Spring 2012

Chemistry & Biochemistry Newsletter

Department of Chemistry & Biochemistry, South Dakota State University

The Avera Health and Science Center officially became the home of the SDSU's Department of Chemistry and Biochemistry on September 9, 2010.

Inside

Department of Chemistry and Biochemistry

Box 2202
South Dakota State University
Brookings, SD 57007-0896

(605) 688-5151

Visit our Web site at:
www.chembiochem.sdstate.edu

South Dakota State University

Chemistry & Biochemistry

Spring 2012

Hello from the Department!

This is normally the spring edition of newsletter, but by the time you receive it we will be well into the summer. There are a multitude of reasons for this (including a very hectic travel schedule for the department head!), but after reading the newsletter I think you'll agree that it's mostly because we've all been very busy here.

Our faculty and students continue to amaze me with all that they accomplish. We are pushing the boundaries of knowledge and contributing to a reinvention of education in our disciplines. We are doing it with a little bit of state funding, some tuition dollars, a lot of grant funding, and with the help of your donations for scholarships, student research fellowships and unrestricted gifts. I can't overemphasize the importance of your investments to what we do, and I hope the stories in this newsletter will amaze you with the return that we provide on those investments. If you are interested in seeing how you can contribute to help us, or if there is a way that we can help you realize your vision of giving back to the Department and SDSU please don't hesitate to contact me.

The Spring 2012 semester is long gone, and with it graduate and undergraduate students that have been with us for some time. We wish them all well, and you can see who these individuals are on p. 7.

This spring also saw the departure of our department's long-time administrative assistant, Natalie Garry. Natalie and her husband both got wonderful new jobs in Sioux Falls and relocated there at the end of the spring semester. We wish Natalie and her family well as they start out on this new chapter in their lives.

The start of the Fall 2012 semester is just around the corner, and new student orientation is almost over. We have several more sessions to go, but we are on track for our largest incoming classes in recent history in the chemistry, biochemistry and medical laboratory science majors (MLS). In fact the MLS program has already exceeded its largest number of freshman enrollees by almost a factor of two! And its on-line "Upward Mobility" program has already filled 20 of the 24 student openings that will make up its first cohort. The graduate program is also expanding; with 17 new students joining the program this fal, this will be the largest incoming graduate class since the Ph.D. program was reinstated in 1989, and perhaps in its history!

With all these new faces, there will be a lot of energy in the Department this fall! That's a good thing and what makes higher education so energizing! We are looking forward to the start of the next academic year.

On behalf of the Department I wish you a restful, relaxing and invigorating summer. We'll visit again next fall.

Stay in touch.

Jim Rice

NSF Grant Challenges Traditional Teaching Strategies

Changing the way students learn about chemistry is the goal of a two-year, $200,000 National Science Foundation grant awarded to associate professors of chemistry and biochemistry, David Cartrette and Matt Miller.

"Students are typically given a recipe and don't always think about how to change it to make a better experiment," said Miller. "It's just a verification process that we hope to change through introducing collaboration between first- and second-year chemistry students."

The nationally funded laboratory curriculum the professors will write is built on three guiding principles. First, students need to be trained in lab techniques with scientific instruments used by most chemists in everyday work. Second, students need multiple opportunities to use these techniques and instruments to answer real-world questions related to science. Finally, experience shows students need to understand that successful, original research and experimentation is not a solo operation.

The lab teaching model developed by Miller and Cartrette brings together a hierarchical system of research that uses an apprentice/mentor model. Their teaching strategies mimic that model by having two different levels of undergraduate classes work together to create a community of learning much like faculty research that engages graduate students.

The interaction of the two class levels intends to simulate what happens when someone starts a new job. The newly hired person is typically trained by someone more experienced with the job and its responsibilities. The second-year students act as trainers, while the first-year students act as trainees. The goal of this interaction, said the professors, is to develop a team environment where students teach and learn from each other.

"The focus is on creativity and collaboration," said Cartrette. "It's taking the abstract and making it applicable to real world issues — taking knowledge and applying it to real problems."

