Fall 2014

Chemistry & Biochemistry Newsletter

Department of Chemistry & Biochemistry, South Dakota State University

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

Inside

Department of Chemistry and Biochemistry

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South Dakota State University

Chemistry & Biochemistry

Fall 2014

Greetings from the Department!

As I write this we are three days away from the end of the fall 2014 semester. It's hard to believe that it went by so fast! We are in the midst of two new (yes, new!) tenure-track faculty position searches that will support the department's participation in the $31 million (that's really a lot of money!) SD EPSCoR/SDRIC research center project that is now fully funded. This project has a large number of programmatic components ranging from basic research to work-force development that engages every public, private and tribal college and university in South Dakota, but our new biochemistry Ph.D. program is the lead graduate research program in the project, and Dr. Adam Hoppe is the research lead (see the story on p. 2).

We have a great group of new graduate students, and several new faculty and staff that have joined us since our last newsletter. You have the chance to meet them all beginning on p. 6.

Our fall 2014 newsletter also highlights some of the many other accomplishments of the department's faculty, office staff, research staff and graduate students. They are a talented group of scientists and support professionals who reflect our commitment to rigorous and relevant graduate AND undergraduate educational programs, and nationally competitive basic and applied research that contributes to meeting national needs.

You can support our activities with your gifts to the department, and on behalf of everyone in the department, I would like to thank all of you who chose to do so this past year. Your support is a critical part of our ability to continue to meet the needs of students, the state and the nation.

On behalf of all of us, faculty, staff and students in the Department of Chemistry and Biochemistry here at SDSU, I wish you a Merry Christmas and the very best as we move into the New Year.

Stay in touch!

Jim Rice

Check us out on www.facebook.com/sdstatechembiochem

BioSNTR Funding Boosts Biotechnology in South Dakota

Scientists in South Dakota will examine living cells at a molecular level to find out how cells become cancerous, how viruses attack animals and humans and how plants can capture more nitrogen through a new collaborative research center called Biochemical Spatio-temporal NeTwork Resource (BioSNTR).

"Our goal is to create the infrastructure to catalyze innovation and discovery in bioscience and biotechnology," said Adam Hoppe, associate professor of chemistry and biochemistry and director of BioSNTR.

BioSNTR brings together plant and animal scientists, biochemists and biomedical engineers from six state universities, three tribal colleges and three private colleges along with medical researchers from Avera Research Institute and Sanford Research. Its focus on improving human health and agriculture is part of the state's science and technology plan.

In 2013, the state awarded BioSNTR $12 million over six years when it was selected as the South Dakota Experimental Program to Stimulate Competitive Research (EPSCoR) submission to the National Science Foundation Research Infrastructure Improvement Track I program.

For his research that built the foundation for BioSNTR and his leadership of the successful proposal-writing effort, Hoppe received the College of Arts and Sciences' researcher of the year award at the university's Celebration of Faculty Excellence.

Imaging molecular interactions of cells

Tools that let researchers track the biochemical machinery of living cells can help solve problems affecting the health of humans, animals and plants, Hoppe explained.

This year he is completing work on a five-year, $785,000 NSF Career grant he received in 2010. With that funding, he designed and built a unique microscope setup capable of imaging the inner molecular working of living cells.

"The main goal was to be able to see when three or more molecules are touching one another," he said, because that is how information is relayed. By tagging these molecules with different fluorescent colors, Hoppe's instrument is able to visualize biochemical communication by measuring the transfer of energy when these molecules touch, bringing the tags to within about one-ten-millionth of an inch of each other.

