

# IU•CHEMISTRY

Association of Indiana University Chemists Alumni Journal

Vol. 61 • College of Arts and Sciences • Fall 2016



## In this issue:

IU Collaborations Lead to 'Carbon Recycling'  
Biomolecular Catalysts Used for Hydrogen Production  
IU-Chemistry's REU Nanochemistry Program

# IU • Chemistry

Association of Indiana University

Chemists Alumni Journal

Vol. 61 • College of Arts and Sciences •  
Fall 2016

## College of Arts and Sciences

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**Cate Reck** takes a selfie with Professor **Steven Tait** before he gives the 2016 Graduation Address.

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

Any questions regarding the content of this publication may be directed to the editor at [creck@indiana.edu](mailto:creck@indiana.edu). The department may be contacted at [cemchair@indiana.edu](mailto:cemchair@indiana.edu).

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## Make Your Mother Proud

*"If I had my way, I'd be a college student the rest of my life,"* states **Ken Guerra**, May 2016 graduate from the IU-Chemistry program. Ken has headed on to Indiana University Maurer School of Law on a Fellowship this fall. IU must have been doing something right since many of our graduates share Ken's sentiment. I completely agree with Ken's statement as I pursued a career that allowed me the luxury of being on IU's campus every day, receiving the benefits that this academic institution affords me.

IU-Chemistry and the College of Arts and Sciences aim to develop students who are intellectually-agile and independent critical thinkers with a zest for reasoned and civil debate, knowledgeable about diverse civilizations and cultures, able to articulate ideas with clarity and passion, committed to life-long learning, equipped with ethical and civic values and prepared for lives of leadership and service. These skills and values are the backbone of a liberal arts education. While our biochemistry and chemistry majors are entrenched in solid science education, they consistently seek out experiences in the humanities, fine arts and social sciences to round out their experiences while at IU.

While consuming this Big-10 experience, IU students demonstrate a deep sense of connection to community, intense student-faculty relationships and collaboration through undergraduate research, passionate teaching and active learning, and powerful outcomes in terms of graduate school, professional schools, and entry-level career placement.

It's probably no exaggeration when I say that the majority of students are nostalgic about the time they spent in college. They tend to call them "the best years of their lives." That's not to say that their current situation is bad; it only goes to prove that those days when you had fewer responsibilities other than to make good grades and stay out of trouble are evergreen in your mind because you were young, carefree and ready to embrace life with zeal and passion.

We gain so much more than just an education from our school and college, so it is imperative that we try to give as much back. The etymology for the term *alma mater* stems from the Latin *mater*, meaning "*fostering mother*". If helping out your educational mother is not reason enough, and if you need further motivation to give back to your department or College, read on:

- Alumni play a large role in determining the future and continued development of large curricular planning.
- Your donations go a long way to support scholarships for deserving students who are short of funds.
- Giving back helps individuals gain a transferable asset, a quality education.

May 2016 Chemistry graduate **Ken Guerra** participates in a service trip to the Dominican Republic. Story, p. 30.



- Regular contributions make a big difference to the operating budget of this department, helping sustain regular programs and initiatives.
- Your money could also be used to fund and sustain innovative programs that help improve the quality of the education offered.
- If you are short of money, volunteering your time or wisdom to the next generation of graduates is equally beneficial.
- When IU-Chemistry continues to remain a popular and prestigious institution, the value of your degree increases as well.
- When alumni contribute openly to their department, it is easier to procure funds from outside organizations and philanthropists.
- You can give back to your department much more than money – your mentorship, creativity and communication makes our department stronger.

Contributing to your *alma mater* in a significant manner gives you and your business good publicity, and publicity never hurt anyone even if it's not your original aim.

The realization that you have been neglecting your *alma mater* can be easily rectified as you can start giving back in any way you can. Help give back today and build a stronger tomorrow for the next generation of graduates. We look forward to hearing from you soon!

*Cheers, Cate*

## Dear IU Chemistry Colleagues and Alumni,

I am pleased to share some of the 2016 achievements and highlights from the Department.

This past year, we celebrated three promotions. Prof. **Silas Cook** earned the rank of associate professor with tenure, and Prof. **Michael VanNieuwenhze** was promoted to full professor. In addition, Dr. **Chun Hsing (Josh) Chen** in the Molecular Structure Center was promoted to the rank of associate scientist.

We also welcome two new faculty members to our Department. Prof. **Jonathan Schleich** joined us in July 2016. His research group studies the physiochemical coupling between the folding and trafficking of integral membrane proteins in the cell and how these interactions give rise to the molecular basis of disease. In January 2017, Prof. **Xingchen Xe** will join us. His research program is primarily directed toward the precision synthesis of colloidal nanocrystals and their integration into mesoscale assemblies for energy conversion.

Our faculty continue to collect top awards locally and at the national and international levels. These achievements exemplify the quality of research and teaching in the Department. The most prestigious of these honors goes to Prof. **Richard DiMarchi**, who was elected a member of the National Academy of Medicine (NAM) for the advancement of biotechnology in the discovery, development, and registration of peptide and protein-based medicines for treatment of diabetes and related metabolic disorders. He is the first elected member of NAM from the IU Bloomington campus. Prof. DiMarchi also received the 2015 Max Bergmann Medaille from the German Peptide Society for career achievements in peptide chemistry and the 2016 ACS Alfred Burger Award in Medicinal Chemistry for his outstanding contributions to research in medicinal chemistry.

Hearty congratulations also go to Prof. **David Williams** for being selected as a Fellow of the Japan Society for the Promotion of Science, for which he lectured extensively in Japan during fall 2015. In addition, Distinguished Professor **Milos Novotny** won the 2015 Jaroslav Heyrovsky Medal for Advancing Chemical Sciences. This medal is the highest recognition in the field of chemistry given in the Czech Republic. Prof. **Sara Skrabalak** garnered the 2016 Magomedov-Shcherbinina Memorial Prize for her pioneering work in the areas of nanoparticle synthesis, characterization, and application.

Other noteworthy honors in 2016 included Profs. **Kevin Brown**, **Megan Thielges**, and **Yan Yu** receiving NSF Early CAREER Awards that support junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and integration of education with their research. Prof. **Kevin Brown** was also awarded the Amgen Young Investigator's Award, which recognized his pursuit of fundamentally new reactions that advance the basic understanding of chemical reactivity. Prof. **Steven Tait** received the American Vacuum Society Prairie Chapter Early-Career Award for his work in surface studies of self-organized supramolecular systems and his contributions to the Society. Prof. **Yan Yu** was honored with Cottrell Scholar Award to further her efforts in teaching and research at the interface of chemistry, materials, and biology. Drs. **Steven Tait**, **Megan Thielges**, and **Laura Brown** were selected as winners of the IU Trustee Teaching Award, which highlights their efforts in the classroom.





Administratively, Prof. **Steven Tait** replaced Prof **Bogdan Dragnea** as the chair of graduate admissions. I would like to thank Prof. Bogdan Dragnea for his three years of dedicated service in this role. As many of you know, the importance of recruiting top quality graduate students to our Department is critical to maintain strong, competitive research and teaching programs.

We are pleased to have had the opportunity to host a number of very prominent scientists as part of our endowed lecture series. The spring series featured the *Raymond Siedle Distinguished Lecturer*, Prof. Susumu Kitagawa from Kyoto University, and the *Ernest Campaigne Distinguished Lecturer*, Gregory Fu from the California Institute of Technology. The fall series included the *V.J. Shiner Distinguished Lecturer*, Prof. David MacMillan from Princeton University, and the *Harry G. Day Lecturer*, Dame Carol Robinson from the University of Oxford.

Our Department and broader campus community also hosted a number of important symposia during the fall 2016. The 26th Inorganic Alumni Symposium was held on Friday, September 16, and included invited speakers **Leigh K. Boerner**, science editor at The Sweethome and the Wirecutter, **Richard L. Lord**, assistant professor at Grand Valley State University, and **Kenneth G. Moloy**, a program director at the National Science Foundation. The 7th Watanabe Symposium in Chemical Biology was held on Saturday, October 8 and had more of a synthetic organic twist this year. Guest speakers included Prof. George Barany from the University of Minnesota, Dr. Steve Hitchcock from Takeda Pharmaceuticals, Prof. Scott Denmark from the University of Illinois at Urbana-Champaign, Dr. Margaret Faul from Amgen, and Prof. Paul Wender from Stanford University. Lectures from these distinguished speakers were complemented by outstanding presentations from our own Profs. **Kevin Brown** and **Thomas Snaddon**.

Summer 2016 marked the beginning of a new Research Experience for Undergraduates (REU) Program sponsored by the National Science Foundation. Drs. **Sara Skrabalak** and **Jill Robinson** directed the activities for the first, highly successful summer. Ten undergraduates from across the United States and Puerto Rico were selected to participate in this highly competitive 9-week program, focused on nanoscale assembly of molecules and materials. The program culminated with poster presentations by the REU students at the 3rd Annual Symposium on Materials Research. The Symposium was anchored with a keynote address by Dr. Babu Gaddam from 3M Company.

This coming year poses many challenges. The College of Arts and Sciences at IU is developing a strategic plan to guide and direct research and teaching over the next decade. In parallel, the Department of Chemistry will undergo an external review in spring 2017. I hope to have many positives to report next year after our review. However, the pressures of university, state, and federal funding continue to impact our ability to educate the next generation of chemists and keep our department at the forefront of research. The entire Department and I are extremely grateful for your continued and generous support. Without the contributions of our alumni, friends, and colleagues, surviving the current environment would be extremely difficult.

For all of the latest news, please check the Department's website (<http://www.chem.indiana.edu/>) and the periodic news releases from the IU Newsroom that promote the accomplishments of Chemistry faculty, staff, and students (<http://www.chem.indiana.edu/news-events/index.asp>).

If in Bloomington, please stop by and visit us!

– *Stephen Jacobson*

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Current members of the collaboration: Chris Tempas, David Wisman, Brian Cook, Toby Morris, Nick Maciulis, and Steven Tait (not pictured: Sasha Polezhaev, Kenneth Caulton)

## Unique Collaboration Provides Solutions to 'Carbon Recycling'

by Steven Tait and Kenneth Caulton

Chemists are under intense pressure to contribute to society, to better the planet, to solve “grand challenge” problems: health, the environment, functional materials, energy harvesting, and energy storage. This pressure applies not just to the commercial sector, but also to academic science. Federal funding agencies set the bar exceptionally high for fundable ideas: they must have outstanding intellectual merit, but at the same time be “transformative” in solving problems of planetary impact. How can we transform chemical science and technology to improve our way of life and to safeguard our environment?

The numbers are staggering: the annual value of products produced using catalysis worldwide is estimated by the North American Catalysis Society as 10 trillion dollars per year. Forty percent of all food production depends on ammonia fertilizer, and indeed the Haber-Bosch ammonia synthesis from nitrogen (in air) and hydrogen, enabled manifold population growth of the earth following that discovery early in the last century.

But as you sit eating your sandwich, can you be content that you bike to work, or use your electric car, and thus live a sustainable, green life? Unfortunately, the bread in the sandwich needed fertilizer, and the hydrogen needed for ammonia production produces huge quantities of CO<sub>2</sub> via the steam reforming of methane and the water gas shift reactions carried out at every ammonia production plant. *As a result, your sandwich is a polluter!*

Catalysis can be done by passing reagents across particles of catalyst, like flow in column chromatography. The Haber-Bosch process employs this heterogeneous (two phase) approach over iron powders, primarily because the needed high temperatures demand thermally-robust catalysts. But life uses enzymes in a solution (homogenous) medium, and with very severe

constraints on temperature, i.e., near ambient.

There is a constant optimism that homogeneous catalysts, in solution medium, can accomplish anything that heterogeneous catalysis already does. This motivates a huge amount of molecular research in homogenous organometallic catalysis. Conversely, there is a growing ambition in surface chemistry that a high degree of reaction selectivity – usually a trait of single-site organometallic complexes – could be designed into heterogeneous catalysts. This was the goal of a Department of Energy supported project that started in the IU surface chemistry group of Prof. **Steven Tait** in 2010. As early results from that project developed, it became clear that transformative catalysis advances of this kind require a multidisciplinary approach.

This collaboration of surface chemistry and inorganic chemistry originated at the grass roots. Creative, insightful and pro-active graduate students from the **Caulton** and **Tait** groups (usually considered very different fields of chemistry) came together to bridge homogeneous and heterogeneous catalysis, by bringing predictive concepts from molecular chemistry onto surfaces.

**Daniel Skomski**, then a PhD candidate in materials chemistry



in the Tait group, attended a Chemistry GRC talk in December 2013 given by inorganic chemistry graduate student **Brian Cook** from the Caulton group. Brian's topic was tetrazine compounds, which Daniel recognized as cousins of a compound he was then testing for novel surface complexes. Brian and Daniel began a conversation about metal-ligand complexes in these very different environments.

The question was: "How does a metal atom, which does have reactivity when 'naked' on a surface, change when the metal is enveloped in a Lewis base donor, a 'ligand'?"

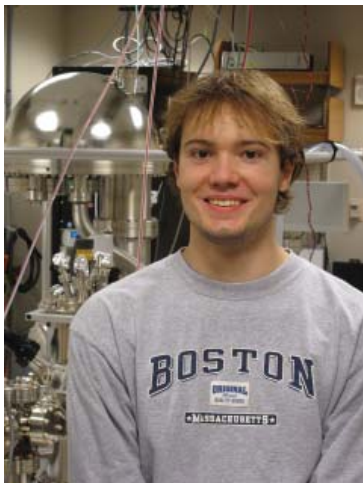
The Caulton group was particularly involved with exploiting the molecular coordination chemistry of ligands (normally thought of as donors) that had the unusual property of being readily reducible (i.e., "redox active ligands").

An elemental metal atom should be a ready source of reducing power: electrons. Redox active ligands are now shown to offer a new dimension to molecular complex reactivity in homogenous medium, so it was natural to ask analogous questions when a planar metal complex is constrained to lay flat on a surface, thus distinctly different from complexes in solution. The Tait group had already begun to study several such ligands, including one of the tetrazine family, and the results with Cr, Fe and Pt were promising. Daniel and Brian put their heads together to form a hypothesis about the impact of increasing N content in the tetrazine ligands and how this could play out in the surface structures and a collaboration was born.

Daniel, now a research scientist at Merck, comments: "Interdisciplinary collaborations like those between the Tait and Caulton groups are essential not only because they advance scientific frontiers, but are also an integral part of the graduate learning experience. The skills I developed in collaborative research at IU have proven essential for my career development as I moved into industrial research and development."

Caulton group participants have had to give up some of their beloved analytical techniques, but the Tait group's unique instrumentation offers two exceptionally relevant ones: Scanning Tunneling Microscopy (STM) and X-ray Photoelectron Spectroscopy (XPS). STM provides real-space molecular resolution of structure, and XPS determines composition and chemical state information from core electron binding energies. Understanding the electron richness at that atom is central to understanding the electron transfer character of redox active ligands more fully.

Two years later: With a key joint publication out, and new exploratory ideas developed, a collaborative proposal was submitted to the National Science Foundation for funding, and the referees reacted positively to the marriage of



Daniel Skomski in the Tait surface analysis laboratory.

organometallics and surfaces. With the technique demonstrated, the groups now focus on what substrates to target for relevance to more rational catalyst design of energy- and environmentally-relevant reactions, hence greater selectivity and more modest temperatures; recall that the energy cost of the high temperature of the Haber-Bosch process consumes nearly 2% of the entire energy consumption of our planet. Lower mechanistic barriers with rationally-designed catalysts can save energy as well as open new pathways to carbon recapture and recycling technologies.

Students currently involved in the project comment: "The ability to control the chemistry of catalyst materials at a molecular scale and to study reactions on those materials will change the future of chemical production, which has a major impact on the world. Personally, it has helped me to improve my critical thinking skills and to help me better present the data from my field to other fields."

"Learning and understanding the physical techniques used have expanded my toolbox in data analysis and comprehension. In addition, working in a collaboration with those outside your field makes one a much stronger communicator of scientific principles, much like learning/teaching a new language."

And finally: "We hope to set new standards for how the community goes about developing interdisciplinary projects in their own departments."

So in the final analysis, this scenario shows what broad thinking, creative, collaborative experimentation, and self-starting graduate students can generate: exciting new science and a half million dollar grant, which funds the research of two students per year for three years. Never underestimate the power of dedicated graduate students in initiating new research themes!

