant Award for studying solar energy conversion. The initial Scialog grants, awarded by the Research Corporation for Science Advancement, focused on "identifying and funding innovative research that has transformative potential for rapid translational application …" and "… encouraging researchers to take greater risks to achieve potentially much greater rewards." Baik's project, "Towards Converting CO_2 to Fuel: A Computer-Aided Experimental Discovery of Novel CO_2 Reduction Catalysts," was one of 11 individual awards granted this year.

Lane Baker was named a Cottrell Scholar for the proposal titled "Instrumentation and Development of New Techniques for Measuring Molecular Recognition with Ion Currents." These awards are unusual in that they recognize faculty who excel in both teaching and research, and they are among the most prestigious fellowships for beginning faculty in the sciences.

Erin Carlson was the recipient of a 2010 Pew Scholar Award. The Pew Scholars Program in the Biomedical Sciences provides funding to young investigators of outstanding promise in science relevant to the advancement of human health. The program makes grants to selected academic institutions to support the independent research of outstanding individuals who are in the first few years of their appointment at the assistant professor level.

Earlier in the year, **Romualdode Souza** was chosen to be a Provost Professor. This is an honor that he will carry for the remainder of his career at Indiana University. Provost Professorships are given to faculty members who have achieved local, national, and international distinction in both teaching and research/creative activity and their interaction.

Richard DiMarchi was honored with the August M. Watanabe Life Sciences Champion of the Year Award, a prestigious honor named in tribute to the BioCrossroads late chair (Watanabe). The award was presented at the sixth annual Indiana Life Sciences Forum in Indianapolis. DiMarchi was recognized as one of the world's leading peptide scientists and biotechnology entrepreneurs for his significant impact on Indiana's life sciences greatness and growth.

Amar Flood was selected as a recipient of a 2010 Camille Dreyfus Teacher-Scholar Award. The award supports the research and teaching careers of talented young faculty in the chemical sciences who demonstrate a strong commitment to education, signaling the promise of outstanding contributions to both research and teaching.

Gary Hieftje was the recipient of the 2010 RSC Robert Boyle Prize for Analytical Science for his contributions in the conception, design, development, and innovation of analytical instrumentation. The award is sponsored by the (RSC) Royal Society of Chemistry.

Daniel Mindiola is the recipient of a 2010 College of Natural Science Alumni Award. This award, under the auspices of Michigan State University, is presented to alumni who have graduated within the last 15 years and shown outstanding professional growth. Award recipients exemplify the MSU commitment to the land-grant mission of teaching, research, and outreach activities through their dedication to professional, community, and MSU service.

Milos V. Novotny delivered the 2010 Dennis H. Desty Memorial Lecture at the Royal Institution in London on October 6, 2010. This annual lecture honors Dennis Henry Desty, one of the pioneers and major developers of gas chromatograph. Desty (1923–1994) devised practical techniques for hydrocarbon separations, combustion, gas-flares, and oil-spill treatment. There are nearly 500 patents in the petroleum field associated with his name.

Krishnan Raghavachari has been elected as a member of the International Academy of Quantum Molecular Science. This is a very prestigious honor in theoretical chemistry. The majority of the U.S. members are also members of the U.S. National Academy of Sciences.

Last spring, **Amar Flood**, **Dennis Peters**, and **Jill Robinson** were the recipients of IU Trustees Teaching Awards. These awards were established by the IU Board of Trustees to recognize excellence in classroom instruction. Courses taught, course enrollments, and student evaluations provided the basis for their selection.

FACULTY PROFILE

There from the beginning

Charles S. Parmenter retires

by George Ewing

Charlie Parmenter

I always enjoy walking into Charlie's office.

He sits at his desk surrounded by what a modern artist might call an installation. On the walls are posters, etchings, and samples of his own fine photographs. On one shelf, a glass case houses a model of a U.S. Navy F5 fighter with a picture of his son Tighe, who was its navigator. Next to this is a chain analytical balance, mahogany-framed with a sliding glass window to protect its delicate brass innards. This working antique was inherited from **Frank Gucker**'s lab and used by Charlie's group for years to weigh laser dyes. (It would likely fetch a high price on eBay.)

Other objects on display, which do not carry an explanatory card, would puzzle the casual visitor.

A diffraction grating, the size of a jumbo Hershey bar, sits on a filing cabinet. This was the guts of an f/10, 1.7-m optical scanning spectrometer designed by Ed Bair and central to Charlie's seminal research on energy transfer. A Pyrex cell, containing several mirrors, collected weak molecular fluorescence.

Bookcases hold his select library. Tucked in the corner of his office is a photograph of Charlie with a number of his students who had gathered to celebrate his induction into the National Academy of Sciences. None of his many other honors (Guggenheim Fellowship, Humboldt Award, the Spiers Medal of the Faraday Society, University Teaching Award, etc.) are on display. A number of plants are placed here and there—mostly cacti, as they are tolerant of neglect. Each time I visit, I see something I had not noticed before. Charlie would offer me a chilled Starbucks cappuccino from his small refrigerator.

His department issued offices have not always been so elegant or welcoming. When Charlie arrived in Bloomington as assistant professor of chemistry in the fall of 1964, he was assigned the office next to mine. I had come to IU the year before. We were on the fifth floor of what was then the "new" 60s addition. The builders ran out of money (and paint) before they reached the upper floors, so our rooms were framed by bare gray cinder block walls with matching gray metal shelving thatFacility's Engineer **Jack Baker** was later to describe as "prison grade." However, neither of us spent much time in our offices—we were in our laboratories across the hall.

Charlie had just come from a Harvard postdoc position with George Kistiakowsky, following his Ph.D. at the University of Rochester with W. A. Noyes, Jr. Both his mentors were among the world's most prominent chemists. His last Harvard project, on the fluorescence of benzene, contained a central unanswered question: What happens to the energy of the isolated molecule after it absorbs light? While this might sound like a trivial question, it was an example of a nonradiative process that occupied a hot experimental and theoretical area that persisted for more than 20 years. Benzene became the "fruit fly" for the study of molecular energy flow and and nonradiative processes. By good fortune, Charlie was there from the beginning.

A few months after his arrival, Charlie was awarded an NSF grant he had applied for during his last months at Harvard. He began building up his laboratory at once. Professor **Ed Bair** showed him how to make a flash lamp for pumping benzene into an excited (S1) electronic state. Charlie's next concern was that his first graduate student, a pretty sleepy guy, would electrocute himself. Later, an exceedingly capable student, **Mike Schuyler**, joined the group, and together they observed fluorescence from a single vibronic level (SVL) of the

benzene molecule. They wrote up these results, and in 1969, Charlie described this work at his (almost) first invited conference near Paris. This grand beginning made a positive tenure decision a sure thing.

Along the way, Charlie took his teaching seriously, certainly to an extent I would have avoided. We had begun team-teaching freshman chemistry that included the laboratory. Charlie realized that one of the experiments had never worked despite reports from hundreds of students over the years. I was never a big fan of undergraduate laboratories and would have just as soon ignored the problem. But Charlie dragged me along, and we finally got the the difficulties sorted out.

For many years, Charlie and I played squash in HPER over the lunch hour. We were evenly matched and gracelessly trashed around the court, sweating for an hour or so. We cooled off leaning on the rail that borders the indoor track while discussing the meaning of life. Then, lunch at Nicks—Stromboli with ice tea. The ice tea got bumped for draft beer after we got tenure.

Charlie's science continued to grow over the years. Invitations to international meetings and honors rolled in. His approach to experiment evolved with the times. Lasers replaced mercury lamps and molecular beams replaced gas bulbs. While this newer equipment looked flashy, I suspect his earlier experiments were much more difficult and required the greater finesse that Charlie was able to apply.

In 2003, the *Journal of Physical Chemistry* honored Charlie with a special Festschrift issue. Charlie's former graduate student, **George Atkinson**, and a British collaborator John Callomon wrote an essay titled, "Scientific Contributions of Charles S. Parmenter." In a summary of his research style, they wrote,

"His changing group of students and collaborators, nearly 50 of them over the years, was at any time never very large: almost half of his publications have only one co-author. With his typical modesty, Charlie will claim that it was they who did it all. Perhaps, even if unlikely. But that is Charlie. In any event, there was always someone who knew what to do and why it was important to undertake it. Most importantly, there was always someone who provided the inspiration and the enthusiasm needed to motivate many different individuals over almost half a century. And there is no doubt that this someone was also Charlie."

By next spring, Charlie will have given up his office. However, I have a plan. When I want good company in a comfortable environment, I will walk over to his house just a few blocks away. Charlie's wife Pat has created a beautiful home for them—actually more inviting than his office. In addition, they have a fancy espresso machine that turns out a fine cappuccino.

"With his typical modesty, Charlie will claim that it was they who did it all."

FACULTY NEWS

A significant effort in the **Lane Baker** group is focused on measurements of local electrochemical phenomenon with a variety of electrochemical microscopes. Scanning electrochemical microscopy, scanning ion conductance microscopy, and electrochemical—atomic force microscopy are all being developed to further advance understanding of ion and molecule transport at small scales. This research thrust has led to several awards and grants, including: an Eli Lilly award in Analytical Chemistry to **Chiao-Chen Chen**, a Cottrell Scholars Award for Baker, a scientist development grant from the American Heart Association, and an R21 grant from the National Institutes of Health.

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, Carlson presented this research at six national and international conferences including invited talks at the New Directions in Small Molecule Drug Discovery Keystone Conference in Whistler, British Columbia, and the ACS New Investigators in Analytical Chemistry Session at Pittcon in Orlando, Fla. Postdoctoral associate Antoinette Odendaal presented the work in natural products discovery performed in conjunction with graduate student **Darci Trader** at the ACS National Meeting in Boston in August of 2010. A manuscript describing this work was recently submitted and is currently under review. Several additional papers are in the pipeline and will be submitted for publication soon. The first review paper was published this year in *ACS Chemical Biology*.

Erin Carlson was named a Pew Biomedical Scholar in July of 2010. The Pew Scholars Program in the Biomedical Sciences provides funding to young investigators of outstanding promise in science relevant to the advancement of human health. This grant supports research in the Carlson group to develop novel antibiotics from natural organisms, such as marine samples from the eastern Pacific region and the Caribbean Sea, and to characterize how antibiotic resistance is developed at the molecular level

(continued on page 14)

FACULTY NEWS

(continued from page 13)

in bacteria. Through these studies, the Carlson group hopes to identify new compounds that can be used as antibiotic therapies.

The **Giedroc** group has a long-standing interest in "homeostatic" mechanisms that control the bioavailability and chemical reactivity of transition metals in cells, most recently in Gram-positive human pathogens. These metal ions, including Fe, Mn, Cu, and Zn, play essential roles as co-factors in metalloenzymes, and must be scavenged from the immediate microenvironment, but are toxic in excess. As a result, this process lies on the front lines of human host-pathogen interactions. In one key paper published in the *Proceedings of the National Academy of Sciences USA*, advanced biomolecular NMR methods were used to solve the solution structure of paradigm zinc sensor from the major hospital pathogen, Staphylococcus aureus. This structure is likely representative a very large family of bacterial metalloregulatory proteins, and reveals for the first time how a metal ion drives a structural change in the sensor protein to mediate zinc efflux from the cell. In other work published in the *Journal of the American Chemical Society*, the Giedroc group, in collaboration with the **DiMarchi** group, used a semi-synthetic chemical ligation strategy to introduce "atom-substitutions" on a single histidine residue in a copper sensor from Mycobacterium tuberculosis, to learn how Cu(I) binding drives inhibition of DNA binding. Ongoing studies are underway of novel transition metal and nitric oxide (NO) sensors from the major respiratory pathogen, Streptococcus pneumoniae, in collaboration with the **Winkler** group in Biology at IU.

Professor **Ron Hites** continues his work on toxic organic contaminants (such as organochlorine pesticides, po-lychlorinated biphenyls, and flame retardants) in the environment. His group is particularly focused on the pathways by which these compounds enter the Great Lakes and the changes in these pathways as a function of time. This work is supported by a $5 million grant titled, "Deposition of Toxic Organic Compounds to the Great Lakes: The Integrated Atmospheric Deposition Network" from the U.S. Environmental Protection Agency's Great Lakes National Program Office. This grant covers the period from October 2009 to September 2014, at which time Hites has promised to retire. More recently, his group began work on a more specific project titled, "Chicago as a Source of Air Toxics to Lake Michigan," also supported by the U.S. Environmental Protection Agency's Great Lakes National Program Office. This grant is a collaborative effort with the Department of Civil and Environmental Engineering at the University of Iowa.

In October of 2009, Hites consolidated his laboratories and offices in Indiana University's new Multidisciplinary Science Building (MSB II) on 10th Street and Walnut Grove. The laboratory and office space in this building is first-rate. The main laboratory has an area of 2,500 square feet and is equipped with 48 linear feet of hoods. Office space is provided immediately adjacent to the laboratory for the students and technicians. A nearby office wing holds office space for Hites, his senior staff, and postdoctoral associates.

From **Dan Mindiola**'s group: The Department of Chemistry is pleased to announce that **Alison R. Fout**, former graduate student in the Mindiola group, has been awarded the 2010 ACS Division on Inorganic Chemistry (DIC) Young Investigator Award. The DIC award provides a $1,000 honorarium and a plaque to commemorate participation in the event. Fout presented a seminar in the Young Investigator Symposium, which was held in fall 2010 ACS national meeting in Boston. Fout is currently a Mary Fieser Postdoctoral Fellow in the Department of Chemistry and Chemical Biology at Harvard University (under the tutelage of Professor Ted Betley). She was also recently awarded the prestigious Ruth Kirschstein NIH Fellowship. Congratulations, Alison!