Hoppe developed a computer program that separates the changes in color intensity that occur from this energy transfer and produces movies of when and where the molecules

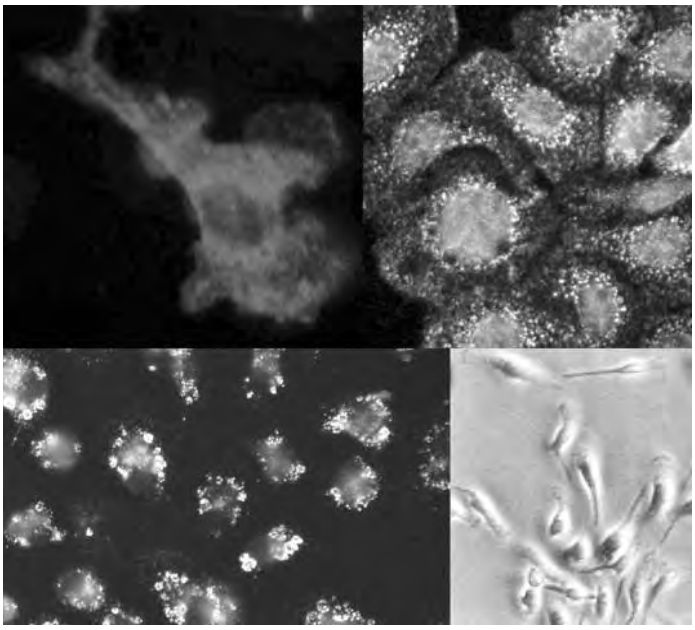
interact. Hoppe and other researchers then use these data to understand cellular processes ranging from what triggers the development of cancer to how viruses work.

Collaborating with researchers from the University of Nebraska Medical Center Eppley Institute for Research in Cancer and Allied Diseases, Hoppe applies this technology to study how molecular disruptions within white blood cells can lead to the development of leukemia.

Improving plants, visualizing viruses

New biological tools that allow scientists to sequence the genetic makeup of plants, animals and even humans provide more opportunities for Hoppe's imaging techniques to help scientists identify which genes are responsible for specific cell functions and to analyze emerging viruses.

SDSU chemistry and biochemistry associate professor and director of BioSNTR Adam Hoppe with the unique cicrosope he developed of five years capable of imaging the inner molecular working of living cells.



Example images of molecular distributions in cells.

Hoppe has collaborated with colleagues in the College of Agriculture and Biological Sciences through his work with the Center for Biological Control and Analysis by Applied Photonics (BCAAP), a governor's research center established in 2010. Many of these interactions set the stage for what has become BioSNTR, Hoppe pointed out.

Virologist Feng Li, a professor in the biology and microbiology and veterinary and biomedical sciences departments, said that Hoppe and fellow biochemist, assistant professor Suvobrata Chakravarty, played a vital role in his discovery of a new influenza virus.

"They helped advance our understanding of this new emerging influenza at the structural and evolutionary levels," Li noted. That led to national and international recognition, including a National Institutes of Health grant for Li and his colleague, immunologist Radhey Kaushik, to study this new virus.

"It's about building bridges between scientists," Hoppe said.

Assistant professor of plant science Senthil Subramanian is identifying the key genes that control the formation of nodules in soybean roots, which house bacteria that fix nitrogen. His goal is to increase the plant's nitrogen-fixing capabilities and thus reduce the need for chemical fertilizer.

Subramanian is collaborating with Hoppe to image the biochemistry of newly identified genes that are involved in nitrogen fixation. This has become one of the central issues to be explored through BioSNTR, Hoppe noted.

Jim Rice, chemistry and biochemistry department head and SD EPSCoR director, said, "This is an example of the collaboration that is so important in today's research work."

BioSNTR is now fully funded, thanks to a five-year, $20 million Track 1 grant awarded to South Dakota EPSCoR this summer. Half of those monies will support BioSNTR, while the other half goes to the state's EPSCoR program.

"Adam is a great example of how we are expanding the university's research capacity," said Rice. "He has a unique opportunity to build an infrastructure that could have a profound effect on the entire state."

New Student Club Decorates Tree

Nate Walstrom, president of the Student Affiliates of the American Chemical Society, which became an officially recognized student organization in September says they entered the Student Union tree decorating contest to gain exposure for the group.

"We've done some community service projects with chemistry presentations at the Children's Museum in Brookings. If we had more members, we could do more projects," said Walstrom, a senior from Rapid City.

The group used traditional decorations. Next year it hopes to decorate beakers and test tubes to hang on the tree.