Students in these lab courses begin their studies in a very traditional sense; they master the techniques used in a chemistry lab. As they progress through the curriculum, they use these techniques to address real problems for which no answer is known. The approach quickly moves students toward more independent thinking and motivates them to perform original experiments. Working collaboratively, the professors said, lets students experience what most research students experience as they begin the research process.

The professors said such cooperative environments help create greater interest in research as students learn about the social aspects of working with others, not unlike a professional research laboratory that includes a wide range of scientists.

Assistant professors David Cartrette (left) and Matt Miller will use an NSF grant to create a collaborative teaching model for undergraduate students.

Cartrette and Miller's efforts address the call for science education enhancement at the state and national levels. In February 2012, President Obama received an executive report that recommended to "advocate and provide support for replacing standard laboratory courses with discovery based research courses."

At the state level, the South Dakota Legislature is proposing increased funding for math and science teachers in public schools.

The NSF-funded curriculum model also addresses upcoming changes in medical school admissions procedures; future editions of the medical school admissions exam, or MCAT, will focus on performance outcomes, as opposed to factual knowledge recall. Miller and Cartrette's project, funded last summer, they said, addresses these proposed changes.

"In a way, we foresaw these changes and acted to modify our curriculum to address them," Cartrette said.

The NSF grant will fund the advanced instrumentation needed for the project. Associate Professor Kenneth Emo, from the Department of Teaching, Learning and Leadership, assisted by chemistry and biochemistry graduate student Jaclyn Nielsen, will evaluate the educational outcomes of the project.

Additionally, presentations made by Cartrette and Miller at national workshops will describe how students learn through collaborative interactions in a lab environment. The two will also write journal articles on the process and develop teacher-training workshops that can be replicated in other educational settings, at both universities and high schools.

Both Miller and Cartrette's teaching experience has earned them awards for their instruction. Both have been awarded the Edward Patrick Hogan Award for Excellence in Teaching at SDSU recognize outstanding achievement in undergraduate instruction. Miller has also received the Elaine and Leo Spinar Chemistry and the Department's Biochemistry Teaching Award.

Economic Development Important CBC Research Outcome

Most people look at the Department faculty and see teachers and researchers. Department Head Jim Rice looks at them and sees entrepreneurs. "Faculty are entrepreneurs," Rice asserts. "They're small business owners."

Rice explains that the department and SDSU provide "venture capital" by investing in resources that will augment research. Professors pay back that capital by earning grants or allowing SDSU a share of the revenue from their commercialized ideas.

While not discounting the importance of teaching, Rice says, "The role of a faculty member is to generate ideas. It's that that can ultimately result in a patent."

Commercialized research can pay off for SDSU as the institution reaps a share of the benefits of the revenue the patent generates. The patent may pay off for the state as investors form a company that's likely to locate close to the professors who did the research.

But, as Rice sees it, research pays dividends long before a patent is issued. "The return on intellectual property is the people you bring into the community," Rice says.

Human trials next step for PhotoBioMed

Rice notes Professor Ron Utecht as a faculty member who's far along the road to commercializing his research.

Utecht founded PhotoBioMed, a development company, in 1998, and Tetherex, a sales company, in 2008. Currently the research focus is on developing a treatment for peripheral arterial disease, what Utecht calls a "poor relation" to the better-known coronary arterial disease.

The coronary disease can be treated with stents in the arteries, a procedure Utecht says doesn't always work well in the legs. The poor circulation that's a result of peripheral artery disease can result in the amputation of toes, the lower limb, or an entire leg.

The treatment that Utecht has developed expands the plugged artery with a balloon, diffuses a chemical created at SDSU, and exposes the chemical to blue light so that a new structure holds the artery open.

PhotoBioMed has five employees, Utecht and two others associated with SDSU and two affiliated with project collaborator Avera McKennan.

A byproduct of the research, according to Rice, has been building a bridge to the biomedical community. "We have a very good relationship with Avera," Utecht says. "They have funded a good portion of this work. And we are working diligently to develop connections with Sanford Research to expand our biochemistry Ph.D. program."

