August 2007

CHEMIGRAM

Brigham Young University

Message From the Chair

Paul B. Farnsworth

The retirements announced elsewhere in this newsletter represent a combined loss of over a century of wisdom and experience from our department. It is a loss that I feel deeply. These men were on the faculty when I was an undergraduate and I have been valued mentors and colleagues throughout my twenty-five year career on the faculty at BYU. My sense of loss is offset by feelings of optimism as new faculty are hired. Our young faculty members are talented and dedicated. The future is in good hands.

BYU is unusual in the length of time that faculty stay at the institution. Once hired at BYU, faculty members tend to stay until retirement. In the rest of the academic world, moves between institutions are common, and are regarded by many as essential steps up the career ladder. Here at BYU the grass is green, both figuratively and literally. Our department is a great place to work.

The Department of Chemistry and Biochemistry is also a great place for students. We are firmly committed to providing the best possible combination of classroom instruction, laboratory training, and research opportunities for our students. In the past year we have fully implemented small recitation sections for our organic chemistry courses to raise the level of individual attention available to students. We have made large investments in equipment for our physical and inorganic chemistry laboratories. During the 2006-2007 academic year we offered a record number of undergraduate research awards that allow undergraduate students to work in research laboratories at a generous hourly wage.

A large fraction of our undergraduate research awards were funded by alumni donations. I encourage you to continue your generous financial support of the department. You can also help by serving as ambassadors for the department. Many potential students, both undergraduate and graduate, are unaware of the excellent learning opportunities at BYU. Share your good experiences with potential students and encourage them to come here.

We will be continuing our tradition of holding an annual alumni gathering the week of homecoming. It is earlier than usual this year, but I hope that you will plan to attend. Please use the form included in this newsletter to let us know if you are coming.

Best wishes,
Paul B. Farnsworth
Chair

A Newsletter for Brigham Young University Chemistry Alumni
Department of Chemistry and Biochemistry, C100 BNSN, Provo, Utah, 84602 Visit our Website at
http://www.chem.byu.edu

NEW FACULTY

Dr. Richard Watt is a bio-inorganic chemist that studies metallo-proteins and metallo-enzymes. The laboratory goals are to define medicinal and material science applications for these metal-containing proteins. The petroleum research fund (PRF) and NASA are funding these projects. The main protein of interest is ferritin, the natural iron storage protein in the body. Ferritin is a spherical protein with a hollow interior that can store up to 4500 iron atoms. The Watt lab has developed methods to prepare ferritin with non-native metal mineral particles inside the ferritin protein. Future goals are to prepare magnetic ferritin particles or quantum dot ferritin particles for materials applications. The Watt lab has also observed that diseases such as Chronic Kidney Disease and Alzheimer's disease show symptoms of disrupted iron metabolism. We are exploring how metabolites that build up during these diseases inhibit normal iron processing leading to free iron and enhanced oxidative damage that furthers the progress of the diseases.

Richard joined the chemistry and biochemistry department this summer after spending 6 years at the University of New Mexico. Richard's wife Camille is a homemaker who received a B.S. degree from Utah State (Go Aggies) in English. She enjoys balancing his life by educating him with English literature and other great literary works. They have three daughters, Hilary (14), Jocelyn (12) and Whitney (3). Hilary and Jocelyn have excelled in dance (ballet, tap and jazz) and participated on national champion dance teams in tap and jazz at the Dance America championship in 2005.

Dr. Young Wan Ham is a new addition to organic chemistry faculty, joining from Molecular Therapeutics, a biotech company in Ann Arbor, MI. He came to the U.S. for graduate study in 1996 from South Korea and received his Ph.D. from Purdue. His research interest is in the area of bioorganic chemistry with a focus on synthesis and problems of biomedical significance at the interface of chemistry and biology. Of special interest to him is the design of small molecular codes for sequence- and/or secondary structure-specific RNA recognition. RNA performs pivotal functions in biological organisms including bacterial and viral pathogens. Developing small molecules that can interact with the RNA and interrupt undesired replicative activities is a promising new path for drug design. RNA remains largely unexplored as a drug target and may provide untapped opportunities to develop novel therapeutics that are unique from protein-targeted drugs. He is also interested in developing polymeric nanoparticles for targeted delivery of small molecule drugs as well as macromolecules like DNA or RNA. Dr. Ham enjoys hiking, camping, skiing, and occasional golfing. With his wife Soo Kyung, he has three children: Jun Hyung (12), Ryan (10) and Rachel (7).