Members of the Student Affiliates of the ACS debate how to finish decorating their tree in the Student Union Dec. 1. Pictured, clockwise from lower left, are Alexandria Kub, a sophomore from Phoenix; Rebecca Thiel, a sophomore from Paulina, Iowa; Jiwoo An, a senior from South Korea; and Nate Walstrom, a senior from Rapid City.

New Graduate Students


Ahmed


Apraku


Bailey


Elgazwi


Gudimani


Jadhav


Manandhar


Martinez


Maslamani


Pay


Roy

Ahsan Ahmed
I was born and raised in Barisal, a small city in southern Bangladesh. I received my B.S. degree in applied chemistry and chemical engineering at the University of Dhaka, in the same department where I completed my master's. I am a Ph.D. student in analytical chemistry, working in the green chemistry laboratory under Dr. Raynie. In ten years time, I envisage myself doing extensive research in the field of chemistry and use my knowledge for the betterment of this beautiful world.

Mustafa Alluhabi
I grew up in Saudi Arabia and received an undergraduate degree in chemistry from Umm Al-Qura University, College of Applied Sciences at Makkah, Saudi Arabia. My research interest is geared toward organic synthesis of drug candidates for treatment of pancreatic cancer. I am pursuing a Ph.D. in chemistry and I am supported by Saudi Arabia fellowship. *Not pictured.*

John Apraku
I graduated from University of Cape Coast in Ghana in 2007 and I received my master's in organic chemistry from Tennessee State University. My research is focused on molecular modeling and drug discovery. I chose SDSU because of its geographical location and great research opportunities at the department.

Elizabeth Bailey
I received my bachelor's degree at Olivet College in Michigan in both chemistry and biology with a pre-medical studies concentration. I am currently working to understand the mechanism of assembly and activation of the GM-CSF cytokine receptor using immunofluorescence and polarized total internal fluorescence microscopy (pol-TIRFM).

Sara Elgazwi
I am from Libya where I received my B.S. and M.S. in chemistry from Omar Almukhtar University in 2009. I am especially interested in biochemistry in drug discovery. I chose SDSU because Brookings is a safe and quite city that I believe will help me to improve my education.

Manik Gudimani
I received my biology and chemistry degree from the University of South Carolina-Columbia in May 2014. I have a passion for organic chemistry and have joined Dr. Zhang's group to further my understanding. I am originally from Mississauga, Ontario, Canada, and I enjoy playing hockey and basketball. I chose SDSU to obtain my Ph.D. as it seemed like a great fit for me.

Balawanthrao Jadhav
I am from India where I received my B.S. in chemistry from Osmania University. I graduated in organic chemistry from Osmania University, India. Currently I am pursuing a Ph.D. in analytical chemistry under the supervision of Dr. Douglas Raynie. My research interest is catalyst optimization and product separations from biomass by using supercritical fluids extraction technique. I choose SDSU because of good research facilities as well as outstanding faculty.

Erica Manandhar
I am from Kathmandu, Nepal. I received a bachelor's degree in biochemistry from SDSU where I was exposed to research in analytical and environmental chemistry. My interests in the field of analytical and bioanalytical chemistry is what made me stay in SDSU for a graduate degree. Dr. Logue is my graduate research advisor.

Machelle Martinez
I am from Clovis, N.M., and earned a B.S. in biochemistry from Eastern New Mexico University. I had received information about SDSU and the chemistry and biochemistry department that included information about the professors

New Graduate Students continued on next page.

Arts & Sciences Contributes 2,875 Items to Food Pantry

Dean Dennis Papini challenged the departments in the College of Arts & Sciences to hold a food drive to help replenish the shelves at the local Harvest Table.

Close to 2,900 items were dispensed September 29, during the Harvest Table meal served by volunteers from SDSU. The church distributes food pantry items the last Monday of the month, and SDSU had volunteered to serve dinner in September.

The inspiration for the food drive came from Delora Bennett, Geography Department secretary. She told Papini that the shelves at the First United Methodist Church Harvest Table food pantry were almost bare.

"There has been such a need since school started," Bennett said. "Many students attend the monthly dinner and collect food, diapers and other items when they are there."

