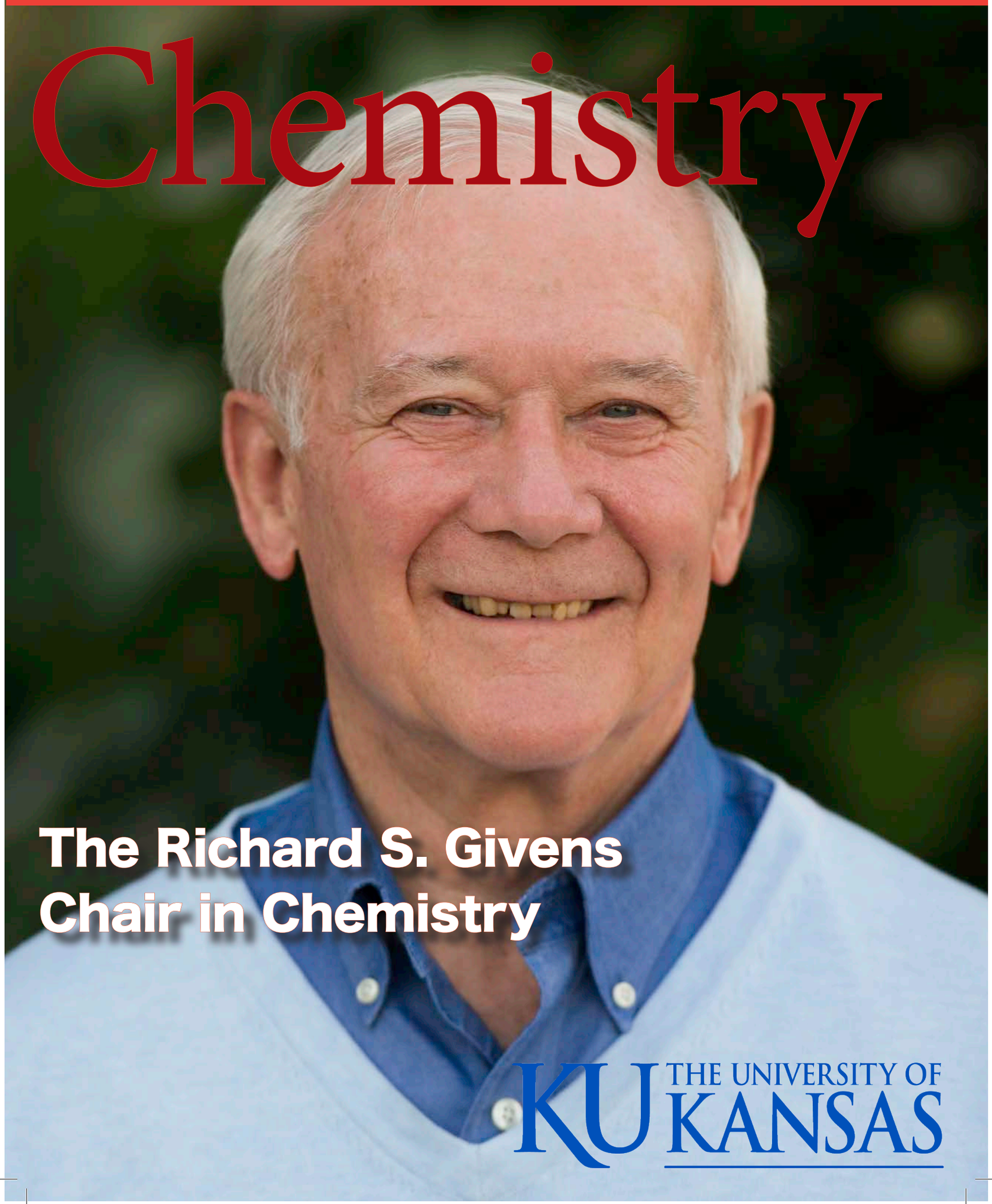
2020

Chemistry



The Richard S. Givens Chair in Chemistry

THE UNIVERSITY OF KANSAS

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Issue Highlights

Greetings from the Department of Chemistry. We hope everyone has stayed safe, healthy, and happy during this eventful year. The pandemic has tested all aspects of our daily lives. At KU, it has delayed and modified our research endeavours and significantly altered the way we teach our courses. The Chemistry Department main office remains closed, with staff working remotely from home, which has presented significant challenges as we adjust and adapt to the evolving situation.

In the following pages, we highlight the Department's response to the pandemic. We share our community outreach initiatives, and how we have adapted both our teaching and research missions. Our Department strongly believes in the value of student engagement; so while many departments decided to offer only on-line courses this fall, we kept our courses and laboratories in-person as much as safely possible. Given the reduced room capacities dictated by physical distancing, this required a great deal of work, creativity, and flexibility on the part of our faculty, staff, and students. As of the writing of this note with the semester nearing its end, we have been able to give our students the in-person experiences they deserve without incident or outbreaks.

We are thrilled to share the news that the 2021 National ACS Award in Inorganic Chemistry will be presented to our own Kristin Bowman-James, University Distinguished Professor of Chemistry. With this award, she rightly joins a very select group of recipients. This issue also highlights exciting research ongoing in the Department, some of which is specifically addressing issues arising from the pandemic.

We are very excited about the future, but we need your help more than ever. Given the pandemic and its effect on enrollments, the University is facing a significant budget shortfall that has impacted our Department. Your generous donations allow us to continue important programs that support our students and faculty. Thanks to you, we were able to present over 60 scholarships and awards to deserving students this year. Programs like our ChemScholars initiative and the Dublin City University exchange program rely solely on your generous donations. Your support also provides matching funds for worthy programs like our NSF summer research program for undergraduates and the NIH funded training grant for graduate students. Finally, as you have seen from the cover, we are proudly announcing a fundraising effort to establish the Richard S. Givens Chair in Chemistry. Professor Givens has selflessly devoted his life to our students, Department, KU, and the Lawrence community. With your help, we will honor his collegial and generous legacy through this professorship.

We wish the very best for you and yours in the coming year. We hope you enjoy this newsletter. Rock Chalk Jayhawk!