Milos V. Novotny has continued his activities in directing research in analytical glycoscience under the research grants from different institutes of NIH and the National Cancer Institute. He continues to lecture frequently. The last year's lectures on cancer glycobiology took Novotny to the meetings in Bethesda, Md., and Stanford University. He was also an invited speaker at the international symposia on chromatography and electrophoresis in Riva del Garda (Italy), Prague, and Boston. In November of 2009, Novotny was a special guest and speaker at the 20th anniversary of the Velvet Revolution, which ended the communist rule in Czechoslovakia in 1989. In advancing further his "scientific hobby," the pheromones, Novotny and his pheromone team have concentrated on prey-predator interactions and the role of olfaction in birds. They collaborate with biological investigators internationally and with IU Distinguished Professor Ellen Ketterson of the Biology Department.

During the past year, electrochemical research in the group of **Dennis Peters** has progressed well. Two projects are especially notable. **Peng Du**, who recently earned his PhD , has discovered that o-nitrostyrene can be electrochemically reduced at a carbon cathode in the presence of a modest excess of a proton donor (e.g., phenol) to afford 1H-indole in almost quantitative yield. Presently, he is staying in Bloomington for a short time to explore the generality of this method with several substituted o-nitrostyrenes. If this work proves successful, the electrosynthesis will be a significant improvement over more classic chemical protocols. **Angela Peverly** has succeeded in developing an electrochemical procedure (based on the use of stripping analysis) to measure the concentrations of trihalomethanes (bromoform or chloroform) present as contaminants at the nanomolar concentration level in drinking water that has been disinfected by treatment with chlorine. This approach may serve as a viable alternative to the now-accepted gas

chromatographic procedure that is approved by the Environmental Protection Agency. Both Peng and Peverly presented papers about their research at the meeting of The Electrochemical Society held in Vancouver last April.

Jill Robinson has been working with scientists from the IU Nanoscience Center to develop outreach programs with regional schools and was awarded two grants related to this work. The first came from the IU Institute for Science, Technology, Engineering and Mathematics Education (ISTEME), which focuses on improving Hoosier literacy in science, technology, engineering, and math—or STEM education—for K–12 students throughout the state. The ISTEME project involved working with teachers from new technology schools in Bloomington and Columbus, Ind., to develop nanoscience projects. The projects were built around core chemistry and physics standards but also incorporated modern technology such as computer-based molecular modeling and synthesis of different sized gold nanoparticles. The chemistry students also had the chance to do some hands-on work and chat with scientists during visits to IU's Nanocharacterization Facility and Cyclotron. The success of this project led to the development of a teacher workshop called "Math and Molecules Matters," which is funded by the Indiana Commission of Higher Education. During the summer, Robinson worked with 15 teachers from local middle and high schools to provide training in nanoscience and project-based learning. For more information on the workshop and teacher projects, visit mathmatters.indiana.edu and select the "Molecules Matters" program.

CONFERENCES, SPECIAL LECTURES & SYMPOSIA

Lectures & seminars

In October 2009, David Clemmer, Robert & Marjorie Mann Chair of Chemistry, presented "Measurements for the Masses," as the 2009 **Tracy M. Sonneborn Award Lecture**.

In October 2009, two **Horizons in Chemistry Seminars** were presented by Kenneth Miller, adjunct professor with the IU Department of Chemistry and general manager of sustainability, SABIC Innovative Plastics.

The **Distinguished Seminar-Campaigne Lecture** — "Total Synthesis of Biologically Active Molecules"— was given by K. C. Nicolaou, of the University of California, San Diego. Nicolaou is also affiliated with the Skaggs Institute for Chemical Biology and the Scripps Research Institute.

In February 2010, a **Horizons in Chemistry Seminar** was presented by Kyle Starkey, Lean Six Sigma black belt and manufacturing technology specialist with 3M Film Manufacuring & Supply Chain Operations. Starkey's talk was titled, "Where Do You See Yourself in 10 Years? An Industrial Chemist's Look Back at the First Decade After Graduate School."

Professor Karl Wieghardt, director of the Max Planck Institute Department of Bioinorganic Chemistry in Germany gave a **Distinguished Seminar** in April 2010 titled, "Coordination Chemistry with Radicals—Where are the Valence Electrons?"

Symposia

The **20th Annual Inorganic Alumni Mini-Symposium** was held in October 2010. Participants included:

• Ann Schake, Nuclear and Radio Chemistry Group, Los Alamos National Laboratories, New Mexico. "Highlights of 20 Years at Los Alamos National Lab."

• Daniel Teff, FUJIFILM Electronic Materials USA Inc., Mesa, Ariz. "In Semiconductors and Life, Less Is More."

• Jodi L. Wesemann, Higher Education, American Chemical Society, Washington, D.C. "Learning the Chemistry of the Human Element: Strategies for Navigating the Career Landscape."

• Nancy Winchester, Chevron Energy Technology Company, Houston. "Three Companies, Two Names: Paddling Upstream in the Petroleum Industry."

The **August M. Watanabe Symposium in Biotechnology** was held in October 2010. Participants included:

• Laura Kiessling, University of Wisconsin. "Carbohydrate Polymer Assembly: How Do Mycobacteria Do It?"

• Professor Erin Carlson, Indiana University. "Chemoselective Technologies for Natural Products Discovery."

• Jeffery Kelly, The Scripps Research Institute. "Adapting Proteostasis to Ameliroate Loss- and Gain-of-Function Misfolding Diseases."

• Charles Dann III, Indiana University. (Include dept. info?) "Targeting Cancer Cells: Antifolate Drug Design and the Human Folate Receptors."

• Ron Raines, University of Wisconsin–Madison. "Electronic Effects on Protein Stability."

• Bogdan Dragnea, Indiana University. "Single Virus Tracking: A Tale on Local Warming."

• Thomas O'Halloran, Northwestern University. "Dynamic Remodeling of the Copper and Zinc Metallome in Infectious Disease and Mammalian Development."

STAFF PROFILE

Our chair has three strong legs

by Kate Reck

The Department of Chemistry is successful due to the collection of staff who fill our offices and facilities. Without them, the department would cease to function.

At the center of this cooperative web of roles is the Chair's Office, which is often the face of the department to the outside world—students, parents, industrial collaborations, and private and corporate donors. While the chair's faculty identity usually changes every three years, the consistent personnel in the Chair's Office are an institution of knowledge, grace, and function. The warm individuals who make this office run smoothly and successfully are **Kathy Fisher**, **Judi Roberts**, and **Mary Swarthout**.

Kathy Fisher has been an administrative secretary in the office since 2000, Judi Roberts has been the chair's secretary since 1999, and Mary Swarthout hasbeen the chair's administrative assistant since 1989. With 44 years of combined experience in the chair's office, each one of these staff members has become effectively irreplaceable in their respective roles. They work as a well-honed team, and together they can, and do, accomplish anything put before them.

Kathy Fisher

Fisher, a Bloomington native, started working in the registrar's office in 1974 before everything was done with computers. In 1977, she transferred to the Department of Chemistry and took a position in the Graduate Office as secretary (the position now held by Dalane Anderson), a position she held for eight years.

In 1985, Fisher became a research secretary for Professor Paul Grieco. Much of her time was spent managing the group's accounts and preparing manuscripts as office technology was just coming into the computer age. When Grieco left the department for Montana in 1997, Fisher worked for Professor David Clemmer for three years. In both positions in the Graduate Office and as research secretary to faculty, she most enjoyed the interactions with the graduate students.

Fisher works mornings at present, spending her time on donor thank-you letters, typing up thousands of teaching evaluations, organizing faculty recruiting, and working in her favorite capacity—archiving. Building on her love of genealogy, she appreciates delving into the departmental archives when it is warranted.

Fisher enjoys watercolor painting, knitting, genealogy, and spending time with her husband, who recently retired from the IU electronics department. She has a son, two step-children (a son and a daughter), five step-grandchildren, and three cats.

Judi Roberts

Roberts is a native of Vancouver, Wash. She first came to Bloomington in 1974. After marrying in 1975 and while raising two children, Roberts worked in several diverse positions at IU—administrative assistant for the dean of admissions at the School of Law; page layout coordinator at the *Indiana Daily Student*, and at the first campus Wrubel Computing Center. Almost 20 years later after relocating back to Vancouver after a divorce, Roberts had the opportunity to go to college and earn a business degree. After graduating in 1997, she came back to Bloomington to be near her children and their growing families.

Roberts remarried in October of 1998. She and her husband enjoy a rich life outside work, traveling the country on motorcycles and participating in mission trips. This past summer (2010), they traveled more than 7,000 miles in two weeks on their Harley Davidsons for a visit to Vancouver. Heading west from Indiana, they ventured through sites such as Mesa Verde National Park, the Grand Canyon, Yosemite National Park, and the Golden Gate Bridge. They watched whales on the California Coast, enjoying the bounty of beaches missing in the midwest. When asked what she misses most about her childhood home, Roberts says she misses her family, the beaches, and hearing the sounds that accompany the shoreline. These trips out west rejuvenate those memories and sustain her until she can return for another visit.

Roberts has also participated on several mission trips, specifically to Kenya, Costa Rica, and Brazil. Her first trip to Nairobi, where she spent two weeks out in the bush, will remain her most memorable. Not only was the landscape completely disparate compared to the lush landscape of home, the poverty she saw there was overwhelming—it changed her forever, giving her a deeper perspective and appreciation of her life in Indiana. Her group's mission was to provide medical, dental, and eye care—in addition to food and clothing—and to share

their faith as they served the Masai people. The most unforgettable part of the visit was when two Kenyan sisters invited Roberts and her husband to their humble home (a small shack), serving their last scone with tea (chi), while they ate nothing. The sisters
were very touched by the group's aid and presence, and this was one way that they could show their gratefulness.

Roberts's giving spirit can be summed up by her favorite quote by Maya Angelou: "I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel." Roberts continually strives to make people feel welcome, loved, and respected.

Mary Swarthout

Swarthout grew up in Indianapolis. After graduating from high school, she studied elementary education, taking classes at IU Bloomington for one year before she transferred to the IU extension campus in Indianapolis (now known as IUPUI). After completing several classes and relocating back to Bloomington, she worked full-time as an operator and later as a supervisor at Indiana Bell. From 1967 to 1970, Swarthout worked as a research secretary for Microbiology Professor **Thomas Brock**. After marrying, she left the work force for a short time to raise her children. Returning in 1978, she joined the Department of Chemistry and worked for Professors **Gary Hieftje** and **John Hayes** until 1980. She continued on as research secretary for Hieftje from 1980 to 1988, at which time she took the position in the Chair's Office as the chair's secretary. She was promoted a year later to the administrative assistant role.

Swarthout has worked with seven faculty who've held the chair's position during her 22 years in the office. The hardest part, she says, is adjusting to new administration—passing on information and getting the new chair acclimated to the expectations and the academic timetable. Her duties have changed drastically over the past years, with the central integration of the computer and e-mail into daily functions.

Swarthout is an anchor in the department. When you don't know the answer to something, ask her, and she will know the answer 99% of the time. And if she doesn't, she will point you to the person who does. She is present for almost every function and is the last one to leave, making sure everything is done, cleaned up, and settled.

Swarthout has two children (a son and a daughter) and two grandchildren. In her spare time, she loves to travel to places such as Arizona—where her son is working on his doctorate—hiking in the remote hills and mountains of Utah, and more recently, visiting Germany and the beautiful historic museums and vineyards of France. She also enjoys sewing and gardening.

When Fisher, Roberts, and Swarthout were asked what they like best about their jobs, the unanimous answer was "the people." All three agree that they enjoy the people in the deaprtment and the diversity of cultures. "It's nice to know that the people in the department really care about each other and are willing to help out when necessary," says Roberts.

What has changed most about their jobs over the years? All three say that the technology and the arrival of computers mandates that they stay current and learn new skills constantly. Although their skill sets have had to adapt and change with the onset of technology, it is evident they have been up to the challenge. Likewise, the pace of has become more rapid with the increase in communication and the intensity of the issues needing to be addressed "yesterday."

Courtesy Kate Reck

Judi Roberts, Mary Swarthout, and Kathy Fisher

Fisher, Roberts, and Swarthout have contributed to the department for a great many years, and most of that service has been spent in the Chair's Office. A vast amount of knowledge is catalogued in their brains—information that is only gained through years of experience.

When you walk into the Chair's Office, you know you will always get help and a smile, whatever the situation or need.

STAFF NEWS

Due to reorganization of the departmental advisor positions, **Shawn Adrian**'s position (chemistry advisor) was moved to the College of Arts and Sciences on Sept. 1, 2009. Adrian left the University in October 2009 and Carly Friedman was hired in November 2009 as his replacement.

Abdullah Mohammed was hired as an electronics engineer specialist in the Electronic Instruments Service. Mohammed came to Bloomington from Boca Raton, Fla. He received a B.S. in electrical engineering (2006) from Osmana University (India) and an M.S. in electrical engineering (2008) from Wright State University. Mohammed has worked for several companies over the past few years as a contract FPGA engineer/test analyst for Technisource, Valco Cincinnati, and Orbit Solutions.

Aulaire Schmitz was hired as a lecture demo technician in the undergraduate teaching labs (replacing Jacqueline (Wozniak) Vasseur). Schmitz received her BA in chemistry from Gustavus Adolphus College in St. Peter, Minn. She is currently working toward the completion of a master's degree in organic chemistry in David Williams's laboratory. She has AI experience at Indiana University for C343 and C344 organic laboratory courses, which provides her with the skills and knowledge required for working in the undergraduate labs.

Selina Williams was hired as the administrative secretary to Professor Hieftje (replacing Melanie Zumhingst). Williams transferred from the Physics Department, where she worked as a secretary. She served in the U.S. Air Force, worked as an administrative assistant, office automation clerk, and paraprofessional while living in England, Iceland, Japan, and Germany. Williams and her family moved to Bloomington in 2008 after her husband retired from the Air Force.