Tetherex, the sales company, has one employee and what Utecht describes as a "plethora of consultants." The consultants are needed, as the company gets ready for its next important step —human trials later in the year.

Biodiesel conversion in a 'flash'

Professor Fathi Halaweish's work is not as far along as Utecht's but it, too, shows promise. His company, Renewable Bioenergy LLC, is working on a technology that will convert waste oil from restaurants into biodiesel fuel. Future applications could include using a similar technology to turn the brown sludge from wastewater treatment plants in biodiesel.

Halaweish says the new technology makes the conversion "in a flash." Usual conversion methods take two days and five or six steps. Halaweish's process takes less than an hour and involves only one step.

To get his project ready, Halaweish is seeking a small business research loan and a Department of Defense grant. "I'm talking to investors as well," Halaweish says.

Economic development in 'basic' chemistry

Assistant Professor Adam Hoppe says he's not averse to commercializing research that come out of his lab, he's just not actively working toward that goal.

"Our main thrust is to solve biomedical problems," Hoppe says. While his research is deemed as more "basic" chemistry than the practice of Halaweish and Utecht, it is nonetheless important and likely to spur economic development.

Hoppe has created a microscope so powerful it allows the user to see molecules. It can probe where the molecules move, an important factor because of the information they carry.

Of course, the microscope didn't build itself. It took plenty of funding. In Hoppe's three years at SDSU he has earned an $800,000 NSF Career Award, a $100,000 Board of Regents grant, and funding from the Governor's 2010 Center and the NIH.

When he first came to SDSU, Hoppe was alone in his lab. In three years he has added two postdocs, a research associate, three graduate students, and three undergraduates.

State seeing good return on investments

Department Head Rice says work done by Utecht, Halaweish, and Hoppe is indicative of the entire department which generates a three-year average of $2.5 million in grants per year. "That's new money that's brought in," he says. That funding is necessary to keep 60 grad students and ten permanent research staff busy.

"We're generating ideas," Rice says and turning those ideas into valuable research and plentiful funding. "Those are pretty decent returns."

High-Tech Equipment Helps Department Study Molecules

New equipment at South Dakota State University will help scientists analyze molecules to determine their make-up in studies ranging from tracking chemicals in polar ice to finding chemical warfare biomarkers in tissues.

Assistant professor Brian Logue said the purchase of an ultra high performance liquid-chromatography tandem mass-spectrometer, or LC-MS-MS, can help scientists find trace amounts of specific molecules in complex samples. A $553,000 grant from the National Science Foundation's Major Research Instrumentation program supplies much of the funding for the $750,000 project.

"It can be very difficult to detect low concentrations of chemicals in a starting material with many components. A chromatography system separates molecules in a starting material and an ultra-high performance chromatography system separates them very efficiently," Logue explained. "Therefore, it does an extremely good job of separating out many components in a mixture."

Mass spectrometry is a technique scientists use to electrically charge a compound and break it apart into smaller fragments in order to understand the composition of the compound by detecting its mass. Tandem mass spectrometry is a related technique in which scientists break apart a molecule to look at the mass, then breaks it apart again to get more information about the composition of the compound under investigation.

"You basically break a molecule apart twice and look at all the mass fragments that are produced," Logue said. By doing this, researchers can identify components of a mixture to a high degree of accuracy because each component should have a specific pattern of fragmentation for the first and then the second fragmentation.

One SDSU project that will rely on the new equipment will study the history of the contaminant perchlorate in the environment. Perchlorates are salts from perchloric acid that are frequently found in the environment as a result of human sources such as rocket propellants, munitions, and fireworks. However, recent studies suggest there may also be natural sources of perchlorate.

Professor Jihong Cole-Dai said trace chemicals such as perchlorate in old polar ice offer a sample of what was in the air at the time of the snowfall. The new LC-MS-MS instrument will help Cole-Dai measure very low levels of perchlorate in ice cores from snowcapped Greenland to generate an unbroken record of perchlorate levels in the atmosphere for the past 500 years. Such a record will help quantify the contributions of natural and man-made perchlorate.