RETIREMENT-

Morris J. Robins joined the Department of Chemistry and Biochemistry at BYU in 1987, coming from the University of Alberta where he established himself as an outstanding researcher and teacher. He brought his talents to BYU and has played a key role in the continued upward trend of our department in both research and teaching. He helped raise research standards in our department and set an i mpressive example by maintaining significant external funding from the American Cancer Society, the National Institutes of Health, and industrial sponsors, publishing dozens of important manuscripts in top-tier journals, and establishing a vibrant research group that has included undergraduate, graduate and postdoctoral researchers.

Professor Robins has been a passionate teacher of organic chemistry and has routinely taught large courses of undergraduate organic chemistry as well as graduate courses. Possibly because his research has been instrumental in the development of treatments for multiple diseases, Professor Robins has been very effective in conveying to his students the potential and importance of organic chemistry in improving the human condition. His students have seen this potential, become infected with Professor Robin's passion for the subject, and mastered the discipline. Professor Robins has been an outstanding citizen in our department and in the university. He has served on and chaired numerous committees, and most recently acted as the chair of the organic area. At the university level, Professor Robins was instrumental in establishing the intellectual property policy and served on the graduate council.

His efforts in teaching, research, and citizenship have been recognized inside and outside of the University. He was awarded the Maeser Distinguished Faculty Lectureship in 1996, and the Wesley P. Lloyd Award for distinction in graduate education in 2005. Among many other recognition and awards, Professor Robins received the Utah Governor's Medal for Science and Technology in 1996 and the very prestigious Pris Galien Canada Research Award in 1998 for contribution to the understanding and development of effective antiviral therapy in regards to the Hepatitis B virus.

Professor Robins' contributions to our department, college and the university have been substantial. His legacy will be the continued upward trend of our department with expanding research endeavors, effective and demanding teaching, and an overall commitment to excellence.

Francis R. Nordmeyer joined the Department of Chemistry at Brigham Young University in 1972 after five years as an assistant professor at the University of Rochester in New York. Fran's thirty-five years in the department have been marked by outstanding, rigorous teaching, important intellectual contributions to research, and dedicated service.

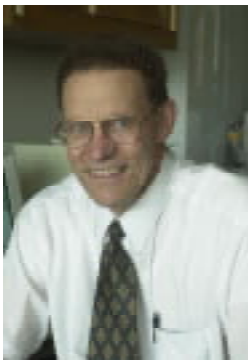
Fran has been an exceptionally versatile teacher. He has taught classes ranging from introductory chemistry for non-majors to graduate courses in kinetics. Within that range he has taught introductory analytical chemistry, organic chemistry for nursing students, and inorganic chemistry for senior chemistry majors. Fran's enthusiasm for the material, his warm personality, and his interest in student learning have been common elements in all of the classes that he has taught.

Several research groups in the department have benefited from Fran's intellectual contributions to the research effort. Fran has been generous with his understanding of kinetics and coordination chemistry, and his insights have strengthened a variety of research projects, particularly in the inorganic area.

In 2006 Fran was awarded the Abraham O. Smoot Citizenship Award in recognition of his service to the department and to BYU. Fran leaves a particularly important and positive legacy as a result of his nine years of service as department chair. During his tenure he supervised the hiring of half of the current faculty members in the department. Fran worked tirelessly to gather the resources that the faculty needed for both teaching and research, and set high expectations in return.

We will miss Fran's full-time presence in the department and wish him the best as he enters this new phase of his life.

Earl M. Woolley joined the Department of Chemistry as an assistant professor in 1970. In his thirty seven years of service he has had a tremendous impact on the department and on the College of Physical and Mathematical Sciences.



Earl's most prominent contributions in the past two decades have been as an administrator. He served as Assistant Chair of the department from 1986-1989, Chair from 1989-1995, and Dean of the College of Physical and Mathematical Sciences from 1999-2007. During his tenure as chair he supervised the planning and construction of the Benson Science Building. Much of what we enjoy in this excellent facility is a reflection of Earl's hard work and attention to detail.

As dean, Earl earned the respect of his colleagues in all departments. He set high standards of performance, and was unfailingly fair in both his expectations and his distribution of resources.

Throughout his years as an administrator, Earl stayed active both as a teacher and researcher. He continued his world-class work in solution calorimetry, publishing regularly up to and beyond his retirement. He received the Huffman award from the Calorimetry Conference in 2006 in recognition of his outstanding research. He is the author of more than 112 research publications.