Tiffany Yoder was hired as the administrative secretary to Dr. Ortoleva (replacing Margaret Jensen). Tiffany is from LaGrange, Ind., where she worked as a staff reported on the *News-Sun*. She worked as a reporter for the *Herald-Republican* in 2007 in Angola, Ind. She received her B.A. in journalism from Indiana University in August of 2007.

Rosalee Burchfield was hired as a full-time electronic technician in the Electronic Instruments Service. Burchfield worked as an hourly in the Electronic Instruments Service in the Department of Chemistry since October of 2003. She received her AAS in electronics from Ivy Tech State College in 2004.

Kylie McFarland was hired as a lecture demo technician in the undergraduate teaching labs (replacing Erick Pasciak, who joined our chemistry graduate program in the fall of 2010). McFarland earned a B.S. in biology, and minors in chemistry and criminal justice, in May of 2010 from Indiana University. McFarland gained experience in laboratory preparation while working as a lab preparation assistant in the Department of Chemistry since August of 2006.

Linda Cage has been hired as the office services assistant (previously held by Julia Rhodes) in the Chemistry Business Office. Cage has been working hourly in the Business Office since September of 2009. Previously, she worked in Chemistry Requisitions as an assistant to Susie Dumond. Cage is a native of Bloomington and earned her associates degree in accounting from Indiana University in 1978.

Service Recognition

10 years: David Felker and Jeannette Silvers

15 years: Susie DuMond

25 years: Gary Fleener and Toni Lady

30 years: Jack Baker and Gayla Bradfield

35 years: Kathy Fisher and Mary Swarthout

2010 Staff Award Recipients

David Felker, Information Technology Group

Judi Roberts, Chair's Office

Retired

John Cramer

Leaving the Department

Shawn Adrian

Selina Williams

GRADUATE NEWS

During the 2009–2010 school year, Professor **Jack Crandall** was the director of Graduate Studies. Serving with him on the Standards Committee were professors **Richard Di Marchi**, **Bogdan Dragnea**, **Caroline Jarrold**, **Dennis Peters**, **Michael Van Nieuwenhze**, and **Dongwhan Lee**. **Stephen Jacobson** chaired the Graduate Admissions Committee.

Evaluating the hundreds of dossiers submitted to the department were professors Dongwhan Lee, Lane Baker, Erin Carlson, Charles Dann III, Sarah Skrabalak, Steven Tait, Silas Cook, and Michael Van Nieuwenhze.

2009–2010 Fellowship Awards

• **Soumya Ghosh** was awarded the Chester Davis Inorganic Fellowship. He joined the lab of Mu-Hyun Baik in the fall of 2007.

• **Pucheng Ke** was awarded the Chester Davis Organic Fellowship. He joined the lab of David Williams in the fall of 2006.

• **Nicholas Mayhall** was awarded the Richard Slagle Fellowship. He joined the lab of Krishnan Raghavachari in the fall of 2006.

• **Pablo Garcia-Reynaga** was awarded the Lilly Organic Fellowship. He joined the lab of Michael Van Nieuwenhze in the fall of 2006.

• **Bruce Atwater** was awarded the Lilly Organic Fellowship. He joined the lab of David Williams in the fall of 2006.

• **Yuran Hua** was awarded the Raymond Siedle Materials Fellowship. He joined the lab of Amar Flood in the fall of 2005.

• **David Rothgeb** was awarded the E.M. Kratz Fellowship. He joined the lab of Caroline Jarrold in the fall of 2006.

• **Amanda Peterson** was awarded the Raymond Siedle Inorganic Fellowship. She joined the lab of Sara Skrabalak in the fall of 2007.

• **Ruogu Peng** was awarded the Marvin Carmack Fellowship. He joined the lab of Michael Van Nieuwenhze in the fall of 2007.

• **Mario Vieweger** was awarded the Dissertation Fellowship through the College of Arts and Sciences. He joined the lab of Bogdan Dragnea in the fall of 2006.

• **Matthew Lauber** was awarded the Kraft Fellowship. Matthew joined the lab of Dr. James P. Reilly in the fall 2007.

• Women in Science Fellowship recipients were **Meghan Mulcrone** and **Joan Walker**.

Other fellowship recipients were: **Brian Finan** and **Shujiang Cheng**, Linda & Jack Gill Fellowship; **Jeremy Felton**, **Lindsey Fischer**, **Alicia Friedman**, **Justin Luebke**, **Paul Gladen**, **Akshay Shah**, **Fese Mokube**, **Keith Searles**, **Lesley Sevcik**, **Ashley Sidebottom**, and **Elizabeth Siegel**, Deans Allocation Fellowship; **Ryan Biczo**, Mann Fellowship; **Edward Hall**, Paget Fellowship; **Irma Hamilton**, Mays Fellowship; **Andrey Malyutin**, Wentworth Fellowship; **Mallory Mueller**, Bill Carroll Fellowship; **Zachary Poulos**, Abbott Fellowship; **Srinivas Tekkam**, Berk Fellowship; **Elise Dennis**, **Deven Shinholt**, **Andrew Storey**, **Elizabeth Wagoner**, and **Andrew Wilkens**, Metacyt Chemistry Fellowship; **Jacob Shelley**, CAID Fellowship, **Ben Kester** and **Vincent Waldman**, NIH Training Grant Fellowship; and **Leigh Boerner**, McCormick Science Fellowship.

(continued on page 20)


Soumya Ghosh


Ruogu Peng


Pucheng Ke


Mario Vieweger


Bruce Atwater


Matt Lauber


Yuran Hua


Meghan Mulcrone


David Rothgeb


Joan Walker


Amanda Peterson

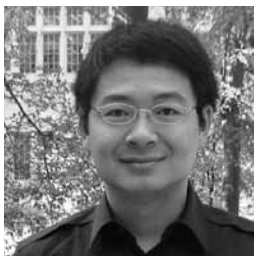

Darci Trader

All photos taken by Toni Lady or Dalane Anderson

GRADUATE NEWS

(continued from page 19)

Chiao-chen Chen



Wenjun Liu

Rui Chen

Kevin McDonald

Rashid Zakeri

Research and University Graduate School Fellowships were awarded to **Christopher Benson**, **Ryan Biczo**, **René Buell**, **Elise Dennis**, **Christopher DeSantis**, **Lee Elrod**, **Jeffrey Everett**, **Jeremy Felton**, **Lindsey Fischer**, **Alicia Friedman**, **Benjamin Gamoke**, **Puja Gandhi**, **Edward Hall**, **Irma Hamilton**, **Zachary Harms**, **Alica Hui**, **Lauren Kacz**, **Brittany Kish**, **Amanda Lear**, **Junjie Li**, **Sarah Lindahl**, **Justin Luebke**, **Andrew Malyutin**, **Brendan Monks**, **Kirstin Morton**, **Mallory Mueller**, **Meghan Mulcrone**, **Kevin Pfeuffer**, **Zachary Poulos**, **Keith Searles**, **Lesley Sevcik**, **Devin Shinholt**, **Ashley Sidebottom**, **Elizabeth Siegel**, **Andrew Storey**, **Lauren Strawsine**, **Srinivas Tekkam**, **Abraham Verdoes**, **Elizabeth Wagoner**, **Joan Walker**, **Nathaniel Webber**, **Kaelyn Wilke**, **Andrew Wilkens**, and **Steven Zucker**.

Annual Chemistry Department Award Winners

At the Chemistry Honors Banquet in April of 2010, the following students were honored.

• E. Campaigne C500 Award: **Darci Trader**

• Eli Lilly Analytical Award: **Chiao-Chen Chen**

• Wendell P. Metzner Memorial Award: **Ruogu Peng**

• William H. Nebergall Memorial Award: **Wenjun Liu**

• Felix Haurowitz Award: **Sarah Keane**

• Henry R. Mahler Award: **Rui Chen**

• David A Rothrock Award: **Yuran Hua**

• Associate Instructor Awards: **Rui Chen**, **Kevin McDonald**, **Meghan Mulcrone**, **Joan Walker**, and **Rashid Zakeri**

Congratulations, graduates!

PhD

• Debashis Adhikari (inorganic, Mindiola, August 2009)
Postdoc, Northwestern University

• Stella Aniagyei (analytical, Dragnea, November 2009)
Postdoc, Indiana University, Biology

• Suraj Dixit (physical, Dragnea, December 2009)
Postdoc, Florida State University

• Margaret Donoghue (analytical, Jacobson, April 2010)
Postdoc, University of Minnesota

• Christopher DuFort (analytical, Dragnea, December 2009)
Postdoc, University of California

• Glen Ferguson (physical, Raghavachari, February 2010)
Postdoc, Argonne National Lab

• Matthew Foley (analytical, Peters, November 2009)
Assistant Professor, U.S. Naval Academy

• Tae-Young Kim (analytical, Reilly, October 2009)
Postdoc, California Institution of Technology

• Michelle Kovarik (analytical, Jacobson, October 2009)
Postdoc, University of North Carolina

• Yogita Mantri (biological, Baik, November 2009)

• Samuel Merenbloom (analytical, Clemmer, November 2009)
Postdoc, University of California Berkeley

• Yinglong Miao (physical, Ortoleva, August 2009)
Postdoc, University of Tennessee, Oak Ridge National Lab

• Kun Qu (physical, Ortoleva, February 2010)

• Justin Riddle (organic, Lee, August 2009)
Senior Research Chemist, 3M Company

• Duane Rogers (analytical, Hieftje, September 2009)
Postdoc, Naval Research Laboratory

• Gregory Schilling (analytical, Hieftje, August 2009)
Chemist, LECO Corporation

• Anne Starace (physical, M. Jarrold, May 2010)

• Isaiah Sumner (physical, Iyengar, February 2010)
Postdoc, University of Chicago

• Amy Walstrom (inorganic, Caulton, December 2009)
Postdoc, National Renewable Energy Lab

• Liangyi Zhang (analytical, Reilly, December 2009)
Postdoc, Genentech Inc.

MS

• Ming Lei (analytical, Novotny, July 2009)
Associate Scientist, Life Technologies

MAT

• Justin Orlando (May, 2010)
High school teacher, New Hampshire

All photos taken by Toni Lady or Dalane Anderson

A summer internship in Beijing

Anastasia Yesnik was chosen to represent Indiana University for a prestigious summer internship with Beijing Honglin Pharmaceutical Company Ltd. in Huairou, Beijing Province, China.

Yesnik was one of many that applied for the internship through the Hutton Honors College. She interviewed with Dean Matthew Auer. Ultimately, she was selected personally by Mr. Simon Goe—the owner of Beijing Honglin Pharmaceutical Ltd. and a Kelley School of Business graduate—to be the first intern from the United States in his laboratory and the sole representative of Indiana University.

Yesnik worked in the Quality Control Department from 8 a.m. to 6 p.m. for five to seven days a week during her internship, which ran from late May to early August. Her main role was to validate medications synthesized on-site at the company by conducting analytical experiments in the physical chemistry laboratory. Beijing Honglin Pharmaceutical Company creates a wide variety of drugs that include those used for high blood pressure, depression, muscle pain relief, acid reflux, symptoms of the common cold, and diabetes.

To validate the drugs, many analytical instruments were used every day, such as High Performance Liquid Chromatography (HPLC), Ultraviolet Spectroscopy (UV Spec), Gas Chromatography (GC), and dissolution apparatuses. Yesnik felt well-prepared for this pharmaceutical internship thanks to her excellent background in chemistry from IU.

Each day, Yesnik would work with one particular batch of medication and perform multiple validation experiments on the pills or capsules. Validation of a particular drug involved multiple analyses, including those for content, impurity, dissolution, and potency of the active ingredients over time in a high- temperature, high-humidity environment. The dissolution tests were a critical component of the overall validation of a particular batch because they simulate how a drug is dissolved over time in a gastric-like solution. The dissolution tests would have a series of time points, usually 1 h, 2 h, 4 h, 6 h, and 12 h, at which Yesnik would take a filtered 1.5 mL or 5 mL sample of the dissolved drug to analyze using HPLC or UV, respectively.

The filtered samples would be compared against a standard sample (using HPLC or GC) she had prepared earlier in the day to ensure the active ingredients present in each tablet were within the same 5% concentration. Following the detailed protocol required for validating the medications and working as part of a professional team gave Yesnik the valuable opportunity to practice the strict laboratory procedures necessary in an industrial pharmaceutical setting.

Photo courtesy Anna Yesnik

Anastasia Yesnik and the Great Wall of China

"I am so grateful for this once-in-a-lifetime opportunity to intern with Beijing Honglin Pharmaceutical Company and be fully immersed in a new culture," Yesnik said. "I had an incredible internship, and I learned so much about validation in analytical laboratories. Living and working in Huairou for the entire summer offered me the rare chance to experience first-hand the daily life, rich traditions, breathtaking sights, and complex language of China. All of my colleagues were so supportive, and I made some lifelong friends. I feel so lucky to have had this exceptional internship, where I was constantly learning about the fascinating Chinese culture and gaining countless new laboratory skills."

Some of the places Yesnik visited during her stay included the Great Wall of China, the Forbidden City, Tiananmen Square, the Beijing Olympic Green, Summer Palace, and Hongluo Temple. During her stay, she celebrated the three-day Dragon Boat Festival in the He Bei Province, where her manager's family taught her how to make traditional Chinese dishes such as dumplings and noodles.

Yesnik's colleagues commented that she learned Chinese very quickly and by the end of her internship she had become quite proficient, even capable of discussing some of the basic scientific protocol in Chinese. Yesnik plans to continue studying the Mandarin language and hopes to return to China again one day.