Brian Logue

The new equipment will enable Logue to continue his own studies looking for biomarkers in biological fluids or tissues that could help determine if someone has been exposed to chemical warfare agents, for example. Logue wants to find new ways to detect such biological markers for longer periods of time. The research is important to the military because it can help assure appropriate care and monitoring for soldiers who have been exposed to chemical warfare agents.

"When you're exposed to a chemical warfare agent, your body tries to break it down as fast as possible because it's a toxic agent," Logue explained. "As your body tries to get rid of those agents, it reduces them to very low concentrations. We need to use the LC-MS-MS to detect those low concentrations in mixture with many other protein and chemicals in the body."

Logue adds that what sometimes happens is that part of the chemical warfare agent binds to a biological molecule in the body such as a protein forming a new complex called a protein adduct. The LC-MS-MS is very good at protein analysis so it may be able to detect those adducts.

"If we have an instrument to detect a protein adduct, that can be very important, because protein adducts act as long-term repositories of information regarding chemical warfare agent exposure," Logue said.

Another SDSU study already in the works will use the LC-MS-MS to help identify the cellular functions of 19 proteins in a species of blue-green algae. SDSU Associate professor Ruanbao Zhou's work specifically looks at a newly discovered mechanism for controlling the way cells send signals called regulated intramembrane proteolysis, or RIP. So far there has been no systematic study of RIP in any organism. Zhou's NSF-funded project, is a genome-wide study of RIP in Anabaena variabilis, a photosynthetic microbe with potential uses in agriculture and bio-energy. Since RIP is involved in the regulation of many crucial biological processes, including the pathogenesis of human diseases such as cancer and Alzheimer's, the SDSU work also has implications for human health.

Zhou and professor Bill Gibbons in SDSU's Department of Biology/Microbiology, working with Stephen Hughes of the U.S. Department of Agriculture's National Center for Agricultural Utilization Research, are also applying the LC-MS-MS to help develop a suite of engineered blue-green algae that are separately capable of converting carbon dioxide into biofuels

(for example, ethanol, butanol and hydrocarbons) and commodity chemicals.

Logue also will make the equipment available as a teaching tool connecting K-12, undergraduate, graduate students and faculty through what he calls the Water Analysis to Educate and outReach program, or WATER.

"The idea is to send some sampling gear out to high schools and undergraduate institutions that don't have an LC-MS-MS. They will take water samples that are of interest to them, whether it's a river or stream, their drinking water, whatever it is. They then send those samples to us and then we have our students, the undergraduates, run some of the samples on the LC-MS-MS. We should be able to get a good idea of what is in their water. We'll put the data on an Internet server so that the high school students can see what was identified."

Initially the tests can target pesticides such as atrazine, then expand as needed to identify other contaminants.

Chemistry Education Joins Western Regional Graduate Student Exchange

The master's-level chemistry education program at South Dakota State University will become part of a regional exchange that qualifies students from participating states for the resident tuition rate.

The master's degree in chemistry with a chemistry education specialization at SDSU will join the Western Regional Graduate Program operated by the Western Interstate Commission for Higher Education (WICHE) with the approval of the South Dakota Board of Regents.

The exchange program offers students access to master's and doctoral degree programs that are of demonstrated quality and not widely available in the western region. Graduate students from 14 other western states may qualify for the resident graduate tuition rate, rather than a higher out-of-state rate, if they enroll in the approved chemistry education program.

Regents' officials said student exchange programs serve an important dual purpose. South Dakota is able to recruit additional graduate students from other states into programs where there is capacity, and South Dakota students gain the opportunity to pursue specialized programs elsewhere that are not available in South Dakota.

WICHE states participating in this program are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. The graduate exchange offers 280 high-quality programs at 50 participating institutions.