In his time at BYU, Earl earned a reputation as a rigorous, well-prepared instructor. He was particularly effective in the laboratory courses. In the time between the end of his service as chair and his appointment as dean he completely overhauled the department's quantitative analysis course, incorporating new instrumentation and up-to-date computer control of experiments.

Earl retired at the end of June, 2007. He and his wife Anita are preparing to serve a mission in the Czech Republic in November of this year. We will miss Earl's talent and leadership in the department and the college, but are confident that those qualities will bless the lives he touches in his missionary service.

Delbert J. Eatough made his mark with significant and prolific contributions to environmental science, especially in research on atmospheric chemistry and air pollution monitoring. He began his career at Shell Development Company in 1967. Three years later, he moved to TRONAC but also held a half-time appointment at BYU as the Director of the Thermochemical Institute; the next year he became the full-time director. Beginning in 1972, he held an adjunct appointment in the chemistry department and, in 1980, was brought into the department as a full-time professor of chemistry.

Delbert's studies helped elucidate the chemistry of sulfur and nitrogen oxides and acid rain, characterized organic particulate matter as a function of particle size, and delineated the role and lifetime of aerosols. He and his students and colleagues made major advances in analytical techniques for sampling atmospheric fine particulate matter. His work has had significant effect on health and visibility standards for both indoor and outdoor pollution; it played an important role, for example, in the adoption of the PM2.5 air quality standard. His studies have been particularly important for air quality in Utah Valley and the Grand Canyon.

He has been recognized with several awards, including the Calorimetry Conference Sunner Award, a BYU Maeser Research and Creative Arts Award, and the American Chemical Society Utah Award, and he has served the profession in a variety of positions in societies, editorial boards, and conference organizations. His many research students greatly appreciated his mentoring, and they are particularly loyal to him.

Delbert's life outside of science has also been full and interesting. He is an accomplished pianist and an outdoors enthusiast. The latter fits in nicely with his research interests because camping out in the field was a necessary part of setting up and maintaining much of his monitoring equipment. He is a devoted husband, who takes pride in the artistic talents of his wife, Judy, an accomplished weaver. He is an involved father and grandfather and takes much joy in his family. He will have no problem finding much to do in retirement. We wish him well.

Faculty Awards

Francis R. Nordmeyer was recognized with the Abraham O. Smoot Citizenship Award. This award is presented to university faculty members who through careers of distinguished service demonstrate those qualities of service and personal sacrifice to the university that were exhibited by Abraham O. Smoot. He was appointed associate of the Department of Chemistry and Biochemistry in 1994, and he then served as chair from 1995 to 2004. As chair, Fran worked tirelessly on behalf of his colleagues, and he performed many tasks that he refused to assign to others because he did not want to impose on their time. The department prospered under his leadership. When he stepped down as chair in 2004, he could have coasted to retirement, but instead he volunteered for additional teaching responsibilities.

Paul B. Farnsworth was selected as the 2007 winner of the Utah Award in Chemistry from the Salt Lake and Central Utah Sections of the American Chemical Society. This award is given annually to a Utah Scientist who has made outstanding contributions to the chemistry profession. He was recognized for his excellent research and his contributions in the field of chemical education. He is considered to be the leading authority in the world in the chemistry and physics of inductively coupled plasmas. He and his students have developed new spectroscopic and kinetic tools for probing the transport of material and energy in these sources which have led to both fundamental understanding and practical advances. He was recently recognized for these pioneering contributions by his selection for the Spectrochimica Acta Atomic Spectroscopy Award and the Lester W. Strock Award of the Society for Applied Spectroscopy.

Juliana Boerio-Goates was selected as an Alcuin Fellow. These awards recognize outstanding teacher scholars whose work at the university transcends the limits of their disciplines and who have made significant contributions to the general education and honors curriculum.

Paul B. Savage was selected as a Karl G. Maeser Professional Faculty Excellence Award recipient. This award recognizes outstanding achievement in fulfilling professional faculty responsibilities. Paul manages a large, well-funded research group of undergraduate, graduate, and postdoctoral students. His research is recognized internationally for synthesizing a new class of antibiotic compounds. This work has attracted significant scientific interest and has appeared in journals such as Science and Nature. It has also had an impact on the commercial world, serving as the basis for three start-up companies. Professor Savage sets an exceptional example of both versatility and high quality in his research. His teaching has been recognized by peers and students, most notably with the Maeser Excellence in Teaching Award in 2004. He also serves as the associate chair in our department.