Sincerely

Robert C. Dunn
Professor and Chair


Prof. Jon Tunge
Director
Graduate Studies
tunge@ku.edu


Prof. David Benson
Director
Undergraduate Studies
drb@ku.edu


Elizabeth Coleman
Executive Program Associate
elizabethm@ku.edu


Emily Matteson
Business Manager
emily.matteson@ku.edu


Betsy Carlson
Program Administrator
betsy.carlson@ku.edu


Elaine Knight
Administrative Specialist
eknight@ku.edu


Erin Kelley-Garrison
Undergraduate Studies Advisor
ekg@ku.edu


Megan Belaire
Graduate Studies Advisor
mbelaire@ku.edu

Kristin Bowman-James

2021 ACS National Award in Inorganic Chemistry

The Chemistry Department is proud to announce that Kristin Bowman-James, University Distinguished Professor of Chemistry, will be the recipient of the 2021 American Chemical Society National Award in Inorganic Chemistry. The award recognizes her seminal contributions in coordination chemistry, and, in particular, her groundbreaking work in providing insight to anion coordination from a transition metal coordination perspective. While operating somewhat outside the mainstream of traditional inorganic coordination chemistry, she succeeded in expanding the concept of coordination chemistry beyond the dative bond to include supramolecular interactions, as observed in anion host-guest interactions as a form of coordination chemistry.

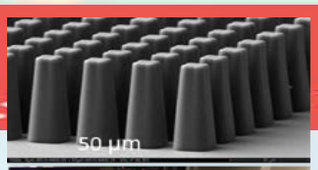
As often happens in science, the beginning of this fruitful direction began by chance in Kristin's group. Mr. Gun-Jian Gu, a Visiting Scholar from China, reacted uranyl nitrate with a macrocycle and was disappointed to find uranium missing from the mass analysis. They decided to solve the crystal structure anyway and found that the macrocycle had encircled the nitrate anion. Subsequent work by Susan Mason, a graduate student in the group, found that the bicyclic analog of the same macrocycle entrapped two nitrates. "I didn't believe it until we got the amazing crystal structure with the two nitrates butted up against each other. And that was the start of anion coordination chemistry."

"It is truly exciting that my inorganic chemistry colleagues considered my research worthy of the ACS Award in Inorganic Chemistry," Kristin said. "This acknowledgment of my research is validation of my ideas and research findings." When asked about the response she has received since the award was announced, Kristin replied: "I have been overwhelmed at the response from my former students and colleagues. E-mails from all over the world have poured in...What I least expected was the response from KU faculty, some of whom I didn't even know, who were so excited about the award." When asked about spending her entire academic career at KU: "I'd say all-in-all, I couldn't have had a better career as a result of the excellent students, both undergraduate and graduate, faculty colleagues, and support staff than at Kansas", Kristin said. "It was really a good day indeed, when I said yes to Jack Landgrebe's [former Chair of Chemistry] offer." It was also a very good day for the Department of Chemistry and KU! Congratulations Kristin on this prestigious and well-deserved honor.

Research Highlight
Home Testing for COVID-19

https://today.ku.edu/ku-researchers-developing-quick-turnaround-covid-19-test

The Soper group has received funding from the National Institutes of Health (RADx Program) to develop a new diagnostic test for home-use that can sample saliva and search for SARS-CoV-2 particles and count them one-by-one to determine viral load. This simple test can be completed in less than 15 minutes and is fully automated making it amenable as a screening test. The test uses a small (38 mm × 42 mm) plastic chip that can enrich the viral particles from saliva, release them, and use a nano-Coulter Counter to enumerate the particles. The enrichment is accomplished using a nucleic acid aptamer that recognizes the S-protein of SARS-CoV-2 and is attached to the surface of 1.5 million pillars situated within the chip. Following release from the pillars, the viral particles are passed through a 200 nm hole to count individual particles (SARS-CoV-2 particles are 150 nm in diameter). Because the chip can be produced using injection molding, large-scale production can be mobilized to manufacture >30 million chips per year at a cost of $2 per chip. Soper is collaborating with Dr. Andrew Godwin (KUMC) to validate the test using saliva samples.



The Pandemic at KU

In March 2020, campus life came to a halt as the coronavirus pandemic swept the nation. For just over two months, the campus remained completely closed with on-site research and teaching activities suspended. Limited access to buildings was allowed for critical maintenance and care, but everything else was shifted to remote only operation. This resulted in the remainder of the spring semester and all of our summer courses being taught on-line.

In late March, the Kansas Department of Health and Environment (KDHE) put out an urgent call for RNA extraction supplies to help with early COVID-19 diagnostic testing. KU organized a collection and individual research labs donated supplies to the KDHE. The call then came out from the Lawrence community for help with personal protective equipment (PPE), and the Chemistry Department answered.

Inspired by the previous success, students, faculty, and staff in Chemistry scoured their labs and stockrooms for available PPE to distribute within the local community. Volunteers, all working under the then-new physical distancing and masking guidelines, amassed an inventory of approximately 650 boxes of disposable examination gloves (roughly 70,000 gloves) and assorted splash goggles and isolation gowns. On April 9, enough PPE to completely fill a minivan and full-sized pick-up truck, was loaded by faculty and staff volunteers and delivered to Lawrence-Douglas County Public Health and the Heartland Community Health Center. The supplies were distributed to their network of front-line healthcare workers.

To further supplement the needs of the Lawrence community, the Chemistry Department partnered with The School of Pharmacy to help produce batches of Jayhawk-made hand sanitizer for local childcare facilities. In an effort led by the Dean of Pharmacy, Ron Ragan, and Prof. Michael Hageman in Pharmaceutical Chemistry, the Department of Chemistry donated feedstocks necessary to produce large quantities of hand sanitizer for local distribution.

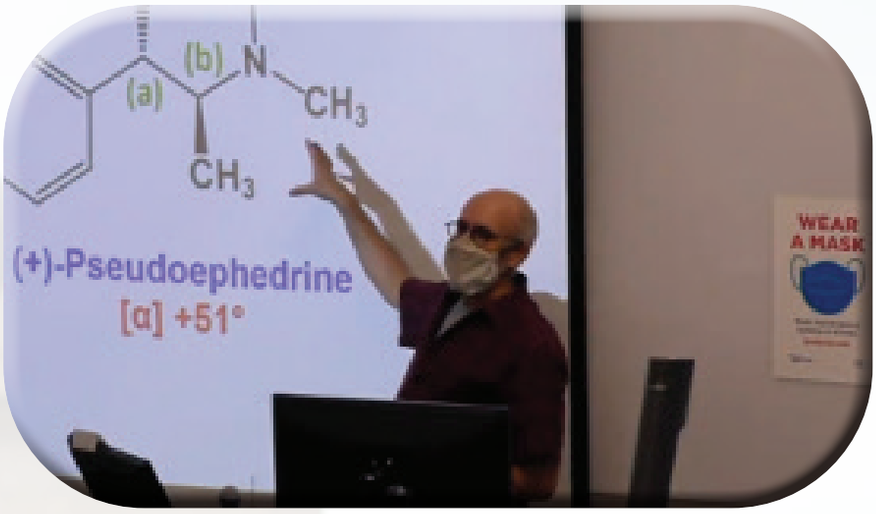
On campus, the phased reopening of Chemistry research spaces began in mid-May, with new mask mandates and physical distancing guidelines. The latter forced many groups to adopt a shift-work approach given the limited room capacities mandated by social distancing. In mid-June, the administration announced that the campus would re-open for in-person classes in the Fall. The final decision as to whether to offer classes in-person or on-line in the Fall, however, was left largely to the individual instructors and Departments. While some departments opted to go completely on-line with their classes and labs, Chemistry felt strongly about the importance of in-person student engagement and the value of our hands-on laboratory experiences. We decided, therefore, to offer all of our courses in-person as much as safely possible.