Alum Jared L. Anderson joins LCGC's Editorial Advisory Board

LCGC Magazine recently announced the addition of Jared L. Anderson, professor of chemistry in the Department of Chemistry at The University of Toledo, to its editorial advisory board. He joined the university as an assistant professor in 2005, was promoted to associate professor in 2009, and to full professor in 2011.

His research interests include the synthesis of new classes of ionic liquids and materials derived from polymeric ionic liquids, the use of ionic liquids as catalytic solvents, and the use of ionic liquids in all aspects of separation science, including analytical extractions, purification, and chromatography.

Anderson received his B.S. in chemistry from South Dakota State University in 2000, followed by his Ph.D. in analytical chemistry under the supervision of Daniel W. Armstrong at Iowa State University in 2005.

Adam Hoppe Wins Berg Award for Research Excellence

South Dakota State University honored excellence among its faculty at its fourth annual Celebration of Excellence banquet February 21 in the Student Union.

Adam Hoppe, assistant professor of Chemistry & Biochemistry, was presented the Sherwood and Elizabeth Berg Young Scientist Award. His research focuses on understanding how cell-surface receptors control cell function. To this end, he is developing new imaging technologies to interrogate these molecular interactions within the cytoplasm of living cells.

CBC Doctoral Candidate is SDSU Grad Student of the Year

How can scientists discover if life forms have existed on the moon, Mars or other planets? Part of that answer can be found in research being done by SDSU graduate student Michael Stutelberg, from Woodbury, Minn., who in January was awarded the university's graduate student of the year scholarship.

Stutelberg's earth-bound research seeks to design a sensor that can detect DNA and RNA compounds. He uses a well-established technique that utilizes a spectrometer to detect chemicals that bind to a roughened metal surface. What makes his research unique is the use of a different type of metal surface.

His work will use a porous silver nanotube network. In addition to being porous, it has an ultra-high surface area, a unique, three-dimensional nanostructure, and is highly reproducible.

The hypothesis is that this material will make detection of minerals, microbes and biomarkers efficient and very sensitive with no special requirements for sample preparation, according to Stutelberg, who does his research in open atmosphere in a lab at the Avera Health and Science Center on campus.

Ultimately, this research could be used on a rover vehicle sent to the moon or points beyond, he said.

Stutelberg has been working on the project for about a year and has had success detecting DNA and RNA nucleotides using the traditional metal surface. Now he is preparing to use the porous silver nanotube network. He expects to do experimentation for another 18 to 24 months and then begin work on his dissertation as he prepares for a May 2014 completion of the doctorate in chemistry.

Stutelberg credits his chemistry teacher at Woodbury Senior High for getting him "hooked" on chemistry. "I just found it interesting to find out how everything happened at the molecular level."

There is nothing micro about the Joseph F. Nelson Graduate Scholarship he received from SDSU's Nelson Scholarship Committee. Stutelberg topped 20 other applicants for the one-year, $7,600 award, which covers tuition and fees.

Stutelberg came to State in fall 2010 after earning his bachelor's degree in chemistry in May 2010 from Augustana College.

Brian Logue, his advisor at State, said, "I have known Michael for about a year and a half. During this time, he has worked with my analytical chemistry laboratory group and completed advanced analytical chemistry. Michael is a poised, dedicated person who displays all the traits necessary for success in the research sciences."

Stutelberg said he would like to continue to participate in research while teaching chemistry at a small college.

Graduate student Michael Stutelberg examines a solution in the analytical chemistry research lab under the watchful eye of his advisor, assistant professor Brian Logue. Stutelberg received the university's graduate student of the year scholarship.

The Robert and Katherine Burris Distinguished Lecture Series

Gerard Marriott, a bioengineering professor at University of California-Berkeley, delivered this year's Burris Lectures at SDSU on Thursday and Friday, April 26-27, describing key developments in the study of bioluminescence.

Marriott earned his bachelor's degree in biochemistry from Birmingham University in the United Kingdom and his Ph.D. in biochemistry from the University of Illinois in 1987. He did postdoctoral work in Germany and Japan before teaching at the University of Wisconsin from 2005 to 2009, after which he went to Berkeley.