Staff Awards

Peggy I. Erickson

was recognized with the Fred A. Schwendiman Performance Award for exemplary contributions to the university through consistent and superior service. Known for her willingness to far exceed the extra mile, Peggy serves as executive secretary in the Department in capacities that extend well beyond her job description. Responsible for aiding in all departmental management areas, she meets her expanding workload professionally, courteously, consistently, and endearingly, with personal care for all things human. Peggy's positive attitude draws administrative, faculty, staff, and student associates to her desk, and her multitasking ability lets her work with attention to the details of several assignments at once. Peggy demonstrates success in mentoring student employees and aiding them in any way necessary to help prepare them for life's pursuits and challenges. They rely daily on her upbeat personality and positive reinforcement, and she shares personal insight and strength as she gives them that which she loves most—opportunities to work and serve.

Dorothy K. Siebert

was honored with the President's Appreciation Award for her exceptional service, creativity, and competence. Dorothy received this recognition for her outstanding work and dedicated service as the administrative assistant in the Department.

Research Highlights

Chemists Create Chemical Similar to Morphine from Plant

Steven L. Castle's research group has developed the synthetic, mirror-image version of a molecule derived from the "Stephania japonica," or Japanese tape vine, that has a molecular structure that closely resembles that of the addictive painkiller morphine.

"I'm optimistic that our synthetic version of the Hasubanonine molecule will exhibit painkilling properties," said Steven. "And I think it's possible that it will have fewer of the negative side effects of morphine – the chief being its addictive characteristic."

Steven notes that the compound has yet to be tested for any painkilling ability, but that he and his students are busily working to refine the process used to produce the new molecule before sending samples to the National Institutes of Health, where other scientists will make that determination.

Stephania japonica, the plant from which the Hasubanonine compound is derived, is native to Australia and can be found on the margin of rainforests. Years ago, Japanese scientists isolated the Hasubanonine molecule from the plant.

Castle's research paper detailing the synthetic molecule's creation, published in the Aug. 17, 2006 issue of Organic Letters was co-authored by BYU student Spencer Jones and postdoctoral researcher Liwen He.

"It's noteworthy that Spencer, who did roughly 90 to 95 percent of the work on this project, was an undergraduate at the time," said Castle, adding that Jones was recruited by Harvard and Caltech, but that he will begin graduate school at Princeton next month.

Erik Sorensen, the Arthur Allan Patchett Professor in Organic Chemistry at Princeton, says that the creation of compounds like the one synthesized in Castle's lab are challenging objectives for research in chemical synthesis because they are complex and hard to form efficiently.

"Steve and his students did beautifully in solving a difficult problem in complex alkaloid synthesis," said Sorensen. "I am impressed by the logic of their plan for synthesis and the outcomes they achieved.

"This particular achievement in natural product synthesis is especially impressive because a BYU undergraduate student, Spencer Jones, played a leading role on the project," Sorensen continued. "Complex undertakings like this one almost always require the experienced leadership of well-trained graduate students and postdoctoral chemists. This achievement speaks to Spencer's talents in experimental organic chemistry and Steve's abilities as a teacher."

What Makes a Stradivarius Violin Sing?

Noel Owen has recently completed a research project on the topic of "What makes a Stradivarius violin sound so Lively and transcendent that musicians are willing to pay up to several million dollars to own one?". For years, debate has raged on what exactly the Cremonese master did to make his instruments sound so good. Some contend it's the glue or varnish he used. Others believe it's the way he shaped the violin's belly and back plate. Dr. Owen's research shows that at least part of the answer is in the wood.

Using Attenuated Total Reflection Fourier Transform Infrared Spectroscopy, ATR FTIR, he analyzed thin shavings collected from Stradivari's and lesser-known Guarneri's instruments during repairs. "The 'spectral fingerprint' of the old masters' instruments is different from instruments made in London and Paris at the time," said Owen, adding the same holds true when comparing modern examples of tone wood from eastern and central Europe. "Some people say this is due to aging, but we ruled that out. The best explanation (for the superlative sound of a Stradivarius) is that there was a chemical treatment of the wood that modified its chemical structure."

In addition to Owen's analysis, study co-author Joseph DiVerdi of Colorado State University did nuclear magnetic resonance tests on the samples and noted differences in the instruments' wood, too.