The decision to go in-person presented significant challenges. Lecture halls had to be reconfigured to adapt to the new physical distancing guidelines and we had to adapt undergraduate laboratories to respond to similar reductions in room capacities. To accommodate students, our general chemistry labs adopted a hybrid format where each week half the class carried out in-person experiments while the other half worked remotely on virtual experiments. This was only made possible by a Herculean effort over the summer to create on-line content (videos, etc.), spearheaded by Prof. Dave Benson, Prof. Misha Barybin, and our Director of Undergraduate Labs, Dr. Roderick Black.

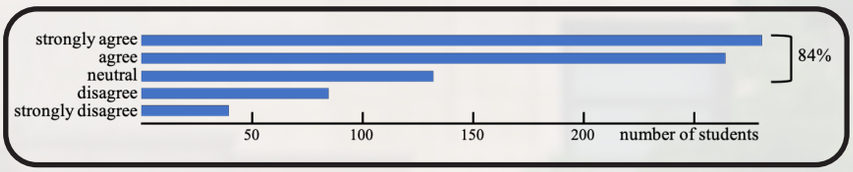
For our lecture courses, smaller classes carried-on much as they

did before the pandemic, with additional resources added to accommodate students in quarantine or unable to travel to campus (on-line synchronous and asynchronous lecture content, etc.). Our larger classes, however, were forced to adopt a hybrid model given the reduced room capacities. Our largest lecture room in Gray-Little Hall, for example, dropped from accommodating 330 students before social distancing to just 69 after the new protocols. This forced us to use a hybrid model where each day only a portion of the class attends in-person while the remainder view the lectures on-line.

The Fall semester followed a condensed calendar and as of the writing of this newsletter, in late November, the in-person teaching portion of the semester has ended and the remainder, including final exams, will be remote only. The Chemistry Department is extremely proud of our students, staff, and faculty, who safely provided our undergraduates with the in-person learning experiences they deserved, without outbreaks or incidents.



Top: Prof. David Benson delivers an in-person lecture in Organic Chemistry I (CHEM 330). Even for in-person classes, the lectures are live streamed and recorded so that students in quarantine or unable to travel to campus can view them. Students and faculty are requred to wear masks and social distance in the classrooms.
Below: Early in the Fall semester there was a lively discussion on campus about teaching modes and what undergraduates desired. We decided to ask them. We polled all 2190 undergraduates taking a chemistry course, with 818 students responding (37% response rate). The bar graph shows the reponses to the question: "The final decision on content delivery (on-line, hybrid, etc.) was left largely to the discretion of each department this semester. The Chemistry Department decided to offer our courses "in-person" as much as possible, within limits set by safe social distancing (i.e. room size). Which of the following best describes your view of this decision?". As you can see, the results supported our decision.



Opposite page: (Top to Bottom) Prof. Mike Johnson helps transport PPE. Donated PPE sitting on loading dock ready for loading. Prof. David Weis helps load Prof. Soper's truck for PPE transport. Prof. Bob Dunn with hand santizer manufactured in the Pharmacy School for distribution to local child care centers.

Right: Before (left) and after (middle) pictures of the GL 1146 lecture hall used for many of our courses. The before picture shows the layout with tables and monitors meant to encouage collaborative learning. Before the semester, the furniture was replaced with desks to conform with new social distancing guidelines. This room now has our largest capacity at 97 students. The right image shows our fixed seating lecture hall (GL 1154) that normally has a capacity of 330 students. With social distance seating (stickers on chairs), room capacity has been reduced to just 69.

Right: Graduate student Khurshed Akabirov records himself doing an experiment for our general chemistry labs. Over the summer, a significant effort was devoted to developing on-line content for our undergraduate labs.

Alumni Profile - Dr. Binodh DeSilva (Ph.D. 1994)

Binodh DeSilva is the daughter of two science teachers, so it wasn't surprising when she earned her undergraduate degree in chemistry from the University of Colombo, Sri Lanka in 1987. She came to KU for her graduate studies and as a first-generation immigrant found that "KU was warm and welcoming. To this day I am extremely grateful for that." Working under the direction of Prof. George Wilson, Binodh developed novel immunological reagents for applications in immunoassays. As a graduate student, Prof. Wilson remembers an incredibly productive and talented student who excelled in "...problem-solving skills and her ability to relate to and organize people". He continued that "her talents go well beyond her science." Binodh remembers the collegial nature of the department. "The nurturing we received ... was so invaluable – not just the Wilsons with their generosity... others like, Richard & Barbara Schowen, Susan and Craig Lunte, Drs. Iwamoto, Kuwana, Adams. It was a family."

Upon graduation in 1994, Binodh remained at KU to carry out her postdoctoral studies before launching her independent career in 1995, when she joined the bioanalytical chemistry group at Procter & Gamble Pharmaceuticals. In 2001, she moved to Amgen (Thousand Oaks, CA) to join the Pharmacokinetics and Drug Metabolism Department. There she quickly rose through the ranks from Research Scientist, to Associate Director, and finally Director. In 2010, she moved to Bristol-Myers Squibb (BMS) in Princeton NJ, as the Executive Director of the Bioanalytical Sciences Department.

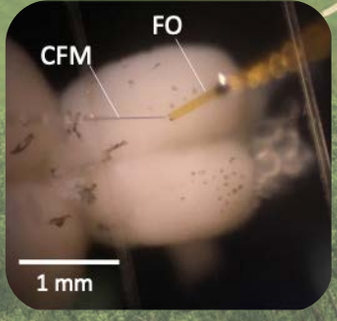
At BMS, Binodh established the Reagent Center of Excellence. Dr. Johanna Mora, another KU graduate and fellow BMS scientist, remembers that, "Before Binodh joined BMS, the process for reagent generation to support ligand binding assays was not established. This often resulted in struggles during method development and the validation of PK assays to achieve adequate sensitivity to support clinical studies." Another key achievement of Binodh's was the creation of an Immunogenicity Council to ensure proper risk assessments aligned with the bioanalytical strategy. Binodh remains at BMS today, where she is currently the Vice President of Leads Discovery and Optimization.