Anastasia Yesnik is a senior from Crawfordsville, Ind., and is in the College of Arts and Sciences majoring in chemistry and Spanish (honors thesis completed in May 2010). She has more than three years of research experience in the Ortoleva Laboratory in the Department of Chemistry. Her research has culminated in two scientific publications: "Splicing-Alternative Regulatory Network (SARN) Reconstruction from Exon Array Data" in the Journal of Theoretical Biology and "Multiscale Analytic Continuation Approach to Nanosystem Simulation: Applications to Virus Electrostatics" in the Journal of Chemical Physics.

Her involvements include the vice president and diversity chair of the Honors Student Organization; coordinator of and volunteer in the IU-ER Volunteer Program at Bloomington Hospital; instructor of "Bienvenidos" (a positive mental health class taught entirely in Spanish for immigrants from Spanish-speaking countries); medical interpreter for physicians/pharmacists on the 2009 Timmy Foundation medical brigade to Quito, Ecuador; member of IU STARS (Science Technology and Research Scholars); IFLE Research Program participant; Undergraduate Coordinator of and three-year participant in the Hutton Honors College Undergraduate Research Symposium; and an intern at the Walter Reed Army Institute of Research Pathology Division in the summer of 2009. Anastasia is an Eli Lilly Scholar and a Hutton Honors College Della J. Evans Scholar. After graduating from IU in May 2011, she plans to attend medical school and volunteer for Doctors Without Borders as a bilingual physician in underserved regions around the world.

A semester abroad at Oxford

by Esther Uduehi

Oxford, England is home to more than 30,000 students and holds a worldwide reputation as being a first-class epicenter for learning and intellectual development. With plenty to do at the various museums, theatres, cinemas, cafés, and pubs throughout the city, students find a multitude of cultural events when not focused on their studies. Another advantage to studying at The University of Oxford is that students are centrally located to the rest of England.

Due to the difficulty in articulating chemistry classes between the two curricula, chemistry and biochemistry students from Indiana University have not studied at The University of Oxford previously. Esther Uduehi broke new ground as the first IU biochemistry major to study at at Oxford, the first of what we hope will be many in future years. This fall, Esther was one of 32 students nationwide to be awarded the 2010 Rhodes Scholarship. This honor allows her to pursue a D.Phil. in chemistry at Oxford University.

"My time at Oxford seemed too short, but the memories and friendships made will last a lifetime."

Since high school, I had wanted to study abroad at Oxford University. As soon as I heard about the opportunity, I jumped at the chance to study chemistry and biochemistry at St. Edmund Hall ("Teddy Hall") at Oxford. The tutorial system provided a unique learning experience. I had individual meetings once a week with professors, where we discussed specific homework topics. I enjoyed learning in this one-on-one environment. There was much freedom in the way I chose to tackle scientific topics, which is quite different than the American university system.

I was fortunate to have an additional educational experience, through participating in research. In the Harry Anderson group, I attended weekly group meetings and performed organic synthesis reactions as a part of a fourth-year undergraduate's project.

Living with Oxford students enriched the cultural experience and provided easier integration into the "Oxfordian lifestyle." I bought a not-so-normal bicycle, nicknamed "Sir Spring-a-Lot," which always kept bike rides interesting. It was not difficult to find ways to occupy my time. With hundreds of clubs and organizations to choose from, I joined the Gastronomy Club, the Teddy Hall Alternative Choir, and the Teddy Hall football (soccer) team. Surprisingly, administrators at Oxford were rather adept to American traditions. They hosted a five-course thanksgiving dinner, complete with singing Christmas carols and performing (an abridged) *A Charlie Brown's Thanksgiving* play. There was an end-of-the-term Christmas dinner, where we all sang English Christmas songs and the traditional English pudding!

Photo courtesy Esther Uduehi

Esther Uduehi and "Sir Spring-a-Lot"

I also saw where *Harry Potter* was filmed. One very special experience for me was that I met my favorite fashion designer, Diane von Furstenberg.Oxford hosted several great speakers and lecturers, and I found it very difficult to attend most of them.

All in all, my time at Oxford seemed too short, but the memories and friendships made will last a lifetime.

Esther Uduehi is a senior from Evansville, Ind., and in the College of Arts and Sciences majoring in biochemistry and mathematics. Her involvements include the IU Presidential Intern, co-founder and president of the IU Minority Association of Pre-Medical Students (MAPS), vice-president of the Board of Aeons, IUSA diversity director, co-founder of the IU Photography Society, Alpha Chi Sigma Chemistry Fraternity, IU Art Museum docent, and secretary of the National Organization of Black Chemists and Chemical Engineers.

She is a Wells Scholar, McNair Scholar, a member of Phi Beta Kappa, and a member of the Hutton Honors College. After graduating from IU, Esther will use her Rhodes Scholarship tp pursue a D.Phil. in chemistry at Oxford.

UNDERGRADUATE NEWS

We were pleased to add 112 new alumni to the department during the 2009–2010 academic year, as 25 chemistry B.S. degrees, 23 biochemistry B.S. degrees, 48 chemistry B.A. degrees, and 16 biochemistry B.A. degrees were awarded to our students. As always, many of our graduates are employed in industry, while many others are continuing their education through graduate programs that include research or the health professions.

Our department continues to attract and retain high quality students. More than 140 students were honored at the 2009–2010 Honors Banquet, including 83 students on the Honor Roll, 22 students inducted into Phi Beta Kappa, and other academic scholarship and award recipients. The fall 2010 semester will see 57 students directly admitted to the department based on their strong high school academic performance and interest in pursuing a biochemistry or chemistry major. Students continue to work with faculty mentors in their research groups (C409 research credit) as a method of gaining invaluable experience in the field.

During fall, spring, and summer semesters, 54 students received academic credit for their research. In the spring semester of 2010, we held out first G410: Senior Thesis Research Symposium, where six graduating seniors (Amy Dreischerf, Travis Graham, AshaJamzadeh, Jason Johnson, Kyle Mandla, and Kristen Reeder) presented their senior theses research to an audience of faculty members, undergraduate students, and graduate students. The symposium culminated with a lunch at the Uptown Café with speakers, advisors, and family members.

Additionally, several talented students continue to enhance their leadership skills in the roles of departmental tutors in the evenings on Sunday, Monday, and Wednesday nights from 6:30 to 9:30 p.m., providing help for both general and organic chemistry. Furthermore, we have had several students apply for G499: Internship in Chemical Instruction, where undergraduates work with a faculty member to teach a discussion section or lab section, acting as an undergraduate associate instructor (UAI). Students who have participated as a UAI is rewarding and a good learning experience, and that teaching reinforces their knowledge.

Photo courtesy Kate Reck

Senior Honors Research Symposium seniors: Kristen Reeder, Kyle Mandla, Travis Graham, Jason Johnson, Amy Dreischerf, and Asha Jamzadeh

Recently, our department has been focusing efforts on finding methods for more majors to pursue overseas studies. Science majors, especially biochemistry and chemistry majors, find it particularly challenging to find room in their schedules to pursue overseas studies. Often, students can only pursue non-science courses abroad, and it's especially difficult to design a semester where no science courses are needed in a student's schedule. We have been working with foreign universities to get science coursework to articulate well enough for our students to take coursework that applies to the major while abroad. In this issue of the magazine, we have highlighted two department majors who have successfully participated in unique overseas experiences. We hope to continue to foster these experiences for our majors in the future.

One such successful experience was for biochemistry major Esther Uduehi, who spent the fall semester 2009 studying at Oxford University. She successfully completed three chemistry courses (two physical chemistry lectures and one biochemistry lecture) through the Oxford tutorial system, a system that is very different from the U.S. system. She was the first biochemistry major to take chemistry courses abroad at Oxford University (see full story on page 22).

Biochemistry major Anastasia Yesnik was chosen among dozens of applicants to pursue a competitive internship in China for 10 weeks in the summer of 2010. Her experience gave her the experience of working in an industrial global setting and traveling abroad in Beijing (see full story on page 21).

Students love being a part of the Department of Chemistry at Indiana University. Whether it is providing academic or career advice, taking the time to listen to questions or concerns, or celebrating with barbeques or ice cream socials, our faculty and staff let students know that they have their support.

Chemistry Honor Roll

The following chemistry and biochemistry majors attained an overall grade point average of 3.7 or better through the fall 2009 semester.

Class of 2010 (Senior) Honor Roll: Tyler Grant Atkins, Thomas Everett Balestri, Emilia Jean Blaser, Anthony David Bowen, Rachael Renae Burchfield, Samuel Louis Corey II, Kathryn Anne Dickerson, Graham Scott Erwin, Brett Renner Finkelmeier, Kate Elizabeth Goeller, Lindsey Nikoa Grabek, Travis Austin Graham, Abby McCain Howenstein, Asha Esfandyar Jamzadeh, Katherine Jane Kaplar, Nathan Ryan McAninch, Stephen Kyle Mendenhall, Kaitlyn Elizabeth Neumann, Robert Cramer Pease, Lauren Kathleen Reckley, Elizabeth Esther Siegel, Madhavi Singhal, Charlene Marie Steiner

Class of 2011 (Junior) Honor Roll: Jessie Elizabeth Atkinson, Bryant Lee Barrett, Lani Beams, Kirk Edward Cahill, LarryDean Davis Jr, Lauren Elizabeth Evenson, Brian Francis Fisher, Kathryn Rachelle Geiger, Daniel Mark Hostrander, Alexei A. Krainev, Greg Lawrence Lackner, Bryan Robert Lanning, Shona Marie Lee, Anne Noelle McLaren, Alexandra Joanna Mims,

(continued on page 24)

UNDERGRADUATE NEWS

(continued from page 23)

Nicholas Kelley Molby, Brenda Ng, Christi Dionne Perkins, Zachary J Plummer, Adam Thomas Ramey, Jeffrey Remster, Madeline Riffle, Lauren Santiesteban, Katherine Seat, Jeong Ho Seo, Sonja Skljarevski, Eric Skorupa, Douglas Snyder, Aaron Sue, Esther Uduehi, Juan Velez-Valencia, Matthew Watson, Cody Weaver, Mackenzie Weaver, Tommy Wilson, Anastasia Yesnik, Ryan Zipper, Mary Zorn

Class of 2012 (Sophomore) Honor Roll: Aleksander Alavanja, David Armes, Edwin Becher III, Stefanie Beidelman, Kyle Brown, Arefin Chowdhury, Quinn Easter, Omar Elsheikh, Jeremy Hage, Zachary Hallberg, William Remington Howard, Risa Hurwich, Samuel Kasmark, Neil Keshvani, Kyuwon Kim, Kyle Kleist, Mohineesh Kumar, Grant Lin, Nicholas McColley, Eric Scripture, AnjaSkljarevski, Isaiah Steffen, Theodore Timothy

Class of 2013 (Freshman) Honor Roll: Sukriti Bansal, Clark Baumberger, Nielson Baxter, William C. E. Berry, Stacy Blank, Matthew Bower, Melissa Burger, Bryce Burton, Andrew Carlsgaard, Kevin Chaung, Ryan Clodfelter, Matthew Colin, Trevor Crafts, Ariel Dodrill, Taylor Eagan, Lisa Nicole Frank, Rachel Frantz, Shawn Gabriel, Julie Ghekas, Kent Griffith, Logan Guckien, Nicholas Hidalgo, Hailey Holland, Eric Jarrett, Ryan Kessens, KelseyJean Lawrence, Joseph Maginot, Christopher Mattson, Terra Mauer, Timothy D. McCall, Adrienne Meier, Priyanka Parekh, James Rizkalla, Jared Salisbury, Rebecca Reed Schwab, Gwen Seamon, Sung Hyun Seo, Christopher Thomas, Henry Thomas, Joseph Thomas, William Tilbury, Max Wallace, Omid Zolali-Meybodi

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.

