UNIVERSITY OF SOUTH DAKOTA

# DEPARTMENT OF CHEMISTRY

College of Arts & Sciences | Newsletter | January/February 2013

Both good things and sad things happened in Chemistry in 2012. We were all very saddened by the loss of Professor Chuck Estee, USD Distinguished Professor Emeritus, who passed away in August. Over his fifty year career at USD, Dr. Estee impacted the lives of innumerable students with considerable encouragement, good advice, caring and grace. Dr. Koppang has provided a fitting tribute to Dr. Estee's lasting legacy below, and if you have a favorite memory of Dr. Estee please let us know. The 2012 Estee Lecture was given by a returning Dr. Royce Engstrom, who took over as Chair upon the retirement of Dr. Estee, and who is now President of the University of Montana (more about Dr. Engstrom's eagerly awaited return to USD below). The 2012 Haines Lecture was given by Prof. Mukund Sibi, North Dakota State University - "*Better Living through Plants*". Overall 16 outside speakers and 18 USD graduate students gave seminars in chemistry last year. The Department currently hosts ~60 chemistry majors, 10 Master's students and 27 Ph.D. students. In 2012, Dr. Prem Basa became the Department's second Ph.D. graduate since inception of the Ph.D. program in 2007. This number is certain to grow in the coming year as more and more students complete and defend their dissertations. For all of you that have provided support for USD Chemistry this year or in the past, my humble thanks, and if you are ever in the area, please stop by for a visit, we are always happy to hear about your adventures beyond USD.

Best to everyone in the New Year,

A. Sykes

Andrew G. Sykes, Professor and Chair, asykes@usd.edu

**Dr. Charles Remington Estee** (October 7, 1921 – August 14, 2012) This past year, the Chemistry Department said goodbye to Professor Charles Remington Estee, who passed away on Tuesday, August 14, 2012. Born at Hecla, SD, October 7, 1921, he graduated *cum laude* from Jamestown College in 1942, received his M.S. (1944) and Ph.D. (1947) in Physical Chemistry at the University of Iowa (DuPont Fellow 1945-46). During WWII he worked at Oak Ridge, TN, on the Manhattan Project that developed the atomic bomb.

Dr. Estee came to the Chemistry Department at the University of South Dakota on September 1, 1947, where he taught general, physical and environmental chemistry and instituted the department capstone course, Chemical Literature. He served as department chair from 1952 to 1984, during which time he helped the Department establish a Ph.D. program in Chemistry, which graduated fifteen students before the program ended. He was Interim Dean of the College of Arts and Sciences 1987-1988. After his retirement, the university honored him with the title of University Distinguished Professor Emeritus and the Board of Regents with the title of Distinguished Professor Emeritus in 1991. He then became Chemical and Hazardous Waste Control Officer until his second retirement in 1997 when the Board of Regents honored him with a special resolution for fifty years of dedicated and outstanding service to the S.D. system of higher education.

Dr. Estee was Assistant Program Director (1961-62) for the National Science Foundation (NSF) in Washington D. C. and was a member of the Executive Committee for the National Science Teachers Association Board of Directors (1970-72) and President of the Society for College Science Teachers 1982-83. He was successful in obtaining many Comprehensive Grants for Teacher Education (NSF) for annual summer institutes for high school science teachers, which he directed (1957-72). During this time he made many visits to high school science programs around the state and was dedicated to improving science teaching in the state and region. He was named Fellow of the South Dakota Academy of Science, Fellow of the American Association for the Advancement of Science, Fellow of the Iowa Academy of Science, and Science Faculty Fellow, Department of Chemistry, University of Minnesota.

Alumni, colleagues, and friends raised two endowments in his honor. The Charles R. Estee Lectureship in Science Education brings to USD each year an outstanding chemical educator of chemistry or related sciences. The Charles R. Estee Presidential Alumni Chemistry Scholarship is a four-year renewable scholarship for a student majoring in Chemistry.

He is survived by his wife of thirty-six years, Judith. He was preceded in death by his first wife Doris and is survived by their son, Charles, daughters Barbara Remington and Elizabeth Estee, granddaughters Stephanie and Rebecca, grandson Charles "Cal", and sister Eleonore Osher.

**Recent Graduates** In 2012, seventeen students graduated with a major or double major in chemistry. Eight Master's degrees were awarded and one Ph.D. student graduated.

**Awards**

Pardee Prize (Top Senior); Mariah Hoffman, Sioux Falls, SD (applying to Graduate School and NSF Graduate Fellowship)
Inorganic ACS Award; Elizabeth Day, Vermillion, SD (pursuing a PhD in Chemistry at the Univ. of Georgia)
Organic ACS Award; Jack Kerner, Winner, SD (applying to pharmacy school)
Merck Index Award; Josh Doorn, Sioux Falls, SD (attending USD Medical School)
Analytical ACS Award: Nick Beare, Sioux Falls, SD
CRC Freshman Award; Nicholas Pekas, Brookings, SD

From generous gifts by USD Chemistry alumni, almost $34,000 in scholarship and summer research support was awarded to twenty-six different undergraduate chemistry majors in 2012.

