

# CHEMIGRAM

THE NEWSLETTER FOR BYU'S DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY • AUGUST 2013



## Message from the Chair

Gregory F. Burton

Time continues to pass at a seemingly ever-increasing pace. We are blessed with a strong department due to the quality of our students and the many contributions of our staff and faculty. As a department, we continue to experience much in the way of change. After almost 32 years of service to the University, Juliana Boerio-Goates retired on July 1, 2013. Additionally, after over 19 years of service, Philip Brown will retire on January 1, 2014. We will miss these two devoted colleagues who have blessed the lives of many students over the years and we

wish them well as they pursue new goals and experiences. Emily Bates, who joined us in 2009, will also be leaving at the end of the summer to accept a new position at the University of Colorado Health Sciences Center in Denver. While we'll miss Emily and the contributions she's made to the department, this will be a wonderful opportunity to strengthen her research activities.

This past year, two new colleagues joined us. Dr. Joshua Andersen, a biochemist arrived October 1st, 2012 and Dr. David Michaelis, an organic chemist, arrived on April 1st of this year. They have both successfully recruited graduate students to their groups and submitted proposals for external funding. We are also fortunate to have two new faculty members joining us shortly: Dr. Stacey Smith, a physical chemist who will be heading up our X-ray diffraction facility, and Dr. John C. Price, a biochemist studying proteomics. We look forward to the unique strengths that each new colleague will bring to the department and our students.

This continues to be a productive year for us as a department. By the end of this year we will graduate 51 students with BS/BA degrees, 3 with MS and 7 with Ph.D. degrees. Our faculty submitted 45 proposals in 2012, the second highest number submitted from this department in the past 20 years. Moreover, our faculty and students published 116 peer-reviewed publications, and 81% of our faculty with a research expectation published during the year. Our faculty mentored 206 undergraduate students in individual laboratory research projects; 59% of the students were our own majors with 34% coming from other departments and the remaining 7% coming from high schools and other universities. Our exit interviews with graduating seniors indicate that performing mentored research with faculty in their labs is one of the very best ways of cementing the principles they learned in their didactic coursework. In addition to our undergraduate student mentoring, we also supervised

101 graduate students in our laboratories and 87% of these were seeking doctoral degrees. In April of this year, we celebrated the accomplishments of our students in our annual awards banquet. Seventeen awards recognizing undergraduate student accomplishment were presented while another twenty graduate students received awards or fellowships. We thank you, our alumni, for making these awards possible. It is your contributions to the Department that provide the opportunity of making these awards to our students. This continued support richly blesses the lives of our students!

The current tight economy and government cutbacks are impacting the department in terms of our external funding. During 2012 we brought in approximately one-half of the external funds that we received in 2010. As a consequence of current funding levels, we are writing more proposals and working creatively to identify new funding opportunities. We continue to be favored with generous support from the Church. Furthermore, we are blessed with generous alumni, and I thank you for all that you do in supporting the continued endeavors of the department! As you consider the many invitations you receive to donate, I hope you will continue to think of the Department as a worthy recipient. Your funds are used to support undergraduate and graduate students in doing mentored research, recognizing significant student accomplishments with awards and providing travel assistance to students attending scientific conferences to present their research. Thank you for supporting our endeavors and for being such great ambassadors for the department, college and university.

We look forward to seeing you again at our annual alumni dinner in October. We are working on the program for this year and hope that you will find a warm welcome, the opportunity to associate with old friends and to make new ones. Thank you for supporting our endeavors.

# NEWS

## Y-Chem Commended by American Chemical Society

Jessica Henrie

The Y-Chem Society was selected in September to receive its second consecutive Commendable Award for its activities during the last academic year.

The Commendable Award is the second-highest recognition that can be given to student chapters by the American Chemical Society. Y-Chem is one of 81 student chapters selected by the ACS' Committee on Education to receive a Commendable Award. Dr. Daniel Austin, who served as Y-Chem's faculty advisor last year, is proud of the students in Y-Chem.

"It's a competitive award," Austin said. "All of the [student chapter] reports go to a committee who chooses chapters to recognize for 'outstanding,' 'commendable' or 'honorable mention.' ... They [the student chapter] have to balance lots of different things they have to do, like social activities and leadership and development activities."

Activities put on by Y-Chem last year include: performing several magic shows at elementary schools and various other groups, as well as one show at the Utah County Fair in Spanish Fork; attending the ACS meeting in San Diego in March, where "a good number" of students also presented their research, Austin added; and hosting record numbers of junior high and high school students in May for Open Lab Day on BYU campus.

Austin credited the students involved in Y-Chem with making the chapter so successful.

"Really the students did all the work last year. I was really hands-off," he said. "The club has built up a lot of momentum in recent years. We went from my first year as advisor, when we didn't get any award at all, then we got an honorable mention, and now we've got two commendable awards, which is really significant."

Undergraduate student Joel Everett, who served as treasurer for Y-Chem last year and is now serving as its president, named three ways the chapter benefits both students and the community when he described his decision to become an officer. Y-Chem helped him feel connected to the students and professors in the chemistry ma-





job, gave him opportunities to promote chemistry to the public, and allowed him to become better friends with his peers by spending time with them socially and not just in a study setting.

“Being an officer in Y-Chem has given me the awesome opportunity to work with lots of different professors and students,” Everett said. “I feel much more connected with my major and the department because of my involvement in Y-Chem. I think that what Y-Chem does is really important. We promote chemistry in the community by putting on magic shows and hosting Open Lab Day. I think it’s important to get kids interested in the sciences through these activities. I also think it is important that our club members have the opportunity to volunteer in the community to promote something they obviously are passionate about. The social aspect of Y-Chem is also important to our club members. Although we spend a lot of time studying together, it’s great to connect with the other members by going to social functions, research conferences or through volunteering. Y-Chem is a great way to become better friends with your peers.”

This is Everett’s third year being involved in Y-Chem. Dr. Scott Burt took over as chapter advisor at the end of the last academic year.

## World-Renowned Biotechnologist Visits BYU

Jessica Henrie

On Thursday, Feb. 7, world-renowned biotechnology authority Dr. Robert Langer received the 2013 Izatt-Christensen Award in the Benson Science Building on BYU campus.

Esteemed emeritus chemistry professor Reed M. Izatt was in attendance when the award was presented and at the following lecture on novel drug delivery systems. Dr. Langer delivered the technical lecture to a room packed with students and professors from the Department of Chemistry and Biochemistry and the Department of Chemical Engineering. His general lecture the previous day, “Biomaterials and Biotechnology: Drug Delivery to Tissue Engineering,” was similarly well attended.