Amy Dreischerf, Graham Scott Erwin, Travis Austin Graham, Asha Esfandyar Jamzadeh, Kyle Mandla

Departmental Scholarships & Awards

C117 Award: Kevin Chaung

S117 Award: Chris Mattson

C341 Award: Kristin Hines

American Chemical Society Awards: Anthony Bowen, Stephen Mendenhall, Chris Than

Keith Ault Scholarship: Kate Goeller

William H. Bell Awards: Alexei Krainev, Christi Perkins, Sonja Skljarevski

John H. BillmanSummer Scholarship: Vincent Bottomley

Harry G. Day Summer Scholarships: Jessie Atkinson, Kyle McWilliams, Alexandra Mims, Esther Uduehi, George Venious, Anastasia Yesnik

Dr. & Mrs. Harlan English Scholarship: Brian Fisher

Courson Greeves Scholarship: Daniel Hostrander

R. J. Grim Memorial Scholarships: Kyle Brown, Bryan Lanning, Grant Lin, Lauren Santiesteban, Madhavi Singhal, Mary Kala Zorn

Russel Leo &Trula Sidwell Hardy Scholarship: Zachary Hallberg

Hutton Honors College Summer Research Grants: Jessie Atkinson, Kyle McWilliams, Alexandra Mims, Esther Uduehi, George Venious, Anastasia Yesnik

Hypercube Scholar Award: Emilia Blaser

Ira E. Lee Memorial Fund in Chemistry: Rachael Al-Saadon Hall, Kent Griffith

Andrew Loh Scholarship for Analytical Chemistry: Jessie Atkinson

Frank Mathers Undergraduate Summer Research Scholarships: Joseph Rheinhardt, Nathan Spahn, Tyler Stanage

John H. & Dorothy McKenzie Scholarship: Anastasia Yesnik

Merck Index Awards: Travis Graham, Derek Zipkin

Dennis G. Peters Scholarships: Kirk Cahill, Joseph Rheinhardt

William G. Roessler Scholarship: Madeline Riffle

Joseph B. Schwartzkopf Award: Graham Erwin

Earl G. SturdevantSummer Research Scholarship: Christi Perkins

Enola Rentschler Van Valer Trafford Scholarship Awards: Elizabeth Siegel, Esther Uduehi

Viola Scholarship in Nuclear Chemistry: Tom Balestri

Verling & Elizabeth Votaw Undergraduate Summer Research Award: Joseph Thomas

Francis & Mildred (Eckerty) Whitacre Scholarships: Kent Griffith, Chris Mattson

James C. White Award: Asha Jamzadeh

Mary Frechtling White Award: Emilia Blaser

Phi Beta Kappa Fall & Spring Inductees

Tyler Grant Atkins, Thomas Everett Balestri, Emilia Jean Blaser, Anthony David Bowen, Matthew Steven Eskew, Megan Michele Farrell, Brett Renner Finkelmeier, Kate Elizabeth Goeller, Travis Austin Graham, Elizabeth Esther Siegel, Madhavi Singhal, Charlene Marie Steiner, Esther OluchukwuUdehi, Jessie Elizabeth Atkinson, Lani Beams, Samuel Louis Corey II, Kathryn Anne Dickerson, Graham Scott Erwin, Stephen Kyle Mendenhall, Robert Cramer Pease, Lauren Kathleen Reckley, Tommy John Wilson

GRADUATION 2010

Chadon Photography

Photo Courtesy William Unrue

1) Professor Kate Reck 2) Professor Charles E Dann III 3) Professor Michael Edwards
4) Professor Romualdo de Souza 5) Professor Dennis Peters 6) Professor Jeff Zaleski
7) Professor Andrea Pellerito 8) Professor Todd Stone 9) Professor Jill Robinson
10) Professor Norman Dean 11) Emilia Blaser 12) Madhavi Singhal 13) Jonathan Brosmer
14) Elizabeth Siegel 15) Teela Wyman 16) Bethany Burrell 17) Kathleen Gifford
18) Phillip Drayton 19) Asha Jamzadeh 20) Maureen Quigley 21) Derek Zipkin 22) Kristin Reeder
23) Kaelyn Brown 24) Garrett Alexander 25) Kaitlyn Newmann 26) Rachel Wall 27) Kathryn Lilly
28) Stephanie Davenport 29) Kevin Smolar 30) Tyler Atkins 31) Eric Cox 32) Joanna Lucas
33) Alice Cui 34) Anthony Bowen 35) Adam Clark 36) Travis Graham 37) Lindsey Grabek
38) Nam Nguyen 39) Nada Alakhras 40) Hannah Lewis 41) Cassie Taylor 42) Christopher Than
43) Stephen Mendenhall 44) Chad Warkentien 45) Chelsey McCory 46) Saud Rana 47) Kurt Drury
48) Amit Pithadia 49) Ethan Sperry 50) Kathryn Dickerson 51) Suzanne Spinola
52) Graham Erwin 53) Kyle Mandla 54) Eric Pozsgai 55) Robert Pease 56) Sam Corey II

Our future Marie Curies: Women in Chemistry 2010

by Erin Carlson and Sara Skrabalak

Photo courtesy Erin Carlson

WiChem members visit Butler Winery for a tour and wine tasting.

The IU organization Women in Chemistry (WiChem) seeks to encourage dialog and empower students, postdoctoral researchers, and faculty, as well as facilitate community-building within and among scientific divisions, academic ranks, and gender. These goals are being accomplished through a combination of formal and informal events and programs.

For example, WiChem sponsors summer research fellowships for outstanding undergraduates from underrepresented groups. In 2010, these summer stipends ($1,000 each) were awarded to undergraduate researchers **Christi Perkins** and **Esther Uduehi**, of the research groups of **Peter Ortoleva** and **Amar Flood**, respectively.

These stipends enabled undergraduate students to participate in research over the summer, allowing them to gain valuable laboratory experience. They also facilitate relations with graduate students, postdoctoral researchers, and faculty. We hope that these stipends will encourage undergraduate students from underrepresented groups to continue their chemistry training as graduates. WiChem also established travel awards ($1,000 each) for postdoctoral researchers and graduate students to facilitate attendance of scientific conferences.

In 2010, five travel grants were awarded to the following outstanding graduate students and postdoctoral associates: **Indrani Bhattacharyya**, **Jiyoung Jung**, **Sarah Keane**, **Meghan Mulcrone**, and **Elizabeth Opsitnick**. The opportunity to present their work at a professional conference will not only enhance the communication skills of these exceptional female chemists but will help them establish networking relationships likely to be critical later in their careers.

As one awardee remarked in her award summary: "I was able to discuss my work with several leading scientists and found this to be the most open forum of any conference I have attended. I saw several professors that were at other conferences, but this meeting provided a much more open dialogue between students and professors, as well as students from different universities. In talking with a variety of professors, I received good advice about how to proceed in my academic future—how to make the best choices to give me the best chances of landing the job of my dreams."

During the 2009–2010 academic year, we also initiated a WIChem-sponsored seminar series to invite prominent female scientists from academia and industry, who were selected by a committee of students, postdoctoral researchers, and faculty. The invitees were encouraged to lecture on a topic of broad interest not only to the department but to other science departments at IU. Nicole Sampson from the State University of New York at Stony Brook and Teri Odom from Northwestern University were the inaugural speakers in this seminar series. Each speaker spent half of their day on campus with graduate students and postdoctoral scholars, who were given the opportunity to present their research and network.

WiChem is also committed to providing career-development opportunities to the department. This past year, we hosted an evening event titled, "Introduction to the Postdoctoral Application Process: Perspectives on the Search for a Position," where graduate students had the opportunity to discuss the application and selection process with current postdoctoral scholars and faculty members. More than 35 students, both women and men, attended this event, making it a huge success.

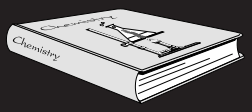
Finally, women of the department are encouraged to get to know one another through informal gather-

"The year 2011 is the International Chemistry Year and marks the 100th anniversary of the award of the chemistry Nobel Prize to Marie Curie. Curie was the first woman to be awarded a Nobel Prize and the first person honored with two Nobel Prizes—in physics and chemistry."

ings hosted by WiChem. Recent events included a potluck dinner, a tour and tasting at Butler Winery (see photo) and the annual family-friendly picnic at Bryan Park.

The year 2011 is the International Chemistry Year and marks the 100th anniversary of the award of the chemistry Nobel Prize to Marie Curie. Curie was the first woman to be awarded a Nobel Prize and the first person honored with two Nobel Prizes—in physics and chemistry. This anniversary provides an exceptional opportunity to educate the public and the IU community about Marie Curie and her extraordinary contributions to chemistry.

In collaboration with the local chapter of the ACS (SISACS), WiChem plans to host an event that will include a short lecture about her scientific accomplishments and a screening of the film *Madame Curie* (1943) at a local theater. Please keep an eye out for this exciting event, and join us in Bloomington to learn more about the many contributions of women, both past and present, to the field of chemistry!



LIBRARY NEWS

Apprentices and e-books on the rise

Tiea Julian continues as branch coordinator while assistant librarian **Brian Winterman** and I continue to split our time between the Chemistry Library and the Life Sciences Library. Brian Winterman's duties have expanded recently, and he spends more of his time in the Wells Library working as the information fluency and assessment librarian.

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 graduate assistant is **Yuening Zhang**, who will continue working with us until the end of the 2010 fall semester. Yuening was awarded the 2010 Lucille M. Wert Scholarship. This award is administered by the Division of Chemical Information of the American Chemical Society and is designed to help persons with an interest in the field of chemical information.

In 2011, **Elsa Alvaro** will be with us. Alvaro will also receive the IU Davis/Davis Fellowship. She has an M.S. and Ph.D. in chemistry from Spain. She is currently doing a postdoc at the University of Illinois and wants to be a chemistry librarian. **Lisa Shelling**, our SLIS graduate assistant in 2009, is now the GIS librarian at the University of Wisconsin–Milwaukee.

Jacquelyn "Jakki" Petzold was our SLIS graduate assistant for 2007–08. After a stint as the chemistry and biology librarian at the University of Nebraska, she is back at IU as a Ph.D. student in biology for the fall 2010 semester.

The economic downturn has affected libraries, too. Our materials budget that funds our journals, books, and databases was flat in FY2010, but we received a 2% increase for FY2011. Journal cancelations and lower than expected price increases in FY2010 paid off and have allowed us some flexibility to purchase new items. Some additions include added subscriptions to the Royal Society of Chemistry journals. One of the new titles is *Metallomics*. **Jeff Zaleski** and **Gary Hieftje** are on the Editorial and Advisory Board of this journal. Our offering of electronic books has increased greatly in the last couple of years, and the library is purchasing fewer print books. The IU Bloomington libraries have access to Springer e-books from 2005 to 2010, Wiley e-books from 2007 to 2010, Elsevier titles from 2008 to 2012, and RSC e-books from 1968 to 2010. Yuening Zhang and I plan to conduct a user survey this fall to determine how well our library users like e-books.

— Roger Beckman

SISACS 2009–10: Education and Outreach

By Erin Carlson

The Southern Indiana Section of the American Chemical Society (SISACS) is working to enhance the educational experiences of the graduate and undergraduate populations at Indiana University and perform outreach activities to inform the greater Indiana community about chemistry.

For the calendar year 2010, **Erin Carlson** was the chair, **Sara Skrabalak** was the chair-elect, **Kate Reck** was the secretary, and **Andrea Pellerito** remained as Treasurer. **Kenneth Caulton** was our local section councilor, and **Zachary Aron** was our alternate councilor.

One of the cornerstones of our educational efforts is the initiation of a new seminar series titled, "Chemistry of Everyday Life." This series provides a forum to invite speakers in less "traditional" areas of chemistry to present topics of interest to students, faculty, and staff of the greater IU community, as well as the Bloomington city community. SISACS received an ACS Innovative Project Grant to launch this outreach-focused seminar series. These presentations are recorded and posted online at sis.sites.acs.org.

Erin Carlson

Jennifer Hass, Carolkyn Bertozzi (student-selected seminar speaker), Sarah Keane, and Darci Trader

The first speaker in this series, Eric Block, author of "Garlic and Other Alliums: The Lore and The Science," is from University of Albany–SUNY. Block came to IU during National Chemistry Week on October 22, 2010, to discuss the chemistry of the edible alliums, which include garlic, onions, leeks and chives. Our second speaker, Charles Bamforth, will visit campus on April 21, 2011. Bamforth is a professor of food science and technology at the University of California, Davis, and will be speaking on "Tapping into the Chemistry of Beer and Brewing." We anticipate that these seminars will attract a great amount of interest from the undergraduate population at IU and from members of the surrounding community.

During the 2009–2010 academic year, SISACS initiated the "Student Selected Seminar Series." This series is unique in that it provides the graduate student populations of the Departments of Chemistry and Molecular and Cellular Biochemistry with the opportunity to select a prominent speaker and to present their research to this scientist during their visit to campus. Student-selected seminar invites are regarded as extremely prestigious, and this series attracts a number of very well-known scientists to the IU campus. Our first speaker, Phil Baran, from The Scripps Research Institute, visited on March 31, 2010, and presented his work to a packed lecture hall. Reception to this event was so positive, we invited two speakers for the 2010–2011 academic year: Carolyn Bertozzi from the University of California, Berkley, who visited on Sept. 1, and Benjamin Cravatt, from The Scripps Research Institute, who will visit campus on April 6, 2011.

SISACS will provide another exceptional opportunity for IU graduate students and postdoctoral associates in the spring of 2011. A two-day workshop titled, "Preparing for Life After Graduate School Workshop" will be offered May 9-10, 2011. This career-development workshop, offered through the ACS Office of Graduate Education, is designed to inform chemistry graduate students and postdoctoral scholars about their career options after graduate school, and how to prepare for them. Students will receive the necessary knowledge and tools that would otherwise require weeks of individual effort to obtain.

The ACS is committed to recognizing the accomplishments of undergraduates at IU. Three students, **Anthony Bowen** ('10), **Stephen Mendenhall** ('10) and **Chris Than** ('10) received ACS awards for "Outstanding Undergraduate in Chemistry" during the Chemistry Department's honors banquet ceremony in April, 2010. Mendenhall is currently studying medicine at the Vanderbilt University Medical School in Nashville, Tenn., and plans to practice medicine and perform medical research in academia. Bowen is an M.D./Ph.D. studentat the Albert Einstein College of Medicine. He plans to pursue infectious disease research and apply this work in clinical practice. Than is presently applying to medical school and plans to pursue a career in surgery. Currently, he is volunteering with Habitat for Humanity and studying ancient eastern philosophy.

National Chemistry Week was celebrated during the week of October 17-23 in the Chemistry Building at IU. This year's theme was "Behind the Scenes with Chemistry," emphasizing special effects in movies and theater. In addition to the lecture presented by Block, the IU Department of Chemistry held an open house featuring interactive lab rooms with AXE, SAACS, and NOBCChE—and a magic show.

Finally, chemistry colleagues are encouraged to get to know one another through informal gatherings hosted by SISACS. Recent events included our annual Ice Cream Social and a Friday afternoon happy hour. You can learn more about our past and future activities at our new website: sis.sites.acs.org.

IN MEMORIAM: MARVIN CARMACK

Scholar, scientist, mentor, colleague, and friend

by V. J. Shiner

Professor Marvin Carmack, 96, of Bloomington, passed away July 6, 2010, at Bloomington Hospital. He was the only child of Robert Rae and Elsie (Jackson) Carmack. Carmack was born on September 1, 1913, in Vermillion County, Ind. He married Joan Margaret Scully of Western Springs, Ill., in 1960.