In 2008, Marriott's work with optical lock-in detection of energy transfer was recognized by *Scientist* magazine as one of the top 10 inventions of 2008.

His Thursday lecture was "Light and Life: Observations and Studies of Luminescence Through the Ages" which ended with an account of current applications of bioluminescence in biotechnology for the detection of disease and for imaging tumors.

Marriott's Friday talk was "Optical Switches and Actuators: High Contrast Imaging and Reversible Control of Proteins in Biological Systems."

Universities & K-12 Schools Partner Up to Improve Math and Science

Six projects that partner public universities with K-12 schools will receive nearly $300,000 in federal grant funding to improve science and mathematics instruction in middle and high schools.

The Title II grants from the U.S. Department of Education pair university science, math, and education faculty with teachers and administrators from high-need school systems to develop relevant professional development activities. More than 135 teachers from across South Dakota will participate.

The partnership grants, each funded at about $50,000, include:

- SDSU and Takini School for a "STEM Enhancement Teacher Institute: Sustained, Effective Teacher Interaction" project. Matt Miller CBC associate professor is principal investigator on this project.
- Black Hills State University, along with South Dakota State University and Bennett County School District, for a "South Dakota Counts" project;
- BHSU and Colome School District for a "Life Science Concepts for Teachers" project;
- SDSU and Bennett County School District for a "Cosmic Connections 2012" project;
- BHSU, along with Dakota State University and Cheyenne-Eagle Butte Schools, for a "South Dakota Counts" project;
- SDSU and Colman-Egan School District for an "Engineering the Future" project.

The grants will involve teachers in specialized summer workshops and follow-up activities that lead to implementation of lesson plans in math and science throughout the school year. The South Dakota Board of Regents administers the grant funds under the No Child Left Behind Act of 2001.

The projects will bring together higher education faculty, local school systems, and other education agencies and partners to achieve statewide impact. Funding runs from April 2012 through September 2013.

Recent Graduates

Bachelor of Science — Spring 2012

Biochemistry
Jessica K. Baldwin, Biochemistry
Bradley E. Iverson, Biochemistry, *Summa Cum Laude*
Megan L. McDougall, Biochemistry, *Magna Cum Laude*
Samantha Jeanne Przybelski, Biochemistry
Eric Dale Swanson, Biochemistry

Chemistry
Bradley A. Anderson, ACS Certified Chemistry
Michael P. Collins,* Chemistry
Zachary Isaiah Merrick, Chemistry
Elizabeth Landle Westall Wolfram, Chemistry

Medical Laboratory Science
Shawn E. Andrews,* Medical Laboratory Science
Melissa M. Bushfield,* Medical Laboratory Science
Caleb J. Cooke,* Medical Laboratory Science, *Cum Laude*
Nicole M. Deurmier,* Medical Laboratory Science
Caleb T. Distel,* Medical Laboratory Science, *Cum Laude*
Rachel A. Gervais,* Medical Laboratory Science
Cory S. Gunderson,* Medical Laboratory Science
Amber L. Halter,* Medical Laboratory Science
Jessie Marie Paris,* Medical Laboratory Science, *Cum Laude*
Holly Ann Pueppke,* Medical Laboratory Science
Andrew Anthony Rueb,* Medical Laboratory Science

** Indicates prior or subsequent semester graduation candidate.*

Master of Science, Chemistry Education

Kristin King (B.S., South Dakota State, 2005), Chemistry
Joy Korman (B.S., South Dakota State, 2008), Chemistry
Teresa Meland (B.S., South Dakota State, 1987), Chemistry
James Musil, (B.S., South Dakota State, 1979), Chemistry

Doctor of Philosophy

Lei Geng (B.S., University of Science and Technology of China, 2006) Chemistry

Major Advisor: Dr. Chandradhar Dwivedi
Dissertation: Isotopic Composition of Nitrate from Greenland Snow and Ice Core: Implications for Anthropogenic Impacts and Ice Core Nitrate Preservation.