An example of a metal organic complex studied by the Tait/Caulton collaboration. See JACS 136, 9862-9865 (2014), [DOI: 10.1021/ja504850f] and JACS 137, 7898-7902.(2015), [DOI: 10.1021/jacs.5b03706].



**Kenneth Caulton's** research has been in the areas of transition metal hydride chemistry as it relates to homogeneous catalysis and photochemistry. His work has been directed towards making exceptionally unsaturated metal complexes where the several empty orbitals enable reactivity with fast rates (hence less energy-consuming), and with high capabilities for attacking even the most inert of bonds, such as C-H and C-F. A topic of special interest is learning the characteristic reactivities of transition metal radical molecules, including those where significant spin density "leaks" onto the ligand.



**Steven Tait's** research focuses on functional nanometer-scale architectures at surfaces formed by self-assembly of organic building blocks. This research combines the understanding of growth kinetics and materials characterization of physical and analytical chemistry with the rich building block library and supra-molecular organization schemes of organic and inorganic chemistry. Efficient patterning of solid surfaces with organic materials is a challenging research problem that has the potential to open up new opportunities and new technologies in many fields, including molecular electronics, catalysis, molecular recognition/sensors and magnetism.

# Self-assembling biomolecular catalysts for hydrogen production

by Trevor Douglas

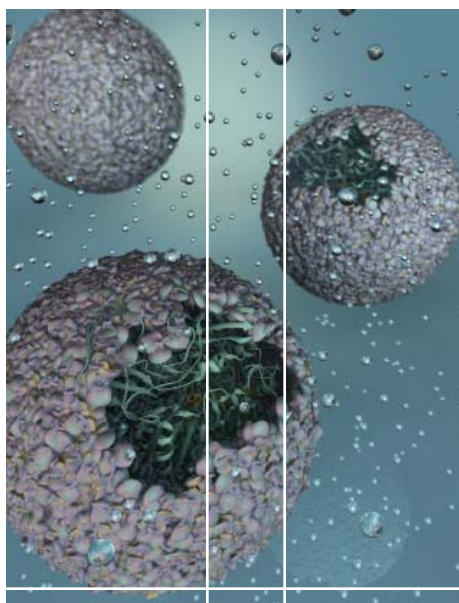
Scientists in the department of chemistry at Indiana University have created a highly efficient biomaterial that catalyzes the formation of hydrogen from water protons – a significant step towards the production of renewable and non-polluting fuels.

The material is produced through a directed self-assembly process where a fragile and sensitive enzyme (NiFe hydrogenase) is encapsulated, with high copy number, within the capsid shell of a virus. The protein-based viral capsid protects the enzyme and enforces the active quaternary structure of the hydrogenase enzyme resulting in a nanomaterial that is 150 times more active than the free form of the enzyme. *“The end result is a virus-like particle that behaves as a highly sophisticated material that catalyzes the efficient production of hydrogen gas”* said **Trevor Douglas**, the *Earl Blough Professor of Chemistry*, who led the study. The design, synthesis, and characterization of the material was reported in a paper titled “Self-assembling biomolecular catalysts for hydrogen production” in the journal *Nature Chemistry* in January 2016.

Other IU scientists who contributed to the research were Assistant Professor of chemistry **Megan C. Thielges**, who assisted with the spectroscopic characterization and interpretation of the unique metal center which has CO and CN — ligands bound to the metal centers; **Ethan J. Edwards**, a Ph.D. student; and **Paul C. Jordan**, a postdoctoral researcher at *Alios BioPharma*, who was an Ph.D. student at the time of the study.

The genetic material used to create the enzyme, hydrogenase, was produced from two genes from the common bacteria *Escherichia coli*. The proteins produced from these genes were encapsulated inside the protective capsid using methods previously

developed by these IU scientists through a process of directed self-assembly. The genes, *hyaA* and *hyaB*, that encode the subunits of the hydrogenase enzyme. The protective capsid is derived from the bacterial virus known as bacteriophage P22. The form of the hydrogenase enzyme is one of three occurring in nature: di-iron (FeFe), iron-only (Fe-only), and nickel-iron (NiFe)-hydrogenase. The third form was selected for the new material due to its ability to integrate into the self-assembled biomaterial and its ability to tolerate exposure to oxygen.



The bioreactors are made up of hydrogen-producing enzymes (green) within virus protein shells (gray), also known as capsids.

The depiction (left) shows high-density packing of nanoscale bioreactors that convert water to hydrogen. These tiny reactors are based on biological functionality and are synthesized through a process called “directed assembly” in which researchers manipulate the system’s natural growth processes to make a new system. The bioreactors are made up of hydrogen-producing enzymes (green) within virus protein shells (gray), also known as capsids. Directed assembly resulted in confinement of the enzymes within the capsid shells, which led to a more stable and active hydrogen-forming material.

The resulting biomaterial, called P22-Hyd, is not only more efficient than the unaltered enzyme, but is also produced through a simple bacterial overexpression process at room temperature. The material is potentially far less expensive and more environmentally friendly to produce than other materials, such as the costly and rare metal platinum, commonly used to catalyze hydrogen production. The NiFe-hydrogenase also gains significantly greater resistance upon encapsulation to breakdown from chemicals in the environment, and it retains the ability to catalyze at room temperature. Unaltered NiFe-hydrogenase, by contrast, is highly susceptible to protein cleavage and



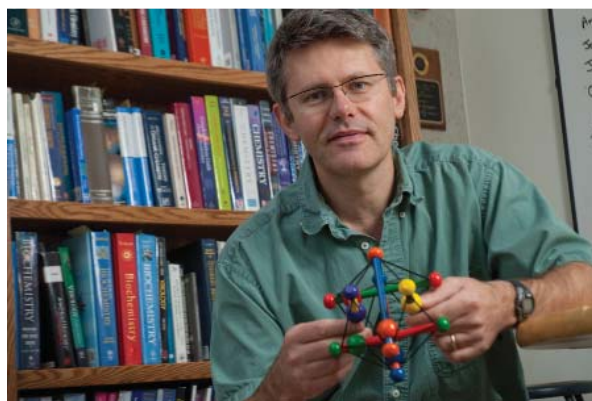
breaks down at temperatures much above room temperature - both of which make the unprotected enzyme a poor choice for use in scale-up and manufacturing.

These sensitivities are “*some of the key reasons enzymes haven’t previously lived up to their promise in technology*,” Douglas said. Another is their difficulty to produce.

Beyond the new study, Douglas and his colleagues continue to craft P22-Hyd into an ideal ingredient for hydrogen power by investigating ways to activate a catalytic reaction with sunlight, as opposed to introducing electrons using electrochemical methods.

This work was supported by the DOE Office of Science (Office of Basic Energy Sciences). P.C. Jordan, D.P. Patterson, K.N. Saboda, E.J. Edwards, H.M. Miettinen, G. Basu, M.C. Thielges, and T. Douglas “Self-Assembling Biomolecular Catalysts for Hydrogen Production.” *Nature Chemistry* 8, 179 (2015). [DOI: 10.1038/nchem.2416]

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Trevor Douglas became the Earl Blough Professor of Chemistry in 2014 at Indiana University where he continues his work in the area of biomimetic materials chemistry. The Douglas group has pioneered the use of viruses as supramolecular platforms for synthetic manipulation with a range of applications from materials to medicine. Through understanding the inherent properties of these cage-like architectures, which include high symmetry and self-assembly, their use as synthetic templates for modification and molecular design has been exploited.



Developed by a remarkable group of College graduate students, SciIU aims to clearly communicate scientific topics, including such pressing topics as human health and well-being and the sustainability of life on our planet. In the internet age, when the speed and freedom of information exchange is seemingly boundless, we believe that scientists have an active role to play in communities, both virtual and real, in which people are passionate about science. Therefore, we believe that open communication about science is everyone’s responsibility, scientist and non-scientist alike. As such, we the writers behind the SciIU blog are, for the most part, graduate students in scientific fields, who may also be your neighbors, your instructors, and your colleagues, and we aim to foster a passionate discussion among everyone at Indiana University with an interest in science.

The goals of the SciIU blog (<http://blogs.iu.edu/sciu/>) are twofold and aim to benefit the communities on either side of the computer screen. First, by providing well-written, accurate posts about science, we hope to develop our ability to communicate with you about our research and engage you in our work. Second, in turn, we hope that you will gain a new perspective on current research, broaden your understanding of science as a field, and engage in conversation with us about topics that you find interesting. To give some shape to the potentially vast topic, this project begins and ends with the science taking place at the IU College of Arts and Sciences; that in itself gives us limitless possibilities.



# IU-Chemistry's REU Nanochemistry Program

## by Sara Skrabalak

Summer 2016 marked the beginning of a new **Research Experience for Undergraduates (REU)** sponsored by the National Science Foundation and hosted by the Chemistry Department at Indiana University. This grant was awarded to Professors **Stephen Jacobson** and **Sara Skrabalak** to support three years of programming. In its first year, ten undergraduates from across the United States and Puerto Rico were selected for participation through a highly competitive application process. These students spent 9-weeks engaged in research focused on nanoscale assembly of molecules and materials, being paired with host laboratories and graduate student mentors based on their research interests and experiences.

In addition to living in the same dormitory on campus, these students participated in weekly activities geared to enhance their learning and facilitate a fun summer experience. A welcome picnic in Bryan Park brought together undergraduate researchers from IU Chemistry and the REU, marking the beginning to the summer and the program. Weekly discussions and tutorials were led by Dr. **Jill Robinson**. Topics ranged from safety in the laboratory and scientific ethics to entrepreneurship and scientific communication. Guest speakers from The Johnson Center for Entrepreneurship in Biotechnology at IU participated throughout the summer programming.

The REU students also worked with their host groups to prepare hands-on activities based on their research. They then shared their activities with ~200–300 attendees at The Wonderlab Museum of Science, Health & Technology, a science museum located in Bloomington Indiana that is geared for children. These activities included the creation of stained glass from metal nanoparticles, the use of microcontact printing to fabricate Janus particles (those with two faces and named after the Roman god), a demonstration of how Gecko feet provide adhesion to walls, and much more! This event was an excellent opportunity for the REU students to learn more about the Bloomington community while sharing their new knowledge in materials chemistry and nanoscience.

The REU students also spent half a day visiting the major pharmaceutical producer Eli Lilly, Inc. (Indianapolis, IN). There, they met with a team of researchers who answered the students' questions about working within the chemical industry and how their prior experiences prepared them for work in this area. They

also participated in tutorials on nuclear magnetic resonance (NMR) spectroscopy and scanning electron microscopy (SEM) as they are applied to pharmaceutical development, allowing them to see firsthand how these techniques are used in Lilly laboratories. The day ended with the group having dinner in the city and taking in an Indianapolis Indian's baseball game.

The culmination of the program was poster presentations by the REU students at the 3rd Annual Symposium on Materials Research. The students did an excellent job both in their summer research and poster presentations. *Rachel Fadler* (Kalamazoo College) received the top poster award for her research conducted in the laboratory of Professor **Amar Flood**. For her accomplishments, she will receive travel assistance to present her results at a regional or national conference during academic year 2016-17. Other participants included *Joseph Burkhart* (St. Olaf College; Host **Sara Skrabalak**), *Bethany Christopher* (Missouri Baptist University; Host **Nichola Pohl**), *Melanie Geiger* (Pennsylvania State University; Host **Lane Baker**), *Gennady Gorin* (Rice University; Host **Trevor Douglas**), *Vicmarie Marrero Colon* (Universidad Metropolitana; Host **Caroline Jarrold**), *Bryce Marshall* (Center College; Host **Stephen Jacobson**), *Mackenzie Moore* (University of Southern Indiana; Host **Yan Yu**), *Samantha Schrecke* (Fairfield University; Host **Steven Tait**), and *Nicholas Shuber* (Georgia Southern University; Host **Bogdan Dagnea**).

The program will continue in summer 2017, with more information available at <http://www.chem.indiana.edu/reu/>. You may also follow the activities of the REU program at our Facebook page at <https://www.facebook.com/chemreu/>.



**Sara Skrabalak's** research provides general design criteria and strategies for the rational synthesis of new nanomaterials with desirable properties. When an inorganic material is confined to nanometer size regime in the form of nanocrystals, new and size-dependent properties often emerge. These properties can be used in new technologies with the potential to address critical social needs such as better tools for disease diagnosis and treatment and platforms for sustainable energy. Central to these new technologies is the ability to synthesize high-quality nanomaterials, where the composition, size, shape, and architecture of the nanocrystals are precisely controlled. These efforts are directed toward materials that are compositionally complex (and thus traditionally more challenging to achieve as high-quality samples) and toward the development of scalable routes to nanomaterials.





Photos of REU students (top) after their poster presentations at the Materials Symposium, (bottom) at Wonderlab, and during a tutorial on poster preparation.

## IU Molecular Modeling & Design Laboratory

In the fall of 2015, the National Science Foundation awarded a \$1.2 million grant to Professors **Amar Flood**, **Peter Ortoleva**, and **Steven Tait** to advance research on self-assembling molecules and multiscale modeling. The long-term goal of the research is to develop next-generation molecular films for solar cells, circuits, sensors and other technology by a rational design methodology. The grant will fund graduate students and postdocs in each of the labs to combine expertise in molecular design, molecular modeling, synthesis, supramolecular self-assembly, and surface analysis. The project is an experiment-theory collaboration between these three groups and the group of Professor Krishnan Raghavachari in the Department of Chemistry as well as the group of Professor **Mu-Hyun Baik** of the Korea Advanced Institute of Science and Technology, who was previously a member of our department. The project is funded through the NSF "Designing Materials to Revolutionize and Engineer Our Future" program, which is part of the White House 2011 Materials Genome Initiative.



Photo caption: Some of the current IU Molecular Modeling and Design Laboratory collaborators. Back row (L to R): James Dobscha, John Michael Espinosa-Duran, Henry Castillo, Yun Liu, Yuriy Sereda, Sibali Debnath. Front row (L to R): Profs. Amar Flood, Krishnan Raghavachari, Peter Ortoleva, and Steve Tait.

*"There are more than 100 million known molecules, but in the vast majority of cases we cannot predict what sort of structure they will form when those molecules start packing together,"* says Amar Flood, Principal Investigator (PI) on the grant. *"We want to be able to predict, as well as design, those structures."* Early results of the project have been published in *Chemistry – A European Journal* (Vol. 22, pp. 560-569) with more results on the way. Two PIs and five graduate students from the collaboration presented new research advances at the fall 2016 ACS meeting in Philadelphia in six poster presentations and seven oral presentations.

This new IU collaboration, referred to as the IU Molecular Modeling and Design Laboratory, seeks to advance our ability to predictively model complex molecular and supramolecular systems to advance organic film technologies. Read more at <http://chem.indiana.edu/mmdl/>.



# IU Postdoctoral Fellow Investigates Novel Classes of Antibiotics

by Kevin Fryling

**A postdoctoral researcher in the IU Bloomington College of Arts and Sciences' Department of Chemistry is one of only 10 scientists named to the 2016 class of Pew Latin American Fellows in the Biomedical Sciences, a program of the Pew Charitable Trusts.**

A native of Argentina, **Daiana A. Capdevila** will receive support from the program to spend two years in the lab of Lilly Chemistry Alumni Professor **David Giedroc**, whose group conducts basic research into the fight against drug-resistant bacterial infection.

*"My work at IU involves performing experiments with bacteria to explore the biological aspects of protein regulation," Capdevila said. "This includes studying how sensor proteins from bacteria such as *Streptococcus pneumoniae* and *Staphylococcus aureus* cause molecular changes that allow them to bind to DNA and control the creation of proteins, evading the immune response."*

The research puts her in the middle of the "arms race" between the immune system and bacteria. The sensor proteins studied in Capdevila's work are used by bacteria to trigger the activation of genes that allow these microbes to counteract the immune system's efforts to either withhold or poison them with metal ions, a strategy evolved by the immune system to defeat bacterial infection.

Insights from the work could contribute to the development of a novel class of antibiotics able to fight bacteria such as multidrug-resistant *Staphylococcus aureus*, or MRSA. The primary bacterial strain in deadly hospital-acquired infections, MRSA was estimated by the Centers for Disease Control and Prevention to have infected over 72,000 people in the United States in 2014 alone.