Bennett asked the dean if the college would sponsor a food drive challenge among the Arts & Sciences departments. She suggested that the dean's office tally how many items were brought in and treat the winning department to root beer floats.

"It thought it was a great idea, one that is a great fit for our college's emphasis on service learning and hands-on experiences, Papini said.

"It was kind of a 'no brainer' for us. Faculty members and staffers across the departments would engage in a little friendly competition and would provide much-needed assistance for residents from the community of Brookings."

A total of 2,875 items were collected last week by departments and delivered to the Community Life Center for distribution at the Harvest Table on Monday. The Chemistry and Biochemistry Department took first place with more than 1,000 items, which was twice as much than the second place department.

Jim Rice, chemistry and biochemistry department head, is shown with some of the over 1,000 items collected by his department for the Harvest Table food pantry.

"It was great to observe department faculty and staff pull together and make this happen. All 16 departments in the college participated," Papini said. "Special thanks goes to Delora Bennett for proposing the idea, and to Lori Maher, program assistant, and Erin Staniszewski, budget analysis for the dean's office, who took charge of collecting the donated items from the departments and delivering them to the food pantry."

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and their respective research. I decided to attend SDSU because I have interest in fluoresces and it's applications in biochemical research, which overlays with some of the research conducted here. Overall, I am amazed by the personable faculty and powerful instruments available at SDSU.

Nujud Maslamani
I am from Saudi Arabia where I graduated from the University of Jazan with a B.S. in chemistry. I am a first-year graduate student at SDSU pursuing a master's degree in analytical chemistry, which is my interest area. I chose SDSU because it has a good environment for graduate studies and great chemistry programs.

Adam Pay
I am from Sioux Falls, S.D., and graduated from SDSU in 2014 with a B.S. in chemistry and a minor in history. My undergraduate research experience was in drug design and synthesis of drug candidates. I plan to continue studying in the field of synthetic organic chemistry during my graduate education.

Ranen Roy
I am from Bangladesh where I received an undergraduate degree from the University of Dhaka in 2013. I am a first year graduate student at SDSU pursuing a Ph.D. in analytical chemistry. I chose SDSU's graduate program because it has an excellent infrastructure and renowned faculty working in the areas that parallel my interests.

New Faculty and Staff

Anne Eichelberg

I'm the department's new secretary. I moved here from San Diego this past summer when my husband decided he needed a career change. He has family in Brookings, which turned out to be a really good thing because they've played such a big role in making my transition smooth and pleasant. My favorite part about South Dakota so far has to be butter brickle ice cream. I never knew my life was missing any thing until I left California and discovered the goodness that is butter brickle ice cream. My least favorite? The impending doom and gloom of my first real winter, complete with tales of negative degree weather and gusty winds and snow that'll blow me over sideways. In spite of that, I'm excited to go ice fishing, and excited to finally experience a "White Christmas!"

Tanya Gupta

This is my first year as an assistant professor of chemistry and biochemistry at SDSU. I did my postdoctoral research work at Grand Valley State University (GVSU) on project target inquiry which is focused on inquiry-based science teacher professional development. I completed my B.Sc. in chemistry and M.Sc. with specialization in inorganic chemistry in India. After receiving my M.Sc., I worked on a few research projects in the area of inorganic coordination complexes before moving to the U.S. to obtain a M.Ed. and later a Ph.D. in science education from Iowa State University.

My research interests extend in the area of chemical education research (CER), science education and interdisciplinary education research in STEM (Science, Technology, Engineering and Mathematics) and are centered on authentic inquiry-based teaching and learning. One of my research projects involves developing and integrating technology-based interventions in chemistry instruction. Using technology-based interventions such as interactive simulations can aid student understanding of abstract scientific concepts which are otherwise hard to comprehend through textbook and lecture. These interventions also engage students in active learning and empower the teacher to be a facilitator of science. Another area of my research interest is to develop an inquiry-based chemistry curriculum to support teacher facilitation of scientific inquiry in classroom and laboratory settings.

Besides teaching and research, I am an avid, compulsive reader, and I also enjoy doing taekwondo.

Interested in keeping current on happenings in the department?