**The USD Chemistry Department is acquiring a new NMR!** 2012 was particularly exciting for our faculty and students who competed successfully for a new high field NMR spectrometer. The Department was awarded a $270K grant from the National Science Foundation to purchase a badly needed new NMR. The department is currently using a 200 MHz tunable broadband probe. It has been a workhorse for the teaching and research missions in the department, but its limited capabilities have hindered ongoing research projects. The new Bruker Avance IIIHD 400 MHz NMR spectrometer is the top line in Bruker's 400 MHz NMR series. It will come with a SmartProbe™ (BBFO) liquid probe and a solid probe that will benefit materials chemistry research including research on nanotechnology. Drs. Hoefelmeyer, May, Sereda and Sun were hosted by JEOL and Bruker in the Boston area to evaluate 400 MHz instruments. The 400 MHz NMR instruments are a huge improvement over our current instrument, and will allow automated lock and shim, rapid probe tuning at any nucleus for each sample, much higher signal-to-noise and resolution, variable temperature (-150 °C to 150 °C), and numerous types of 2D experiments with the gradient probe. The instrument will also come with an autosampler that has a sample tray at waist height that improves handicap accessibility. This is the first handicap accessible NMR instrument within several hundred miles or Vermillion. We eagerly anticipate the arrival of our new NMR, scheduled for delivery in summer 2013.

## Faculty Research Profiles

**Prof. Stanley May** and his collaborators, Jon Kellar and William Cross at SDM&T, have made something of a splash this year with their work on using invisible inks for applications in security printing and anti-counterfeiting. The inks are based on nanoparticles that can convert invisible near-infrared radiation into visible light: a process known as 'upconversion.' These inks are seen as offering a more secure alternative to UV inks, which are now easily counterfeited. May, et al. published two papers this year on upconverting inks. The first is a cover article in *Nanotechnology* (**2012**, *23*, 185305). The second article, also in *Nanotechnology* (**2012**, *23*, 395201) demonstrates the use of upconversion inks to print covert Quick Response (QR) codes. This second article was noticed by Reuter's news service and went a bit viral, being picked up by multiple national and international news agencies (e.g., NBC, BBC). The article was also recently highlighted in Nature Photonics (6, 2012). Local coverage has included articles in the Argus Leader, Sioux City Journal, and the Sioux Falls Business Journal. This fall, Prof. May was invited to give a presentation of the work to the Document Security Alliance at the Secret Service building in Washington, D.C.

**Prof. Grigoriy Sereda** and Victor Huber (USD School of Medicine, Basic Biomedical Sciences) have won the Interdisciplinary Research Incentive Grant "Rapid and Inexpensive Evaluation of Antibody Efficacy with Custom-Designed Fluorescent Nanoparticles" from the USD Office of Research. This one-year $20,000 project will focus on the application of fluorescent nanoparticles in immunology. Conjugation of fluorescent (with fluorescein immobilized on the surface) silica nanoparticles with an antibody enabled the particles to penetrate inside a macrophage cell (as opposed to

unconjugated particles), track the antibody's role in the immune response, and sense intracellular pH. Currently, the collaborators have submitted an IP disclosure and are developing a new sensor with rhodamine in the nanoparticle's core and fluorescein on its surface for two-color antibody tracking.

**Prof. Chaoyang Jiang** While most visitors enjoy the more than 14,800 instruments from virtually all cultures and historical periods in the National Music Museum (NMM), Dr. Chaoyang Jiang is thinking of some other interesting questions, such as: What kinds of pigments were used in the painted decoration of these historical musical instruments?, How can we build a valuable database on the pigments used?, and can we promote further interest from the arts, material science, and nanotechnology communities? Supported by the USD Office of Research and Sponsored Programs, Dr. Jiang received a $20,000 grant in 2012 and will collaborate with Prof. John Koster at NMM to work on an interdisciplinary research project entitled "*Where Art and Science Meet: Nanoscale and Microscopic Analyses of Pigments in Musical Instruments*". This collaboration will provide us with a unique opportunity to identify materials used in decorative design, the development of a database for heritage authentication, and the future preservation of musical instruments. Dr. Jiang's group will detect pigments in the decorative paintings on the soundboards of seventeenth- and eighteenth-century harpsichords via surface-enhanced Raman scattering techniques, identifying the type of organic dyes for the red and yellow pigments and generating a database for future heritage analyses. The work conducted in this project will combine available expertise in nanoscience in the chemistry Department with the NMM's impressive collection of historical musical instruments.