The study's lead author, Joseph Nagyvary, a retired Texas A&M biochemist, thinks such differences originate from a regional practice of wood preservation that affected the instruments' mechanical and acoustical properties. "We find the Stradivari and Guarneri de Gesu spectra are very different from other old instruments. They show signs of very aggressive chemical treatment," says Nagyvary. The treatment probably wasn't developed by the violin makers but rather a local chemist developed a chemical treatment to fight a woodworm infestation and then sold the treated wood to the violin makers. Stradivari and Guarneri couldn't pass on the secret because they weren't probably aware of the process themselves. "Once the method of wood preservation changed and there was less worm infestation, from then on, the Italian violins became just like the German or French violins of the same period," says Nagyvary. "The actual skills and knowledge of violinmakers were the same in Germany as in Italy. It was a historical coincidence. That's a slap in the face, more or less, for an entire society of violin researchers who have mainly concentrated on the geometry of the violin—the shape, the thickness, the tuning of the plate. What we say is that with that kind of method, you can climb halfway up the mountain but you'll never reach the peak."

Dr. Nagyvary has taken the results of this research to start his own violin fabrication company. You can now purchase violins that have very similar tonal qualities as those of the old masters.

Student Mentoring Grants

Why are increasingly larger percentages of students graduating from BYU's Chemistry & Biochemistry programs being accepted into top tier graduate programs and being aggressively recruited by industry? Besides the obvious fact that they are some of the best looking folks around, they are some of the best prepared for that "next step". That preparation is being greatly enhanced by BYU's student mentoring programs. Our recently retired Dean, Dr. Earl Woolley explained that "student mentoring describes the close intellectual interactions of one or a few students with a faculty member as they learn together outside the classroom. True mentoring is, of course, what occurs often in graduate programs where student-professor interaction is more intense. But for some time, BYU has successfully instilled mentoring at the undergraduate level. We have exceptionally well-prepared, industrious, and curious undergrads who want to know "why," rather than just "what."" This focused mentoring in labs and projects is helping our undergraduates apply the concepts and skills learned in the classroom to the laboratory and research much sooner than in most university environments.

The impact of these mentorships are two-fold. One, they have an opportunity to work closely with a mentor, and two, they are paid for the time spent in the mentorship experience. This income many times frees them from having to have another job outside of their study area and essentially "puts bread on the table" while participating in a learning experience of the highest rank.

Our challenge is that these mentorships are paid for by non-budgeted donations. We have been blessed this last year to receive some very generous donations that allowed us to have many of our students participate in this program. We would like to continue to expand this program as far as faculty resources permit. We invite each of you to consider your days of undergraduate and graduate studies and remember how much a small grant or scholarship made a difference to you. Remembering this, would you send a generous gift to the college and mark it "for student mentorships"? This year these gifts will be matched by the President's Leadership Council up to $5,000 each. That means for every dollar you give, $2 will come into the program. Thanks in advance for your help.

Send your gifts to:

College of Physical and Mathematical Science
Brigham Young University
Provo, Utah 84602

Or email your questions to brenth@byu.edu and Brent Hall, our representative from the philanthropies office will help you. Remember that in addition to cash gifts, there are great tax advantages for giving gifts of appreciated stock and real estate.

Brent Hall
N181G Eyring Science Building
Provo, Utah 84602
Phone: (801) 422-4501 or (800) 525-8074

Mentored Student Research

Benjamin Allred, "Synthesis of Proposed Δ12 Desaturase Inhibitors,"

mentored by Paul B. Savage

The individual project that I have worked on for the last semester consists of synthesizing new compounds that can be used to kill parasites. These compounds will inhibit an enzyme that only exists in certain parasites that infect humans. During the last semester, I have successfully synthesized two of these compounds. One was sent to a collaborating university to test its biological activity. The synthesis has not been as easy as I thought it would be. Different literature gives different methods, and it took time and many trials to find a successful method. Now, I should be able to quickly make the other compounds that will be tested. It was very satisfying to work through many problems and see some progress.

Deborah Gale, "Analysis of Large Energy Transfers between Vibrationally Excited Difluorobenzene and Vibrationless CO_2 by IR Spectroscopy,"

mentored by Eric T. Sevy

By studying vibrational energy transfer we gain insight to the reactivity of chemical reactions. Understanding what factors influence vibrational energy transfer will determine what factors affect reactivity. Recent work has indicated both vibrational mode character and frequency are important factors in energy transfer efficiency. Through the diode probe technique we are currently extending the established research on vibrational energy transfer. To better understand these factors we are studying the energy transfer of the three isomers of difluorobenzene. These molecules have the same vibrational mode character, but different frequencies. We are currently analyzing the energy transfer between 1,3-Difluorobenzene and CO_2. In September 2006, I presented the results and progress that our research group has made at the American Chemical Society Conference in San Francisco, California.