Among her many awards, Binodh received the lifetime achievement award from the Sri Lanka Foundation in 2018, the Distinguished Analytical Scientist Award from CPSA in 2017, and was awarded the prestigious American Association of Pharmaceutical Scientists (AAPS) Distinguished Service Award this year. Since graduate school, she has been a tireless advocate for women in the sciences and devotes significant time to mentoring junior colleagues. As Dr. Mora commented, "...she pushes hard... [but] always has your back." In pursuing these goals, Binodh has assumed key leadership roles including former President of the AAPS.

Binodh is married to Gamini Dharmasena and they have two children, Vidharshi and Nethmi. When reflecting on her time at KU and the impact on her career, Binodh said: "George was an amazing visionary. He told us in the late 80s, that there will be nothing called pure Chemistry in the future, and to broaden our experiences in the life sciences...I only realized the gravity of this message when I started in industry." As Binodh said, "I came to get a chemistry degree; I got a whole lot more."

Research Highlight - Controlling Brain Function with Chemistry & Light

Caged compounds are molecules that, when exposed to light of a specific wavelength and intensity, release a portion of the molecule, known as a photocage. When the resulting compound is biologically active, it can be used to manipulate biological systems. One limitation, however, is that it is difficult, if not impossible, to accurately determine how much compound has been photoactivated in regions not accessible to light, such as opaque brain tissue. In recent work, which is a collaboration between Prof. Mike Johnson and Prof. Rich Givens, a method to electrochemically measure caged compound photoactivation in living brain tissue has been developed. This approach employs fast-scan cyclic voltammetry at micron-sized carbon-fiber microelectrodes (FSCV), a technique often used to measure the release of dopamine, an important brain chemical. Here, the released photocage, in this case a molecule called 4-hydroxyphenylacetic acid, is also measured. This electrochemical method will allow the simultaneous measurement of dopamine release and the photorelease of selected biologically active molecules; thus, important relationships between the amount of photoreleased compound and dopamine release can be determined. Measurements in living, whole brains from zebrafish, an important model organism of neuronal function, have demonstrated the utility of this approach (Fig. 1). A manuscript describing this work has been submitted to Analytical Chemistry, and is currently in revision. Dr. Romana Jarošová, a postdoctoral research associate in the Johnson research group, carried out these measurements and is first author on this manuscript.



Whole, living zebrafish brain with a carbon-fiber microelectrode (CFM) and fiber optic light source (FO) inserted.

Research Highlight
Bright Lights, Big City

In December 2019, members of the Blakemore and Elles Groups traveled to the Advanced Photon Source (APS) near Chicago to carry out collaborative research with Dr. Anne-Marie March and Dr. Gilles Doumy of the Atomic, Molecular, and Optical Physics Group, a group based at Argonne National Laboratory. In the research, the team of researchers is examining the mechanism of carbon monoxide release from a popular class of manganese tricarbonyl, $[Mn(CO)_3]$, complexes that have useful applications in therapeutic CO-release as well as catalytic CO_2 reduction. However, complexes in this class lose their CO ligands and promote complex redox chemistry via unknown pathways, limiting further development.

Using the high brilliance, broad-band X-rays available at APS, the team carried out pump-probe X-ray absorption spectroscopy (XAS) at the femtosecond timescale, using advanced instrumentation that precisely times laser excitation sources to the delivery of pulses of X-ray light generated by the synchrotron. The results, currently being written up for publication, provide a time-resolved series of detailed 'snapshots' of the chemistry taking place as the complexes absorb light, rapidly eject a CO ligand, and engage in bimolecular and electron-transfer reactions.

The collaboration between the Blakemore and Elles Groups began in 2018, with support from the KU Hall Chemical Research Fund. In the project, tunable manganese compounds are prepared in the Blakemore Laboratory, and spectroscopic investigations carried out in the Elles Laboratory, augmented by this further synchrotron-based work. Notably, Dr. Chris Otolski (PhD, Elles Group, 2019) is now a postdoctoral scholar in the AMO Group at Argonne National Lab, and an initial portion of this work was reported earlier this year in Inorganic Chemistry (doi: 10.1021/acs.inorgchem.9b02758).

Pictured: L to R, PJ Srivastava, Dan Johnson, Prof. James Blakemore, Prof. Chris Elles, and Wade Henke.

SEARCH Symposium Highlights Non-Academic Careers in STEM

The 2020 Scientists Exploring non-Academic caReer CHoices (SEARCH) Symposium was a 3-part virtual event that took place on October 24, November 7, and November 14, 2020. The goal of the symposium was to highlight the diversity of STEM professionals by hosting scientists in non-academic careers to discuss diverse career opportunities in the sciences, examine professional skills key to being successful in these careers and foster a network between students and STEM professionals. The symposium's organizing committee included graduate students at The University of Kansas from multiple departments including chemistry, molecular biosciences, and ecology and evolutionary biology. Chemistry PhD candidates Kelci Schilly and Ashley Litton are among the organizers, and Dr. Amy Jystad, who earned her PhD in chemistry in summer 2020, was also part of the committee prior to completing her degree.

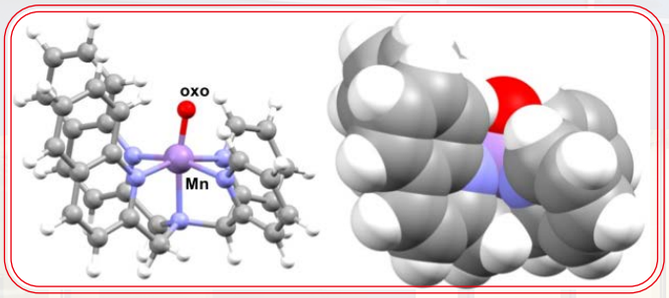
The SEARCH Symposium's keynote speaker was Dr. Sarah Vickery, Vice President of Scientific Communications for the Estée Lauder Companies (ELC) Research & Development. In 2002, Dr. Vickery earned her PhD in Bioanalytical Chemistry at The University of Kansas with advisor Dr. Robert Dunn. Other panelists included KU alumni Drs. Stephanie Pasas Farmer, Nathan Lacher and Joel Welch. Both Dr. Pasas Farmer, the President and Founder at Ariadne Solutions, and Dr. Lacher, Associate Research Fellow in Pfizer BioTherapeutics Pharmaceutical Sciences, earned a PhD in Pharmaceutical Chemistry under the direction of Dr. Susan Lunte. Dr. Joel Welch, Associate Director for Biosimilar & Regulatory Policy at the USDA, received his BS in Chemistry from KU.