Carmack is survived by his foster son, Jonathan Cameron Schoch, and several nieces and nephews: Teresa (Lockrem) Endean, Valerie (Lockrem) Brenci, Lorilei (Long) Croft, Barbara (Long) Kiep, Thomas Skoglund, Harold Long, Angela (Long) Austin, William Skoglund, John Lockrem, Larry Long, Mary Kay (Skoglund) Oneil, Joseph Long, Martin Skoglund, Maria (Long) Corcoran, John Long, Lisa (Long) Tetrault, and Dan Skoglund. Carmack was preceded in death by his parents, wife Joan Carmack, niece Alana (Long) Croft, and nephew James Long.

Tribute to a distinguished colleague

The following text is a slightly edited version of a biography written by Professor Campaign, "In Honor of Retiring Faculty," on the occasion of Professor Carmack's retirement.

Professor Carmack's major research contributions were in the areas of natural products and organosulfur chemistry. In the latter area, his studies elucidated the spectral properties of sulfur compounds, the mechanism of the Willgerodt reaction, and the chemical and biological properties of a new class of heterocycles (the 1,2,5-thiadiazoles). In the area of natural product chemistry, he made internationally recognized contributions to the chemistry of alkaloids and to the isolation and proof of structure of the active principle of Lithospernum Ruderale, the agent of fertility control used by the American Indians. This latter work was done in collaboration with professors **W. R. Brennamen** and **F. J. Zeller** of the IU Department of Biology. Later, Carmack was involved in organizing a team effort to study pheromones—the chemical compounds used by animals for the purpose of communication.

Cormack Family

Marvin Cormack: 1913–2010

Carmack's research was recognized by grants from the National Institutes of Health and the Walter Reed Army Research Institute, as well as a number of chemical companies. He was a consultant to Abbott Laboratories, the DuPont Company, and the Los Alamos Scientific Laboratory. He was a fellow of the American Institute of Chemists and a member of the American Chemical Society, the Chemical Society (London), the Swiss Chemical Society, the National Micrographic Association, the Philadelphia Organic Chemists Club, and the New York Academy of Sciences. He was a member of Phi Beta Kappa, Alpha Chi Sigma, and the Society of Sigma Xi. At Indiana University, he supervised the research of 19 PhD and nine master's degree candidates, and he was author and co-author of more than 100 research articles.

Although Carmack was known for his thoroughness in research and his unwillingness to publish research that was less than perfect, he nevertheless found time to be involved in community and professional affairs. He was a member of the Boy's Club of Monroe County and served as treasurer of that organization from 1974 to 1977. He served on the budget review panel of the United Way fund drive and was a member of the board of the Friends of Music at Indiana University, serving as treasurer from 1974 to 1978. At IU, he served on the Committee on the Arts and was the chairman of the funding subcommittee in 1975–76. From 1974 to 1977, he served on the National Committee on Copyrights of the American Chemical Society.

(continued on page 30)

"I worked for Dr. Carmack for four years as a graduate student. The experience is very important to me. ... Dr. Carmack took the time to be with my daughter during the process of choosing a graduate school, and my granddaughter met him as well. He has thus been a part of three generations of my family, and he will not be forgotten."

— Sam Berkowitz, MS'63

In memoriam

(continued from page 29)

Internationally, he was an invited participant at many conferences, including those of the World Health Organization and European Medicinal Chemists. He also attended the International Union of Pure and Applied Chemistry Congresses in Zurich, Melbourne, London, Stockholm, Munich, and Hamburg.

Carmack greatly enjoyed his teaching, especially one-on-one relationships with research students. He was always willing to spend any amount of time necessary to discuss the complex problems of natural product or organosulfur chemistry with students in the department.

Following his retirement in 1978, Carmack continued to follow research progress in natural products and sulfur chemistry and to write essays on scientific subjects.

A memorial

Within hours of Carmack's passing, former graduate student **Jack Gill** contacted the department. He planned an on-campus memorial service for Carmack with the help of **Mary Swarthout** and **Judi Roberts**. What culminated was a respectful memorial service held on Sept.13, 2010 in Auer Hall. Approximately 80 friends, former students, and colleagues from all parts of the country gathered to honor Carmack's life and contributions to science.

"We are saddened to learn that Marvin Carmack has passed away…We remember Professor Carmack fondly from the time we spent two wonderful years in Bloomington, where I worked as a postdoc in the Chemistry Department with Professor Nebergall. It has been quite a few years since we visited Bloomington and Mrs. Nebergall the last time. Please pass our condolences to the Carmack family."

—Christel and Gunter Kuehl

Remembering Professor Carmack

The following remembrances from former students and colleagues illustrate the nature and quality of our late departed friend and colleague.

"As a young graduate student working for Professor Campaigne, I had the opportunity to interact with Professor Carmack on many occasions. I found Professor Carmack to be an excellent teacher and lecturer with a broad range of knowledge in many areas of chemistry, especially heterocycles. Professor Campaigne always had a high regard for his chemical intuition. In combined Campaigne–Carmack group meetings, he always provided us with very valuable advice and guidance on our chemistry programs.

He served on my thesis committee, and I was extremely impressed with his ability to thoroughly comprehend all aspects of my research efforts and ask very insightful questions. I also found Professor Carmack to be a very caring and kind individual who was very easy to talk to and who was very knowledgeable on many topics (e.g., music) beyond chemistry. I remember his love for cameras and when he was trying out a new model, snapping photos of all of us working in the laboratory. He, like Professor Campaigne, was a strong proponent of the "well-rounded" graduate student—who completes a broad range of coursework, possesses a language skill, and successfully engages in a solid research program. I consider Professor Carmack to be one of my key life mentors, who helped me immensely to prepare for a 30+ year career in chemical research at DuPont."

—Thomas P. Selby, PhD'79

"The year 1951 was a good one for Chemistry at Indiana University. In that year, a young upcoming Professor Campaigne, who had established his reputation for research in the synthesis and study of organic sulfur compounds, decided to further burnish the department's reputation in organic chemistry by hosting the First International Conference on Organic Sulfur Chemistry. One of the invited speakers for the conference was Professor Marvin Carmack of the University of Pennsylvania, another rising star in the field. During the conference, Carmack had the opportunity to meet with Professor Harry G. Day, the newly minted, young chairman of the department. That auspicious meeting led ultimately to an offer to Carmack of a Professorship in the Department at Indiana. He had been impressed not only with the department and its chairman, but also with the higher leadership of the university, including Frank Gucker (former Dean of the College of Arts and Sciences) and President Herman B Wells. These factors, and the further fact that his acceptance of the offer would return him to his native state, led Carmack in 1953 to forsake his Ivy League appointment at Penn and move to Indiana University.

I joined the department as an instructor in chemistry only one year earlier, and was pleased to welcome him as a senior advisor and mentor. Early on, I had the pleasure of traveling with him by auto to New Hampshire to attend my first Organic Reaction Mechanisms conference, where he graciously introduced me to many of the leaders in the field."

—V.J. Shiner

Speakers included Carmack's nephew Martin Skoglund, who gave personal reflections on his uncle from a family perspective. More stories were shared by former student **Mohammed Behforouz**, and faculty members **Gary Hieftje** and **David Giedroc**. Auer Hall is well known for its organ, and music selections were provided by Dean Emeritus **Charles Webb**. The stories had commons themes: they spoke to his love of technology, his contributions to the chemistry department, his science contributions nationally, his loving character, and the strong respect he earned from those he knew. It was evident that the love he bestowed upon his students, friends, and family was completely mutual.

Memorial contributions may be made to the Indiana University Foundation, P.O. Box 500, Bloomington, IN 47402 for the Joan & Marvin Carmack Chair in Bio-Organic Chemistry. Note "Carmack Chair" in the memo line.

"In my first year in graduate school, I was excused from a course in advanced organic chemistry because I had taken such a course in my undergraduate university. With Dr. Carmack's blessing, I was permitted to audit the course in Advanced Organic Chemistry and was awarded an 'A' for my efforts. This made an impression on Dr. Carmack, and he helped me win the Dow Fellowship award for my last year of graduate school."

—Linneas C. Dorman, PhD'61

Necrology 2010

We remember all those in the IU Chemistry family who passed away this year.

Marshall Alexander, BA'40, August 1, 2009
Robert W. Barclay, BA'48, April 16, 2009
Sally McBride Beam, BA'50, August 29, 2008
William O. Beavers, BA'39, MA'41, August, 1971
William B. Beecher, BA'32, December 3, 1992
Cornell A. Bell, BA'47, March 20, 2009
Elmer R. Billings, BA'42, MD'44, April 3, 2010
Gary W. Boley, BA'69, June 18, 2009
Diedrich H. Brandt, BA'47, March 30, 2005
Alan C. Clark, PhD'70, March 25, 2009
Richard M. Davis, BA'42, MD'44, May 6, 2009
Juanita F. Simpson Delano, BA'40, May 4, 2010
Frank DiMoia, MA'48, PhD'50, July 11, 2007
Constantine Douketis, PhD'89, August 26, 2008
Frank G. Evans, BA'41, MD'48, September 17, 2009
Betty I. Holland Fleck, BA'41, June 8, 2010
Gustave Gavis, BA'48, March 31, 2010
John F. Gorsich, BA'61, February 7, 2010
Rolland E. Greenburg, BA'43, June 8, 2008
William J. Guest, BA'33, MA'34, June 24, 2001
Joseph H. Haseman, BA'87, MD'91, June 4, 2009
Robert J. Healey, BA'50, March 26, 2010
Dennis Hearn, BS'62, July 2, 2009
Michael R. Henry, BS'84, April 25, 2009
Paul J. Hettle, BA'47, MD'51, May 5, 2009
Michael Horoda, BA'50, MAT'64, August 19, 2009
Scott L. Hudson, BA'82, July 6, 2009
Irwin Kantor, BA'35, February 3, 2008
Melvin W. Kelley, BA'61, May 1, 2009
Myron B. Kinney, BA'50, September 1, 2009
Frank B. Kitchel, MA'41, November 20, 2006
Joseph G. Klotz, BA'43, MD'45, May 25, 2009
Charles K. Knuckles, BS'82, December 6, 2009
Arnold Levy, BA'50, March 21, 2004
Basil B. Luff, BS'41, March 12, 2010
Robert L. Mann, BS'45, March 13, 2010
Deno Manos, BS'40, February, 1986
Thomas D. Marshall, BA'49, DDS '57, May 31, 2010
Walter C. McCarthy, PhD'49, March 1, 2010
Bruce D. McDonald, BA'71, JD '74, March 31, 2010
Edwin C. Mertz, MA'48, October 5, 2009
Harold W. Muncy, BA'51, September 13, 2009
Charles G. O'Bannon, BS'47, May 4, 2010
Edgar L. Peglow, BA'50, September 2, 2009
Warren C. Polhemus, BA'39, MD'42, March 26, 2009
Eugene D. Raines, MA'34, PhD'38, February 13, 1991
John J. Reinhard, BA'42, MD'44, June 18, 2009
Frederic A. Rice, BA'47, MD'51, June 2, 2009
Ryland P. Roesch, BA'42, MD'48, September 6, 2009
John M. Roper, BA'49, March 11, 2009
Robert L. Rowell, PhD'60, January 18, 2009
Edward L. Schumann, BS'43, February 19, 2009
Edward T. Sedory, MAT'63, May 19, 2006
William E. Shepp, BA'50, June 21, 2009
Nolan B. Sommer, PhD'44, February 8, 2010
Jean William Spear, BA'40, DDS'43, September 28, 2009
Clarence G. Stuckwisch, BA'39, September 3, 2009
Kathryn Campbell Susott, BA'40, MD'42, February 15, 2009
Harold W. Thieman, BS'51, August 26, 2009
Charles H. Tilford, PhD'43, January 22, 2008
Fredric L. Tilton, BA'36, January 22, 2006
John C. Vanatta, BA'41, MD'44, May 29, 2008
Marie A. VanHorn, MAT'59, April 11, 2006
Charles E. VanHoy, BS'40, March 14, 2008
Isabelle Kowal VanHoy, BA'40, November 3, 2008
John S. Visher, BA'42, April 17, 2009
Bert J. Vos, BA'30, December 3, 2009
David M. Votaw, BA'28, June 8, 2003
Donovan A. Weddle, BS'51, August 27, 2008
Harvey O. Wellnitz, BS'40, April 29, 2010
Harold K. White, PhD'54, September 19, 2007
Edmund P. Wozniak, BS'53, December 16, 1998
Marvin L. Yates, PhD'64, March 4, 2010
Robert A. Zimmerman, BA'41, August, 1987

ALUMNI PROFILE

An interview with Kevin Kolack: Actor and stand-up chemist

In both of the last two graduating classes, the department has had graduates with double majors in chemistry and theatre. **Keven Kolack**, PhD'97, had a wider range of interests than a typical graduate student while in Bloomington, where some of his other activities included renovating houses and serving as a volunteer firefighter/EMT for the Bloomington Township Department of Fire and Emergency Services. Kevin was also the subject a recent profile in the *Indiana Alumni Magazine*.

Courtesy Kevin Kolack

Kevin Kolack

Kevin, your acting resume on your website (kevinkolack.com) claims that getting a Ph.D. in chemistry was great training for acting. It says, "Ask me why." So, why was it great training for an acting career?

KK: Successfully and sanely navigating graduate school involves independently learning and working toward a long-term goal over many years for long hours in a collaborative environment, with no set schedule for an advisor and committee whose involvement in your day-to-day research can vary widely. In acting, it's very much the same. The entertainment business is incredibly collaborative and can involve a potentially international crew of hundreds of people with varied backgrounds. Your director may be hands-on or hands-off. There's a lot of "hurry up and wait." Your goal—thanking everyone at the Oscars!—is not going to happen overnight and involves a lot of work that no one will ever see—keeping up-to-date mailing lists and marketing materials, etc., aside from the indy films you do that no one other than your mother and a few film festival goers will ever see!