Jacob Stewart, "DNA-Templated Nanowire Sacrificial Placeholders for the Creation of Nanometer-Scale Pores,"

mentored by Adam T. Woolley

This semester, I used the research award to begin my study of nanofabrication processes. I first learned how to create nanowires by depositing metal along DNA molecules. After creating these wires, I began research into the feasibility of using these wires to form small pores in materials that could be used in very sensitive and small sensing devices. These pores were formed by creating nanowires on a surface, then coating the surface with a very thin layer of material. Next, I exposed the ends of the covered wire and used a chemical etch that would eat away the metal wire while leaving the surface and the layer of deposited material unaffected. I am still conducting tests to confirm that pores have been formed by this process, but the research award was a wonderful way to get started on this project. I will continue my work next semester.

Ryan Thallman, "Water Dependence of the HO_2 + NO Reaction,"

mentored by Jaron C. Hansen

The reaction of HO_2 with NO is important in the atmosphere for two reasons. HO_2 + NO is the primary source of production for tropospheric ozone. Tropospheric ozone is a powerful oxidizing agent and principle component of photochemical smog. We have measured the reaction rate for this reaction in the absence and presence of water vapor. The measured reaction rate is shown to increase by a factor of two under modest concentrations of water vapor at room temperature. This is a significant finding because our atmosphere is full of water vapor which may perturb the kinetics of this reaction. This helps us to better understand the measured concentrations of NO_2 and O_3 in the troposphere.

Jamie Ellsworth, "Single strand PCR amplification of HIV-I using limited dilution method,"

mentored by Gregory Burton

During the spring and summer terms in Dr. Burton's lab, my research centered around developing a new protocol for isolating single genome HIV in preparation for DNA sequencing. Previously, our research group used a very lengthy procedure involving bacterial clones to separate one viral copy from the millions in a tissue sample. This reduced the time available for data analysis and limited the number of patients we could process.

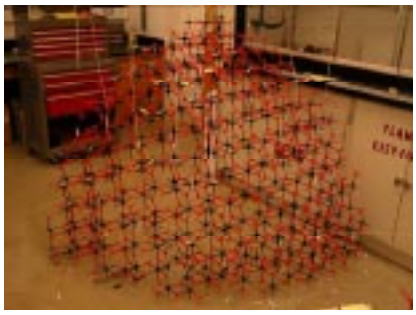
As an alternative route, I applied a general technique called limiting dilution to attenuate a viral sample such that it theoretically contained only one copy of HIV DNA per unit volume. Through several experiments, we showed that a single genome template can be amplified with polymerase chain reaction (PCR). So, assuming the dilution scheme accurately segregates an individual HIV genome, the PCR product can be sequenced directly. The last step in my experiment will be obtaining DNA sequence chromatograms from the Brigham Young University Sequencing Center. If I obtain clear, umambiguous data, our lab will have access to a much more efficient sequencing preparation method.

Stacey Smith, "TiO_2 Nanoparticles,"

mentored by Juliana Boerio-Goates and Brian Woodfield

Chemical reactions often take place on the surface of solid particles. Interestingly, these reactions can occur faster and even completely differently on the surfaces of really small particles called nanoparticles, although the reasons for this are not completely understood. Studies of these nanoparticle surfaces by computer modeling have been limited so far to flat surfaces, but real particles are often shaped like spheres or cylinders and hence are known to have curved surfaces. In order to see what these curved surfaces really look like and to understand why their surface reactions are different, I decided to build people-sized models of two types of nanoparticles—anatase TiO_2 and rutile TiO_2—which are spherical and rod-like in shape, respectively. We chose TiO_2 because it has geological, environmental, and industrial importance.

When both models were complete, I made some interesting observations. Normally in TiO_2, the titanium (Ti) atoms like to have 6 bonds and the oxygen (O) atoms like to have 3 bonds. Computer models of flat surfaces have shown, however, that Ti atoms on the surface only have 5 bonds and O atoms have 1 or 2 bonds. Our models of curved surfaces also showed that O surface atoms have only 1 or 2 bonds, but we found that only half of the Ti atoms on a curved surface have 5 bonds—the other half are reduced to having as few as 3 or 4 bonds. This severe lack of adequate bonding causes these Ti atoms to be high energy sites, or in other words, to be highly reactive; they will bond with practically anything nearby (such as water vapor or oxygen in the air) in order to create the 2 or 3 bonds they are lacking. Thus, the deficiency in bonds of the surface atoms created by the curvature of the nanoparticle itself may be the reason that reactions can occur faster or completely differently on nanoparticle surfaces.