“[Dr. Langer] is a giant in the field of chemical engineering and biomaterials. With nearly 1,190 articles and more than 800 patents to his name, he is one of the most prolific and most cited engineers in history,” states a news release by the College of Engineering and Technology. “A day in the life of Dr. Langer includes halting tumor growth, growing human tissue for skin grafts and teaching at MIT as an Institute Professor. He has also helped start 25 companies and his many awards include the National Medal of Science and the Charles Stark Draper Prize (considered the engineering Nobel Prize). He has been named one of the top 100 most important people in America by *Time Magazine* and CNN, as well as one of the 25 most important individuals in biotechnology by *Forbes Magazine* and *BioWorld Today*.”

## Daniel Ess' Research Highlighted in C&E News

Jessica Henrie

The Chemical & Engineering News (C&E News) recently highlighted a paper by collaborators Dr. Daniel Ess of BYU and Dr. László Kürti of the University of Texas Southwestern Medical Center. The research details the experiment and theory of a new organic reagent that converts aryl boronic acids to primary aromatic amines.

The article was published Oct. 22 in the *Journal of the American Chemical Society* (JACS). *C&E News* referenced it in their Nov. 5 journal as part of a news item titled “Extending Aminations’ Reach.” This breakthrough is an important one because it eliminates the need to use metal catalysts and, by extension, the need to separate the metal catalysts from the resulting compound (the aromatic amines), which is expensive.

“This had never been done before,” Ess said. “People have been trying to get this reaction to work but haven’t been successful until now.”

Aromatic amines are important components of pharmaceuticals, agrochemicals, dyes, and polymers. Chemists have been trying to find a metal-free reaction that synthesizes amines for decades without success – until now. Ess (and his BYU research group)’s specific contribution to the *JACS* article was to use theory to show why this new amination reagent works when so many others do not.

Author’s Note: *C&E News* also mentioned an independent article, published Sept. 24 in the *JACS* by a second research team from Boston College. The Boston team developed a different chemical reaction that also synthesizes amines without using transition metal catalysts.

# Migraine Research Development Attracts National Attention

Jessica Henrie

A new development in Dr. Emily Bates' migraine research may change the future of migraine medicine and has attracted the attention of national news.

National Public Radio interviewed Dr. Bates for a news slot in its award-winning show, "All Things Considered," which aired Wednesday, May 1. Local television news stations including KUTV Channel Two, Fox 13 and ABC4 also covered the story.

With a team of researchers from around the country, Dr. Bates recently determined that a missense mutation in a single, specific gene results in migraines. The mutation reduces activity of an enzyme called casein kinase 1 $\delta$ , altering the gene's control of circadian rhythms (in layman's terms, your biological clock) and making people more susceptible to migraines. The discovery suggests a link between the tendency to get migraines and advanced sleep phase syndrome, which is characterized by having a very unusual sleeping schedule, such as being unable to stay awake past 7 p.m. or sleep past 3 a.m.

The discovery represents years of work and has been long in coming – especially for Dr. Bates personally.

"My own migraines were my motivation for going into science," she said. "I decided in high school that I wanted to understand the disorder that robbed me of my days and was beyond my control. No medication could help, so I wanted to be part of the research that would help."

With that goal in mind, Dr. Bates studied biology at the University of Utah and earned a Ph.D. in genetics at Harvard Medical School. In 2006, she took a postdoctoral position in Dr. Louis Ptáček's lab at the University of California, San Francisco. Dr. Ptáček's group had just traced advanced sleep phase syndrome to a gene mutation while studying a family with both the sleeping disorder and dominantly inherited migraines; when Dr. Bates joined the team, she worked with mice engineered to have the same mutation.

"I joined Louis Ptáček's laboratory ... to figure out whether the mice that had the same mutation were more susceptible to migraine," Dr. Bates explained. She worked on the project in Dr. Ptáček's lab for two and a half years before accepting her current position and continuing her research at the BYU Department of Chemistry and Biochemistry.

Meanwhile, collaborators Andrew Charles and K. C. Brennan from the University of California, Los Angeles imaged the brain during the aura part of the migraine. Dr. Ptáček identified a second family with a mutation in the same gene.

"Together, all of this evidence is a strong case that casein kinase 1 $\delta$  is involved in the pathology of migraine," said Dr. Bates.

She and her collaborators published their findings May 1 in the journal *Science Translational Medicine*. As her research makes the genetic mechanisms behind migraines a little clearer, she hopes scientists will be able to use that knowledge to design better drugs to treat them.



## Milton Lee honored in chromatography journal special issue

Jessica Henrie

On October 26, the *Journal of Chromatography A* published a special issue in honor of Dr. Milton L. Lee, a distinguished and respected researcher in the scientific community and at Brigham Young University.

The issue was organized by Lee's former students and colleagues, and each article included in the issue was written or co-written by someone who worked with and was affected by Lee. The foreword, written by Doug Raynie, a former graduate student of Lee's, gives a comprehensive account of Lee's many accomplishments in both academia and business. Among these accomplishments are three companies Lee co-founded to commercialize instruments he helped develop, more than 20 patents filed, and more than 500 journal publications and presentations.

Lee comes from a highly educated family. He grew up in Hyrum, located in northern Utah near Logan, where his father Garth was a professor of chemistry at Utah State University. Of the ten children in his family, all have advanced degrees – five of which are in chemistry. Lee earned his Bachelor of Arts in chemistry at the University of Utah, his PhD in analytical chemistry at Indiana University, and spent a year doing postdoctoral research at MIT before joining the faculty at the BYU Department of Chemistry and Biochemistry in 1976.

When asked about accomplishments he is most proud of, rather than highlight one of his own achievements, Lee said he is most proud of what his graduate students have accomplished.

"There have been some pretty amazing people come through the program," he said. "I keep track of all of them – there are probably around 60 that have graduated and I have seven now."

In addition to producing the special issue of the journal, Lee's former students and colleagues organized a symposium for Lee last September to celebrate Lee's 65th birthday on July 20, 2011.

"I think having a special issue is a nice thing. I appreciate the

thought," Lee said. "It was also really enjoyable to have the birthday party because I saw so many of my former students and colleagues. It's all about the people. I feel really good that so many of my former students and colleagues appreciate my association and feel I've contributed to their lives in some way. That's pretty satisfying."

Anzi Wang, one of Lee's current graduate students who published an article with Lee in the special issue, appreciates Lee very much.