The Pew fellowship officially began August 1, 2016, but Capdevila has been a part of Giedroc's lab since April

2015. She said she was first drawn to studying in the United States — and Giedroc's lab at IU specifically — for the opportunity to gain expertise in biomolecular nuclear magnetic resonance spectroscopy, an advanced technology not yet widely available in Argentina.

*"Daiana's receipt of this award really strengthens our ties with a number of labs in South America that are very well regarded internationally,"* said Giedroc, who praised the quality of the lab where Capdevila previously earned her doctorate.

Ultimately, Capdevila said she wants to use the skill she gains at IU to establish her own research lab in Argentina. In fact, nearly 70 percent of past fellows in the Pew Latin American Fellows program return to their home countries to build much-needed infrastructure for scientific exploration. Other Pew fellows from this year's class hail from Brazil, Chile and Mexico.

*"The individuals selected [for this fellowship] are just embarking on exciting careers that will expand frontiers in biomedical science, and joining a network of scientists whose work has the potential to improve human health and well-being around the world,"* said Rebecca W. Rimel, Pew's president and CEO. The program was originally established in 1990 to encourage knowledge exchange and collaboration across borders.

Hailing from the bustling capital city of Buenos Aires, with a population of nearly 3 million, Capdevila said life in Bloomington took some time to get used to initially. But she welcomes her sojourn as a Hoosier.

*"Living here for the past year, I've definitely enjoyed*





*the landscape and the surroundings of the town and the woods on campus,” Daiana (left) said. “Bloomington made me realize that I really like biking to the lab, buying local groceries and living in a college town.”*

The Latin American fellows program is part of Pew’s strategy to invest in young scientists who are exploring questions fundamental to advancing human health. Other members of this year’s class are studying at the National Institutes of Health, Cold Spring Harbor Laboratory, Massachusetts General Hospital, Yale University, Columbia University, Tufts University, Rockefeller University and the University of Virginia.

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**Kevin Fryling** is a news and media specialist with IU Communications, focusing on science at IU Bloomington. He has more than 10 years of experience as a writer and editor at research universities, including the University at Buffalo, where he earned a master’s in English, and IU, where he has also worked at the IU School of Medicine and Indiana CTSI. A former newspaper reporter who majored in English and minored in computer science.

## **Library News** *by Jennifer Laherty*

The Chemistry Library has undergone significant changes this year. We bid farewell to **Tiea Julian**, our *awesome* Branch Coordinator for the past ten years. Tiea was a major source of continuous excellent service to chemistry on the IU Bloomington campus. She has moved on to a position at the IUPUI campus. Her absence has been widely felt this fall; however, we are settling into a new working relationship with staff, led by **Justen Warne**, from the Wells Library Access Services Department. Justen is taking care of our everyday operations and managing our excellent crew of student employees.

IU Libraries system continues to consolidate its branches and this year the Swain Hall Library, which served astronomy, informatics, mathematics, physics and statistics, permanently closed its doors in May. Nearly 20,000 volumes from the Swain Library were transferred to the Chemistry Library so that access to important volumes could be maintained on campus while lesser-used volumes went to our storage facility. We are delighted to be joined by my colleague, **Bob Noel**, who is frequently serving Swain Library patrons in our space. We look forward to many future collaborations serving the Science community together.

We were able to find a good home for hundreds of volumes of *Methods in Enzymology* which we withdrew from the library because IU Libraries already had a full print run of this resource in its collections. The staff at the Donald F. and Mildred Topp Othmer Library of Chemical History at the Chemical Heritage Foundation in Philadelphia were very pleased to fill in many missing volumes from their collections with ours.

The facilities staff on campus have finally identified and fixed a major leak under the original 1930’s portion of the chemistry building, in the library’s stacks area. This necessitated a full move of the books which worked well when we integrated the collection from the Swain Library.

We have two new Library Science graduate students working with us this year. **Andy Utterback** is a 2nd year MLS student while **Madison Chartier** is a 1st year MLS student. Both are undertaking research data management and digitization projects for various science departments on campus. Their positive new energy is a welcome addition to our staff.

I am looking forward to meeting the full cohort of new chemistry graduate students this fall to teach them the EndNote Bibliography Citation Management program as they pursue their C500 papers.

Please come by the Library to chat with us if you are in the area or send me email: [jlaherty@indiana.edu](mailto:jlaherty@indiana.edu).

# C500: Introduction to Research Gets a *Facelift*

by Cate Reck and Meghan Porter

The Department of Chemistry habitually accepts 40-50 graduate students into its fold each fall. Most first-year graduate students can expect a fairly rigorous first-year of expectations: teaching undergraduate discussions or labs and taking two to three graduate classes, all while working to identify a research group that will be their creative “home” for the next four to five years. However, incoming graduate students only undergo a one-week Associate Instructor training boot camp the week before classes start. The first few months in a graduate program bring out the best in a student: hard-work, resilience, self-sufficiency and sheer motivation for a goal that will only come to fruition years down the road. As many of you know, graduate school is a marathon, not a sprint.

Incoming graduate students at IU-Chemistry enroll in C500: *Introduction to Research* to help them acclimate to a new paradigm called “graduate school” and choose the correct research group. Until recently, this course has consisted of students sitting through a series of forty-five minute faculty seminars, lasting four days per week for the first several weeks of the fall semester, after which students picked a research group in mid-October. Although the course did its job in educating graduate students on the research being pursued at IU, it did not address the professional development aspects that graduate students needed to best prepare them to become an independent researcher in the most efficient time possible. One common complaint about graduate school has been that it’s a sink-or-swim culture. We sought to change this culture by helping all students start their path to the Ph.D. on equal footing

and improving overall matriculation in our program as best as possible.

*Challenge accepted!*

Most recently, Professor **Cate Reck** and then graduate student **Meghan Porter** (now IU Lecturer) received a Cottrell grant (“*Improving STEM Associate Instruction at Indiana University*”) to revamp C500 and develop it into a professional development seminar to help meet the needs of our incoming graduate students.



The newly revamped C500 is in its third year iteration, and Professors **Amar Flood**, Meghan Porter and Cate Reck oversee and teach the class. Students learn about their research opportunities by attending two research poster sessions in the evenings. Poster sessions allow for more informal and personal interactions with a potential mentor and group members. In addition, new students are expected to interact with a potential group four to five times in different settings (group meetings, shadowing, small groups, one-on-one) to help them make well-informed decisions about their future research homes.

For the seminar portion, we settled on three core themes centering on teaching skills, research skills and professional skills. Teaching topics ranged from active learning strategies in discussion and labs, successful grading practices, classroom management strategies, ending with active discussions of the pedagogical literature. Students are asked to write a short self-reflection of their own teaching and complete a peer-review in both fall and spring semesters.

Faculty and senior graduate students rotate in to help with panel discussions. This semester, Professor **Silas Cook**, Professor **Trevor Douglas**, along with graduate students **Nick Maciulis** and **Kevin Bond**, led a panel



discussion on How to Be Successful in Research, where topics ranged from reading the literature, developing good time management skills, setting and prioritizing goals, good and bad data collection, working with your advisor and committee, and ultimately, gaining your independence in research. **Jen Laherty** (IU Libraries) came to teach students about how to use End Note proficiently to help them get off to a good start in the literature.

Finally, time was devoted to good communication skills (both oral and written), preparing an elevator speech for multiple audiences, ethics case studies, an overview of CV and NSF biosketch preparation, and then finally how to prepare for the C500 Research Plan document that is due mid-November. Amar Flood led students in an overview on how to write a grant proposal and students were encouraged to submit for an NSF or NIH Fellowship.

This course meets on Tuesdays and Thursdays for the first eight weeks of the semester; we think it's a small investment for a large potential return. If our incoming graduate students start off their trajectories strongly, they will finish in a more timely manner, with heightened

skills, more intentional focus during graduate school, and ideally, heightened opportunities after graduation. Ultimately, each student's success is in their hands, but we intend to be here to help them off to a great start. Thus far, we feel the course has done its job in setting the appropriate expectations for graduate school. We will see when we graduate more successful students in the next year or two.



**Cate Reck** is a Clinical Professor and Director of Undergraduate Studies since 2007. She teaches courses in general chemistry, inorganic, organic, and service learning. She is a faculty advisor for five student groups, and chaperones overseas service trips since 2003.



**Meghan Porter** is a Lecturer who teaches classes for non-majors and inorganic chemistry. She specializes in innovative assignments to improve high impact practices in the classroom.

## Intensive Freshmen Seminar: *Function Follows Form*

In August 2016, Associate Professor **Steven Tait** taught a chemistry course in the IU Intensive Freshman Seminar (IFS) program titled *"Function Follows Form: A Molecule's Perspective on Chemistry and Materials."* IFS is a university program that offers incoming IU freshman the opportunity to arrive on campus three weeks before the start of fall semester and take one intense course as they acclimate to the campus and transition to the rigors of college education. Prof. Tait's course was built on the concept that a molecule's chemical structure determines its functional properties. The first three days consisted of a crash course in chemical bonding, molecular structure, and organic chemistry. Following those topics, the class studied specific examples of chemical structure impacting function in polymer chemistry, biochemistry, food chemistry, drugs, and household chemicals.

*"I was initially interested in the IFS program by the idea of creating a small community for incoming freshman within the overwhelmingly large university campus," said Professor Tait, "but as the class progressed, I realized that IFS presents a unique educational opportunity. The students are only enrolled in one course during IFS and there are few activities on campus to distract them, so they have an enormous capacity to learn actively and engage in the class."*

The fifteen students in Professor Tait's class (pictured right) presented a culmination of their studies in an academic forum at the Indiana Memorial Union on August 16, 2016, which included five interactive presentations about polymers, dyes, nutrition, drugs, and "common scents."



# In Memoriam: Max Marsh (1923 – 2016)

## Pharmaceutical Researcher, Chemist and Pioneer

Max Marsh is described as “a person of rare vision and extraordinary insight,” a scientist with an “incisive understanding” of chemical science far beyond his own research areas, “a great mentor,” and a pioneer in computational chemistry.

Max started his course work at Indiana University, but it was interrupted by World War II and the necessity to support his family during a time of national economic adversity. Max joined the US Army in 1943, serving overseas in India for 2½ years. After earning his Bachelor of Science degree in Chemistry with high honors from Indiana University – Bloomington in 1947, he declined a graduate fellowship to Johns Hopkins University and instead accepted a research position at Eli Lilly and Company as a chemist in the Analytical Department where his interests and activities ranged widely in chemistry, molecular biology and informatics. This position would become the beginning of a 42-year career at Eli Lilly and Company.

As a young chemist at Eli Lilly and Company, he began pushing the frontiers of theoretical chemistry and rational drug design. During his tenure, he developed CADD (computer-aided drug design), a program which allowed researchers to purposely develop a specific drug for a specific problem. Recognized for his excellence, Marsh rose to the position of Research Advisor, held by only the most gifted and visionary scientists at Lilly. He also was an enthusiastic proponent of the chemical informatics degree program at IU — and has been an ardent supporter of his *alma mater*. Throughout this extraordinary career, Marsh maintained close ties with the IU Department of Chemistry.

The importance of Marsh’s close and enduring relationship with IU would be difficult to quantify, even for an analytical chemist, but his faculty colleagues say that it is enormous. “He is simply a scientific treasure — a true statesperson for Indiana University,” says

David E. Clemmer, Professor and Robert and Marjorie Mann Chair in the Department of Chemistry at Indiana University Bloomington. “Max’s contributions to science and impact within IU and our department go far beyond the ordinary. He has had an extraordinarily substantive career and has influenced many other scientists, including a number of our faculty.”



When Marsh, an Indianapolis native, began working at Eli Lilly and Company, analytical chemistry was a very different discipline than it is today. Analyses were largely based on “wet” methods; the field of applying electronic instrumentation for chemical measurement was still in its infancy. The job of “discovering” new drugs was the work of organic chemists or biochemists, while analytical chemists were often assigned tasks such as testing for impurities, characterizing compounds, or calibrating dosages.

“In those days, the trial and error method of making and testing compounds was the only road to drug discovery,” says Robert B. Hermann, a former colleague of Marsh’s at Eli Lilly and Company. “One can just imagine some of the chemists’ resistance to the change to structure-based design that Max advocated,” he adds. “But he made it happen, because he was held in such high regard among the scientists at Lilly.” Marsh had been at Lilly only a short time when he published an article assessing the chemical methods that would be appropriate for analyzing pharmaceuticals. His article, “*Pharmaceuticals and Natural Drugs*,” which appeared in *Analytical Chemistry* in 1950, became a classic in the field.

In those early years he worked and published papers on new methods of analyzing pharmaceuticals and on electronic instrumentation and automated approaches for chemical measurement. He was named head of Lilly’s analytical research department in 1956 and, in a promotion that put him very near the top of Lilly’s scientific career path, was named Research Advisor in 1966. Marsh’s ascension to top positions in both research and administration at Lilly was a



rare accomplishment. Recognizing his brilliance and accomplishments as a scientist, Max Marsh's students and colleagues often called him Dr. Marsh.

By the mid-1960s, Marsh had decided that the future of drug development would depend on quantum chemistry and structure-based drug design. *"Max Marsh was a pioneer,"* Hermann says. *"He was the first in the entire pharmaceutical industry to initiate a sustainable program for the use of rational drug design and theoretical chemistry."* Instead of waiting to discover a beneficial drug, scientists could now work to design a specific drug to attack a specific problem. *"Max's vision about CADD (computer-aided drug design) has proven entirely correct,"* says Donald Boyd, Research Professor of Chemistry at IUPUI and also a former colleague of Marsh's at Lilly. *"It took the rest of the world about 20 years to catch up to where he knew pharmaceutical research would evolve."*

While CADD may, among Marsh's many contributions to medical science, be what Marsh is most closely associated with, colleagues say he had myriad distinct interests, was quick to see how advances in one field might lead to further advances in another field, and was a genius for bringing people together. *"At scientific seminars on almost any subject—whether in chemistry, biology, or pharmaceuticals—Max could ask the most thought-provoking, insightful, and useful questions,"* says Boyd. *"He has an incisive understanding that his fellow scientists admire and value."*

Marsh's more than 40 published articles have focused on such distinct topics as theoretical and computational chemistry, organic chemistry and natural products, recombinant technologies, medicinal chemistry, protein structure and analytical chemistry, and biochemistry. *"It is highly unusual for persons of comparable positions in industry to publish as much as he did, to be sought after as frequently as a conference and seminar speaker, and to be selected for service on editorial boards,"* says Milos Novotny, distinguished professor and Lilly Chemistry Alumni Chair at the Indiana University Bloomington Department of Chemistry. *"Max has covered an enormous range in his research career."*

Throughout this extraordinary career, Marsh maintained close ties with the Indiana University Bloomington Department of Chemistry, sharing his knowledge and ideas with faculty members and mentoring graduate

students. In 1971, he was named an adjunct industrial professor of the department. In 1982, the department held a one-day symposium in his honor. After retiring from Lilly in 1986, he moved to Bloomington and accepted a long-term appointment as a visiting research scientist. In 1990, he was named an adjunct professor of chemistry. Max Marsh was ultimately recognized with an Honorary Doctor of Science, D.S., from Indiana University-Bloomington in 2003.

*"At the same time, Max accepted an ever-expanding role in other aspects of the university, where his wisdom and judgment were of tremendous importance,"* says Gary M. Hieftje, Distinguished Professor and Robert and Marjorie Mann Chair in Chemistry at Indiana University Bloomington. *"However, he still found it possible to spend nearly as many hours in the chemistry department as do even most junior faculty members."* Marsh's service to IU included serving on the Board of Directors for the College of Arts and Sciences Alumni Association, holding the offices of Vice President in 1988 and President in 1989. He also served on the Dean's Advisory Board for the College of Arts and Sciences for several years.

Max Marsh personified the American motto: there is no limit to what you can accomplish through hard work and a strong work ethic. Few scientists with doctoral degrees accomplished what he accomplished in the research world with only a bachelor's degree.





At the end of 2015, **William F. Carroll Jr.**, Adjunct Professor in the IU Bloomington College of Arts and Sciences' Department of Chemistry was named a fellow of the American Association for the Advancement of Science, a distinction that recognizes outstanding contributions to the progress of science and research. Carroll was elected due to his distinguished advocacy on behalf of the profession and professionals of chemistry.