STUDENT AWARDS 2007

Undergraduate Awards

Keith P. Anderson-Outstanding Senior
Stacey Lewis Smith

ACS Analytical Chemistry-Junior Award
Debbie Gayle

Analytical Chemistry
Robert Baker

Biochemistry
Chase Campbell

Chemistry Literature
Rebecca Olson

Freshman Chemistry Major
Grant Harper

Freshman Chemistry Non-major
Thomas Cook
Rosemary Swenson

Inorganic Chemistry
Carolyn Evans

Organic Chemistry Major
Kortney Judd

Organic Chemistry Non-Major
Daniel Walker

Physical Chemistry
Jacob Stewart

Catalyst Club-Outstanding Woman
Deborah Gale

Ott Undergraduate Research Award
Devin Kraig Busby

Harr Undergraduate Research Award
Jay Gardner Nelson

Garth L. Lee Undergraduate Teaching Awards

Spring 2006

Jessica Bentley
Robert Blake
Benjamin Greenfield
David Harris
Robert Hill
Ryan Isakson
Matthew Jones
Nathan Lewis
Spencer Morgan
Adam Washburn

Summer 2006

Robert Blake
Blair Bullock
Lindsey Dahl
Robert Hill
Ryan Isakson
Maren Jensen
Tyson Jones
Joshua Larsen
Spencer Morgan
Jeremiah West

Fall 2006

Kristie Aamodt
Robert Baker
Geoffrey Bean
Sarah Cameron
Taylor Clline
Lindsey Dahl
Jennifer Daniel
David Densley
Mary Feller
Robert Hill
Blake Hillstead
Peter McLean
Shawn Mikkelson
Kent Miller
Spencer Morgan
Kirk Morris
Brad Reid
Melissa Schmidt
Cody Smith
Ashley Valdiviesco
Dan Walker

Winter 2007

Geoffrey Bean
Blair Bullock
Jennifer Daniel
David Densley
Justin Farmer
Andrea Griffiths
Kaid Harper
Robert Hill
Blake Hillstead
Jaylan Jones
Spencer Morgan
Lance Moses
Jamie Olsen
Thalia Perryman
Andy Phillips
Kate Sadler
Stacy Smith
Daniel Sperry
Ashley Uhl
Ashley Valdivesio
Daniel Walker
Adam Washburn
Laura Westover

Undergraduate Research Awards

Fall 2006

Student	*Professor*
Benjamin Allred	Paul Savage
Nathan Bair	Roger Harris
L. Robert Baker	Steven Goates
Carolyn Evans	Matthew Asplund
Deborah Gale	Eric Sevy

Kortney Judd	Eric Sevy
Laura McAllister	Steven Castle
Shawn Mikkelso	Merritt AAndrus
Ivan Miller	Steven Fleming
Daniel Nielsen	Steven Castle
Joseph Ostler	Heidi Vollmer-Snarr
Mike Pfeiffer	Allen Buskirk
Jacob Stewart	Adam Woolley
Ryan Thalman	Jaron Hansen

Winter 2007

Student	*Professor*
Lawrence R. Baker	Steven Goates
Rebecca Baum	David Belnap
Josh Chamberlain	Paul Savage
Spencer Dickson	Paul Farnsworth
Daniel Dodson	Merritt Andrus
Carolyn Evans	Matthew Asplund
Matthew Freeman	John Lamb
Deborah Gale	Eric Sevy
Jeremy Goodson	Allen Buskirk
Bryce Harbertson	Heidi Vollmer-Snarr
Nathan Itoga	Lee Hansen
Kortney Judd	Eric Sevy
Laura McAllister	Steven Castle
John-David McElderry	Steven Goates
Peter McLean	Steven Graves
Ivan Miller	Steven Fleming
Daniel Nielsen	Steven Castle
Rebecca Olsen	Julie Boerio-Goates
Rebecca Plimpton	Barry Willardson
Hilary Stcok	Roger Harrison