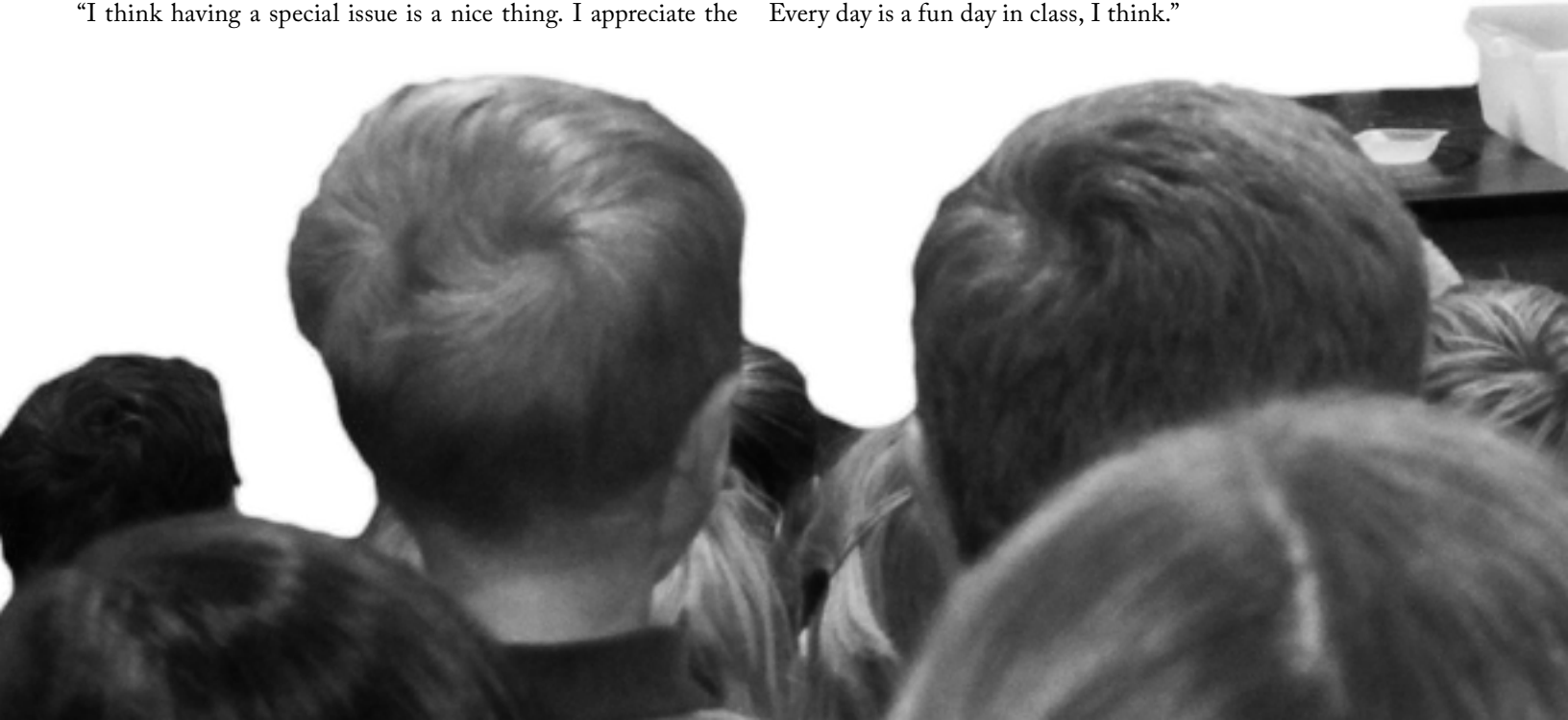
"I chose BYU because of Dr. Lee. I was very interested in chromatography in my [undergraduate] college years and I was looking at graduate schools and saw Dr. Lee," said Wang, a fourth-year PhD student from China, of how he came to work for Lee. "He's just a great mentor. He always supports your ideas; what you think. Say I have this idea. He'll say, 'Great,' and give me money and equipment. He doesn't question your ideas. He also teaches you how to carry on with these ideas and utilize everything to fulfill your plan. In group meetings he always gives me lots of good suggestions. He always tells stories about his companies. ... Dr. Lee is a very successful entrepreneur. He can combine good results in industry with commercial success. Sometimes scientists are good at one or the other, but he's good at both."

Despite playing a founding role for three different companies, Lee prefers working in academia to working in the business world.

"The business world is difficult – it's competitive, challenging," he said. "Academia is really a good job to have. You can do teaching and research – there's lots of things to do."

In fact, teaching is Lee's favorite thing to do in class. One of his favorite memories of teaching at BYU happened while he was teaching Chem 105.

"[This was] before they had all these restrictions on blowing up hydrogen balloons. I told the students I'd blow up any balloon they brought to class," Lee said. "I started with small balloons and got bigger. The bangs got bigger, louder. The students really started to get into it. Finally, on the last day of class, the students brought this huge weather balloon probably four or five feet across. I had the Lecture Prep people fill it with helium, not hydrogen, which floats like hydrogen does but doesn't blow up. I brought it into the classroom and all the students were scrambling to the back of the classroom... I had a TA pop it and it just went, bup! The students were pretty surprised. I have had lots of fun teaching experiments. Every day is a fun day in class, I think."



## National Chemistry Week Awes, Teaches and Inspires

Jessica Henrie

The cotton disappeared in a flash of fire. Dr. Steve Wood smiled at the scattered oohs, aahs and yelps from the audience as he lifted the tile square the cotton had been sitting on, emphasizing the tile's emptiness. He put down the tile, picked up another piece of nitric acid-treated cotton and made a show of laying it on his bare palm, turning his head as if afraid to watch as he aimed his lighter at it.

"Do it! Do it! Do it!" some of the younger audience members chanted. The lighter retreated as the BYU chemistry professor leveled a mock glare at the crowd.

"It's my hand, not yours!" he scolded, earning a round of low chuckles from the adults. Then Wood's smile returned and he quickly touched the flame to the cotton. There was another flash

and it was gone. He held up his hand, unscathed by the fast-burning fuel, and the room burst into applause.

Chemical Magic shows like Wood's, aimed at teaching chemical principles through crowd-pleasing demonstrations, went on all week at the Benson Science Building on BYU campus, Oct. 22-26. The shows, hosted and performed by the Department of Chemistry and Biochemistry, were only one sampling of activities the department planned to celebrate National Chemistry Week.

This year's theme was "Nanotechnology: the Smallest BIG Idea in Science." The department encouraged people to learn more about science by organizing a "nano-symposium" Wednesday, Oct. 24, a research poster session and reception Friday, Oct. 26 and the "magic" shows throughout the week.

Dr. Eric Sevy had a special guest at his Chemical Magic show Thursday, Oct. 25. The family of a local boy fighting A.L.L. leukemia arranged to have him help Sevy in the show. Seven-year-old Connor helped create a tornado of fire, demonstrated the effect of liquid nitrogen on balloons, excited the sugars in two clear liquids to change them to pink and blue, and more.