Bethany Melroe-Lehrman (B.S., South Dakota State University, 2005; M.S., South Dakota State University, 2008) Chemistry

Major Advisor: Dr. David Cartrette
Dissertation: Inquiry in the Chemistry Classroom: An Age Comparative Study.

Chakravarthy Vinnakota (B.S., Osmania University, 1996; M.S. SRTM University, 2000; M.A. University of South Dakota, 2005), Chemistry

Major Advisor: Dr. Brian Logue
Dissertation: Cyanide Exposure: The Development of A Hand-held Sensor and AMethod of Analysis for A Next-Generation Cyanide Therapeutic.

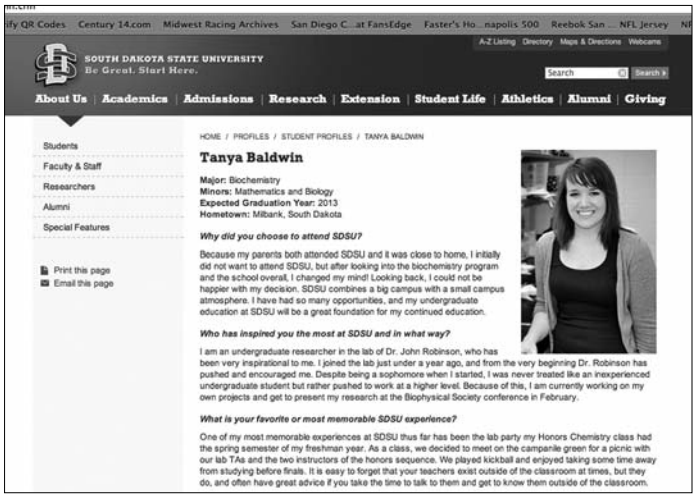
Alumni Update

From **Jared L. Anderson, Ph.D., Professor of Chemistry, The University of Toledo, OH:** "I hope this finds you well! I have heard many great things about the growing department at SDSU and I hear that the new building is now occupied. I am excited to see it one of these days!

It has been a while since I last touched based with you and I wanted to share with you some good news! I found out about a month ago or so that I have been selected to receive the 2012 Young Investigator in Separation Science Award giving by the ACS. I am both happy and humbled to have been chosen for this honor! I will receive the award at Pittcon 2012!

I have been asked to write a biography and am proud to be stating that I received my B.S. degree at SDSU. I really do think that I obtained a great education (both in classroom and in research laboratories) that prepared me well for entering a high-caliber laboratory in my graduate studies.

Another CBC Student Featured on SDSU's Web Site



Recent Grants

Fathi Halaweish: A Cooperative Investigation into Nutritional Analyses of Selected Wild and Domesticated Amelanchier Cultivars, USDS/NIFA, $47,000

Brian Logue: Cyanide Diagnostic: Development of a Second Generation Fluorometric Sensor for Rapid Analysis of Cyanide Exposure and Verification of the Inability of 2-Amino-2-Thiazoline-4-Carboxylic Acid (ATCA to act as a Diagnostic Marker, USAMRICD FPT, $254,281

Matt Miller: SD EPSCoR RII T1 Planning Grant: STEM Education Research Center for South Dakota, $7,912

Doug Raynie: Graphene Synthesis during Biomass Pyrolysis, SDSU Sun Grant, $7,500

Doug Raynie: Torrefaction & Pyrolysis of Prairie Cordgrass to Fungible Fuels, The North Central Regional Sun Grant Center, $104,116

Cheng Zhang: Biochemical Research and Development for Enhanced Electro-Optic Properties, U.S. DOD/Air Force Office of Scientific Research, $34,245

1,814 copies were printed by the Department of Chemistry and Biochemistry at $.00 each. *Printed on Recycled Paper.* Ch024 8/12

South Dakota State University
Department of Chemistry and Biochemistry
Box 2202
Brookings, SD 57007-0896

RETURN SERVICE REQUESTED

NON-PROFIT ORG
US Postage Paid
Brookings, SD
Permit 24