While Carroll has retired from his Vice President position at Occidental Chemical Corp., he has continued service with the American Chemical Society (ACS) presently as a Board Member with previous ACS service as President and Board Chair. A recipient of the IU Distinguished Alumni Service Award, he has spent a career working to advance the success of individual chemists and encourage a climate of business and innovation in the chemistry industry through engagement in professional societies, trade organizations and government. At IU, he leads one-on-one and workshop-based career counseling for graduate and postdoctoral students, and he previously taught a course on polymer chemistry.

Carroll is also involved in sustainability and science policy, and he has served as an expert on groups commissioned by the United Nations Environment Programme, the U.S. Environmental Protection Agency and three U.S. states.

The past year marked many milestones for the **deSouza group**. In spring the group was busily analyzing fusion in  $^{19}\text{O} + ^{12}\text{C}$ , an experiment conducted in 2015. The results show a clear and significant enhancement in the fusion cross-section for neutron-rich light nuclei as compared to their beta-stable counterparts. It was the groups' first successful measurement of a total fusion cross-section with a low-intensity radioactive beam. Collaboration with theoretical colleagues to establish the origin of this enhancement and the publication of the results is in progress. In May, **Tracy Steinbach** was awarded her PhD becoming the first female graduate of the group—another milestone.

Summer was spent on preparations for a fall experiment at Michigan State University, the newest accelerator at the radioactive beam facility, ReA<sub>3</sub>, which will no doubt be a learning experience. Preparing for the fall experiment meant developing a

new type of detector, an axial field ionization chamber. This detector enables identification of contaminants in the radioactive beam at a rate of  $3 \times 10^5$  ions/s, a rate considerably higher than previously possible. Needless to say developing this detector would not have been possible without the assistance of our superb technical facilities in the department notably the Electronics Instrument Services and the Mechanical Instrument Services. The new detector was tested at MSU in July, performed flawlessly and a publication describing it has already been accepted for publication.

In November the group (**Justin Vadas, Varinderjit Singh, Jacob Huston, Sylvie Hudan and Romualdo deSouza**) will trek to East Lansing, MI to measure fusion in  $^{39,47}\text{K} + ^{28}\text{Si}$ . Although East Lansing is not the exciting locale compared to some previous experiments (e.g., Normandy or Florida) the group is excited nonetheless, particularly Justin as it is his thesis experiment! As usual the group traveled to present results at conferences and workshops. Perhaps the most exciting trip was in June when Romualdo deSouza travelled to the Grand Accélérateur National d'Ions Lourds (GANIL) in Caen, France providing the opportunity to reconnect with friends and colleagues. He proposed the measurement of fusion in  $^{20,21}\text{O} + ^{12}\text{C}$ . Despite an extremely high demand for the beamtime the multi-million dollar proposal was approved. It seems that the group will be heading once again to the Normandy beaches in 2017!

**Richard DiMarchi** received the American Chemical Society Alfred Burger Career Award in Medicinal Chemistry and was elected to the National Academy of Medicine. The research of his group was profiled in a July editorial in Nature Medicine titled "*All in One*". Two prominent reviews pertaining to his IU research were published in Nature Reviews Drug Discovery, "*Pursuit of a Perfect Insulin*" and Cell Metabolism, "*Unimolecular Polypharmacy for Treatment of Diabetes and Obesity*". The clinical development of drug candidates directed at cardiometabolic disease and obesity that were discovered at IU have been acquired by Novo Nordisk. As part of this acquisition Prof. DiMarchi has taken full academic leave to assemble and direct a laboratory at Purdue Research Park in Indianapolis focused on diabetes and metabolism. His academic research program in Bloomington continues in macromolecular sciences applied to other therapeutic areas.



**David Giedroc**, Lilly Chemistry Alumni Professor and former chair of the department (2010-2015), was recently awarded a five-year, \$2.9M “*Maximizing Investigators’ Research Award (MIRA)*” from the National Institute of General Medical Science (NIGMS) of the National Institutes of Health (2016-2021). This award is designed to encourage leading NIGMS investigators to pursue a wider range of research directions than is possible by two or more traditional R01 awards. Professor Giedroc hopes to make new discoveries in how bacterial pathogens, including the causative agents of major nosocomial infections, survive host efforts to stave off these life-threatening infections by manipulating the bioavailability of essential transitional metal nutrients, e.g., zinc, copper and manganese. In related studies, he hopes to understand how these same bacteria exploit reactive forms of sulfur (required to synthesize essential amino acids and anti-oxidants) in mitigating the effects of antibiotics-based stress operative at the host-pathogen interface.

Glucose, because of its association with diabetes, is well known, but nature can hold 15 other sugars like glucose plus another 8 sugars like fructose that share the exact same molecular weight as glucose. These small structural variations can enable huge numbers of potential biological functions, but pose a significant challenge for easy identification of each carbohydrate present in a sample. Graduate student **Gabe Nagy** in the **Pohl research lab** has now found the first method to differentiate all these 24 isomers using mass spectrometry, a technique not usually associated with discerning compounds with the same mass.

The group had found earlier that enzymes distinguish related sugars not just by simple binding events, but also by incorporating kinetic effects. In other words, the “wrong” sugar does other things faster than it reacts in the enzyme active site. With a similar logic, Gabe discovered that he could identify any of the 24 individual glucose isomers through binding of the sugar to a metal and chiral ligand pair and then measuring the relative mass ratios of the sugar versus the ligand falling off in the mass spectrometer. Work continues in Simon Hall to incorporate this new discovery into a full process for de novo oligosaccharide sequencing.

In spring 2016, **Cate Reck** taught a new overseas-study seminar preparing students for a service learning brigade to Moca, Dominican Republic. With the help of a Metz Grant, Cate and chemistry undergraduate, **Ken Guerra** (May 2016 IU chemistry graduate), joined nine other travelers on an inaugural trip in May 2016. During this one-week trip, students were able to fabricate the ceramic filters (containing amalgamous silver), meet and educate community members on the benefits of clean drinking water, distribute nearly 50 filters into community homes, test local water samples, and survey past filter recipients on their filter use and general health. This trip will occur on an annual basis, and Cate will continue to chaperone the medical brigade to the Guatemala every spring break.

Cate and IU School of Education graduate student, **Roshan Lamichane**, have been pursuing research toward identifying and evaluating the most relevant misconceptions that undergraduate science majors carry from the general chemistry into the organic chemistry curriculum. Their research findings were presented at the 2016 *Biennial Conference of Chemical Education* in July, and they have a manuscript in review. Cate taught a new course for the Groups Program in summer, helping 36 first-generation college students prepare for their science classes for the fall 2016. With the help of undergraduate, **Raven Black**, and with funding from the Office of the Vice Provost for Undergraduate Education (OVPUE), we were able to pilot a new PASS program. The PASS program is a peer supplemental instruction program that allowed students more one-on-one help outside of class. We hope to expand this program into our mainstream chemistry courses in the coming school year.

Cate continues to serve as a Faculty Fellow for the Women in STEM Living Learning Community along with Professor **Megan Thielges**, mentoring 35 incoming female science majors in fall 2016. This LLC is in its fourth year on campus.



Ten IU students on an inaugural service trip to the Dominican Republic to help fabricate and distribute water filters into homes.

*continued on page 19*

**Jill Robinson** is in the inaugural class on Mosaic Fellows at Indiana University. The Mosaic Initiative designs classrooms to support collaborative learning and evaluates and shares the effectiveness of these spaces. For more information on the Mosaic Initiative visit <https://uits.iu.edu/mosaic>. Jill gave a keynote address entitled “*Learning is not a Spectator Sport: Strategies for Active Learning*” at the W. E. Harris Teaching Workshop at the University of Alberta. In May 2016, Indiana University hosted a three-day workshop for forty analytical chemistry faculty members from minority serving institutions. Participant’s goals were to adopt or adapt modern laboratory experiments and engaging classroom activities from the Analytical Sciences Digital Library website. A National Science Foundation Transforming Undergraduate Education grant funded the workshop.

2015-16 has been marked with new adventures for members of the **Skrabalak group**. The group continues to develop new synthetic methods toward nanocrystals, which are characterized by their small dimensions and size- and shape-dependent properties. To understand their structures with greater precision, they have been working with scientists at Oak Ridge National Laboratory at the Spallation Neutron Source on scattering experiments and the Center for Nanophase Materials Sciences on microscopy experiments. These collaborations produced a 2016 manuscript in ACS Nano which examines how the phase of bimetallic crystals change as a function of particle size (DOI: 10.1021/acsnano.6b02669). Current work is examining how local crystal order contributes to the optical properties of oxynitride photocatalysts, which are capable of absorbing visible light to facilitate reactions at their surfaces.

In summer 2016, Professor Skrabalak and graduate student **Dennis Chen** were selected to participate in the Joint US-Africa Materials Institute held in Arusha, Tanzania. This NSF-sponsored initiative aims to build materials science research and collaborations between the United States and Africa and to develop ties between young materials researchers in both regions. Professor Skrabalak delivered a series of lectures on nanomaterials as a part of the two week program, and Dennis, in addition to participating as a student attendee, led the group in a hands-on activity involving nanoparticle synthesis and characterization.

Other members of the Skrabalak group also attended a number of conferences this past academic year, with Pacifichem (Honolulu, HI) being deemed the best by graduate students **Rebecca Weiner**, **Alison Smith**, and **Meredith Kunz**.

In the **Smith group**, senior graduate student **Anne Hickey** has uncovered a rich vein of chemistry, in which she combines low valent metal ions with very electron-releasing supporting ligands. This combination gives rise to exceptionally electron rich metal center, while still stabilizing analogues of species that are typically transient in nature. For example, she has been able to isolate and investigate the properties of complexes that are analogues of classical organometallic species. This includes an analogue of  $\text{Fe}(\text{CO})_4$ , a molecule that has a fleeting existence and is generally only investigated at cryogenic temperatures. We anticipate that these molecules will have application in bond activation chemistry.

Building on the groups’ expertise in atom transfer chemistry, former postdoc **Mei Ding** (now in Singapore) developed a new synthetic method for the assembly of magnetic clusters, in which partial atom transfer creates a bridge between two magnetic ions (*Inorg. Chem.* 2015, 34, 4560). This result was selected as an ACS Editor’s Choice and featured as a Concentrate in C&E News (September 21, 2015). Mei also discovered new classes of magnetic molecules in which large spin-orbit coupling gives rise to unanticipated single molecule magnet behavior.

The **Yu Group** has had a very exciting and productive year in 2015-2016. Professor Yan Yu received the Faculty Early Career Development (CAREER) award from the National Science Foundation and was named a Cottrell Scholar (among a total of twenty four nation-wide) by the Research Corporation for Science Advancement. Both the CAREER and Cottrell Scholar

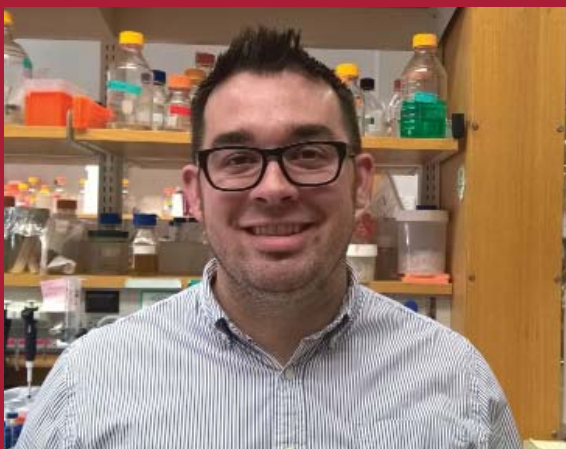
awards recognize the best early career faculty who “exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research.” Both awards will support cutting-edge research in the Yu group as well as their outreach activities aimed to promote interdisciplinary education.

The group continues to develop new nanotechnology-based tools to measure and

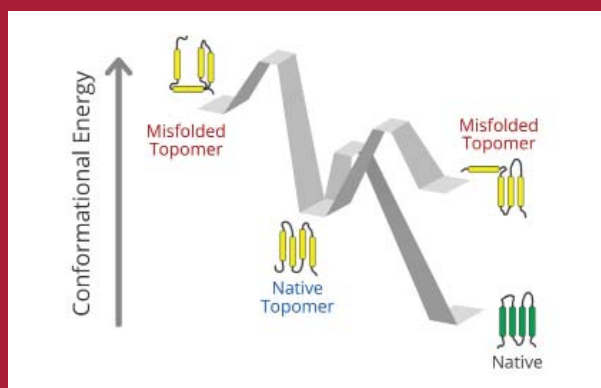


Indiana University hosted a three-day workshop for forty analytical chemistry faculty members from minority serving institutions.

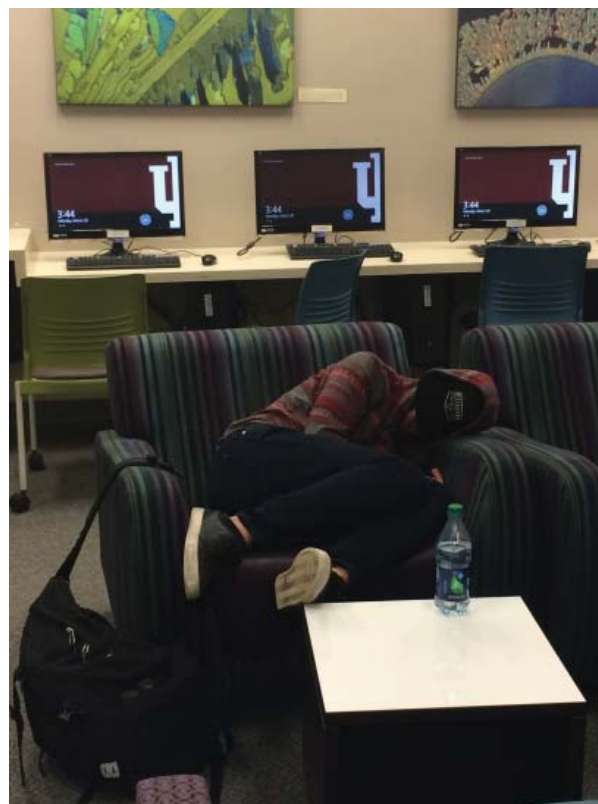




**THE SCHLEBACH GROUP** is interested in the energetics that mediate the folding and misfolding of a ubiquitous class of biomacromolecules known as integral membrane proteins. Correct folding of integral membrane proteins is essential for a wide array of biochemical processes. Furthermore, genetic and/ or environmental perturbations that disrupt these folding reactions are responsible for a wide array of human diseases. Using a complimentary set of biochemical and biophysical approaches, the Schleich group seeks to elucidate the kinetic and thermodynamic properties of integral membrane protein folding reactions. These investigations will also seek to determine the means by which energetic perturbations give rise to the molecular basis of cystic fibrosis, autism, and hereditary blindness. These findings in conjunction with methodological development efforts will provide opportunities to develop new drugs and to improve currently prescribed therapeutics.



control immune functions for potential biomedical applications. Graduate students, **Yuan Gao**, **Kwahun Lee**, and **Lucy Sanchez** have each published a first-author paper in top chemistry journals. Yuan Gao discovered that rearrangement of molecular presentations on particles is effective in reducing the immune clearance of these potential drug carriers. Using unique magnetic particles, Kwahun Lee controlled the activation-and-inactivation of immune cells by using a simple handheld bar magnet, a discovery that has potential application in cancer immunotherapy. Lucy Sanchez developed nanoparticles that look like striped billiard balls to measure previously unseen dynamics of immune cells. Lucy Sanchez and Kwahun Lee presented their research work at the annual Biophysical Society Meeting in February 2016 in New Orleans, LA.



# Strong elements toward

## Kristina McReynolds & Erin Edwards

### Maintain Fiscal Responsibilities

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Funding

At universities across the United States, cuts in federal research funding have started to slow the pace of scientific progress. While 60% of Americans support federally-funded research (January 2015 Pew survey), Congressional funding cuts to basic research, in addition to the across-the-board budgetary reductions, from 2010 to 2013 resulted in the largest overall decrease in a three-year period since the Sputnik era (American Association for the Advancement of Science, AAAS). Longer range viewing comparing federal spending on R&D as a share of the GDP has been in a long, slow decline since the 1970s, when it peaked above 2 percent. According to the AAAS, the fiscal year 2014 figure at 0.78%. Overall, the federal budget provided \$145.2 billion in R&D in FY 2016. In nominal dollars, this represents an increase of 6.4% above FY 2015 (before factoring in an inflation rate of 1.6%). With these types of fluxes in research budgets and the uncertainty of the political landscape, this produces a lot stress for faculty to find funding and keep an active research program funded and vigorous.