Officers from the student council at Springville High School arranged with Y-Chem Society president Joel Everett and executive department secretary Sue Mortensen to include Connor, who loves science, in the magic show. The Springville student council also organized a number of fundraisers during the week to help raise money for Connor's wish for a hot tub via Make-A-Wish Utah. Between the public community fundraiser (a carnival held at the school Oct. 22), fundraising activities among the students (including "spook-o-grams" and cotton candy sales during a Springville football game) and personal donations, Springville High raised just over \$3,000 toward Connor's wish, according to Springville student council advisor Angie Meacham.

For the Nano Symposium, graduate students Trevor Smith, Elizabeth Gates and Chad Jones, along with professor emeritus Gerald D. Watt, co-taught the nano-symposium. Each person presented a nano-related research project they are working on and took





*From top: Nelson Kent Dalley, John Harvey Mangum.*

questions from the audience as time allowed. Smith spoke of using ferritin, a protein in the body that stores iron, to form a nano-bio-explosive by replacing the stored iron with a more explosive compound. Smith is currently working in the lab of Richard Watt on two projects involving explosive ferritin: one with NASA and one with the Department of Defense.

## Recently Departed

We regret to inform you of the deaths of two of our emeriti faculty, Nelson Kent Dalley (June 29, 2012) and John Harvey Mangum (July 14, 2012). Dr. Dalley was born in Pontiac, Michigan, on Feb. 21, 1935. He began studies at the University of Michigan, but after serving an LDS mission in the Northwestern States, he transferred to BYU Provo to finish his Bachelor of Science degree. He went on to complete a Master of Science degree and a PhD at the University of Texas in Austin. He met his wife Jane while in the post-doctoral program at the Argonne National Laboratory. He taught at the Chemistry Department for 32 years. His primary interest was crystallography and he collaborated with colleagues on more than 150 publications, according to his obituary published in The [Provo] Daily Herald.

Dr. Mangum was born April 16, 1933, in Rexburg, Idaho. After attending the University of Utah for one year, he served an LDS mission in the North Central States. When he returned, he earned both his Bachelor and Master of Science degrees at BYU Provo and a PhD in biochemistry at the University of Washington in 1963. After he received his PhD, he joined the biochemistry faculty at the Chemistry Department and taught there until his retirement. Dr. Mangum is known nationally and internationally for his “significant strides in discovering pathways for cures in various types of cancer,” according to his obituary published in the Deseret News.

**See department website  
for obituaries.**



# SELECTED UNDERGRADUATE RESEARCH AWARDS IN 2012



## Devon Blake

**“The Role of Phosducin-like Protein (PhLP1) in Cone-specific PhLP1 Conditional Knockout Mice,”**

mentored by  
Barry Willardson

For my project, I studied the function of phosducin-like protein 1 (PhLP1) in vivo using a rod-specific conditional knockout mouse. It had been proposed that PhLP1 served as a co-chaperone with the cytosolic chaperonin complex CCT to assist in the proper assembly of the g-protein  $\beta$  dimer. Using retinal extracts from PhLP1-knockout and wild type mice, we analyzed the levels of G protein subunits in whole retinal extracts as well as rod outer segment preparations through western blot analysis. We also performed immunohistochemistry to visually determine the effect of PhLP1 on other retinal proteins. Through these experiments, we have found that PhLP1 is essential for the assembly of the G protein  $\beta$  subunits in mouse cone photoreceptor cells. Our research was published in the *Journal of Neuroscience* on May 1, 2013 with the title “Phosducin-like protein 1 is essential for G protein assembly and signaling in retinal rod photoreceptors.” I also presented this research at “The Biology and Chemistry of Vision” FASEB research conference in Steamboat Springs, Colorado on June 9-14, 2013. My mentor is Barry Willardson.



## Thomas C Cook

**“Density Functional Theory Study on the Mechanism for Enantioselective Alkylation Using a Phase Transfer Catalyst,”**

mentored by  
Daniel Ess

This summer I worked with Dr. Ess to determine the mechanism for catalytic alkylation of an enolate to synthesize an amino acid by performing M06-2X theory computations. General enolate alkylation will yield two enantiomers, or mirror images, in 50:50 yield. With the catalyst, the enantiomers form in a 97:3 ratio. Discovering the mechanism of catalytic alkylation will help us understand why the enantiomeric excess occurs and perhaps provide direction for future catalyst synthesis.

I generated minor product transition states that are mirror images of major product transition states generated in previous semesters. I will organize all the major and corresponding minor product transition states by energy and write a brief description of the catalyst/enolate/allyl bromide geometries. After this is completed, the major and minor product transition states will be organized by energy and corresponding major and minor transition states will also be linked. This data will be used in a journal publication and possibly a grant proposal.



## Brendan Coutu

**“Utilizing an Intrasource Separation to Optimize Methods of Shotgun Lipidomics,”**

mentored by  
John Prince

Over the past two and a half years, I have optimized a method of analyzing lipids through mass spectrometry. Almost every disease either directly involves lipids or has a profound impact on the lipid members of a cell.

This semester I have also delved into the parameters by which our mass spectrometer, the Orbitrap LTQ, can handle different perturbations, such as switching the direction of the current which allows for the analysis of negatively charged ions. I intend to publish my results as a part of my Honors Thesis, as well as in a series of papers in the fields of mass spectrometry (specifically, developing a tool to analyze the cellular lipidome), veterinary sciences (lipids involved with bovine metabolic diseases), and physiology/medical oncology (lipids involved with kidney cancer). This work was presented at the American Association for Cancer Research Special Conference on Tumor Invasion and Metastasis in San Diego as well as at the Student Research Conference at BYU.



## Joel Everett

**“The Effect of Temperature Gradients in Solvating Gas Chromatography,”**

mentored by  
Steven Goates

The research project that I was involved with this spring and summer was investigating the effect of temperature gradients in solvating gas chromatography (SGC). The goal of my research is to use temperature gradients in connection with SGC to decrease separation times without losing accuracy in our results. In June, I gave an oral presentation at the 67th Northwest Regional Meeting of the American Chemical Society in regards to my research.

Right now, I am working towards collecting data at a high temperature gradient to compare to lower temperature gradient data. Last summer, I made significant improvements to my experimental setup. To reduce the amount of time aligning optics and the laser, I obtained permission to use a Nd:YAG laser, which will make data collection much easier and more reproducible in the future. After I obtain my results, I hope to publish them in an analytical chemistry journal.



## Erika Handly

**“Construction and Design of a Reactor to Upscale Production of the Catalyst Required for Conversion of Syngas into Useful Hydrocarbons,”**

mentored by  
Brian Woodfield

This semester, I continued conducting tests on the catalyst production reactor to determine effects of temperature and water content on the final catalyst. The goal of the project was to determine if the products that were made in the production reactor matched the products made in the laboratory and if efficient flow could be achieved through the process.