The funding for the SEARCH Symposium included donations from the Chemistry Department, other KU departments, and the KU Student Endowment Board's crowd-funding campaign, LaunchKU. The LaunchKU campaign alone raised over $3,300 from individual donations. The original SEARCH Symposium was scheduled for April 4, 2020 as an in person event, but it was postponed due to COVID-19. For more information about the symposium, please visit their website: https://searchsymposium.ku.edu/

Faculty Spotlight - Tim Jackson

Tim Jackson grew up in a small town thirty miles north of Madison, WI. He earned his B.S. degree in Chemistry from St. Cloud State University in Minnesota where he performed undergraduate research in organic and inorganic chemistry. The organic research went poorly (he succeeded in making black tar by the end of his sophomore year!), but the inorganic project resulted in a presentation at an Undergraduate Research Symposium in his senior year. Thus his path in Inorganic chemistry was set.

Tim attended the University of Wisconsin-Madison and performed his dissertation research in the laboratory of Prof. Thomas Brunold. There he combined techniques and principles from inorganic and physical chemistry to study metal-dependent enzymes, a theme that would carry forward with him in his independent career. Following graduation, he joined the lab of Prof. Lawrence Que Jr. at the University of Minnesota as a NIH postdoctoral fellow. It was there in Minnesota that Tim met his wife, Sarah.



Tim joined the Chemistry Department at KU as an Assistant Professor in 2007. His research program uses a combination of i) reactivity studies of metal ion complexes and enzymes, ii) detailed spectroscopic characterization of transition metal species, particularly unstable intermediates, and iii) computational chemistry calculations to understand and control the properties of the complexes. The initial focus of his program was aimed at synthesizing and characterizing coordination complexes that mimic intermediates in manganese enzymes. These enzymes catalyze an impressive array of reactions, including the detoxification of reactive oxygen species in humans and the splitting of water to protons, electrons, and oxygen in plants. His lab generated the first family of manganese-peroxo complexes, which mimic intermediates in certain enzymes. This early work was supported by the American Chemical Society Petroleum Research Fund and by a CAREER Award from the National Science Foundation (NSF). NSF has continued to support Tim's work since 2011.

Following tenure in 2013, the Jackson lab expanded their focus to the development of earth-abundant metal complexes for hydrocarbon oxidation. While earth-abundant metals, such as manganese, have several advantages over conventional oxidants that rely on more expensive and toxic metals, a better understanding of their reactivity is needed before they realize their full potential. One aspect of this field that had long puzzled researchers was the inactivity of manganese(IV)-oxo complexes compared to their iron(IV)-oxo counterparts. Manganese and iron are adjacent in the periodic table and share a number of similar properties. While iron(IV)-oxo complexes are utilized by a tremendous number of enzymes for hydrocarbon oxidation, manganese(IV)-oxo adducts have long been considered unreactive.

Inspired by prior electronic structure computations, the Jackson lab developed a simple model of manganese(IV)-oxo complex reactivity, driven by the modulation of electron donation from atoms adjacent to the oxo ligand. Domenick Leto and Allyssa Massie, two talented graduate students, synthesized the first manganese(IV)-oxo complex in Tim's lab. Allyssa further made two derivatives to test the model, one of which remains the most reactive manganese(IV)-oxo complex known to date. The reactivity of this complex towards hydrocarbons rivals that of its iron(IV)-analogues. The original Angew. Chemie publication describing this work has been used in both graduate and undergraduate inorganic chemistry courses at UC Irvine and Bowdoin College, since it exemplifies how simple concepts from coordination chemistry can be adapted to design reactive complexes. This project has been funded by the Department of Energy for the past four years and is used to support several excellent graduate and undergraduate students.

In the future, the Jackson lab will be exploring the chemistry of other earth-abundant metals in high oxidation states. The Jackson lab has recently initiated a collaboration with Prof. Dong Wang at the University of Montana to examine the properties and reactivity of cobalt(IV) complexes. While cobalt(IV) intermediates are proposed in catalytic cycles of water splitting and hydrocarbon oxidation reactions, very few examples of well-defined cobalt(IV) complexes have been reported. The initial fruits from this collaboration have recently appeared in the Journal of the American Chemical Society, with the reporting of a new, well-defined cobalt(IV) complex. This is a very promising start to an exciting collaboration.

Since coming to KU, Tim has graduated nine Ph.D. students who have gone on to successful and productive careers at places like Honeywell FM&T, the University of Alabama Birmingham, and the University of St. Mary.

This page: (top) Abraham Opalade, Logan Hessefort (2019 REU student), and Tim. (bottom) Tim with Eleanor Stewart-Jones.

Opposite page: (top) Domenick Leto, Amanda Glass, Gayan Wijeratne, Hannah Colmer, and Prof. Tim Jackson. (bottom) Front Row: Priya Singh, Elaena Barney, Eleanor Stewart-Jones, Shannon Jones, Melissa Denler, Yuri Lee, Elizabeth Grotemeyer, Jaycee Mayfield. Back Row: Prof. Tim Jackson, Joshua Parham, Adedamola Opalade, Samuel Crowell, and Javier Gutierrez.

Timothy A. Jackson

Professor of Chemistry
Director, NIH Chemical Biology Training Program
University Honors Program, Faculty Fellow

2018 – present	Professor
2013 – 2018	Associate Professor
2007 – 2013	Assistant Professor
2005 – 2007	Postdoctoral Fellow University of Minnesota Research Adviser: Lawrence Que Jr.
2004	Ph.D. in Inorganic Chemistry University of Wisconsin-Madison Research Adviser: Thomas C. Brunold
2000	B.S. in Chemistry with Honors St. Cloud State University

2015	Guest Faculty, Université Paris Diderot, Paris, France
2014	Outstanding Educator Award, Board of Class Officers
2012	Chancellor's Silver Anniversary Teaching Award
2011 – 2016	National Science Foundation CAREER Award

Geometric and Electronic Structure Contributions to Bond-breaking and Bond-making Reactions of Mid-valent Manganese-Oxygen Complexes. NSF CHE-1900384

Mechanistic Studies to Enable Aerobic Oxidation of C-H Bonds by Manganese Catalysts. DE-SC0016359, US Department of Energy

Research Service Contract, ExxonMobil Corporation

Mayfield, J. R., Grotemeyer, E. N., & Jackson, T. A.* (2020). Concerted proton–electron transfer reactions of manganese–hydroxo and manganese–oxo complexes. Chemical Communications, 56, 9238-9255.