To help combat these funding insecurities, IU-Chemistry has recently developed two staff positions that work in concertedly to help faculty: find funding opportunities, submit grants that have the best chance of being funded, and once funded make the most out of their research dollars.

Faculty start the process with **Kristina McReynolds**, our Grant Specialist. Kristina has worked at IU for the last four years assisting faculty with their pre-award needs, identifying appropriate programs and divisions for submission, and then assisting in the preparation of the final document for submission on time. In the post-award phase, Kristina aids through progress reports, helping ensure faculty are in compliance with the grants once the funds are granted, and monitoring specific agreements. She is also the Training Program Administrator for the department's Quantitative & Chemical Biology (QCB) Graduate Training Program. In this capacity, she is responsible for handling the website, making brochures, training students, and ensuring Responsible Conduct of Research Training for the QCB participants.



Kristina McReynolds and Erin Edwards

*Where does one get the technical training to do this heavy lifting?* Interestingly, Kristina has a BFA in Ballet with a minor in Communications from the University of Utah. Although not immediately obvious to the casual viewer, her background in dance has given her a strong work ethic and an eye for technical detail needed for this position. She sees each new grant as a form of art, where the scientist uses data, rhetoric, and persuasion to support their request to the funding agency.

After college, Kristina worked at the University of Utah's School of Medicine as an Executive Secretary in Grants and Contracts, acquiring the foundational skills she uses in her position today. From there she was quickly promoted to Project Coordinator, and then Sponsored Research Coordinator where she became signing official for seven departments. In these positions, she gained valuable experience with both federal and non-federal grants, most specifically with the NSF and NIH. After twelve years she said good bye to the outdoor beauty of Utah, and headed to Duke University.

At Duke University, she found a position that allowed her to utilize and expand her skill set as Sponsored Projects Manager. In this position, she set up a software system that helped each research lab track how time was being spent toward each grant (this was especially helpful during the future auditing of a grant). There, she also pushed herself to learn how to design websites, teaching herself Drupal, and many of the web pages are still being used at Duke today.



After a short stint in Northern Arizona, she moved to Indiana University where IU-Chemistry was lucky to acquire her skill set and use it well for our benefit. She has been a great addition to faculty grant submission, progress, and funding success. When not at work, you can find her mountain biking in Brown County if you can keep up with her.

After the success and high of getting that grant, **Erin Edwards'** job typically starts. Erin is the Assistant Director of Business. Among many tasks, Erin helps



ensure that all grant accounts are set up correctly, assists IU's ORA with financial reporting requirements, provides account expenditure projections, sees that no cost extensions are applied for on time and ensures all financial charges are applied correctly to the appropriate grants. In addition, her role oversees Chemistry Scientific Stores and a large amount of the day-to-day fiscal operations, including purchasing and receiving as well as auxiliary and service center billings, in the Business Office.

Originally from Zionsville, Erin is a Hoosier. She graduated from Indiana University in 2006 with a BA in Telecommunications and a BA in Sociology. Her employment with the department started in 2007 as an Administrative Assistant, working for several faculty on the third floor until 2012. This experience first exposed her to the proposal development process and award administration arena. While working in 2013, she started a Master's program in Information Science with IU's Information & Library Science department. With only a couple courses to go, she will graduate in summer 2017. With a zest for creativity, she has an eye for detail and the end user experience and hopes to channel her professional and academic knowledge to develop and expand available resources for account and award management.

Both Erin and Kristina enjoy knowing they have played a part in making the funding process at IU chemistry work. Without their positions and having faculty be able to rely on their knowledge and abilities, the faculty's ability to apply for, receive, and then handle the funding would truly be minimized.

1. <http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/>
2. <https://www.aaas.org/fy16budget/federal-rd-fy-2016-budget-overview>

## Staff News by Cheryl Johnson

**Gabe Hare** was hired as the Apple Systems/Media Specialist (new position). Gabe worked previously as an hourly in the Chemistry IT Group. Gabe received his BA in Studio Arts in 2008 and Master of Library Science in 2012, both from Indiana University. His experience includes management of Macintosh Systems and Undergraduate teaching labs, installation and configuration of operating system and software in the University Domain in both server and client environments, and operating system administration and management for Windows and Macintosh.

**Liz McCarthy** was hired as a Lecture Demo Technician in the undergraduate teaching labs (replacing Caitlyn Cooper). Liz received a BS in Biochemistry from Purdue University in 2009. Her prior position as a Research Technologist was at Penn State University in the Entomology Department.

**Jim Lewis** was hired as the Proposal and Administrative Coordinator (new position) in the Chemistry Department. Jim has a BA in Anthropology from Indiana University and is fluent in Modern Greek. He was the owner and appraiser of Lewis Appraiser Services in Indianapolis for 14 years, then Senior Sales and Development Specialist at Moriden America, Inc. for about 2 years. He worked at UITS Finance Office, Data Center at Indiana University as a Receiving/Shipping Attendant prior to accepting his current position in the Department of Chemistry.

**Colleen McConahay** was hired as an Administrative Secretary in the Research Support Group (replacing Amy Dowell). Colleen's previous experience includes a

Secretary/Customer Service Representative for Cook Aviation at the Monroe County Airport, and most recently, an Administrative Assistant for the City Controller at the City of Jeffersonville, Indiana. She received a B.S. in Exercise Science (Major), and Psychology (Minor) from Indiana University in 2008.

### Service Recognition

**10 years – Jeremy Anderson**

**Jeremy Boshears**

**15 years – Becky Wilson**

**35 years – Jackie Drake**

**Don Garvin**

**Cheryl Johnson**

**40 years – Rick Hackler**

### 2016 Staff Award Recipients

**Aulaire Schmitz** (Lecture Demonstration Technician for Undergraduate Labs)

**Thomas Smith** (Research Machinist in Mechanical Instrument Services)

If you read the *Wylie Diaries* (**Theophilus A. Wylie** was the cousin of the first IU President and a prolific note-keeper regarding IU history) from 1905, you will read that the importance of 'outside lectures' to then **President Swain** (1893 – 1902). Swain noted in his recommendation to the Board of Trustees in November 1896 that he wanted authorization to bring in speakers of "highest standing in his line to give a series of lectures to the students." It was not until 1905 that the Department of Chemistry felt this financial reward and invited its first outside specialists in chemistry. The first outside speakers to chemistry were C.F. Burgess and Lewis Kahlenberg, both arriving in the same week in 1905.

The IDS reported on April 17, 1905: "The Chemistry Department was honored this morning by a visit of Professor Burgess, Professor of Applied Electro Chemistry, at the University of Wisconsin. His topic was 'Electrolytic Iron.'"

Professor Kahlenberg delivered a four-day set of seminars in Beck Chapel from April 18 – 21, 1905, titled: "The Importance of Original Investigation in State Universities," "The Objects and Aims of Modern Physical Chemistry," "The Present Status of the Theory of Solutions," and finally, "The Theory of Solutions."

The IDS reported: "Prof. Kahlenberg is one of the best known workers and teachers in this line of Chemistry, in this country or in Europe, and besides this is a very interesting lecturer."

One hundred years later and the Department of Chemistry continues this tradition of inviting outside speakers to enlighten our students every week. The 2015 – 2016 academic year boasted over 100 seminars throughout the school year. Below are just the highlights of our distinguished invited speakers and symposia held on campus. To catch us up to the time of printing, you will see a couple symposia listed twice.

## Special Seminars

September 30, 2015 - *Frank C. Mathers Distinguished Lecture*: Michael T. Bowers, Professor, Department of Chemistry and Biochemistry, University of California at Santa Barbara, "Non-Covalent Peptide Assembly: The Latest Results"

November 18, 2015 - *Harry G. Day Distinguished Lecture*: Brian T. Chait, Camille and Henry Dreyfus Professor, Laboratory of Mass Spectrometry and Gaseous Ion Chemistry, The Rockefeller University, "Hybrid Methods for Defining the Structure and Function of Cellular Machines"

February 17, 2016 - *Ernest Campaigne Distinguished Lecture*: Gregory C. Fu, Altair Professor of Chemistry, Division of Chemistry and Chemical Engineering, California Institute of Technology, "Metal-Catalyzed Cross-Coupling Reactions of Alkyl Electrophiles"

April 20, 2016 - *Raymond Siedle Distinguished Lecture*: Susumu Kitagawa, Professor, Department of Synthetic Chemistry and Biological Chemistry, Graduate School of Engineering, Kyoto University, "New Dimensions of Porous Coordination Polymers/Metal-Organic Frameworks"

## 25<sup>th</sup> Inorganic Annual Alumni Symposium:

September 25 – 26, 2015

This long-held symposium had successful attendance at the seminars on Friday, culminating in the picnic at Brown County State Park on Saturday.

- **Alison R. Fout**, Assistant Professor of Chemistry, University of Illinois at Urbana-Champaign, "Transitioning Within the Big 10: From Early to Late First-Row Metals"
- **Tim Nadasdi**, Strategy Advisor, ExxonMobil Research & Engineering, "Greasing the Skids for a Chemistry Career in Industry"



Alumni **Tim Nadasdi** (center) speaks with Inorganic graduate students at the Inorganic picnic at Brown County



- **Eyal H. Barash**, Patent Attorney and Member of Barash Law LLC, *"Intellectual Property After Academia – Hitting the Ground Running"*
- **Timothy P. Hanusa**, Professor of Chemistry, Vanderbilt University, *"Organometallic Chemistry with a Hammer: Adventures in Mechanochemical Synthesis"*

### 2015 Gill Symposium: September 30, 2015

The Linda and Jack Gill Center for Biomolecular Science (GCBS) was established to advance the understanding of complex biological processes and to train next generation scientists in state-of-the-art biomolecular measurements, especially in the field of neuroscience. Collaborations include Indiana University's world-class Departments of Biology, Chemistry, Molecular and Cellular Biochemistry, Physics, Psychological and Brain Sciences, Neuroscience, and the School of Medicine. The Gill Center is located in the new Multidisciplinary Science Building which provides the headquarters and scientific research laboratories for the Gill Chairs, students, post-doctorates and fellows.

The 2015 invited speakers included:

- 2015 Gill Distinguished Scientist Award Lecture, *"Neuroplasticity in the Brain Stress Systems in Addiction"*, George F. Koob, Director, National Institute on Alcohol Abuse and Alcoholism
- 2015 Gill Transformative Award: *"Dissecting the Neural Circuits that Mediate Motivated Behavior"*, Garret D. Stuber, Assistant Professor, UNC Neuroscience Center, University of North Carolina at Chapel Hill

Featured speakers:

- Mary Kay Lobo, Assistant Professor, University of Maryland School of Medicine, *"Divergent Roles of Nucleus Accumbens Projection Neuron Subtypes in Motivational Behaviors"*
- Loren Parsons, Professor, The Scripps Research Institute, *"Losing Balance: Impaired Endocannabinoid Signaling in Stress and Addiction"*
- Marina E. Wolf, Professor and Chair of the Department of Neuroscience at the Chicago Medical School, Rosalind Franklin University of Medicine and Science, *"Synaptic Mechanisms Maintaining Persistent Cocaine Craving"*

Eli Lilly and Company for nearly a decade, and who was a pioneer in the study of the cellular mechanics of the heart. In 1994, Watanabe assumed the role as President of Lilly Research Laboratories and is responsible for launching eleven new and pivotal pharmaceutical products. The list of invited speakers is below:

- Marv Caruthers, University of Colorado, *"Oligonucleotide Synthesis Interfaced with Molecular Biology and Nanotechnology"*
- **Trevor Douglas**, Indiana University, *"Redesigning Virus Particles"*
- Sam Gellman, University of Wisconsin, *"Mimicry of Protein Surfaces with Alpha/Beta-peptide Foldamers"*
- Chad Rienstra, University of Illinois, Urbana-Champaign, *"Insights from Solid-State NMR into Parkinson's Disease, Antifungal Drug Mechanisms and Blood Coagulation"*
- **Megan Thielges**, Indiana University, *"Dynamics of Protein Molecular Recognition"*
- James Williamson, The Scripps Research Institute, *"Dynamics of Ribosome Assembly in Bacteria"*
- **Zhong-Yin Zhang**, IUSM Department of Biochemistry & Molecular Biology, *"Drugging the Undruggable: Therapeutic Potential of Targeting Protein Tyrosine Phosphatases"*

### NOBCChE Research Symposium:

October 17, 2015

A breakfast, poster session, lunch culminated in a keynote speaker, Professor Theodore Goodson III, University of Michigan, *"Novel Optical Properties of Small Metal Clusters"*



Organizing members of National Organization of Black Chemists and Chemical Engineers (NOBCChE)

### 6<sup>th</sup> Annual August M. Watanabe Symposium in Chemical Biology: October 8, 2015

The Watanabe Symposium honors the late August "Gus" Watanabe, a renowned physician, researcher and professor who led research and development at

*continued on page 25*



### Symposium on Materials Student Organizing Committee:

Back Row (left to right): Dr. Steven Tait, Lucy Sanchez, Jared Kafader, Ben Noffke, Wencao Yang, Hitesh Waghvani, Kwahun Lee, Meredith Kunz, Evan Rugen. Front Row: Kimberly McCoy, Chris Williams, John Michael Espinosa, Dennis Chen, Jhanvi Sharma, Colleen McConahay, Daniel Biner. Not Pictured: Bo Qiao.

## 3<sup>rd</sup> Annual Symposium on Materials Chemistry: July 28, 2016

The Third Annual Indiana University Symposium on Materials Research took place on Thursday, July 28 in the Indiana Memorial Union. Based on prior successes of the first two symposia in 2014 and 2015, the symposium was continued with three key objectives:

1. provide a forum for presentation of research by students and postdocs,
2. foster an interactive environment that will lead to cross-fertilization of ideas and new collaborative interactions, and
3. provide professional development and networking opportunities for undergraduate students, graduate students, and postdocs.

The keynote address was delivered by Dr. Babu Gaddam of the 3M Corporation, in which he gave an overview of his career in polymer material research. In the afternoon, Dr. Gaddam conducted a discussion on careers in industrial materials research with students and postdocs. The graduate student organizing committee of the symposium made an effort to provide more student and postdoc presentation opportunities in this year's symposium. There were ten oral presentations by students and postdocs, representing eight different research groups in the Chemistry department.

The afternoon poster session included presentations from 20 graduate students and 15 undergraduate researchers, including ten NSF-sponsored "research experience for undergraduates" (REU) summer visitors from around the country. **Kwahun Lee** (grad student, **Yu lab**) and **Elisabeth Fatila** (postdoc, **Flood lab**) were recognized for outstanding oral presentations. **Dennis Chen** (grad student, **Skrabalak lab**), **Ranjit Koliyatt**



(grad student, **Douglas lab**), **Alison Smith** (grad student, **Skrabalak lab**), and **Rachel Fadler** (REU, **Flood lab**) were recognized with awards for outstanding poster presentations.

The symposium, attended by 83 students, postdocs, and faculty, culminated in a "picnic" dinner party, which was moved to the atrium of Jordan Hall due to thunderstorms. The symposium was planned and organized by a graduate student committee consisting of **Daniel Biner**, **Dennis Chen**, **John Michael Espinosa Duran**, **Kimberly McCoy**, **Jared Kafader**, **Meredith Kunz**, **Kwahun Lee**, **Ben Noffke**, **Bo Qiao**, **Even Rugen**, **Lucy Sanchez**, **Jhanvi Sharma**, **Hitesh Waghvani**, **Chris Williams**, and **Wencao Yang**, with Prof. **Steven Tait** as faculty advisor. Financial support for the symposium was provided by the Department of Chemistry and the College of Arts and Sciences.



Materials symposium outstanding presentation award winners (left to right): **Ranjit Koliyatt** (grad student, **Douglas lab**), **Alison Smith** (grad student, **Skrabalak lab**), **Elisabeth Fatila** (postdoc, **Flood lab**), **Kwahun Lee** (grad student, **Yu lab**) and **Dennis Chen** (grad student, **Skrabalak lab**)



## 26<sup>th</sup> Inorganic Annual Alumni Symposium:

September 16 – 17, 2016

This long-held symposium had successful attendance at the seminars on Friday, culminating in the picnic at Brown County State Park on Saturday.