To determine the effects of varying parameters, tests were run at various temperatures and water additions. Runs were conducted with 400 mL and 600 mL of water and 40 and 60 degrees Celsius. Six runs were conducted at each parameter setting to determine if a steady yield could be achieved after all the machinery was coated in the reactant material.

Through BET and XRD analysis, it is clear that the catalyst coming from the reactor is comparable to the catalyst made in the lab. However, the product coming out of the reactor has gray and yellow tinges where it is supposed to be pure white, indicative of some contamination. Further analysis still needs to be conducted on this.



## Kenneth McGary

**“Bacterial Inhibition with the Antimicrobial Agent CSA,”**

mentored by  
Paul Savage

This semester I have been using an undergraduate research award to work on a project under the direction of Dr. Paul Savage. My project involved the testing of an antimicrobial agent known as CSA against bacteria, and a coating that could be put on metal pins, staples, and plates that in the long term, would be used in surgery to prevent infection. At the beginning of the semester I worked on a coating that would create an appropriate thickness, our goal was for the coating to be less than 10 microns thick, we achieved 8. After we confirmed that this was possible on metal pins, we worked on creating the optimal percent CSA to be added to this coating. For convenience we started testing this coating on silicon coupons that are easy to create and handle for coating and testing. We originally hypothesized on 10-30% CSA in our polymer but found we could do less. We recently ran a 4% CSA coating and are still running a 10% CSA coating. The 4% trial lasted 4 days before showing control like bacterial growth and the 10% are still going after 14 days.

As of yet there are no publications that include this experimental data. This experiment is showing promise and I would like to thank you for your support.



## William Rankin

**“Role of Diethanol Amine and Water in the Formation of Zinc Oxide Nanoparticles,”**

mentored by  
Roger Harrison

We have investigated the effects of temperature, pH, and different amines on the synthesis of the ZnO prisms. We characterized the materials by XRD, SEM, and TEM. We found that the ZnO prisms do not form until the gel precursor is heated to 95 °C, at which temperature water is removed from Zn(OH)<sub>2</sub> and ZnO forms. Synthesis with ethanolamine, diethanolamine, and triethanolamine, produced prisms.

Synthesis with triethylamine, methylamine, and diisopropylethylamine did not produce prisms. Thus, the alcohol groups on the amines seem to be vital to the formation of the prisms. When amine wasn't present and NaOH was used to create a similar pH, nanoparticles formed instead of prisms. This indicates that the hexagonal prism structure cannot merely be attributed to pH. These advances give us greater insight into the prism formation mechanism. We are very close to compiling the data, proposing a mechanism and publishing our results.



## Brendan Tobler

**“ChemCompanion and PrepChem,”**

mentored by  
Steven Wood

The project that I was working on during this last semester was titled ChemCompanion/PrepChem Interactive. This is an online textbook that visually demonstrates basic concepts of General Chemistry through animations and videos along with narrations. Dr. Steven Wood did the scripts and narrations while myself and others completed the animations and video of the materials used on the screen. The goal during this past semester was to have a workable beta version of the project. We were informed early on in the term that a professor teaching CHEM 101 during the spring was interested in using our material as the main textbook for the class. This was a great goal for us to strive for and was difficult to some degree because material that was lost during the previous semester has yet to be recovered. However, we have completed a usable beta version of PrepChem Interactive that will be used during the spring term for a CHEM 101 course. We will continue to work on fixing any of the bugs and increasing the usability of the online learning tool, but we are very happy with what we have produced so far.



## Jonathan P. Wright

**“The Effects of Hydrogen on a Helium Based Dielectric-Barrier Discharge Ambient Desorption/Ionization Source,”**

mentored by  
Paul Farnsworth

My research focused on a technique in analytical chemistry called mass spectrometry, which is used to determine the molecular structure of different molecules. In order for this to occur, a sample needs to be ionized, or converted into a charged particle, by an ion source and sent into an instrument called a mass spectrometer. Our research was with a helium-based ion source and our goal was to determine the mechanism by which the ion source ionizes the sample. Using a setup that included both desorption and ionization of different analytes off of a glass slide, we came closer to achieving our goal.

Previous results showed that adding a small amount of hydrogen to the helium increased the sensitivity of the source. We separated the desorption and ionization steps through a gaseous experiment and found that the added hydrogen clearly affects the ionization process. This work was presented at the National Meeting of the Society for Applied Spectroscopy in Kansas City, MO in October. Also, we submitted a paper to the *Journal of The American Society of Mass Spectrometry* and it was just accepted for publication. Our results have inspired future experiments and we are excited to continue progressing throughout the next semester.

# AWARDS AND RECOGNITION

## Reed Izatt recognized at alumni dinner

Jessica Henrie

Reed M. Izatt was honored for his numerous contributions to the Department of Chemistry and Biochemistry with the Distinguished Pillar Award at the Homecoming Alumni Dinner on Friday, Oct. 12.

Paul Savage, professor of organic chemistry, gave a brief introduction of Dr. Izatt prior to presenting the award on behalf

of the Department. Of the top 10 faculty members at BYU in number of scholarly publications, eight are chemists, including Izatt. Izatt also has the top h-index, which refers to how often a researcher's publications are cited by others.

"Of all the papers published at BYU, Dr. Izatt has published over two percent of them," Savage said. "[His h-index] is a record that will stick around a long time ... That tells you he's making a difference here and with others."

Savage had the opportunity to collaborate on research with Izatt as an undergraduate when he worked for Jerald Bradshaw, another emeritus professor. He also read a letter by Gerald Watt, who worked



for Izatt as a graduate student, which described how Izatt guided him – expertly but not without mercy. (Watt later joined the department faculty and is now retired.)

“Reed demands excellence of himself and those he works with,” Savage concluded. “He is honored and recognized as a pillar of our Department. We need to realize we have the resources we have because of professors [like Reed] who worked well... to mold us into a premier department at the university.”

The audience burst into “Happy Birthday” shortly after Savage finished. Izatt shares his Oct. 10 birthday with three other chemistry professors: Leo P. Vernon, Coran L. Cluff and John D. Lamb.

The Distinguished Pillar Award was presented for the first time in 2010 to J. Rex Goates and Eliot A. Butler. J. Bevan Ott was the 2011 recipient of the Distinguished Pillar Award. The purpose of the award is to recognize and honor emeritus professors and the groundwork they have laid in making the Department of Chemistry and Biochemistry what it is today.