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Zolnhofer, E. M., Wijeratne, G. B., Jackson, T. A.*, Fortier, S., Heinemann, F. W., Meyer, K., Krzystek, J., Ozarowski, A., Daniel, M. J.*, & Telser, J.* (2020). Electronic Structure and Magnetic Properties of a Titanium(II) Coordination Complex. Inorganic Chemistry, 59, 6187-6201

Chen, X., Rice, D. B., Danby, A. M., Lundin, M. D., Jackson, T. A., & Subramaniam, B.* (2020). Experimental and Computational Investigations of C-H Activation of Cyclohexane by Ozone in Liquid CO_2. Reaction Chemistry & Engineering, 5, 793-802

Rice, D. B., Grotemeyer, E. N., Donovan, A. M., & Jackson, T. A.* (2020). Effect of Lewis Acids on the Structure and Reactivity of a Mononuclear Hydroxomanganese(III) Complex. Inorganic Chemistry, 59, 2689-2700

Massie, A. A., Denler, M. C., Singh, R., Sinha, A., Nordlander, E., & Jackson, T. A.* (2020). Structural Characterization of a Series of N5-Ligated Mn^{IV}-oxo Species. Chemistry a European Journal, 26, 900-912

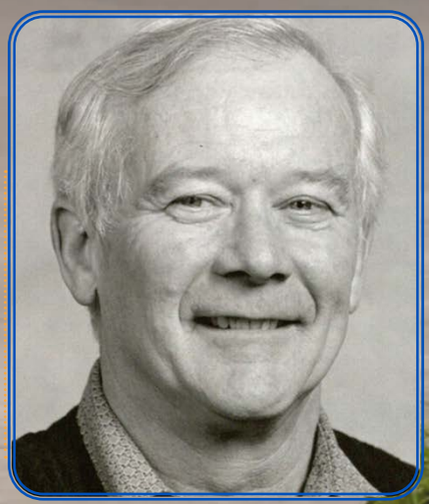
The Richard S. Givens Chair in Chemistry

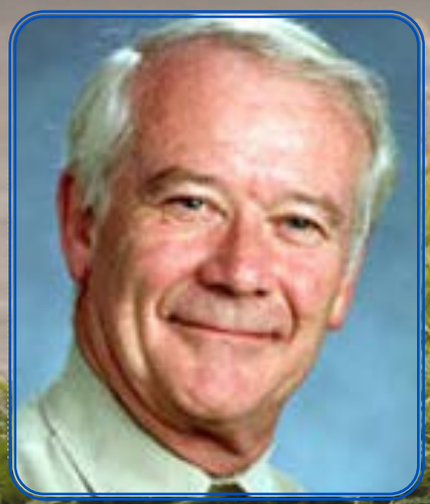
www.kuendowment.org/GivensChairChem

The Department of Chemistry is proud to announce a fund-raising effort to establish the Richard S. Givens Chair in Chemistry. Professor Givens came to KU as an Assistant Professor in Chemistry in 1967 and quickly established a world-renowned research program in physical organic chemistry. In addition to his highly productive and influential research program, Prof. Givens has a well-deserved reputation as one of our most popular and effective educators. His clarity and rigor in the classroom are legendary. Finally, Prof. Givens has served at all levels at KU and was equally generous with his time professionally. His leadership in Chemistry helped shape our Department, which continues to be one of the most collegial and productive on campus. It is this excellence in all three areas that has inspired the creation of the Richard S. Givens Chair in Chemistry. This rotating chair will be awarded every three years to a deserving faculty member in recognition of their outstanding contributions in research, teaching, and service. During the 3-year term, each awardee will hold the title of the Richard S. Givens Chair in Chemistry and receive support for their scholarly activities from the income generated by the Chair's endowment. With your help, we will endow the Chair at the $300,000 level, providing $15k a year in support for the deserving recipients.

Born in Buffalo, NY in 1940, Rich finished high school in Sisterville, WV and received his B.S. degree cum laude in Chemistry from Mariett College in Ohio in 1962. He earned his Ph.D. degree in organic chemistry at the University of Wisconsin in 1966, working under the direction of Prof. Howard E. Zimmerman. There he studied the photochemistry of dibenzoylethylenes and *semi*-bullvalene, where he used light to stimulate chemical reactions. It is also here that he met and married Susan Gillett, a nursing student at UW.

Rich and Sue moved to Ames Iowa where he joined the laboratory of Prof. Glen Russell at Iowa State University as a NIH Postdoctoral Fellow. There they welcomed their first daughter, Barbara, before moving to Lawrence in 1967 to begin his appointment as an Assistant Professor of Chemistry. As Rich remembers, "I came to Lawrence with a pretty good understanding of the Department of Chemistry and of Medicinal Chemistry because Gary Gruenwald, a fellow Zimmerman student....and the best man at my wedding...". He had introduced me to the night life in Lawrence! "Sue and I could see ourselves settling down and raising a family in Lawrence and we never looked back." Sue establihsed her career in the maternity of Lawrence Memorial Hospital, where she remained for 35 years and where they also welcomed three more daughters: Beth, Marjory, and Meg; while Rich quickly rose through the academic ranks. He was promoted to Associate Professor with tenure in 1972 and Professor in 1976.





Rich is a physical organic chemist with expertise in a wide array of photochemical processes. He and his group are pioneers in the development and synthesis of photoreactive compounds designed to release their cargo in response to light. When asked about his work, Rich said that "There were several practical, and sometimes almost esoteric molecular rearrangement accomplishments discovered by my students and co-workers using photochemistry." Among their other applications, these compounds have been particularly useful in teasing apart the complicated signaling pathways in biological systems. Rich modestly adds, "Of course, these were the accomplishments of my students and my collaborators for which I also benefitted."

Sadly, Sue passed away in 2015 after being diagnosed with pancreatic cancer. The family lost their compassionate leader while the University and Lawrence community lost a loyal and caring friend. Sue and Rich often welcomed graduate students into their home for special occasions and her passing was felt by the whole community. Recently, Rich met Bonnie Johnston, a former English teacher who worked at the Adult Learning Center in Lawrence. They quickly formed a strong bond and Rich proposed over the Christmas holiday in 2018. Happily, Rich and Bonnie were married in Lawrence on May 26, 2019.