Was acting something you were always interested in? How did you get started?

KK: Growing up in public school in the deep south, I was under the incorrect assumption that if you were smart, you had to become a doctor, lawyer, or scientist. I thought I couldn't stand the sight of blood (firefighting showed me it's just *my* blood I have a problem with!) and didn't really like lawyers (still don't), so before I knew it, I was happily at IU Chemistry. However, like my father, Dr. David Kolack (a lifelong barbershop chorus member for whom a scholarship at the IU School of Optometry is named) before me, I maintained both right- and left-brain interests throughout. So when I saw an ad in the *Herald-Times* for a visiting talent scout from New York City, I had to check out what he had to say. Thus began week-long trips to New York for workshops, and weekly treks to Chicago for classes through the second half of my graduate career. Luckily, I had a very understanding and encouraging advisor (Prof. **George Christou**, now at the University of Florida). I taught one semester at IU after I graduated, and moved to New York City on January 1 of the next year.

What do you consider to be your biggest and/or most interesting acting accomplishment to date?

KK: On camera, I really enjoyed developing the bad guy character in the fan film *Little Indiana Jones*, which you can see on YouTube. Off camera, I've enjoyed the philosophical discussions I've had with several of the cast members of *Law and Order: SVU*. And I'm very happy with my voice work as Tokkori on the cartoon *Kirby*, which I describe as "Ross Perot on crack."

You haven't let your chemistry skills stagnate through your acting career, either. Many people haven't heard of The Cooper Union. What is it like teaching chemistry there?

KK: Cooper is one of the top engineering schools in the country, and is tuition-free for all students, thanks to an endowment from inventor Peter Cooper. Notable graduates include Thomas Edison, animator Max Fleisher, and interestingly, both of my maternal great-grandfathers. More kismet! (Both of Kevin's parents attended graduate school at IU.) I'll admit that teaching at IU spoiled me for teaching anywhere else. I'm grateful to have been able to supplement my acting income by "performing stand-up chemistry" at Cooper the past 10+ years, but in terms of support for teaching, there's just no comparison—I miss those demos from the folks in Room C021!

Is there anything from Bloomington that you can't find living in New York?

KK: New York City really is a great place to visit. But apparently, PhDs grow on trees here, because part-time faculty are paid so little! I do miss the fire department and the food. Having married a native New Yorker, I've recovered a bit of the community I lost upon leaving Bloomington. And she's an amazing chef. But I had no trouble rattling off a list of restaurants for a friend who was attending a conference at IU this past summer. I can't wait to come back for a visit.

ALUMNI NEWS

Rod S. Berman, MS'79, is a partner in the Los Angeles office of the California law firm Jeffer Mangels Butler & Mitchell. As chairman of the firm's intellectual property law group, he focuses on patent, trademark, copyright, unfair competition, and Internet responsibilities. Berman's practice includes counseling, litigation, opinions, licensing, and prosecution. He represents many nationally and internationally known clients, and has been involved in a number of published patent, trademark, and copyright cases in a wide variety of industries. Berman has been recognized by one of the country's foremost legal publications, the *Daily Journal*, as one of the top 30 intellectual property attorneys in the State of California, and by the *Los Angeles Business Journal* as one of the top 100 attorneys in Los Angeles. He lives in Beverly Hills, Calif.

Norman R. Bryant, BA'51, writes, "[I am working on] a theory of gravity that everyone is ignoring. A collider may not be the only way to view gravity. Frequency may be another way." Bryant retired in 1985 as an analytical chemist from the Naval Warfare Center in Indianapolis. He lives in Indianapolis.

Bradley A. Burkhart, BS'08, is a representative for Dow Chemical. He lives and works in Evansville, Ind.

In February, Boston University School of Medicine named researcher **James A. Hamilton**, PhD'74, as the recipient of the 2010 Avanti Award in Lipids. The award is bestowed by the Biophysical Society Award Committee and recognizes Hamilton's innovative contributions in the application of nuclear magnetic resonance methods to phospholipids and fatty acids. The Biophysical Society is a professional, scientific society established to encourage development in the dissemination of knowledge in biophysics. Hamilton is a professor of biophysics and physiology, with joint appointments in biomedical engineering and medicine. He has been a member of the faculty at BUSM for more than 30 years.

In May, **Cynthia L. Henry**, MS'90, was named one of 80 Woodrow Wilson Indiana Teaching Fellows for 2010. Woodrow Wilson Fellows are often regarded as the "Rhodes Scholars" of teaching and are chosen by the Woodrow Wilson National Fellowship Foundation of Princeton, N.J. Each of the fellows receives a

(continued on page 34)

Scott Wallace helps a small child in Haiti.

Photo courtesy Scott Wallace

Helping in Haiti

For months, IU Chemistry alumnus **Scott Wallace**, MAT'08, and his family tried to book a vacation for the summer of 2010 on a beach in Central America. For various reasons, plans continued to fall through. On Jan. 12, a massive 7.0-magnitude earthquake struck the impoverished island country of Haiti, devastating its capital city, Port-au-Prince.

The earthquake's epicenter was shallow—only about 16 miles southwest of the city and centered just 6.2 miles below Earth's surface. Nearly 3 million people were affected by the earthquake and its 52 aftershocks. In its rubble, more than 200,000 people were crushed and killed, 300,000 were injured, and more than 2 million Haitians were left homeless. It instantly became clear to the Wallace family that this is what they were supposed to devote their summer to: not beaches and sun, but rubble and trauma. Plans were made to join a team of 19 people, ranging in ages from 15 to 60. They planned to travel with loads of donated supplies to the densely populated capital of Port-au-Prince, the area hit hardest by the quake.

In the heart of the capital, a missionary named Dr. Eddie Bazin, a native Haitian, tends to a church of about 1,200 members. During the week, Dr. Bazin offers an education to almost as many students, both young and old. Dr. Bazin is a well-respected member of the community. The property that houses the church and school sustained over $200,000 USD worth of damage, including the destruction of the walls that provide safety to those inside. Yet Haitians around the compound respect him and his service to the community so much that despite massive looting and violence, Dr. Bazin's compound remained an oasis in a sea of chaos, a testament to the character of a man well respected by those around him.

The team the Wallace family traveled with joined up with Dr. Bazin to serve the people of Haiti. In the first week, some members of the group worked with Haitian ministers and their families to offer support in meeting the needs of the people. These families had assisted in meeting basic needs like food, water, clothing, and shelter, but also counseling and psychological support that had been desperately needed by Haitians. Many Haitians whose homes

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ALUMNI NEWS

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$30,000 stipend and enrolls in a master's degree program that provides intensive clinical preparation for teaching math and science in urban and rural high schools. In return, the fellows commit to teaching in high-need Indiana schools for three years. Henry is a former professional chemist with Eli Lilly Inc. She will pursue master's level degree work at the University of Indianapolis.

Samantha A. Herbst, BA/BS'04, is a project manager at EPIC Inc., a Verona, Wis.-based company that makes software for mid-size and large medical groups, hospitals, and integrated health-care organizations. Herbst earned a master of science degree in biochemistry from the University of Wisconsin in 2008. She lives in Madison, Wis.

Brett M. Jackson, BA'08, is pursuing a master's degree in landscape architecture from Ball State University in Muncie, Ind. He expects to graduate in 2012. Jackson lives in Fishers, Ind.

Michael T. King, BA'08, is currently attending the IU School of Medicine and plans to graduate with a doctor of medicine degree in 2012. He lives in Noblesville, Ind.

In March, Indiana Gov. Mitch Daniels named **Gregory N. Larkin**, BA'71, MD'74, the state's health commissioner. Larkin is responsible for overseeing Indiana's 92 county boards of health. Prior to his appointment, Larkin served as chief medical officer for the Indiana Health Information Exchange, an organization that promotes the advancement of community and patient health care through information technology.

Michael J. Lawler, PhD'08, is a senior research scientist for Wyeth-Ayerst Laboratories in Pearl River, N.Y. His wife, Melanie, PhD'07, is a medical writer for AlphaMedica Inc., a medical-communications agency based in Tarrytown, N.Y. The couple lives in Hillsborough, NJ.

In July, the Indiana Historical Society named four IU alumni as 2010 Indiana Living Legends. Bestowed annually, the honor celebrates individuals who have had a significant and positive impact on the state. The 2010 honorees included entrepreneur **William G. Mays**, BA'70, MBA'73, DSc'00, and his wife, Rose (Cole), MS'74.

Sarah E. McDonough, BS'08, is a research specialist with Hatton Cardiac Research at Bethesda North Hospital in Cincinnati. In her free time she is a church board member and Sabbath schoolteacher, and mentors local teens. McDonough also enjoys running and training for marathons. She was IU Union Board student director in 2006 and 2007.

Katie Wagner Petra, BS'08, is a teacher at Lighthouse Christian Academy in Bloomington, Ind. She teaches pre-calculus, trigonometry, algebra, chemistry, and health. Her husband, Matthew, BS'07, is a student in the JD/MBA program at IU Bloomington. He plans to graduate in 2011. The couple lives in Bloomington.

Colleen Hartsock Riley, BA'86, OD'92, MS'98, is vice president of professional development at Vistakon, the contact lens subsidiary of Johnson & Johnson based in Jacksonville, Fla. She is responsible for leading efforts to develop and implement strategies and programs in the Americas that focus on professional and practice development for eye care professionals. Riley oversees the market development and professional and medical affairs teams, and also the Vision Care Institute, another Johnson & Johnson company. In addition, she is a member of the company's management board for the Americas Region. She joined Vistakon in 2004 as assistant director, clinical claims research and development, and has served in a number of other positions within the company. Riley lives in Jacksonville.

Alan J. Rosenbaum, BA/BS'08, is a student at the University of Pittsburgh School of Medicine. He plans to graduate with a medical degree in 2013. Rosenbaum lives in Pittsburgh.

Mark E. Schneider, BA'96, has been an assistant U.S. attorney in the Department of Justice in Chicago for five years. He focuses on white-collar crime and public corruption. Schneider spent more than a year in Iraq in 2008–09 at the U.S. Embassy in Baghdad helping oversee the justice sector reconstruction efforts. He served as IU Bloomington Union Board student director in 1993. Schneider lives in Chicago.

Matthew B. Strausburg, BS'08, is a student at the IU School of Medicine in Indianapolis. He lives in Indianapolis.

Anthony "A.J." Voelkel, BA/BS'04, MBA/MD'09, and his wife, **Sara (Scott)**, BS'03, welcomed their first son, Wyatt John Voelkel, in December 2009. The couple lives in Louisville, Ky. Sarah is a resident in foot and ankle surgery at Norton Hospital and Health Care Systems, and A.J. is a resident in internal medicine at the University of Louisville.

In 2007, **David D. Weis**, PhD'98, accepted a tenure-track position in the Department of Chemistry at the University of Kansas in Lawrence. He writes, "The research in my lab focuses on the application of mass spectrometry to understand the biophysics of protein-protein interactions with an emphasis on disordered proteins and multi-protein complexes." Weis previously taught at Middlebury and Skidmore Colleges and was a research assistant professor at the University of New Mexico in Albuquerque from 2004 to 2006. He lives in Lawrence.

Keegan T. Wilson, BS'08, is a quality control analyst with CSL Behring in Kankakee, Ill. The company is a global leader in the plasma protein biotherapeutics industry, researching, developing, manufacturing, and marketing biotherapies that are used to treat serious and rare conditions. Wilson lives in Bourbonnais, Ill.

Jeffrey D. Zubkowski, PhD'83, was awarded the 2009–10 Council of Historically Black Graduate Schools and Educational Testing Service Award for Excellence and Innovation in Graduate Education during the 2010 meeting of the Council of Historically Black Graduate Schools in Savannah, Ga. He is associate graduate dean and professor of chemistry at Jackson (Miss.) State University. Zubkowski lives in Brandon, Miss.

50 years ago

Graduate school remembered

by Henry H. Kramer, PhD'60

Shortly after I got out of the Army (being drafted during the Korean War), I applied to the Indiana University Department of Chemistry as a doctoral student, having already received a B.A. and an M.A. in chemistry at Columbia University. Indiana University offered me $125/month. I was offered an entitlement to the in-state fee rate of $6 per credit hour, tuition was not charged, and my total fees, laboratory deposits, health services, etc., would not exceed $80/month.

Early one morning just after Labor Day in 1956, I started out for Indiana University. My path to Indiana University was south down the New Jersey Turnpike to the Pennsylvania Turnpike, exited the Pennsylvania Turnpike at Washington, Pa., onto Route 40, which took me through Wheeling, W. Va., Columbus, Ohio, and on to Indianapolis, where I turned south on Route 37 to Bloomington.

I'll never forget our rest/gas stop in Zanesville, Ohio. This was the first time I had been this far west. While eating, I noticed that the wall clock in the diner was on Standard Time and not on Daylight Savings Time. I remarked to the man behind the counter that the clock was off by an hour. The man responded something to the effect, "No, it's correct. If it isn't in the Good Book, we don't do it." I heard that the Midwest was called the Bible Belt, but *wow*, is this what I was getting into?

"I heard that the Midwest was called the Bible Belt, but wow, is this what I was getting into?"

Another introduction to Midwestern culture (which is dramatically different than New York City culture) was being caught behind several very large trailer trucks carrying livestock (primarily pigs) on an impassable two-lane road on a hot day. Boy, what a stink! This happened to me several times on Route 40 between Columbus, Ohio, and Indianapolis.

Another thing I noticed on Route 37 going from Indianapolis to Bloomington was that there were a number of small bridges over streams that, at best, were almost two-cars wide. You had to slow down when crossing these bridges if there was oncoming traffic.