Lee Hansen finished off the evening with a presentation about his and Jaron Hansen’s (no relation) research on turning waste to energy. Although Jaron was originally scheduled to deliver the lecture, he was unable to attend at the last minute and Lee graciously filled in, describing their accomplishments thus far. Drs. Lee and Jaron Hansen first began researching “poop to power” five years ago and in 2009 started their own company, AD Tech (Anaerobic Digestion Technology).

Working in collaboration with professors from Utah State University (who started Andigen LLC), Drs. Lee and Jaron Hansen developed technology to process waste into energy. Now, their biggest challenge is persuading waste plants that the up-front cost for installing an anaerobic digester (which processes waste into compost and biogas) and a biogas conditioner (which cleans the gas from hydrogen sulfide and water) is worth paying. Most recently, the Hansens installed a biogas conditioner in China. They are working on installing a conditioner at a sewage treatment plant in Utah Valley.

“The technology is ready to go,” Lee Hansen said.

He admitted the up-front cost could be daunting, but firmly believes this kind of renewable energy is the future.

“It’s an investment – you pay for a biogas conditioner up front and save on energy later. It actually makes money for the city,” Hansen said.

## CPMS Recognizes Dr. Macedone for Excellent Teaching

Jessica Henrie

Dr. Jeff H. Macedone recently received the Faculty Excellence in Teaching Award (3-10 years) at the College of Physical and Mathematical Sciences Awards Banquet on Thursday, January 31.

“[Dr.] Macedone is an energetic teacher whose enthusiasm is contagious,” an article in the college newsletter reads. “Though his courses can be tough, students continue to give him the highest ratings.”

Appropriately, Dr. Macedone’s favorite part about his job is turning students on to chemistry, which can sometimes be a challenge.

“I enjoy finding ways to spark student’s curiosity about chemistry,” he said. “Some students come into my class thinking that they ‘have’ to take chemistry. It’s exciting to feel a change throughout the semester that they feel like they ‘get’ to take chemistry.”

To help achieve this end, Professor Macedone enjoys using chemical demonstrations to

help students relate to more abstract concepts and keep them on the edge of their seats.

“I know I am doing my job right when the classroom experience prompts a student to ask a question that is at the next level of understanding or application,” Dr. Macedone said. “One particular student came to my office to declare that they couldn’t believe a certain principle I had been teaching. We talked over the concept and designed an experiment that they could do in their kitchen. The student went home, performed the experiment, and brought back pictures the next day. The student had a big smile and said, excited, ‘OK, now I totally believe this!’”

Dr. Macedone accepted his current full-time position at the Department of Chemistry and Biochemistry in January 2007. He earned a Ph.D. in analytical chemistry at BYU and worked with Dr. Paul Farnsworth as a postdoctoral student.

Peggy Erickson, the administrative assistant for the department, also received a 20-year University Service Award at the banquet, recognizing her for 20 years of hard work and dedication.

## Chemistry professor recognized for internationally accepted virtual lab programs

Jessica Henrie

Physical chemistry professor Brian F. Woodfield was honored with two colleagues in the Department of Biology at the Annual University Conference August 21.

Drs. Woodfield, Keith A. Crandall and C. Riley Nelson each received the Creative Works Award, which, according to the conference program, “recognizes faculty members and university personnel who demonstrate outstanding achievement in the development of creative works that have had wide acceptance and distribution nationally or internationally.”

The three highlighted professors all worked on the Virtual Biology Lab, an intricate computer program that allows biology students to obtain needed lab experience without the expense of a real lab. Dr. Woodfield has also worked on Virtual ChemLab,



Virtual Physics, Virtual Earth Science, and Virtual Physical Science. All were developed at BYU, for BYU, but are licensed to Pearson Education, which sells them to middle schools, high schools and higher education institutions worldwide.

“There are estimated to be somewhere around a million users a year around the world,” Dr. Woodfield said. “If you go to our web site at [yscience.byu.edu](http://yscience.byu.edu) you can find a lot of information about the labs.”

## Dr. Adam Woolley to receive Reed M. Izatt and James J. Christensen Faculty Excellence in Research Award

Jessica Henrie

Professor Adam T. Woolley received the 2012 Reed M. Izatt and James J. Christensen Faculty Excellence in Research Award September 13. In conjunction with the award, he also delivered a lecture on his research in developing novel systems for application in chemical analysis and materials chemistry.

He and his research group use their knowledge of molecular interactions to make innovations and help streamline existing procedures such as quantifying biomarkers, analyzing samples and engineering nanoscale structures through DNA origami.

In his lecture, Dr. Woolley addressed three current areas of interest in the seminar: integrated immunoaffinity and solid-phase extraction microfluidic devices for biomarker quantitation, “flow valve” microfluidic systems for simple measurement of sample concentrations, and DNA-templated formation of designed hybrid organic/inorganic nanostructures.

“These studies demonstrate the exceptional versatility of using molecular interactions to enable various chemical methods,” Dr. Woolley concluded in his abstract. “We have utilized these capabilities in enhancing the synthesis of nanoscale materials with controlled dimensions and compositions, simplifying biochemical quantitation systems, and providing automated biomolecular analysis. These broad applications highlight the considerable future promise of leveraging molecular interactions in the chemical sciences.”



## Chemistry professor honored for teaching excellence

Jessica Henrie

University president Cecil O. Samuelson honored Dr. Paul Farnsworth from the Department of Chemistry and Biochemistry at the 2012 University Conference on Tuesday, August 21.

Dr. Farnsworth, a professor of analytical chemistry and former department chair, received an alumni professorship for teaching excellence. The award includes a three-year stipend made possible by the BYU Alumni Association.

“Paul B. Farnsworth has served the university and its students for over 30 years,” the University Conference program reads. “He has an infectious love for chemistry and education, and he skillfully brings his enthusiasm for learning into the classroom and laboratory as an interactive instructor who engages students at all levels. Paul is noted for his rigor and genuine desire to help students reach their full potential. ... In short, Paul is a consummate professor who demonstrates the very best attributes of the profession.”

## Inorganic chemistry professor recognized for contributions to ion chromatography

Jessica Henrie

Professor John D. Lamb recently received an award for “sustained and significant contribution” to ion chromatography at the International Ion Chromatography Symposium in Berlin, Germany, Sept. 17-20.

Dr. Andreas Seubert, a professor at the University of Marburg, Germany and organizer of this year’s symposium, presented the 2012 Ion Chromatography Award to Dr. Lamb at the conference, which has been held nearly every year since 1988. Dr. Lamb, who goes to the symposium frequently, estimated that about 200 scientists from around the world typically attend. Recipients of the Ion Chromatography Award are selected from a pool of nominees by an awards committee and are invited to give a lecture in conjunction with receiving the award.

Dr. Lamb delivered a lecture about his group’s research, “Applying Host-Guest Chemistry to Ion Chromatography.”