Rich officially retired with emeritus status in 2010. He still participates in a number of productive collaborations and publishes regularly in top journals. His devotion to the Chemistry Department, KU, and the Lawrence community remain a model of responsible citizenship and collegiality. We are very fortunate that he chose to spend his career at KU. It is expected that awardees demonstrate the same level of commitment and dedication. We are very proud to introduce the Richard S. Givens Chair in Chemistry and hope we can count on you for support.

Liz Coleman Wins!

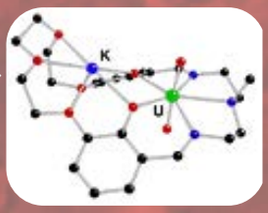
Liz Coleman, executive program associate in Chemistry, was recognized along with Erin Herschell from the Edna A. Hill Child Development Center, as the first recipients of the College Staff Excellence Awards. Liz (right) and Erin (left) are shown receiving their awards with interim Dean John Colombo at the College's Staff Appreciation Reception on Nov. 21, 2019. Along with the recognition and title, they also received a cash prize. Awardees were selected based on their: "...work ethic, excellence in job duties, contributions to a positive and collegial work environment, and promotion of values such as adaptability, customer focus, inclusiveness and innovation." The Chemistry Department has always been fortunate to have an exceptional staff. It is gratifying to see that recognition extend beyond the Department. Congratulations Liz!

Research Highlight Bringing K and U Together at KU

In 2018, with support from the US Department of Energy, Office of Basic Energy Sciences, the Blakemore Group began investigating how Lewis acidic, redox-inactive metal cations could be used to modulate the chemical and electrochemical properties of the challenging uranyl dication (UO_2^{2+}). This species, although perhaps not one that is immediately recognizable, is an important player in the chemistry of uranium. As a result, gaining better control over its reactivity and speciation could impact improvement of nuclear fuel reprocessing and waste remediation.

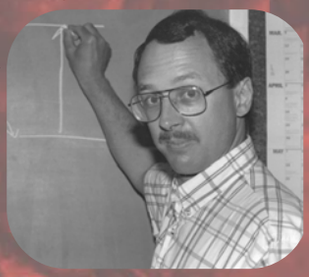
In the group's most recent work, published in the February 12, 2020 issue of The Journal of the American Chemical Society (2020, 142, 3032-3041, doi: 10.1021/jacs.9b11903), Ph.D. candidate Amit Kumar led an effort to prepare the first family of tunable heterobimetallic uranyl complexes. These compounds bring uranyl into close proximity of a set of redox-inactive Lewis acidic metal ions by using a macrocyclic approach demonstrated first in the 1980s but underappreciated until recently. In particular, the synthetic strategy outlined in the new report enables preparation of heterobimetallic complexes of UO_2^{2+} with K^+, Na^+, Ca^{2+}, and Y^{3+}.

Of all the derivatives, the one of most sentimental value is the complex bringing K^+ into close proximity of UO_2^{2+} (see Figure), as this complex is referred to by the nickname [K,U]. In particular, the research shows that bringing the K and U together in this complex has important consequences, both shifting the reduction potential of the uranyl unit and modulating its rate of electron transfer in comparison with monometallic species. In ongoing work, these features will be used to study and eventually provide control over activation of the strong U–O bonds of the uranyl unit.



Professor Carey Johnson Retires

I joined the Chemistry Department at KU in 1985 after a postdoc at the University of Pennsylvania. The chemistry faculty numbered about 24 at the time, as I recall, including my colleagues in physical chemistry Bill Argersinger, Paul Gilles, Marlin Harmony, Peter Hierl, and Shih-I Chu. Marlin Harmony was chair of the department. All of my colleagues went out of their way to support a young assistant professor who had a lot to learn, not only about research and teaching, but also about being a good departmental citizen and colleague. One of my first concerns was the low number of graduate students in the department, especially in physical chemistry students. During my first or second year, Joe Heppert and I, concerned about increasing graduate student enrollment, organized the first graduate recruiting weekend, a tradition that has continued until the present. Although graduate student enrollment didn't turn around overnight, it gradually increased, and as we added more physical chemistry faculty, more physical chemistry graduate students began to sign up as well.



I was given lab space in the basement of Malott Hall. We immediately faced the problem of how to move in a heavy laser table. This was the first, or one of the first, large laser tables in Malott Hall. Jack Rose, business manager of the department, hired an elderly gentleman whose expertise was lifting houses off of their foundations and moving them.

He came in with a few iron pipes to serve as rollers and with one or two helpers, rolled the laser table into place. Being in the basement, my lab was subject to occasional floods caused by water overflows in the floors above—at least three substantial flooding instances over the years, about one per decade. One of these doused one of my laser power supplies. Surprisingly, after it dried out, it still worked! Recently my lab moved into the new Interdisciplinary Science Building (Gray-Little Hall). By now there were many laser tables to move, both in my lab and in Chris Elles's lab, and experienced movers who, although they probably hadn't moved houses had moved just about everything else. Many things changed through the years, but the support and collegiality of the department have remained constant, a fact for which I am very grateful. In retrospect, thirty-five years have passed in a picosecond. Looking back, I find that interactions with students have been the most rewarding part of the job. (Faculty meetings are a close second, of course.)

My greatest pleasure over the years has been working with graduate and undergraduate research students in the lab, discussing results and planning next steps. I will miss that greatly! My wife Jean and I are looking forward to new adventures in travel and service.

Left to Right:
Dylan Hendricks,
Prof. Carey Johnson,
Lexi Snyder
Summer 2019
REU Program

Research Highlight - Lipids in Neurological Disease

The research in the Hartley laboratory is broadly focused on two aspects of lipids in the central nervous system (CNS): (1) the role of lipids in neurological disease, and (2) hormone-mediated regulation of lipids in the CNS. We are currently focusing on identifying novel mechanisms of CNS lipid metabolism and regulation related to myelin. Myelin, the lipid-rich membrane that surrounds axons, is a major component of the CNS, and myelin has more lipids (70-80%) than normal cellular membranes (40%). Myelin damage is a central pathology in multiple sclerosis, but it also occurs in many neurological disorders including Alzheimer Disease and leukodystrophies. The laboratory will use the tools of chemical biology, analytical chemistry, and neuroscience to address critical questions that represent a barrier to advancement in the understanding of myelin biology and ultimately treatment of demyelination diseases.

I began setting up the laboratory in June 2020 with a group of talented graduate students and other researchers. One of the graduate students, Matt Zupan, was selected as a Trainee for the NIH Training Grant in the Dynamic Aspects of Chemical Biology. Our current projects involve profiling lipid and gene changes related to myelination, thyroid hormone and myelin disease. We were recently awarded a Research Grant from the American Thyroid Association for a portion of this work. Despite the challenges of starting during a pandemic, our laboratory is mostly set up and we are starting to make progress!