Harpsichord by Andreas Ruckers, Antwerp, 1643 (cat. no. NMM 10000) and the details on its soundboard.

**Prof. Ranjit Koodali's** research work related to solar energy conversion was among eleven selected research projects (the only chemistry project) highlighted in the NSF FY 2013 budget request to Congress as an example of transformative work in science and engineering. Dr. Koodali and Dr. Wang are also part of a SD team of researchers participating in a grant funded by NASA to synthesize structural thermal insulation composites that could someday play a role in humans' ability to live on the moon or other planets. See http://siouxcityjournal.com/news/local/a1/usd-professor-s-pet-project-moving-to-the-moon/article_d8dfd270-3286-512b-a8cf-3958516b68d3.html for more details. Dr. Koodali, along with Dr. Forster, USD Sanford School of Medicine, is also the recipient of an award from the USD Nelson Faculty Research Grant program for their proposal, "*Developing Nanotechnology to Deliver Neuropeptides to the Brain*."

Prof. Mary Berry was recognized in 2012 for outstanding research and was awarded the *President's Award for Research Excellence for Established Faculty.* Recipients were selected through a highly competitive process with both university and external reviewers. The selections are a strong endorsement of each researcher's creativity and innovation, and an honor for the university to bestow. Each award recipient receives a $3,000 grant and a plaque. The *President's Awards for Research Excellence for Early-Mid Career Faculty*, *Established Faculty*, and *Research Innovation & Entrepreneurship* are awarded annually and open to USD faculty nominated by their peers. Congratulations Mary!

Candidates were reviewed based on past and current research accomplishments, including criteria such as publications, presentations, successful grantsmanship, serving as a peer reviewer, maintenance of an active graduate and/or undergraduate program, and other competitive research awards. "Each year, the reviewers for these awards are presented with the challenge of choosing just one winner in each category from a very talented group of faculty," said Laura Jenski, Ph.D., vice president for research at USD. "USD is honored to recognize these deserving faculty members for their continued excellence in their research endeavors."

Dr. Berry's research specialties include: the study of the photodissociation and photoionization mechanisms of lanthanide-based laser assisted chemical vapor deposition (CVD) precursors, and the investigation of upconversion nanoparticles. She is also the director of two major NSF grants within chemistry: *The Northern Plains Undergraduate Research Center* (NPURC), $3M, which promotes undergraduate research opportunities within the region, and an *Integrative Graduate Education and Research Training* (IGERT) program, $3M, that provides collaborative graduate research opportunities between South Dakota universities in the area of photovoltaics.

**Dr. Royce Engstrom**, President of the University of Montana, returned to USD to present the 2012 Estee Lecture entitled "*Signal-to-Noise.*" The lecture was presented to a packed auditorium and focused on how fundamental concepts from chemistry apply to public policy issues in higher education. Dr. Engstrom became the 21st Estee Lecturer, an annual lecture series in Chemical Education to honor the late Professor Charles Estee. Dr. Truman Schwartz, USD graduate and Professor of Chemistry at Macalester College, the first Estee Lecturer, was also in attendance. As a faculty member at USD from 1979 to 2007, and Chair from 1985 to 1996, Dr. Engstrom taught Analytical, Environmental and General Chemistry, and conducted an active research program in electrochemistry. Throughout his career, President Engstrom has been an enthusiastic participant in undergraduate research, first as a student, then as a mentor, and finally as an administrator working to develop undergraduate research programs. He is a Past-President of the *Council on Undergraduate Research* and has been active in the *Experimental Program to Stimulate Competitive Research* (EPSCoR), a federal program designed to help states build their research infrastructure and competitiveness. President Engstrom grew up in Nebraska and received his Bachelor of Science degree in Chemistry from the University of Nebraska at Omaha and his Ph.D. in Analytical Chemistry from the University of Wisconsin-Madison. Dr. Estee was Chair of the Chemistry Department when Dr. Engstrom accepted his first academic position at USD. Accompanying Dr. Engstrom on his return to USD was his wife Mary, a former teacher in the Vermillion school system and later a faculty member in the USD School of Education. We thank President and Mrs. Abbott for also hosting a reception in honor of both Royce and Mary.

**Safety** Recent accidents in research laboratories at UCLA and Yale have put the spotlight on safety measures in academic settings and begs the question of USD faculty and students: Do we know how to handle and store chemicals safely? How do we clean up a chemical spill? What is the proper procedure for disposing of used chemicals? And do we have the proper protection and safety equipment available? To answer these questions, USD employs a specialist to assist us with these matters. His name is Kevin O'Kelley, and he is USD's new Director of Environmental, Health and Safety (EHS), who started working at USD last summer. Kevin has been working in this field for many years, most recently managing safety and environmental compliance for a company with multiple acid manufacturing facilities in the United States. This is his first time in an academic setting since leaving college himself, and he says that he is excited to be back. In addition to leaving industry for academia, Kevin has left busy California to be here with us in South Dakota. He says that it was not an accident that he ended up here, and he and his wife, Samantha, are quite content living in Vermillion. This is the first time in his life that he has had less than a one-hour commute to work; he now walks to work and back every day in about 5 minutes.