“Host-guest chemistry involves interactions where guest molecules or ions are selectively bound by host molecules in such a way as to make the separation of guest chemical species possible,” Dr. Lamb explained. “An example of that is the use of 18-crown-6 (the host molecule) to separate inorganic anions (the guest species) via a new technique we developed called capacity gradient chromatography.”

Dr. Lamb’s current projects involve host molecules which are much more complex than 18-crown-6, but the principle is the same, he said. He is collaborating with Dr. Roger Harrison on this project with funding from Thermo Fisher Dionex, a global corporation for scientific research equipment based in California.

“I was amazed and pleased when I was notified I would receive the award,” Dr. Lamb said.

# STUDENT AWARDS

## Jerald Bradshaw, Students Recognized at Chemistry Awards Banquet

by Jessica Henrie

Department administrators decided to change up the April 3 Department of Chemistry and Biochemistry Awards Banquet a bit this year by including the presentation of its annual Department Pillar Award.

Dr. Jerald S. Bradshaw was awarded the honor, which recognizes emeritus professors who have made a significant impact on the department. Organic chemistry professor Dr. Paul B. Savage spoke of the many achievements Dr. Bradshaw accomplished without the benefit of the state-of-the-art laboratories and facilities students and faculty currently enjoy.

“We have great labs and facilities in the Benson [Science Building]. That didn’t happen by accident. ... Key people did great things with poor facilities,” Dr. Savage told students at the banquet. “Sometimes we look at it [a ‘pillar of the department’] as a pillar we’re standing next to. I look at it as a pillar we’re standing on and building on. Jerald Bradshaw is one of those giants.”

Following the Pillar Award presentation, approximately 34 subsequent student honors were awarded to both undergraduate and graduate students. The banquet attendees also recognized all graduating seniors, Master’s and PhD students.

Dr. Adam T. Woolley offered congratulations to all the graduates, adding a special thanks to the graduate students: “Our graduate students play a key role in moving the department forward and in mentoring undergraduate students.”

The banquet was well attended, with about 200 people on hand to share in the celebration.

## STUDENT AWARDS 2013

*The following awards were presented by Dr. Matthew Asplund, Chair of the Central Utah Section of the ACS.*

### Spring Research Conference Section Winners

*Recognizes the top presenters in chemistry sections of the Spring Research Conference.*

#### 1st Place

David Enfield  
Sambhav Kumbhani  
Paul Lawrence  
Zhiwei Ma  
William Rankin  
Bhupinder Singh  
Dipti Shah  
Anzi Wang  
Jonathan Wright  
Ella Wyllie  
Philip Young

#### 2nd Place

Sarah Bahr  
Courtney Britsch  
Molly Clemens  
Brittany England  
Megan Hirschi  
Tori Kinard  
Suresh Kumar  
Ryan Paxman  
Glen Thurston  
Junting Wang  
Jie Xuan

### ACS Analytical Chemistry Junior Award:

*Recognizes an outstanding junior student with exceptional aptitude in analytical chemistry.*

**Devon Blake**

### Catalyst Club Outstanding Continuing Undergraduate Woman:

*Recognizes an outstanding female junior student in chemistry or biochemistry. This award is sponsored by the Catalyst Club, an association of women who are current or emeritus members of the department or spouses of current or emeritus members.*

**Alicia Garff**

*The following awards were presented by Dr. John Lamb, associate chair of the department.*

### Undergraduate Student Awards

#### Freshman Chemistry Major Award:

**Chapman Ellsworth**

#### Freshman Chemistry Non-Major Award:

*Recognizes an outstanding student in the General Chemistry 111/112 sequence (majors) and an outstanding student in the 105/106/107 sequence (non-majors).*

**Brett Graham**

#### Organic Chemistry Major Award:

**Jefferson Tyler**

**2013 ACS Division of Organic Chemistry Undergraduate Award in Organic Chemistry Organic Chemistry Non-Major Award:**

*Recognizes an outstanding student in the Organic Chemistry 351M/352M sequence (majors) and an outstanding student in the 351/352 sequence (non-majors).*

**Ryan Gillis**

**Chemistry Literature Award:**

*Recognizes an outstanding student in Chemistry 391.*

**Lisa Heppler**

**Hypercube Scholar Award:**

*Recognizes an outstanding student for scholastic excellence in chemistry.*

**Philip Young**

**Physical Chemistry Award:**

*Recognizes an outstanding student in the Physical Chemistry 462/463 sequence.*

**Jack Fuller**

**Biochemistry Award:**

*Recognizes an outstanding student in the Biochemistry 481M/482M sequence.*

**Brian Bingham**

**Analytical Chemistry Award:**

*Recognizes an outstanding student in the Analytical Chemistry 521/523 sequence.*

**Matthew Nielsen**

**Inorganic Chemistry Award:**

*and 2013 ACS Division of Inorganic Chemistry Undergraduate Award in Inorganic Chemistry Recognizes an outstanding student in the Inorganic Chemistry 514/518 sequence.*

**Matthew Nielsen**

**Eliot A. Butler Service Award:**

*Recognizes a student who has provided significant service to the department while maintaining a high performance in course work and professional activities. This award is named in honor of Eliot A. Butler who was a former professor, chair, dean and associate vice president.*

**Joel Everett**

*(for his service in YChem)*

**& Brendan Coutu**

*(for his service on the Student Advisory Council)*

**Named Undergraduate Research Awards for Spring and Summer**

**Glenda L.M. Harr Undergraduate Research Award:**

*Recognizes a student with enthusiasm for chemistry and potential for success in research. This award is named in honor of the mother of an outstanding undergraduate teaching assistant who spent countless hours tutoring the donor of this award.*

**Charlotte Reininger**

**James A. and Virginia S. Ott Undergraduate Research Award:**

*Recognizes a student for academic achievement and potential for success in research. This award is named in honor of James A. and Virginia S. Ott who were master teachers.*

**Lisa Heppler**

**Keith P. Anderson Outstanding Graduating Senior:**

*Recognizes outstanding graduating senior(s) for overall scholarship and professionalism and classroom performance. This award is named in honor of Keith P. Anderson, a physical chemist who taught at BYU for more than 35 years.*

**Brian Bingham,  
Matthew Nielsen**





*The following awards were presented by Dr. Adam Woolley, associate chair of the department.*

### Graduate Student Awards

#### Loren and Maurine F. Bryner Award:

*Recognizes advanced continuing graduate students. This award is in honor of Loren C. Bryner, professor of chemistry for 38 years, and Maurine F. Bryner, a faculty member of Food Science and Nutrition.*