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Courtney Jones

I'm in charge of the department's web and print media, grad student recruiting, and grant submission. I also serve as the secretary for BioSNTR. When I'm not at work I'm taking care of my kid, working at Buffalo Wild Wings, interning with the SDSU athletic department and working on a master's in sport management.

Julie Liebold

I began my education at the University of Wisconsin-Oshkosh where I received a B.S. in chemistry and with a minor in math. During my summers at Oshkosh, I interned at a small generic pharmaceutical company and at the American Museum of Natural History. While at the AMNH I became interested in geology and how it relates to chemistry. After graduating from Oshkosh, I attended the Colorado School of Mines where I earned my Ph.D. in Geochemistry last year. I am now a lecturer in chemistry at SDSU and teaching mainly at the Lake Area Technical Institute in Watertown, S.D.

Akash Mehta

I am originally from India. Before coming to SDSU, I taught organic chemistry at the University of Northern Iowa. I received my Ph.D. from the Max Planck Institute in Germany and came to the U.S. to pursue postdoctoral research in solid-state chemistry and chemical education. My research interest in chemical education centers on developing, and implementing inquiry-based curriculum in organic and inorganic chemistry. I plan to develop laboratory activities for undergraduate and grad level chemistry courses with emphasis on synthesis, characterization, and structure-property relationships to enable students to connect to the subject matter and gain a deep understanding and appreciation for chemistry by engaging in scientific inquiry. Another interrelated area of my interest lies in developing, implementing and researching the effectiveness of a blended approach to teaching organic and inorganic chemistry via flipped classrooms.

Swaminathan Venkatesan

I hail from India where I completed my undergraduate degree in metallurgical and materials engineering. After my bachelor's I pursued master's in materials science and engineering at the University of Southern California where I got familiar with semiconductor processing and device physics. Then I joined SDSU to complete my doctoral degree in electrical engineering where I worked on nanostructured materials and devices for photovoltaic applications. Currently I am a research associate with Dr. Cheng Zhang on optoelectronic and morphological characterization of ring protected molecules for photovoltaic and transistor application. My research work comprises microscopic investigation of semi conductor surfaces and interfaces as well as fine tuning the electrical properties of materials for desired application. My expertise in scanning probe microscopy enables me to see things at nanoscale which is not possible through any other technique. Tailoring the nanoscale morphology can make path to low cost flexible solar cells in the near future.

Zhiling Zhang

I was born and grew up in Shanxi Province in China. After graduating from the Chemistry department at Beijing University, I became a teacher at the high school affiliated to Beijing University and a technician in the Agilent laboratory at Beijing University. I came to SDSU and earned an M.S. in chemistry and then earned a Ph.D in electrical engineering. I am now a chemist in Dr. Logue's lab and it has been fun to work with all of the graduate students in his group. I very much enjoy my work.

Recent Faculty Publications

Fathi Halaweish

Mahmoud S. Ahmed, Lucas C. Kopel, and Fathi T. Halaweish; Structural Optimization and Biological Screening of a Steroidal Scaffold Possessing Cucurbitacin-Like Functionalities as B-Raf Inhibitors, *ChemMedChem*, 9, 1361-1369, 2014.

Galal H. Elgemeiel, Nahed M. Fathy, Ayman B. Farag, Ossama M. El-Badry, Ghaneia S. Hassan, Kamelia M Amin and Fathi Halaweish, Design, Synthesis and In vitro Anti-tumor Evaluation of Novel Acrylohydrazide Thioglycosides; *Med. Chem.* 4 (4), 400-406, 2014

Ron Hirko

Hirko, Ron Chemistry 112L General Chemistry I Laboratory, Eighth Edition, bluedoor, LLC: Minneapolis, 2014

Hirko, Ron Chemistry 114L General Chemistry II Laboratory, Eighth Edition, bluedoor, LLC: Minneapolis, 2014

Hirko, Ron; Jewell, Melody Chemistry 106L Chemistry Survey Lab, Eighth Edition, bluedoor, LLC: Minneapolis, 2014

Brian Logue

Randy Jackson, Robert P. Oda, Raj K. Bhandari, Sari B. Mahon, Matthew Brenner, Gary A. Rockwood, and Brian A. Logue (2014) The development of a fluorescence-based sensor for rapid diagnosis of cyanide exposure. *Analytical Chemistry*, 86(3), 1845-1852.