Spring/Summer 2007

Student	*Professor*
Nathan Bair	Roger Harrison
Rebecca Baum	David Belnap
Spencer Dickson	Paul Farnsworth
Aubri Erbe	Heidi Vollmer-Snarr
Alan Erdmann	Roger Harrison
Deborah Gale	Eric Sevy
Kaid Harper	Merritt Andrus
David Healey	Allen Buskirk
Nathan Koji Itoga	Lee Hansen
Amber Jordan	Eric Sevy
Kortney Judd	Eric Sevy
Jeremiah Keyes	Richard Watt
Craig B. Larsen	John Lamb
Christopher Lee	Juliana Boerio-Goates
Bryan Mangelson	Matthew Asplund
Kirk Morris	Roger Harrison
Daniel Nielsen	Steven Castle
Laura Nielsen	Steven Castle
Hilary Stock	Roger Harrison
Samuel Tartakoff	Steven Castle
Jacob Thomas	Gregory Burton
Nathan Thomas	Lee Hansen
Landon Wiest	Matthew Linford
Marie Wilcox	Steven Castle

Graduate Awards

Fellowships

Bradshaw Graduate Fellowship in Organic Chemistry –
Crystal Ward
Outstanding continuing graduate student in organic chemistry - 10-hour research assistantship for up to 12 months beginning Fall 2006.

Charles E. & Margaret P. Maw Research Fellowship-
Xuifei Sun
Outstanding continuing graduate student in any area - 20-hour research assistantship for up to 12 months beginning Fall 2005.

Roland Robins Research Fellowship
Morad Alawneh
Michael Christiansen
Thomas Culwell
Yanshu Feng
Alyson HowlettK
Kilyoung Kim
Bing Ma
Karen Merrell
Changna Wang
Outstanding continuing graduate students in any area - 20-hour research assistantship for up to 12 months beginning Fall 2005.

BYU Graduate Studies Research Fellowships (Internships) –
Jacob Crandall
Yuanyuan Li
Guaray Saini
Lijin Xia
Outstanding continuing graduate students in any area -10-hour research assistantship for up to 12 months beginning Fall 2005.

Stanley & Leona Goates Research Fellowship-
John Edwards
Outstanding continuing graduate student in any area - 20 hour research assistantship for Spring and Summer beginning Spring 2005.

CONTINUING STUDENT SUPPLEMENTARY AWARDS

Garth L. Lee Award –
Michael Christiansen
Outstanding continuing graduate student in any area, based on religious commitment, service, and scholarship- $1,250

Loren C. & Maurine F. Bryner Award –
Megan Larsen
Matt Heywood
Yang Liu
Xuefei Sun
Outstanding continuing graduate student in any area - $1,000

Jennie R. Swensen Award –
Chun Wan Lai
Eduardo Sanz-Garcia
Doug Tanner
Outstanding continuing biochemistry graduate student - $1,000

GRADUATING AWARDS

Outstanding graduating Ph.D.
Hector Becerril-Garcia

Highlights from National Chemistry Week

Dr. Steve Fleming presents a Chemistry Magic Show during National Chemistry Week. The show is presented to the community during the third week in October.

Members of the YCHEM Society, the student organization of the Central Utah Section of the American Chemical Society, make ice cream with liquid nitrogen to sell to students during National Chemistry Week.

2007 BYU HOMECOMING EVENTS

Please mark your calendars and plan to renew your friendships in the department at our homecoming activities as follows:

Department of Chemistry and Biochemistry Activities on September 21

6:00 p.m.	Reception
6:30 p.m.	Dinner
7:30 p.m.	Speaker – Professor Milton L. Lee, "Nontraditional Directions in Analytical Separations"

(Room W-170 Ezra Taft Benson Science Building)

Homecoming Spectacular, September 20 & 21 (Marriott Center) 7:30 p.m.

Homecoming Parade, 10:00 a.m. September 22 (downtown Provo)

Homecoming Game, BYU vs Airforce Academy, September 22

Below is a reservation form which you can return to Homecoming, Department of Chemistry and Biochemistry, C-104 BNSN, Brigham Young University, Provo, UT or by email to marcia@chem.byu.edu. Please make your reservations no later than September 14, 2007.

RESERVATIONS FOR DEPARTMENT ACTIVITIES

Dinner, September 21, Friday; 6:00 pm

☐ Yes Number of Guests _____
(Please include yourself in the total.)

☐ No

(Please RSVP no later than September 14)

Featured Speaker Milton L. Lee, September 21, Friday, 7:30 pm

☐ Yes Number of Guests _____
(Please include yourself in the total.)

☐ No

Name: _____

Address: _____

City, State, Zip: _____

E-mail: _____

Department of Chemistry and Biochemistry
Brigham Young University
C100 Benson Science Building
PO Box 25700
Provo, UT 84604-5700