- **Leigh K. Boerner**, Science Writer, The Sweethome and the Wirecutter (Bloomington, IN), *"Research, Writing and Realizations"*
- **Richard Lord**, Assistant Professor, Grand Valley State University (Grand Rapids, MI), *"Research and Teaching at a Comprehensive Liberal Arts College"*
- **Kenneth G. Moloy**, Program Director, National Science Foundation (Washington, DC), *"A career in Chemistry: From IU to DC"*

## 7<sup>th</sup> Annual August M. Watanabe Symposium in Chemical Biology: October 8, 2016

The Watanabe Symposium honors the late August "Gus" Watanabe, a renowned physician, researcher and professor who led research and development at Eli Lilly and Company for nearly a decade, and who was a pioneer in the study of the cellular mechanics of the heart. In 1994, Watanabe assumed the role as President of Lilly Research Laboratories and is responsible for launching eleven new and pivotal pharmaceutical products.

The list of invited speakers is below:

- George Barany, University of Minnesota, *"Orthogonal Chemistry for Biological Science"*

- **M. Kevin Brown**, Indiana University, *"No Strain, No Gain: Advances in the Synthesis and Use of Cyclobutanes"*
- Scott Denmark, University of Illinois at Urbana-Champaign, *"Discovery and Optimization of Enantioselective Catalysts through Chemoinformatics"*
- Margaret Faul, Amgen, *"Opportunities and Challenges in Pharmaceutical Process Development"*
- Steve Hitchcock, Takeda Pharmaceuticals, *"Discovery and Validation of Highly Selectively-Expressed Drug Targets"*
- **Tom Snaddon**, Indiana University, *"Chemical Synthesis Methods by Cooperative Catalysis"*
- Paul Wender, Stanford University, *"Function Through Synthesis-Informed Design: Approaches to HIV/AIDS Eradication, Alzheimer's Disease, and Drug Delivery"*



Dr. Semin Lee has been awarded a University Graduate School Distinguished Dissertation Award for 2016. This is the highest honor for research that Indiana University bestows upon its graduate students. Dr. Lee is currently a Beckman Fellow at the University of Illinois.



# CHEMISTRY GRADUATE NEWS

by Dalane Anderson & Toni Lady

During the 2015-2016 school year, Professor **Amar Flood**, was the Director of Graduate Studies. Serving with him on the Graduate Standards Committee were Professors **Lane Baker**, **Srini Iyengar**, **Liang-shi Li**, **Martha Oakley**, **Jeremy Smith**, and **Michael Van Nieuwenhze**.

Professor **Bogdan Dragnea** chaired the Graduate Admissions Committee. Evaluating the hundreds of dossiers submitted to the department were Professors **Kevin Brown**, **Charles Dann III**, **Jeremy Smith**, **Tom Snaddon**, **Steven Tait**, **Megan Thielges**, and **Yan Yu**.

## Graduate Student

**Riyadh Alshamari**  
**Thomas Attack**

**Staci Anthony**  
**Edward Basom**  
**Seth Bawel**

**Daniel Beckett**  
**Chris Benson**  
**Allison Bergmann**  
**Henry Castillo**  
**Dennis Chen**  
**Michael Conner**  
**Nicholas Daanen**  
**Nicholas DeGraan-Weber**

## Graduate Fellowship(s) & Award(s)

Saudi Arabia Fellowship  
Chester E. Davis Organic Fellowship  
Wendell P. Metzner Memorial Award  
Provost's Travel Fellowship  
McCormick Science Fellowship  
Eli Lilly Organic Fellowship  
Robert & Marjorie Mann Fellowship  
E. Campaigne C500 Award  
Three Minute Thesis Competition  
Robert & Marjorie Mann Recruiting Fellowship  
Arts and Sciences Presidential Diversity Fellowship  
Arts and Sciences Presidential Diversity Fellowship  
Jack K. Crandall Award  
NSF Graduate Research Fellowship  
Robert & Marjorie Mann Fellowship

## Research Lab

Jeffrey Zaleski  
Silas Cook

Martin Jarrold  
Megan Thielges  
David Williams

Krishnan Raghavachari  
Amar Flood  
Kevin Brown  
Steven Tait  
Sara Skrabalak  
Kevin Brown  
Sara Skrabalak  
James Reilly



Thomas Attack



Edward Basom



Seth Bawel



Daniel Beckett



Henry Castillo



Dennis Chen



Michael Connor



Nick Daanen



# GRADUATE NEWS



Nick DeGraan-Weber



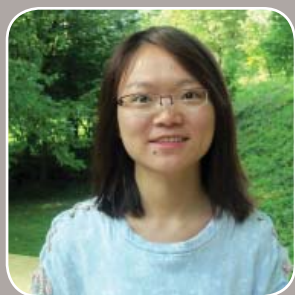
Benjamin Draper



Carmen Dunbar



John Espinosa-Duran



Jie Fu



Anne Hickey



Andrew Kneller



Panagiotis Kondylis

## Graduate Student

Benjamin Draper  
Carmen Dunbar  
Tarick El-Baba  
John Espinosa-Duran

Jie Fu

Anne Hickey

Stephanie Hogan  
Neelam Khanal

Andrew Kneller  
Panagiotis Kondylis  
Jocelyn Legere  
Yun Liu  
Kaitlyn Logan

Corinne Lutomski  
Erin Martin

Kimberly McCoy  
Gavril Nagy  
Gabriel Nieves-Colon  
Benjamin Noffke  
Alyssa Pirinelli

## Graduate Fellowship(s) & Award(s)

Robert & Marjorie Mann Fellowship  
Robert & Marjorie Mann Fellowship  
ChemGRC Travel Grant Fellowship  
Briscoe Teaching Scholar Fellowship  
Felix Haurowitz Award  
Chester E. Davis Inorganic Fellowship  
David A Rothrock Award  
Chester E. Davis Inorganic Fellowship  
Provost's Travel Fellowship  
William H. Nebergall Memorial Award  
INSGS Fellowship  
Robert & Marjorie Mann Fellowship  
Provost's Travel Fellowship  
E.M. Kratz Fellowship  
E. Campaigne C500 Award  
Chester E. Davis Organic Recruiting Fellowship  
Arts & Sciences Travel Grant Fellowship  
Eli Lilly Organic Fellowship  
Chester E. Davis Organic Recruiting Fellowship  
Provost's Travel Fellowship  
Provost's Travel Fellowship  
Robert & Marjorie Mann Fellowship  
Robert & Marjorie Mann Recruiting Fellowship  
Provost's Travel Fellowship  
Carmack Fellowship  
Dean's Excellence in Science Fellowship  
Arts and Sciences Presidential Diversity Fellowship  
Provost's Travel Fellowship

## Research Lab

Martin Jarrold  
Martin Jarrold  
David Clemmer  
Peter Ortoleva

Sara Skrabalak

Jeremy Smith

David Clemmer

Stephen Jacobson  
Stephen Jacobson  
Sara Skrabalak  
Amar Flood  
Kevin Brown

Martin Jarrold  
Dennis Peters

Trevor Douglas  
Nicola Pohl  
Nicola Pohl  
Krishnan Raghavachari  
Nicola Pohl

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## Graduate Student Bo Qiao

Manisha Ray  
Timothy Ricard  
Chelsea Rintelmann  
Jonathan Rittichier  
LaToya Rush  
Anumita Saha  
Lucy Sanchez  
Kevin Schwarz  
Arkajyoti Sengupta

Alison Smith  
Kevin Smith

Virginia Smith  
Christa Snyder

Chris Tempas  
Justin Vadas  
Sean White  
Bret Williams  
David Wisman  
Yao Xu  
Elizabeth Yuill  
Maryam Zahedian

## Graduate Fellowship(s) & Award(s)

Robert & Marjorie Mann Fellowship  
Lynne L. Merritt Award  
Robert & Marjorie Mann Fellowship  
Robert & Marjorie Mann Recruiting Fellowship  
QCB Fellowship  
Briscoe Teaching Scholar Fellowship  
Mays Diversity Fellowship  
ChemGRC Travel Grant Fellowship  
QCB Fellowship  
Lilly Organic Fellowship  
Kraft Fellowship  
Karljin Keijzer Award  
Crane PhD Fellowship  
Lilly Organic Fellowship  
Chester E. Davis Organic Fellowship  
Burton L. Appleton Award  
Briscoe Teaching Scholar Fellowship  
Provost's Travel Fellowship  
Three Minute Thesis Competition  
Raymond Siedle Materials Fellowship  
NSF Graduate Research Fellowship  
Bernard Berk Recruiting Fellowship  
Robert & Marjorie Mann Recruiting Fellowship  
Crane PhD Fellowship  
Provost's Travel Fellowship  
Provost's Travel Fellowship  
Provost's Travel Fellowship

## Research Lab

Amar Flood  
  
Amar Flood  
Srinivasan Iyengar  
Nicola Pohl  
Michael VanNieuwenhze  
Thomas Snaddon  
Lane Baker  
Yan Yu  
Thomas Snaddon  
Krishnan Ravhachari

Sara Skrabalak  
Kevin Brown

Bogdan Dragnea  
Stephen Jacobson

Steven Tait  
Romualdo de Souza  
Kevin Brown  
Caroline Jarrold  
Steven Tait  
Kevin Brown  
Lane Baker  
Bogdan Dragnea



Kaitlyn Logan



Erin Martin



Bo Qiao



Chelsea Rintelmann



Jonathan Rittichier



Toya Rush



Lucy Sanchez



Kevin Smith



## Undergraduate News by Carly Friedman

**W**e added 106 new alumni to the IU-Chemistry family after 2015-2016 fall and spring graduations. The Department of Chemistry conferred 17 Chemistry BS degrees, 33 Biochemistry BS degrees, 38 Chemistry BA degrees, and 19 Biochemistry BA degrees to our students.

**T**he Chemistry Undergraduate Advisors, **Carly Friedman** and **Carlin Schrag**, work diligently with students to ensure that they complete their degrees within the time-frame that they desire. Between General Education, College of Arts and Sciences, and major requirements, there often is little time for self-selected electives. Therefore, we are excited when students, inside the department and out, choose to spend their time in one of our service learning classes. Service learning courses allow students to adapt material they learn in class to real-life situations. IU students, the Bloomington community, and even overseas communities can benefit from our service learning courses as the scope of these courses range from local to global.

**E**very fall, Professor **Ben Burlingham** has between twelve and eighteen students participating in his *G201: Service Learning in Chemistry Hoosier Riverwatch* to work in cooperation with Monroe County Parks and Recreation, City of Bloomington Utilities, and the Indiana Department of Environmental Management. For six years the class has monitored local streams including Cascades, Jordan River and Clear Creek. The monitoring includes chemical and biological parameters, and all data is deposited on the statewide database as a service to the city, county, and state. Fieldtrips have included visits to the Dillman Wastewater Treatment Plant, Monroe Water Treatment Plant, and ICS Water Treatment for PCB removal; speakers have included guests from the City of Bloomington and Indiana Department of Fish and

Wildlife. Students actively engage in discussions of the risk/benefit analysis and methods for delivering potable water to areas of the world which lack available drinking water. **Sarah Johnson**, a first-year Biochemistry BS major explains that she enrolled in the course “*because I want to learn how to utilize my chemistry knowledge to serve my community and my planet.*”

**C**oordinator of Outreach, **James Clark**, has taught the *G201: Service Learning in Chemistry Community Outreach* course at least one semester every year since the spring of 2008. The class size averages 10 to 12 students each semester it runs. Through partnerships with three community organizations, the Boys & Girls Clubs in Monroe County, Girls Inc., and the Banneker Center, students in the course provide a service to these after-school programs by creating weekly one-hour science programs for some or all of the kids at the agency. Parents appreciate that their children spend time working on hands-on activities that provide science education in a low-pressure environment that is free from homework, assignments, and assessments.

**O**ur students who are enrolled in this course find it rewarding as well. They review much of their general chemistry knowledge and are pushed to comprehend the material at a higher level. They are consistently asked to be working at the higher levels of Bloom’s taxonomy, creating lessons and evaluating their own choices for activities and lessons, their presentations, and the value of their service. The lessons are evaluated by the instructor for educational value, safety, and engagement. A high emphasis is placed on learning by doing. The teachers and the learners both benefit from this applied approach to chemistry.

On a global front, Professor **Cate Reck** has been teaching two overseas service learning courses, *G203: Timmy Global Health Overseas*, in conjunction with the non-profit organization Timmy Global Health (<https://timmyglobalhealth.org/>) and the student chapters here on campus. Since very few of our science majors have time in their course-intensive schedules to pursue overseas study, these short-term service learning courses offer science students an opportunity to broaden their global perspectives while in college. One course focuses on the cultural, political, historical, and health-related aspects of Latin America, while preparing students for a service trip to Guatemala focusing on global health and medical health issues. The course includes a one-week trip for typically twenty science majors to Guatemala over spring break each year, where students shadow health professionals to help bring sustainable health care in four villages where we have had a relationship since 2008. Although Cate has been chaperoning similar trips since 2003, this course has only been running since spring 2015 with the hope of bolstering students' education and appreciation on the service trips.

The second overseas course prepares students in a similar vein; however, the focus is learning about the cultural, political, historical, and water quality related aspects of the Caribbean, specifically the Dominican Republic. Coursework helps prepare students to understand water-quality related issues, methods for treating water, in anticipation of preparing students for a service trip to the Dominican Republic. While on this one-week trip, students participate in fabricating ceramic filters (containing amalgamous silver), meeting and educating community members on water quality issues, distributing filters into community homes, and surveying community members where filters had been used for years on efficacy and overall family health.



BS Biochemistry major, **Sonali Mali**, forms a ceramic water filter on a service trip in the Dominican Republic, May 2016.

May 2016 was the inaugural trip for eleven participants, and we anticipate running this trip on an annual basis.

Our Hoosier Riverwatch, Community Outreach, Timmy Global Health Overseas service learning sections benefit both our students, the Bloomington Community, and our partner communities overseas. Our students are able to learn critical thinking, communication, and collaboration while enhancing both their science knowledge and ability to become an engaged community citizen. They often complete the course with a better appreciation for the community and career prospects where their chemistry knowledge and a liberal arts education can be applied.