Bhandari R.K., Manandhar E.,* Oda R.P., Rockwood G.A., and Logue B.A. (2014) Simultaneous high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS-MS) analysis of cyanide and thiocyanate from plasma. *Analytical and Bioanalytical Chemistry*, 406(3), 727-734.

Doug Raynie

V. Essel and D. E. Raynie, "Green Chemistry Perspectives on Analytical Extractions," LC/GC, inpress (2014).

G. Degam, D. E. Raynie, "Comparison of Solvatochromic Properties of Deep Eutectic Solvents with Organic Solvents and Ionic Liquids," *Chem. Today*, in press (2014).

Surtaj Iram

Iram SH and Cole SPC. Differential rescue of Lys513 and Lys516 processing mutants of MRP1 (ABCC1) by chemical chaperones reveals different domain-domain interactions of the transporter. *Biochim Biophys Acta*. 2014 Mar;1838(3):756-65.

Jim Rice

Khalaf, M.; Chilom, G.; Rice, J. A., 2014, Comparison of the effects of self-assembly and chemical composition on humic acid mineralization, *Soil Biology & Biochemistry*, 3: 96-105, DOI 10.1016/j.soilbio.2014.02.013.

Hoffman, L.; Chilom, G.; Venkatesan, S.; Rice, J. A., 2014, Characterization of interfaces between natural organic matter fractions, *Microscopy and Microanalysis*, 20: 521-530, DOI 10.1017/S1431927614000038.

Chintala, R.; Schumacher, T.; Kumar, S.; Malo, D.; Rice, J.; Bleakley, B.; Chilom, G.; Julson, J.; Papiernik, S. K.; Clay, D.; Gu, Z., 2014, Molecular Characterization of Biochars and Their Influence on Microbiological Properties of Soil, *Journal of Hazardous Materials*, 279: 244-256, DOI 10.1016/j.jhazmat.2014.06.074.

Student Engineers (and a biochemist) Without Borders

Seven SDSU students, including Brian Peterson, a biochemistry major, journeyed 3,500 miles to west-central Bolivia in August to continue a water purification project in a rural mountain village. They came home a week later without having completed the long-planned project, yet excited about future work in Carmen Pampa, which is located in a region that has a poverty rate of 40 percent.

The was the fifth visit in four years by the Engineers Without Borders (EWB) chapter at SDSU in conjunction with Carmen Pampa's Unidad Académica Campesina.

"We're improving the quality of life for about 1,000 people and for future generations. It's eye-opening to be part of an organization that is affecting all these lives," said Meghan Danielson, a grad student who is SDSU chapter president.

Peterson was the only non engineering student, however his biochemistry major was valuable for the chlorination work, Danielson said. One of the lessons she gained from the trip is "it takes a diverse group of people to do a project like this." Students don't have to be an engineering major to belong to Engineers Without Borders, she said.

EWB built and installed a gravity-fed chlorinator built of PVC pipe on the upper campus on 2012 and in 2013 did survey work to install a similar chlorinator in the lower campus in 2014.

SDSU civil and environmental engineering instructor and chapter adviser Kyungnan Min led a group of seven students to install the lower campus chlorinator and do more survey work.

Right: Brian Peterson found that not all problems require engineering or biochemistry.

Below: Seven SDSU students went to Bolivia in August 2014 with the SDSU Engineers Without Borders. Brian Peterson (front row right), SDSU biochem major, was the only nonengineering student on the team.

The EWB students found themselves in a local controversy over whether the new chlorinator should benefit only the Unidad Académica Campesina campus or the entire Carmen Pampa community. Although the chlorinator was not finished, a solution was reached and plans for more projects will go forward.

The students' cost was offset by grants and donations from the Jerome J. Lohr College of Engineering and the departments in which the students were majors including the chemistry and biochemistry department.

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