When I arrived the next day (the driving distance was about 900 miles, and it took about 18 hours to drive from my parents' home to Indiana University), I was amazed at the size and beauty of the campus, situated in the rolling hills of Bloomingtona. My guess is that, at that time, the campus measured about ½ mile by 2 miles. Today, it is many times that size.

Most of the buildings in the center of the campus were built pre-WWII, and their facades were made of Indiana limestone. There were many limestone quarries in the area and some of the older quarries were swimming holes used by the students. Tall trees and shrubs surrounded all the buildings (such as the Chemistry Building), and in some cases, the trees and shrubs hid a building from view. Paths connected all the campus buildings and the student housing. Student dorms were the only new buildings on the campus. There were even two trailer parks next to the football stadium that were temporary married student housing. They were being phased out the year I arrived for new married students housing at the edge of the campus.

I was housed in a recently built graduate student dorm called "Rogers"which was at the edge of the campus. Rogers was about ¾ of a mile from the Chemistry Building and about one mile from the Physics Building, so we had many vigorous walks to classes and back for lunch. There were separate dorms for men and women. In addition, there was a large mess hall situated near our building where all the Rogers students ate. I was assigned to a corner room on the second floor of "Rogers M," overlooking the main entrance to the dorm.

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50 years ago

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"The chemistry building was always open and the graduate students could come and go as they pleased, which they did."

My room was called a large double and was about twice the size of the regular dorm rooms. Costs were $666 per semester (per student) for the room and meals. Each room was supplied with two single beds (bunk beds in the regular dorm room), two desks with desk lamps, two desk chairs and one bookcase. We were served, cafeteria-style, 20 meals per week (no meals were served on Sunday nights), and we had maid service. The maids "cleaned" your room once a week and changed your sheets and pillowcases. (The cleaning done by the maids was only cursory.)

One of the women's dorms, "Rogers S," was about 50 yards away on a small hill in front of our dorm across the Jordan River. The Jordan River was a very small stream that swelled into a pond about 100 feet across after a downpour, which happened occasionally during the fall. The reason that I mentioned Roger S is because this was where my future wife, Carol, lived until we were married.

The weather was beastly hot and humid from mid-April to early-October. The best weather was during March and October. In addition to the heat and humidity, when it rained, it really rained. Some of the downpours were so heavy that one could not see 50 feet through the raindrops. In addition, the lightning storms were spectacular. I have never seen anything like them anywhere else in the world.

A streak of lightning would start on one horizon, split into two streaks, and each subsequent streak would subsequently split into at least two streaks, etc., until the crescendo ended on the opposite horizon filling the whole sky with lightning streaks. The resulting thunder started as a rolling drum-like noise that increased in intensity as it crossed the sky and ended with a very loud boom. *Wow*. That was really something to watch. Because many of the lightning storms occurred before it rained, we were able to go outside to watch the show.

During my first year, I was a teaching assistant in graduate chemistry laboratory courses. I already had my master's degree and had qualified as a Ph.D. candidate, so I had to pick my thesis professor toward the end of my second semester (spring 1957). I interviewed several physical chemistry professors for thesis topics, and their graduate students (to determine how they felt about their thesis professors), and selected Dr. **Ed Bair**. Dr. Bair had recently joined the faculty. I was his second graduate student—the first left because of family reasons—so I was his first graduate student to graduate.

Dr. Bair was an outstanding experimentalist, and he believed that a graduate student should build everything from scratch to develop a foundation in research. In my thesis project, I had to design and build all my electronic equipment, including a VTVM (my first three publications were on electronic equipment); blow all my glass apparatus; and machine all the mechanical parts for the apparatus I used in my experiments. When in trouble, Dr. Bair was always there to help me and would correct some of my bumbling.

The chemistry building was always open and the graduate students could come and go as they pleased, which they did. I did my thesis work in a laboratory on the first floor of the chemistry building next to the machine shop. The chemistry graduate students would set their own times to work in their labs on their theses. Typically, I would go to the lab by 9 a.m., work until noon, eat lunch, go back to the lab by 1 p.m., worked until 5 p.m., eat supper, go back to the lab by 7 p.m., and work until 10 p.m. I was the only student at that time in the graduate chemistry department to have a key to the department's machine shop, where I did my machining during the evening hours—all alone. The department's machinists would show me how to use the shop's equipment between 4:30 and 5 p.m., just before they went home. I always left the machine shop cleaner than I found it. This was a practice that my father drilled into me as a kid. He told me that whenever you borrow a tool, return it cleaner than you found it. That way you will be able to borrow it again.

The chemistry department Ph.D. requirements included passing required chemistry courses, passing a number of other science courses (there was a minimum number of course credits needed for the advanced chemistry degrees), passing two foreign language exams (translating scientific publication written in either German, French, or Russian—you had only two chances to pass each of the two languages; it took me two times), and passing five cumulative chemistry exams in one year (10 were given in a year). I passed the first four of these cumulative exams and didn't pass the fifth one until the tenth exam. Boy, I was worried.

Even though Dr. Bair was low-key, he could be very firm when it was called for. After working for him for almost two years, he "woke me up" when I returned from visiting my parents in the summer of 1958. When I returned, he came into the lab and told me that I wasn't focused enough, and that I should consider leaving him. *Wow*! I was shook-up. I initially didn't know what I would do. I talked to several of the chemistry profs for advice. One said that Dr. Bair might be

right. Another prof told me to "hang in there," use my head, and plow ahead.

Fortunately, Dr. Bair did not kick me out, but left me essentially alone for several months before he began to accept my efforts and see that I was focusing on the real issues and problems. The crossover to full acceptance was when I solved a sticky impedance-matching problem that was bugging us for more than a year. Dr. Bair, through his patience, and by knowing what he wanted from a graduate student, really helped me grow professionally.

It took me two-and-a-half years to build the equipment I used for my thesis. Just after the New Year (1960), I had completed two weeks of accumulating and analyzing my thesis data with the help of the new IBM 550 computer at IU, using machine language, at 2 to 3 a.m.—again alone in the computer facility. Dr. Bair reviewed the results of my experiments. He then told me to stop my research and present a seminar on my work to the Chemistry Department. At that time, it was the practice at the Chemistry Department for all the professors and students to attend your seminar and assess if your work was worthy for publication—the key measure of a complete thesis work. *What a surprise! I may have finished my thesis experimentation! The end may be in sight!*

For the next several weeks, I prepared for the seminar. It was a stomach-turning time. I gave the seminar on February 4, 1960, at 4:30 p.m. The next morning, Dr. Bair came into the lab and said "Write up." I have never heard sweeter words. I left Indiana University during the first week of June and started my professional career in industry on June 15, 1960.

In July, I flew back to Indiana University for my thesis oral exam, which I passed. I received my Ph.D. on September 6, 1960. What a year 1960 was in my life. My educational experiences at Indiana University under the tutelage of Dr. Bair gave me a solid experimental research foundation for my professional career as a successful scientist.

The first oppotunity to revisit IU and Dr. Bair was in May of 2005, 45 years after I left. Carol had her 50th-year nursing school reunion in Indianapolis that year. We flew into Indianapolis, rented a car, and drove to Bloomington to visit Dr. Bair. He had retired, but was still active as an emeritus professor, going to his office in the Chemistry Building every day to work on a book about energy resources.

It was a very rewarding visit. Dr. Bair and his wife, Dorothy, joined Carol and me for dinner, and they gave us an evening tour of the IU campus. The campus was now the size of a small city, covering many square miles. The next day, Dr. Bair gave us a tour of the Chemistry Building, where he introduced me as his first graduate student. He was proud of me, and I was proud of him. It was a great feeling.

He told me that his lab was the leading lab in fast (microsecond) chemical reactions for over a decade. This is a major accomplishment for any academic laboratory, and one for him to be really proud of. I am very glad that I visited him.

Post Script:

I sent this memoir about Indiana University to Dr. Bair. Our e-mail string follows.

Hi Henry:

I was interested in the differences between our perceptions of that time period. What I remember is that I was beginning to get a little desperate that I had tackled more than I could accomplish with the resources that were available. The Air Force thought their grant was generous and expected the University to contribute a lot more than they did. The department thought its contribution was generous, but a diffraction grating and two collimating mirrors were not nearly enough. The department was proud of the shop facilities, but Morris Williams was the professional, and Jack Baird was the boss, and between them was chaos. Without graduate students like you, nothing would have gotten done. I was always embarrassed we could not accomplish more science.

When we visited China with a delegation of physical chemists a few years ago, I stayed behind to talk with a young faculty member at the Chinese Academy of Science in Beijing who had set up a femto-second spectroscopy lab modeled after his postdoc experience in the U.S. He almost wept to find someone who understood what he was going through. The relative state of the CAS, Beijing, in 1997 was very comparable to state of the Department of Chemistry at IU while you were here. I think we can both look back at a healthy contribution which few people fully understand.

Best regards to you and Carol,
Ed Bair

I always thought that all the hands-on machining and building of electronic equipment was part of his training of graduate students. It appears that hands-on work had to be done because there weren't sufficient funds to purchase any equipment to pay a machinist. There are always at least two sides to every story and event.

Hi Ed:

I never realized the problems you had at that time. I can assure you that doing all the hands-on work became an extremely valuable asset. In my industrial research, I had to design (mechanical and electric) equipment for my research projects. Based on my experiences at IU, I knew how to tell the machinists what I wanted and I would know it could be made—which they did on the first try. I also made major modifications in purchased electronic measuring equipment to better suit my experiments, and which significantly expanded the versatility of such equipment. A number of times, a manufacturer of the equipment came to my lab to learn how I modified their equipment, and would often include my modifications in their newer models.

Best regards to you and Dorothy,
Henry

CHEMISTRY HONOR ROLL 2010

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Haiti

(continued from page 37)

Photo courtesy Scott Wallace

Devastation in Port-au-Prince

were spared were so traumatized by the events that they could not even enter their homes because of immense fear. Other members of the team held Vacation Bible School activities with the children on the compound, all of them students at the school. The small snack the team was able to provide was the only meal many of the children would eat each day.

The team also donated considerable money to repairing the security wall that crumbled in the earthquake. Interestingly, physical labor was not greatly needed. There were plenty of Haitian men looking for work and through monetary donations, Dr. Bazin was able to employ a number of eager workers to rebuild the walls. The Haitian economy is merciless to its poor citizens. Because most everything is imported to the impoverished island, prices were astronomical. A gallon of gas was $9 USD and a 5-gallon jug of water was $22 USD. Most laborers make only $5 USD each day! In a country that is estimated to have 80% of its people living in poverty, it continues to be a losing battle.

The second week the team was there, they traveled to see more of the Haitian countryside. One entire day was spent visiting with and encouraging 30 children living in an orphanage in the mountains. This orphanage was in dire need of support. When the team arrived, they were shocked to find that it had been days since anyone at the home had eaten. The team quickly arranged for food and supplies to be delivered to the home. Games were played, balloon animals made appearances, and songs and toys were the agenda for the day. Many of the Americans found it nearly impossible to leave that orphanage at the end of the day.

Fifteen days of oppressive heat and discomfort was enough to change the perspective of every member of the trip, both first-time travelers and veteran globetrotters. In the end, badly-needed supplies were left with those with greatest need and lifelong relationships and friendships were formed between Haitians and Americans. Many on the team are anxiously awaiting the next opportunity to return and continue the work that was started.

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About the back cover photo:

Lightning erupting from a thunderhead is the most familiar consequence of atmospheric electrification. However, other examples abound. Active volcanoes generate lightning as do dust storms. An exotic case is the perpetual lightning surrounding the mouth of Rio Catatumbo as it spills into Lago de Maracaibo, the largest lake in South America. More accessible is waterfall electrification where in certain regions of the Austrian Alps sparks can be observed. Of more general meteorological significance is wave action over lakes and oceans that produces electrified drops. All these diverse atmospheric phenomena are tied to the transfer of electric charges from water droplets, ice fragments or dust particles as they are buffeted by the weather. The mechanism of the charge transfer must depend ultimately on the nature of the particle interface - or so Martin Jarrold and George Ewing believe. Through carefully designed experiments, they are trying to make the connection between microscopic properties of the interface and macroscopic observations of lightning.

The phenomenon of electrification has drawn to its study Franklin, Volta, Faraday, Peltier, Rayleigh, Kelvin and a host of other scientists from the 18th , 19th, and 20th centuries yet basic questions remain about the mechanism of charge separation. One of the impediments to understanding the general phenomenon is the uncertain nature of the water interface. Here techniques coming to maturity in the 21st century (e.g. non-linear spectroscopies and molecular dynamics calculations) are providing snapshots of the interface on a molecular scale.

Martin's group, with George kibitzing, has explored charge transfer from both water droplets and ice particles. In an ongoing experiment, undergraduate student Shane Dorsey and graduate student Indrani Bhattacharyya are measuring the charge transfer from silica particles whose surfaces are coated with a thin film of water. One question we hope to answer is the identity of the charge carriers – electrons, hydronium ions or hydroxide ions? We will relate our findings to meteorological observations on the electrification of dust storms.

In order to bring together the diverse communities of chemical physics and meteorology, Martin and George, together with MIT Lincoln Laboratory meteorologist Earle Williams, organized a workshop in Telluride, CO entitled "Electrification of Water Drops and Ice Particles: Through Simulations, in the Laboratory and in the Natural Environment". In this 2009 NSF sponsored workshop, scientists who approach atmospheric electrification from a macroscopic view (10 kilometer thunderheads) and those who explore material from a molecular standpoint (0.1 nm interface) could share experiences. The 30 attendees were enthusiastic about the workshop and ideas shared. We plan to meet again in 2012.

George Ewing and Martin Jarrold follow up on Ben Franklin. John Huffman used Photoshop to combine an image of the Professors by Charlie Parmenter with an image of nature's fury by his son, Charles C. Huffman.

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