Graduating students precess into Harry Day lecture hall, Chemistry C122, as parents and faculty watch them get seated, May 2016





G410 Senior Honors Symposium during the Spring 2016 Chemistry Honors Banquet

## Chemistry Honor Roll

The following chemistry and biochemistry majors attained an overall and in-major grade point average of 3.75 or better through the fall 2015 semester

Senior Honor Roll: Alec Bell, David Burke, Vincent Campiti, Mariah Chambers, Alyssa Cheng, Ha Eun Cho, Daniel Cox, Arthur Cross-Najafi, Christopher Dietrich, Alexander Duckworth, Justine Galambus, Hendrik Glauning, Kaitlyn Goggins, Connor Hannon, Samantha Harvey, John Hauber, Mark Hazelbaker, Hannah Henderson, Devin Jones, Alexandra Jostes, Logan Keating, Alisa Klepach, Corrine Kumar, Kevin Kuo, Emilee Larson, Harrison Love, Bryce Manifold, Joshua Mann, Boran Mao, Evan Mazurkiewicz, Joseph McCann, Molly McFadden, Brittany Olson, Parth Patel, Michael Peng, Arden Piepho, Kyle Prisby, Mitchell Rice, John Rose, Lucas Rowe, Alaina Roy, Paige Schultheis, Juan Serna, Jay Shukla, Connor Singrey, Hajeung Song, Theresa Spech, Chiang Tieng Tan, Cody Tragesser, Lauren Wahle, Alexander West, Sen Xiong, Christine Yang, Jason Zappia, Madeline Zook

Junior Honor Roll: Ashely Booe, Liza Burns, Marielle Cabe, Megan Coghlan, Jasper Dittmar, Parker Gill, Mitchell Gray, Lennon Gregor, Sara Hardman, Sarah Harping, Rachel Hartman, Logan Hille, Michael Hinton, Miriam Hu, Oluwagbemisola Ibikunle, Zachary Lee, Samantha Lisy, Sophia McClain, Nicholas Monesmith, Catherine Morgan, Adam Nan, Matthew Pappas, Minal Patel, Wednesday Rees, Andrew Rejer, Clarissa Ren, Elaina Roach, Gina Roesch, LeeAnn Sager, Eda Shi, Andrew Stark, Brett Walker, Sarah Weismiller, Wyatt Wright

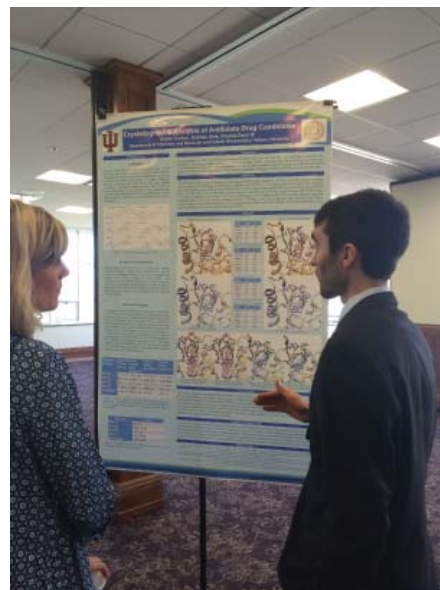
Sophomore Honor Roll: Christopher Arnold, Robert Brenner, Jessica Collins, Jonathan Dietrich, Ayden Farrier, Eric Fleck, Timothy Gruenhagen, Allyson Hamilton, Daisy Heath, Evan Keiser, Hayley Kwasniewski, Bret Lawson, Peter Leonard, Zahra Naderi, Ashley Nguyen, Michaela Pettit, Jacob Pottratz, Austin Reilly, Laura Scanameo, Julie Simon, Zitong Song, Madeline Storz, Jonathan Watson, YoungJun Woo, EJun Yun

Freshman Honor Roll: Sarah Myers, Ethan Theroff

## 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.

Kenneth Carlson, Mariah Chambers, Priscilla Choo, Connor Hannon, Samantha Harvey, Joseph McCann, John Rose



Senior **Austin Collins** (Dann lab) explains his capstone research poster to Professor **Jill Robinson**.

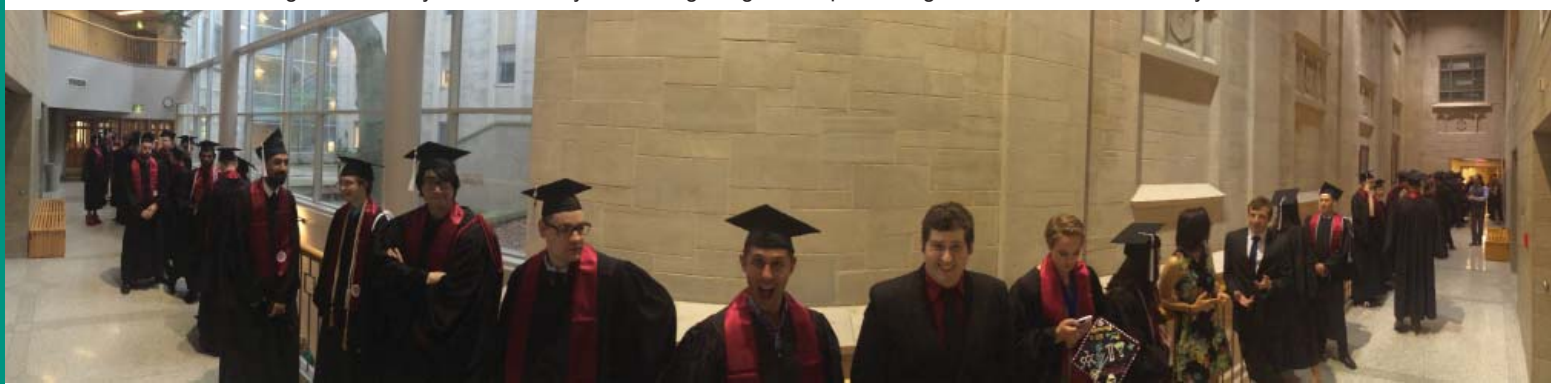
## Phi Beta Kappa Fall and Spring Inductees

Taylor Bastin, Alec Bell, David Burke, Vincent Campiti, Ha Eun Cho, Daniel Cox, Laura Daily, Justine Galambus, Kaitlyn Goggins, Connor Hannon, Samantha Harvey, John Hauber, Devin Jones, Alexandra Jostes, Hanui Kim, Alisa Klepach, Harrison Love, Boran Mao, Joseph McCann, Molly McFadden, Brittany Olson, Parth Patel, Kyle Prisby, John Rose, Juan Serna, Theresa Spech, Cody Tragesser, Albin Vleck, Trent Wagoner, Lauren Wahle, Sen Xiong



1. Professor Dennis Peters, 2. Professor Theodore Widlanski, 3. Gabrielle Davison, 4. Kristoffer Bryant, 5. Samantha Harvey, 6. Tyler Blensdorf, 7. Justine Galambus, 8. Mohammad Issa, 9. Professor Meghan Porter, 10. Professor Sara Skrabalak, 11. Alexander Philip, 12. Alisa Klepach, 13. Aaron Cox, 14. Tyler Barnes, 15. Lauren Wahle, 16. Professor Steven Tait, 17. Stephen Libbing, 18. Professor Stephen Jacobson, 19. Kaitlyn Goggins, 20. Jacob Johnson, 21. Connor Hannon, 22. Madeline Zook, 23. Zachary Hicks, 24. Nick Baird, 25. Emilee Larson, 26. Kevin Kuo, 27. Juan Serna, 28. Mariah Chambers, 29. Priya Parikh, 30. Matthew Rieger, 31. Professor Martha Oakley, 32. Professor Cate Reck, 33. Professor Laura Brown, 34. Professor Jill Robinson, 35. Chiang Tieng Tan, 36. Michael Carson, 37. Gina Kang, 38. Travis Bales, 39. Kenya Tobin, 40. Jiayang Zhang, 41. Kyle Hardwick, 42. Ayanna Smith, 43. Breanne Hand, 44. Dominique Bass, 45. Kelsey Doyle, 46. Dylan Long, 47. Mitchell Shoemaker, 48. Devin Jones, 49. Kristoffer Bryant, 50. Haeun Cho, 51. Joseph McCann, 52. Alexandra Lazerwitz, 53. Alexandra Roper, 54. Jonathan Ellefsen, 55. Sean Hilgenberg, 56. Justin Fick, 57. John Belt, 58. Parth Patel, 59. Taylor Bastin, 60. Jonathan Lenkey, 61. Shubhkarman Multani, 62. John Rose, 63. Kylie Black, 64. Tyran Snyder, 65. Vincent Campiti, 66. Boran Mao, 67. Timothy O'Connor, 68. Joseph Wendt

Graduating biochemistry and chemistry students getting lined up before graduation in the Chemistry Atrium.





## Departmental Scholarships and Awards

C117 General Chemistry Award:	<b>Cody Jacob, Miriam Hu</b>
Organic Chemistry:	<b>Winston Winkler</b>
American Chemical Society Award:	<b>Ha Eun Cho, Justine Galambus, Lauren Wahle</b>
Keith Ault Scholarship:	<b>Kyle Miller</b>
William H Bell Award:	<b>Paige Dausinas, Samuel Patterson, Robert Satterthwaite</b>
John H. Billman Summer Scholarship:	<b>Christine Hustmyer</b>
Harry G. Day Summer Research Scholarship:	<b>Alexander Duckworth, Hendrik Glauning, Jacob Huston, Michael Kundler, Alexander West</b>
Leroy Dugan Scholarship:	<b>Alexander West</b>
Dr. & Mrs. Harlan English Scholarship:	<b>Jasper Dittmar, Molly McFadden</b>
Courson Greeves Scholarship:	<b>Jacob Huston</b>
R.J. Grim Memorial Scholarship:	<b>David Burke, Christopher Dietrich, Hendrik Glauning, Sara Hardman, Logan Hille, Eda Shi</b>
Hypercube Scholar Award:	<b>Corrine Kumar</b>
John R. & Wendy L. Kindig Scholarship:	<b>Stephen Feldhake III, Christine Hustmyer, Maria Khan, Luke Schkeryantz</b>
Margaret C. & Anne Marie Kuzmitz Scholarship:	<b>Michael Kundler</b>
Russell Leo & Trula Sidwell Hardy Scholarship:	<b>Hayley Kwasniewski</b>
Ira E. Lee Summer Research Scholarship:	<b>Daniel Cox, Christopher Dietrich</b>
Andrew Loh Scholarship:	<b>Gina Roesch</b>
Robert & Marjorie Mann Scholarship:	<b>Haider Al-Awadi, Stanley Bram, Hayley Kwasniewski, Bryce Manifold, Adam Oldham, Andrew Rejer, Gina Roesch, Jonathan Specker</b>
Frank Mathers Undergraduate Summer Research Scholarship:	<b>LeeAnn Sager, Eda Shi</b>
Dennis Peters Scholarships:	<b>Daniel Cox, Alexander Duckworth, Joshua Mann, Christine Yang</b>
William G. Roessler Scholarship:	<b>Andrew Rejer</b>
Joseph B. Schwartzkopf Award:	<b>Joseph McCann</b>
Raymond Siedle Scholarship:	<b>David Burke, Jasper Dittmar</b>
Earl G. Sturdevant Summer Scholarship:	<b>Luke Schkeryantz, Trent Wagoner</b>
Lee J. Todd Chemistry Memorial Scholarship:	<b>Joshua Mann</b>
Enola Rentschler Van Valer Trafford Scholarship:	<b>Mariah Chambers</b>
Viola Scholarship in Nuclear Chemistry:	<b>Joe Peculis</b>
Votaw Undergraduate Summer Research Scholarship:	<b>Brett Walker</b>
Forest L. Warner Scholarship:	<b>Bryce Manifold, Trent Wagoner</b>
Francis & Mildred (Eckerty) Whitacre Scholarship:	<b>Brett Walker, Andrew Stark</b>
James C. White Memorial Chemistry Scholarship:	<b>John Rose</b>
Mary Frechtling White Memorial Chemistry Scholarship:	<b>Samantha Harvey</b>

# Alumni Profile: Renã A. S. Robinson

**Renã Robinson** started out like most science students do, on the pre-medical path. Convinced early on that she wanted to be a doctor, she majored in chemistry because it seemed like a straightforward path to becoming a cardiac surgeon. An internship in health sciences during college, however, convinced her that being a medical doctor was not her destiny. Instead, equipped with a chemistry degree with a concentration in Business from the University of Louisville she pursued graduate school to follow up on another career interest in cosmetics.

Renã joined the research group of Professor **David Clemmer** at Indiana University, and learned to navigate and combine two valuable techniques — ion mobility and time-of-flight mass spectrometry — for the large-scale analysis and identification of proteins in biological systems. While a graduate student in the Clemmer laboratory, her research focused on the protein “makeup” (this was the closest that she got to cosmetics) of *Drosophila melanogaster*, commonly known as fruit flies, specifically toward understanding how they age. Chemists and biologists use model systems to try and help answer research questions that aren’t directly easy to study in humans. Renã used fruit flies to study aging because they provide a great alternative to humans, especially as they live less than three months. In addition to their short life span, 60% of the genes found in humans are found in fruit-flies. Scientists also have the ability to easily ‘turn-on’ or ‘turn-off’ a gene in a fruit-fly, allowing them to figure out if a gene might be important in the human aging process. Indiana University houses the largest repository of fruit-fly genetic mutant lines and thus was very accessible for Renã’s research.

Robinson graduated from Indiana University with her PhD in Analytical Chemistry in 2007 and became a Lyman T. Johnson Postdoctoral Fellow and UNCF/Merck Postdoctoral Fellow for two years in D. Allan Butterfield’s laboratory at the University of Kentucky. After this time she started her independent career at the University of Pittsburgh in the fall of 2009.

While reflecting on her career as a student in K-12 through her graduate and postdoctoral years, Robinson recognized that along her path there were not many faces like hers in chemistry. Driven by her experiences and potential to impact other students’ decisions to pursue chemistry, she pursued academia in hopes of addressing the lack of African American — especially female — role models in this field.

In her research lab at University of Pittsburgh, Robinson continues to study aging and neurodegenerative

diseases because a fundamental understanding of these phenomenon is lacking. Her research focuses on finding out how the brain and other systems in the body interact in aging and in Alzheimer’s disease, with the ultimate goal of improving our understanding of the disease and identifying new therapeutic avenues. Addressing this problem however requires new high-throughput proteomics tools to better measure proteins and she is tackling this in her laboratory also.

One large question that she asks is: Do changes outside the brain, such as oxidative stress or metabolism changes, precede or are a response to changes in the brain in Alzheimer’s disease?

Information about oxidative stress and where it takes place in the body could help alter our perception of Alzheimer’s as just a brain disease and lead to new ways to monitor or treat it. Furthermore, Robinson

wants to understand how proteins in the body respond to Alzheimer’s or warn of the disease’s onset. To achieve this, she uses isotopic labeling to tag proteins extracted from various tissues and then carries out proteomics analysis (large-scale protein separations) on them. Robinson has taken what she learned at IU to solve complex problems, combining biochemistry, analytical, and bioinformatics tools to analyze complex mixtures isolated from mammalian and human systems. Her and her laboratory’s efforts are being recognized in different arenas, and she was recently distinguished as one of the Class of 2016 The Talented 12 by Chemical and Engineering News.

Renã Robinson is an excellent example of how to not only be a successful chemist with research but how to also use that chemistry to make an impact in mankind. She has picked important and necessary health problems to study and is committed to improving diversity in the sciences. I know we will continue to proudly keep our eye on her future.

For more information on her research visit her website at [www.rasrlaboratory.com](http://www.rasrlaboratory.com) and see selected publications below:

“Global cPILOT Analysis of the APP/PS-1 Mouse Liver Proteome” (Proteomics: Clin. Appl. 2015, DOI: 10.1002/prca.201400149)

“Proteomics Reveals Age-Related Differences in the Host Immune Response to Sepsis” (J. Proteome Res. 2014, DOI: 10.1021/pr400814s)



Photo courtesy of Renã Robinson



# 2016 Alumni News

Bose McKinney & Evans attorney **Alan W. Becker**, BS'78, JD'81, was selected for inclusion in the publication *Best Lawyers in America 2016* in the area of corporate governance and compliance law. He is a partner in the firm's business services and public offerings and securities regulation groups, assisting clients with many types of corporate and financial transactions, including forming business entities and structuring their ownership arrangements, raising capital from third parties, and buying, selling, and combining businesses. Becker lives in Indianapolis.

During the summer of 2015, Wall Street market strategist **Bryan R. Brown**, BA'78, successfully completed the longest unsupported solo kayak descent of Canada's MacKenzie River watershed. At 2,100 miles, the MacKenzie River watershed is the third largest on earth, after the Nile and the Amazon. Brown's kayaking portfolio now includes some 7,000 miles of unsupported wilderness travel under some of the most challenging conditions possible and the eco/adventure traveler was recently inducted into the Explorers Club. Founded in New York City in 1904, the Explorers Club promotes the scientific exploration of land, sea, air, and space, and its members include Sir Edmund Hillary, Neil Armstrong, and John Glenn. Brown lives in Beverly Hills, Calif.

Colleagues, family, and friends of **John W. Brown**, BA'67, MD'70, have established the John W. Brown Chair in Cardiothoracic Surgery at the IU School of Medicine in his honor. Brown was chief of the division of cardiothoracic surgery at IU for 20 years. After his retirement in 2010, he became the Harris B Shumacker Emeritus Professor of Surgery at IUSM and continues to practice cardiac surgery at IU Health and St. Vincent Hospital in Indianapolis. In 1988, Brown performed the first pediatric heart transplant in Indiana. He and his wife, Carol Ann, own and operate a crop and livestock farm near Gosport, Ind., where they both grew up.

**William F. Carroll Jr.**, PhD'78, is an adjunct professor of chemistry at Indiana University, having retired as vice president of industry issues for Occidental Chemical Corporation after a 36-year career. He is a member and past chair of the board of directors of the American Chemical Society, and also a past president of the organization. He is a Fellow of the Royal Society of Chemistry, and in 2009 he was chair of the Council of Scientific Society Presidents. On behalf of OxyChem, he chaired numerous committees for industry associations, including the American Chemistry Council. He has also served on expert groups commissioned by the United Nations Environment Programme and the U.S. Environmental Protection Agency. Carroll holds two

patents, and has over 75 presentations and publications indexed by the Chemical Abstracts Service in the fields of organic electrochemistry, polymer chemistry, combustion chemistry, incineration and plastics recycling. His lives in Dallas, Texas.