The EHS Director is an in-house resource for students, staff, and faculty. His goal is to assist the Chemistry Department properly manage the safety hazards in our teaching and research labs. Kevin assures us that he does not want to be considered a "Safety Policeman." If he sees something that he thinks is dangerous, he will speak up, but he would rather that people call him with questions, and invite him in to look around their work spaces to offer advice. He offers training and consultation to the Department and he has recently assembled a variety of information sheets on the questions he is most often asked, and posted them online. Visit the EHS Resource Page to see what resources are available including electronic access to Material Safety Data Sheets (MSDS). With Kevin's help, the Department recently passed the State of South Dakota's risk-assessment site visit and has significantly reduced the inventory of old chemicals stored on-site and helped develop a rigorous departmental safety policy.

EHS and the Chemistry Department have also set up a graduate fellowship that supports a Master's-level student who helps conduct the duties of the EHS office, including helping dispose of chemical, biological and radioactive waste from around the University. This student will complete all the requirements of a Master's degree, including a research project and thesis, but will also earn valuable training in EHS duties and receive an EHS certificate at the completion of the degree, which is a highly sought after combination on the current job market.

Charlie Coyote wants to be safe, but how many safety violations can you find in the picture of Charlie dressed up in his protective gear (Personally, I think he is a wee bit hindered by his suit!)?

# CONTRIBUTIONS – USD CHEMISTRY

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Support from alumni and friends makes a big difference to the Chemistry Department. Please consider a gift to one of the funds below:
(If no fund is specified, your gift will be applied to the Chemistry Current Fund)

**Chemistry Current Fund** ☐ **$50** ☐ **$100** ☐ **$200** ☐ **Other $_____**
(Supports student travel, visiting speakers and other departmental needs)

**Estee Scholarship Fund** ☐ **$50** ☐ **$100** ☐ **$200** ☐ **Other $_____**
(Undergraduate scholarships)

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***Thank you for your support of Chemistry students and faculty at USD! We would appreciate any comments you wish to make about the Chemistry program at USD or any news about yourself.***

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## Recent Department Publications (USD undergraduate and graduate students*)

- Sereda, G.; Moorthy, R.; Basa, P.*; Sykes, A.; Purohit, K.; Rajpara, V.*; Becht, D. 'Unexpected Diastereo-selective Acetylation of 1,8-Dimethoxyanthracene Adducts with Maleic Anhydride and Dimethyl Maleate' *Eur. J. Org. Chem*., **2012**, *4*, 810.
- Haoran Sun, Anjaneyulu Putta*, Justin P. Kloster, Usha K. Tottempudi* 'Unexpected photostability improvement of aromatics in polyfluorinated solvents' *Chem. Commun.* ***2012****, 48*, 12085.
- Dai, F.-R.; Wang, Z. 'Modular Assembly of Metal–Organic Supercontainers Incorporating Sulfonylcalixarenes' *J. Am. Chem. Soc.* **2012**, *134*, 8002; http://dx.doi.org/10.1021/ja300095j
- J.-H. Son, J.D. Hoefelmeyer '1,2-nucleophilic addition of 2-(picolyl)boranes to nitrile, aldehyde, ketone, and amide' *Org. Biomol. Chem*., **2012**, *10*, 6656, DOI: 10.1039/C2OB25518A**.**
- Amanda S. Weber, Anne M. Grady, and Ranjit T. Koodali, 'Lanthanide modified Semiconductor Photocatalysts'***Catal. Sci. Technol.***, **2012**, *2*, 683.
- Prem N. Basa*, Arundhati Bhowmick*, LaShawn Medicine Horn, and Andrew G. Sykes, 'Zinc(II) Mediated Imine–Enamine Tautomerization' *Org. Lett.*, **2012**, *14*(11), 2698.
- Bao, Y.*; Luu, Q. A. N.*; Zhao, Y.; Fong, H.; May, P. S.; Jiang, C., 'Upconversion Polymeric Nanofibers Containing Lanthanide-Doped Nanoparticles via Electrospinning' *Nanoscale* **2012,** *4*, 7369. http://dx.doi.org/10.1039/C2NR32204H
- Jiangchao Chen*, Andrew Schmitz, and Dmitri S. Kilin, 'Computational Simulation of the p-n Doped Silicon Quantum Dot' *International Journal of Quantum Chemistry* **2012**, *112*, 3879.