**Pankaj Aggarwal,  
Swati Anand,  
Shawn Averett,  
Paul Cropper**

#### Jennie R. Swensen Award:

*Recognizes advanced continuing graduate chemistry or biochemistry students. This award is named to honor Dr. Albert D. Swensen and his lifetime of contributions to the department and in memory of his wife, Jennie Romney Swensen.*

**Andy Gross,  
Jintao Jiang,  
Komal Kedia,  
Suresh Kumar,  
Catalina Matias**

#### Telford and Frank Woolley Memorial Research Award:

*Recognizes outstanding students who are conducting significant research in cancer or in other health-related areas. This award is named in honor of Telford Woolley, a physician who passed away prematurely due to cancer. When his father died, his name was added to the award.*

**Mark Acerson,  
Takuma Aoba,  
Jonathan Lee,  
Matthew Ollerton**

#### Garth L. Lee Award:

*Recognizes an outstanding continuing graduate student for religious commitment, service and scholarship. This fellowship is named in honor of Professor Garth L. Lee, who was a professor of chemistry at Utah State University for many years.*

**Andy Peterson**

#### Outstanding Graduating Ph.D. Student:

**Elisabeth Gates**

### Graduate Research Fellowships

#### Stanley and Leona Goates Fellowship - 20 hr. assistantship for Spring and Summer 2013:

*Recognizes an advanced chemistry graduate student for outstanding scholarship and achievement in research. This award is named in honor of Stanley and Leona Goates, the parents of Dr. J. Rex Goates, professor of chemistry emeritus, and grandparents of Steven R. Goates, professor of chemistry.*

**Tayyebah Panahi**

#### Bradshaw Organic Chemistry Fellowship - 10 hr. research assistantship for 2013-14:

*Recognizes an advanced organic chemistry graduate student for scholarship and achievement in research. This award is named in honor of Jerald S. Bradshaw, an outstanding emeritus faculty member.*

**Zhiwei Ma**

#### K. Robins Fellowships - 20 hr. research assistantship plus a cash award:

*Recognizes outstanding graduate students for outstanding scholarship and promise in research. These awards were created to honor Dr. Roland K. Robins, who was world-renowned for his creativity and activity in the syntheses of new medicinal compounds.*

**Chad Jones,  
Sambhav Kumbani,  
Chris Woolstenhulme**



# NEW FACULTY



## David Michaelis

David J. Michaelis completed his undergraduate work in chemistry at BYU in 2005. He earned his PhD in 2009 in organic chemistry from the University of Wisconsin–Madison, where he worked on the development of new oxidation reactions.

By the time Michaelis arrived at BYU in April of 2013, he already had three graduate and three undergraduate students researching in his lab.

“We plan to develop new catalysts for converting oil-based materials into drug-like molecules,” he said. “We also hope to develop catalysts that mimic the way nature synthesizes drug-like molecules, which could greatly impact the cost of production for important antimicrobial drugs like those for malaria and tuberculosis.”

Michaelis met his wife as an undergraduate at BYU. They now have three daughters and a son. When he is not busy at the lab or with church service, Michaelis enjoys reading and spending time with his wife and children.



## Josh Andersen

Dr. Joshua L. Andersen joined the Department in October 2012 as an assistant professor of biochemistry. Josh graduated from BYU in 2001 with a B.S. in Plant Genetics. After his postdoctoral studies, he was hired as an assistant professor in the Department of Medicine at Duke before deciding to return home to join the faculty at BYU.

At BYU, Josh has continued to pursue his interest in understanding how cellular metabolism influences cell fate decisions (e.g., apoptosis, proliferation). Currently, Josh and his students are trying to gain a mechanistic understanding of how cancer cells adapt to and survive metabolic stresses which frequently occur within tumors and often yield chemoresistant tumor cells. By understanding these mechanisms, they hope to develop novel strategies to reduce the incidence of chemotherapy failure.

Josh and his wife Audrey live in Orem UT with their 3 kids: Eli (12), Kate (6), and Sam (4).

## Give Back

Giving back to BYU is a special treat many graduates from BYU’s Department of Chemistry and Biochemistry have found. Recently I attended a meeting where a BYU graduate was telling of the happiness that giving has brought to his family. He mentioned that when he sold his company he bought a new house, a cabin, a truck and traveled the world, but still wasn’t happy. Then someone suggested he explore helping programs at BYU. He described the joy, satisfaction and purpose that he now feels. Many people have told me that joy is a high they can feel in few other ways. The second part of these stories is the impact that giving has on our students and programs. This summer Brent Kamba will be assisting Professor Jennifer Nielson in teaching chemistry to middle school children in Uganda. He describes himself as being raised in Canada by a mother of pioneer heritage from the East coast of the U.S. and a convert father from the Congo. Both parents worked and he often was responsible for the care of a younger sister with Prader-Willi Syndrome. After serving a mission in England, he returned to BYU and hopes to enter medical school next year. He says that without the help of generous donors there is no way he could have stayed at BYU. The joy that donors have experienced has altered Brent’s life course and will make a difference through generations of his descendants.

We invite you to experience this satisfaction and engagement by giving to BYU Department of Chemistry & Biochemistry. Whether it’s a small amount or a large amount, it will make a difference. Make you check out to BYU and send it to:

Brigham Young University  
Attn: Brent Hall  
N181 ESC  
Provo, Utah 84602-4605

If you want to talk about an estate gift or have other questions, call Brent at 801-422-4501 or email him at [brenth@byu.edu](mailto:brenth@byu.edu).

# HOMECOMING EVENTS

## Department of Chemistry and Biochemistry Activities on October 11th

6:00 p.m. Reception

6:30 p.m. Dinner

7:30 p.m. Award presentation and talk

## University Activities

Homecoming Dances  
October 11, Times TBA  
Venues: TBA

Pancake Breakfast  
October 12, 8:30 a.m.

Homecoming Parade  
October 12, 10:00 a.m. (Downtown Provo)

Homecoming Game BYU vs. Georgia Tech  
October 12 (LaVell Edwards Stadium. Time TBA)

Below is a reservation form for  
the Department Homecoming activities.

Please mail your reservation form or email to  
marcia@chem.byu.edu.  
Reservations should be made no later than  
October 2, 2013.

### Mailing address:

Homecoming  
Department of Chemistry and Biochemistry  
C-104 BNSN  
Brigham Young University  
Provo, UT 84602

### RESPONSE CARD FOR BYU DEPARTMENT OF CHEMISTRY HOMECOMMING EVENTS

#### I PLAN TO ATTEND:

Yes

No

Number attending \_\_\_\_\_

Number who are BYU Alumni \_\_\_\_\_

*Please include yourself in both totals*

Name \_\_\_\_\_

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_

E-mail \_\_\_\_\_

Telephone \_\_\_\_\_