**Gregg Dickerson**, BA'80, MD'84, gave a talk at the annual meeting of the Chinese Society of Therapeutic Radiation Oncology last fall. The conference was designed to strengthen cooperation between scientists in China and those working worldwide. Dickerson's talk addressed his experience in treating more than 1,000 patients. Dickerson is chief of radiotherapy and medical director at Anova Cancer Care in Lone Tree, Colo.

**Gary M. Gaddis**, BA'79, PhD'84, MD'86, has served as the St. Luke's/Missouri Endowed Chair in Emergency Medicine at St. Luke's Hospital of Kansas City since 1999. He is also professor of emergency medicine at the University of Missouri-Kansas City School of Medicine. Gaddis provides academic leadership in the area of emergency medicine education and research. In 2012, he was the recipient of the Peter Rosen Award from the American Academy of Emergency Medicine. Gaddis lives in Kansas City.  
<http://prabook.org/web/person-view.html?profile-id=671296>

**Theodore Largman**, PhD'52, now 92, was honored by Morris Township, NJ, for 50 years of volunteer service on various Township commissions: 50 years on the Environmental Commission, 10 years on the Wildlife Management Committee, and 16 years on Whippany River Watershed Action Committee. Morris Township residents can reserve their garden plot now in the new Theodore Largman Community Garden. Largman, a WWII veteran, served under McArthur in New Guinea and the Philippines. Starting as a chemist at Allied Chemical and Dye Corporation (transitioning to Allied Chemical Corporation, Allied Corp., Allied Signal, finally Honeywell), he worked his way up to Senior Research Scientist obtaining 35 patents during his career. After becoming President and Founder of Triad Industries from 1990-1995, he continued to consult until the time of his retirement.

*"I'm happy to say that I've just published my fourth book, *Product Stewardship: Life Cycle Analysis and the Environment*, published in 2015 by CRC Press," writes **Kathleen E. "Kate" Sellers**, BS'81. She adds, "*Behind that academic title is an exploration of the sustainability and environmental consequences of our use of synthetic chemicals, a subject of vital importance to all of us. Key to writing the book was my BS in chemistry at IU. I'll be forever grateful for that training.*" Sellers is a vice president and principal environmental engineer with ARCADIS U.S., where she supports clients' product stewardship programs. She is on the board of directors of the Product Stewardship Society. She is the co-author and editor of *Nanotechnology and the Environment* (2009). Sellers lives in Groton, Mass.*

Chemist **William J. Sparks**, BA'26, MA'29, DSc'66, was inducted posthumously into the National Inventors Hall of Fame for co-inventing butyl rubber. Responding to calls from the government for much-needed synthetic rubber during the years preceding World War II, Sparks (along with Robert Thomas) co-invented butyl rubber while working at Standard Oil. Butyl rubber was critical to keeping the U.S. and its allies supplied with tires, rafts, boots, and other products during World War II when Japanese warships cut off shipments of natural rubber. Today, butyl rubber is used in protective gloves, sealants and adhesives, inner tubes, and sports balls. Sparks, who lived from 1905 to 1976, had 145 patents to his name.

**Tara C. Stuart**, MS'02 is an intellectual property attorney in the Atlanta office of the law firm Cantor Colburn. Her practice includes litigation, patent opinions and analysis, patent drafting and prosecution, and post grant proceedings. She has several years' experience working with innovative and generic pharmaceuticals, including litigation and opinions in support of abbreviated new drug applications. Stuart has experience with a broad range of technologies in addition to pharmaceuticals, including bioinformatics, biotechnology, medical devices, small molecules and chemical compositions, electronics, computer software and hardware, and e-commerce. Prior to practicing law, she worked as a research assistant at the Loyola University Cardinal Bernardin Cancer Center, where her research focused on leukemia research. Her responsibilities included biochemical and biological characterization of the MLL protein and MLL fusion proteins that are known to cause leukemia and related genes. Stuart lives in Villa Rica, Ga.

**Barbara J. Wagner**, BS'84, has been promoted to special counsel at the Barnwell Whaley law firm in Charleston, S.C. She advises and represents a broad range of clients primarily in the areas of construction law and products liability. Wagner is an attorney, a chemist, a former professor of chemistry at the College of Charleston, and an inventor with 20 U.S. patents. Her law practice areas also include business law and civil litigation, insurance and intellectual property. She has represented chemical and drug manufacturers, tire and boat manufacturers, governmental entities, and numerous construction trades, among others. Wagner lives in Charleston.

## Biology's Corpse Flower: Chemistry Meets Biology

On Thursday, July 14, 2016, **John Lemon**, Jordan Hall Greenhouse Supervisor, announced: "*Our Amorphophallus titanum plant in the tall, first-floor greenhouse conservatory is going to bloom this year for the first time.*" Housed in Jordan Hall, the campus was abuzz this summer in watching and waiting for "**Wally**" to open. Finally, the *titan arum* bloom opened on Friday (July 29, 2016) evening, giving rise to a rotting stench. The rotting stench was strong once the bloom fully opened around 9pm on Friday, the odor being evident even outside of the greenhouse.

Insects such as dung beetles, flesh flies and other carnivorous insects are the primary pollinators of this type of flower. These insects typically eat dead flesh, and the smell and the dark burgundy color of the corpse flower are meant to imitate a dead animal to attract these insects to help ensure pollination. By Saturday morning, the odor had greatly abated, and the spathe (outer sheath) closed and the spadix collapsed at 3:56 a.m. on August 2, 2016.

According to the Chicago Botanic Garden's blog chemical analysis of the stench consists of:

- *dimethyl trisulfide* (also emitted by cooked onions and limburger cheese)
- *dimethyl disulfide* (which has an odor like garlic)
- *trimethylamine* (found in rotting fish or ammonia)
- *isovaleric acid* (which also causes sweaty socks to stink)
- *benzyl alcohol* (a sweet floral scent found in jasmine and hyacinth)
- *phenol* (sweet and medicinal, as in Chloraseptic throat spray)
- *indole* (like mothballs)

Pollen was collected on Monday morning (August 1, 2016) from the *titan arum* "**Wally**" (pictured left) and express-mailed to the U.S. Botanic Garden in Washington, D.C. where a *titan arum* just bloomed. The USBG staff attempted to fertilize its *titan arum* with Wally's pollen. Although pollination did not occur, the USBG was going to send our greenhouse some of the seeds had the attempt been successful.



Once the *titan arum*'s bloom died back and the plant went dormant, and the greenhouse staff dug up the corm (the underground, bulb-like structure) and weighed it (August 30, 2016); it weighed 36 pounds. They planted it in a larger pot on September 12, 2016. A new shoot has already begun to emerge.



# Necrology:

*We remember those in the IU Chemistry family who have passed away during 2015. Included here are deaths of which we learned this year (\*degree year shown is deceased alumni preferred class year).*

EPaul R. Sargent, BA '54, January 07, 2015

Harvey D. Mulder, PhD '50, January 17, 2015

Harvey D. Mulder, PhD '47, January 17, 2015

Richard J. Phillips, MD '69, January 17, 2015

Margaret A. Tolzmann, BA '53, January 22, 2015

Otto T. Englehart, MD '41, February 12, 2015

Craig T. Hinshaw, BA '63, February 19, 2015

Robert L. Gottschalk, DDS '88, February 21, 2015

Hugh W. Johnston, PhD '48, March 01, 2015

John W. Droege, PhD '42, March 03, 2015

Ella M. Bettinger, BS '49, March 18, 2015

Paul J. Fries, BA '51, March 25, 2015

James P. Burnett, PhD '61, April 03, 2015

Robert E. Talbert, MD '49, April 04, 2015

Gerald M. Moredock, MD '70, April 14, 2015

Nancy L. Iatarola, PhD '85, April 24, 2015

Peter G. Arvan, MA '44, April 25, 2015

Roberta J. Peterson, BS '50, May 11, 2015

Mary R. Saxton, BA '42, May 13, 2015

David V. Kirkpatrick, BS '40, May 28, 2015

Gary A. Hunt, DDS '74, June 11, 2015

Rex L. Winchell, MA '48, June 14, 2015

Justin M. Clarke, BA '51, June 23, 2015

William A. Arnett, MBA '59, July 13, 2015

Margaret L. Young, BS '48, July 17, 2015

Maurice M. Rath, MD '36, July 24, 2015

Mary K. Samuel, BS '87, July 25, 2015

Tat-Kin Tsang, MA '73, August 08, 2015

Paul E. Tack, BS '41, August 15, 2015

Delmar C. Sanders, MD '68, August 19, 2015

Charles W. Whittenberger, BA '64, September 01, 2015

Louis F. Bradley, MD '51, September 01, 2015

Wilfred J. Brockman, BA '42, September 05, 2015

Henry G. Nachtsheim, MA '41, September 14, 2015

John W. Chung, BS '48, MA '49, September 20, 2015

Joann M. Laswell, BA '54, September 24, 2015

Ronald L. Wagner, BA '57, September 24, 2015

Thomas P. Konicke, MD '62, September 29, 2015

Kathy A. Saturday, PhD '79, October 01, 2015

William C. Day, MS '55, October 05, 2015

Leonard J. Czuba, PhD '61, October 06, 2015

Ralph H. Carmichael, BS '49, October 17, 2015

Morris Zimmerman, PhD '55, October 28, 2015

George P. Claxton, BS '56, October 29, 2015

Marvin E. Mishkin, MD '58, October 31, 2015

Richard E. Ehlers, MS '70, November 24, 2015

Stephen A. Free, BA '40, December 07, 2015

Neil A. Weikart, JD '72, December 16, 2015

John W. Moore, BA '63, December 17, 2015

David C. Hightshue, MD '62, December 28, 2015

Frank J. Rishe, BA '67, December 28, 2015

Marvin J. Boskin, MA '54, December 28, 2015

If you would like to submit an obituary to be included in the next issue, please send the information and/or a photo to [chemalum@indiana.edu](mailto:chemalum@indiana.edu).



## Corporate Honor Roll

3M Foundation Inc.  
 American Chemical Society  
 American Heart Association Inc  
 Benevity Social Ventures, Inc  
 Bluegrass Documentation  
 Bristol - Meyers Squibb Foundation Inc.  
 Calibrium, LLC  
 Eli Lilly & Company  
 Fidelity Charitable Gift Fund  
 Gaussian, Inc.  
 General Electric Foundation  
 Human Frontier Science Program  
 Iowa State University  
 Johnson & Johnson  
 Law Offices of Mark E. Neff  
 North Carolina GlaxoSmithKline Foundation, Inc.  
 Occidental Petroleum Charitable Foundation, Inc.  
 Pfizer Foundation  
 Procter & Gamble Fund  
 Research Corporation for Science Advancement  
 Sanofi-Aventis  
 The Michael J. Fox Foundation for Parkinson's Research  
 Vanguard Charitable Endowment Program  
 Visit Indy  
 W. W. Grainger, Inc.  
 Waters Corporation

Andrew and Christen Combs  
 Robert and Kathleen Conard  
 James and Kelly Corning  
 Joan Coveleskie  
 Jack and Judith Crandall  
 Arnold Crelier  
 David Dai  
 Dwight Davis  
 Romualdo and Kelly DeSouza  
 Alan Dickinson  
 Bruce Diehl and Diane Wagrowski-Diehl  
 Arthur and Carolyn Diesing  
 Michael and Barbara DiPierro  
 Michael and Mary Doherty  
 Linneaus and Phae Dorman  
 Forrest L Gager Jr Revocable Trust  
 Hugh and Suzanne Gardner  
 Mary Kratz Gasser  
 Frank Gay  
 Vernon Geiss  
 Joshua and Erin Gentry  
 Gregory and Catherine Georgiadis  
 Stephen Jr. and Carole Godomsky  
 Alan Goldhammer  
 Patricia Golgart  
 Raymond Grant  
 Conrad and Rachel Gratz  
 Christopher Growcock and Martha Kapitz-Growcock  
 Charles and Catherine Gwaltney  
 Douglas and Mary Gwost



## Individual Honor Roll

Aleyamma Abraham  
 Robert Ake  
 Robert Anders  
 Mark and Ann Anderson  
 Deon and Lisa Anex  
 Timothy and Irene Ayers  
 Ann Bailey  
 Donald Ball  
 Richard Barber  
 Bruce Barner  
 John and Mary Bart  
 Larry and Karen Becker  
 Jean Beckman  
 Uma Bedi  
 James and Nancy Beeson  
 Nicholas Bensko  
 Genia Berk  
 William and Anne Billman  
 Lawrence and Cheryl Black  
 Merred Blair  
 Holly Bone  
 Charles and Joyce Boxman  
 Ludwig and Sheila Brand  
 Robert Briner  
 Chad Brodt  
 William and Patricia Bromer  
 Richard and Bette Brown  
 Warren & Judith Buddenbaum  
 Susan Buhrow  
 Charles Bunnell  
 Matthew Burk  
 John and Emily Canada  
 William Jr. and Mary Carroll  
 Brent Caudill  
 Tony and Carrie Cheung  
 John Chung  
 Richard Cole

Robert and Judith Douglas  
 Orlando Driver and Paula Potratz-Driver  
 Melvin and Judy Druelinger  
 Ronald Dykstra  
 Dorythe Earl  
 Mark Eaton  
 Richard Ebeling  
 Dwight and Linda Edman  
 Keith Edmonson  
 Rich and Ann England  
 Jeffrey and Cheryl Ferguson  
 James Ferris  
 Sally Foley  
 Geraldine Fouts  
 Froning Family Trust  
 Scott Halasz  
 Robert Hamilton  
 Vernon and Sue Hammersley  
 Daniel Handschu  
 Nancy Harrison  
 Larry Hartman  
 David and Mary Hauber  
 Scott and Claudia Hein  
 John Hemperly  
 William Hodes  
 Zachary and Judy Hodes  
 Alexandra Hoogestraat  
 Mansoor Hoosein  
 Jonathon and Margaret Howell



# 2015-2016 Honor Roll

Tony and Judith Hugli  
E. Victor Indiano  
Stephen and Juli Jacobson  
David and Patricia L. Janizek  
Alex and Elaine Jeffcoat  
Celia Jenkins  
Michael and Gloria Jennings  
John Jewett  
Chang Ji  
Eric Johnson  
Mayn Johnston  
Thomas Jones  
Jurjus Jurayj  
John Kagel  
Maxine Kaplan  
Jerry Keilsohn  
Charles Kelley  
Robert III and Judith Kelly  
Tad Kleindienst

John and Deborah Leonard  
Melvyn and Michele Levy  
Larry and Ricki Lewis  
Reuben Lidster  
James and Nina Light  
Peter and Mary Lindahl  
James and Carolyn Lindsay  
Vida and Jonathan Lohnes  
Lars and Janet Luther  
James Luthy  
Nancy and John Maddox  
Michael and Mary Mahony  
Wayne Mahoney  
Spencer Marcus  
Julia Martin  
Leslie May  
Lawrence and Jennifer  
Burke McBride  
Charles McCrory

B L. Mylari  
Stephen and Deanna Nash  
Mark and Ann Neff  
Edward and Gertrude Neiss  
Deanna Nelson  
Raymond Ng  
William and Susan Nugent  
Hazel O'Connor  
Edward Ottensmeyer  
Andrew & Allison Overhiser  
Kevin Owens and Judy  
Edling-Owens  
Mary and Brian Pack  
Charles & Barbara Paget  
James Pasterczyk  
Donald and Elizabeth  
Paulson  
Richard and Sandra Paur  
Daniel Percy and Mittida  
Raksanaves  
Rex and Margaret Pendley  
J. Greg Perkins  
Philip and Kathryn Perlman  
Dennis Peters  
Stephen Peterson  
Terry and Marga Pletcher  
Paul Prather  
James Qualkinbush and  
Brenda Barker  
Michael and Sharon Rapp  
John and Donna Rau  
Michael and Valerie  
Raymond  
Gerald and Suellen Reisz  
Larry and Jean Rhodes  
James Rice  
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