(L to R) Prof. Meredith Hartley, Rashmi Binjawadagi, Matt Zupan, Achala Punchi Hewage, Nishama Mohotti, and Liz Arends.

Research Highlight - Portable Microfluidic Assay for COVID-19

The Lunte group is working on a microfluidic based portable assay for on-site testing of saliva for antibodies to the COVID-19 virus. This test would tell if a person had been infected with the virus and has generated an immune response. It can also be used to test the effectiveness of vaccines to COVID-19. The project is sponsored by Ni20, a national medical device company and involves a collaboration of three universities (UNL, Georgetown and KU) and two other small companies. The final instrument will consist of a saliva collection device, custom reagents, a microfluidic cartridge and a portable reader. The Lunte group has been working with Ni20 to develop and evaluate the cartridge for the microfluidic immunoassay. (pictured: Galina Bulgakova)

Staff Spotlight - Erin Kelley-Garrison

Rushville, MO native and Emporia State alumna Erin Kelley-Garrison came to KU to help provide students with a family-like experience she had at her alma mater. "My time in college was one of the most wonderful and difficult times in my life." Erin was a first generation student, navigating life away from her small hometown. "My grades were rough for a while, and I lost my mom during that time." What helped Erin get through her trying times was her involvement in Residence Life and Sorority & Fraternity Life, which became her built-in family, ready to celebrate Erin when she needed it. After graduation, Erin realized there were likely students like her who needed their own cheer squad and family. "I looked around after graduation and thought: 'Wait, I can do this for a living and help other people like me?' I stepped foot on KU's campus for interviews and I was hooked."

Being at KU was the adventure Erin didn't know she needed. "Just when you think you've experienced everything you can and met all the people you want to meet," Erin says, "something or someone comes along that knocks that thought right out the park!" And, talk about being a part of one, big Jayhawk family: "I REALLY love when I wear Jayhawk gear while traveling and hear "Rock Chalk" halfway across the airport!"

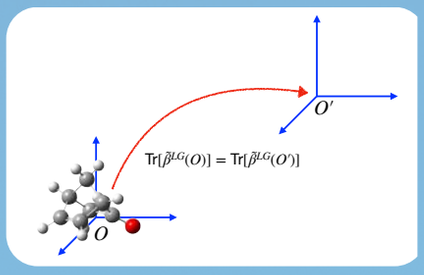
Erin not only exudes enthusiasm for KU, but also for our Chemistry undergraduate students, so much so that Erin was nominated as Advisor of the Year in 2020. "I love the people, the students, the staff, the faculty! I love sharing stories and getting random emails about how much people miss seeing me, it really makes me feel like part of a family!" While Erin's office hours are now entirely virtual, her connection with the students has remained steady. "I miss seeing my students and the [Chemistry] staff and faculty friends in person, but I'm still here! I love getting to be more accessible to students and to get to see everyone's pets."

When Erin isn't taking her dog, Molly, on walks, she's spending time with her husband and family. Erin is a proud aunt of two and big sister to a teenage brother. "My sister is a Rockstar with two kiddos… Of course I also have a teenage brother who gives me grey hair and teaches me all the new trends, so I think it evens out in the end!"

Megan Belaire (L) and Erin (R) at the 2019 Department Staff Fall Party.

Research Highlight - Improved Methods for Simulating Optical Rotation

In this work, the Caricato group solves an outstanding issue for the simulation of the optical rotation in chiral molecules using highly accurate (but still approximate) electronic structure methods. Optical rotation (OR) is one of the manifestations of the optical activity of chiral molecules, where the plane of polarization of linearly polarized light passing through a sample with an enantiomeric excess of a chiral compound is rotated by a certain angle. Measurement of the OR can help in the assignment of the absolute configuration of a sample when they are aided by accurate simulations of this molecular property. This is fundamental for practical applications in biochemistry or in the pharmaceutical industry, because of the homochiral nature of all biologically relevant molecules and supramolecular systems.



Before this work, calculating the OR using the common length gauge for the electric dipole and accurate non-variational methods such as those belonging to coupled cluster (CC) theory provided values that were origin dependent. This means that by moving the origin of the coordinate system one would get a different value of the OR, which is clearly an unphysical result! This limitation was pretty disappointing given that CC methods are among the most accurate and reliable methods we have in computational chemistry.

The main outcome of this paper is to introduce a relatively simple transformation of the OR tensor that makes the result origin invariant when calculated with CC methods, as a physically meaningful result should be. Therefore, this work provides the means to compute this important molecular property more accurately and efficiently than possible before.

The Art of Giving

Marty Gibson is an artist who grew up in Arkansas City, Kansas and now makes her home in the enviably named Carefree, Arizona. She studied studio painting and graphic design at KU and graduated with a Bachelors of Fine Arts in 1963. After graduation, Marty applied her graphic design talents in the advertising departments of companies like Macy's. While her graphics design work paid the bills, painting remained her passion. She was able to merge these two when she became a graphics specialist for the Seattle Biomedical Research Institute. There she supported a dozen doctors, bringing their microscopic studies of disease to life by creating imagery to support their publications, lectures, and grant applications. It is here that she developed a passion for the sciences and the backstory it helped to create for her art.

Marty is an accomplished painter and printmaker, and you can learn more about her work and exhibitions at www.martygibson.com. Marty has graciously agreed to support KU Chemistry by creating original artwork for our new building. These original, chemistry-themed pieces will be proudly displayed in the public spaces of Gray-Little Hall (formerly the Integrated Science Building) and available for sale, with proceeds benefiting the Department of Chemistry. Marty's first piece is entitled "Metals" and is inspired by the periodic table. "Metals" will hang prominently in the 2nd floor foyer of Gray-Little Hall next to the historic periodic table moved from Malott Hall. The latter, as many of you will remember, hung in the first-floor lecture hall of Malott Hall and contained hand painted elements that were added as the elements were discovered. "Metals" is nearing completion and will be hung early next year. Please visit our website at www.chem.ku.edu for updates, pictures, and to contact us if you are interested in acquiring this, or other unique chemistry-themed pieces created by Marty.

Research Highlight - Rapid Amino Acid Analysis for Metabolic Diseases

Amino acid analysis is important in food science, biomedical research, and in the diagnosis of disease and disorders. Since amino acids are constituents in many metabolic pathways, diseases that influence these pathways can alter amino acid levels in the body. Newborn screening in developed countries has been extremely successful at diagnosing and treating amino acid disorders, but similar screening is less prevalent in emerging economies. Amino acids are a challenging analytical target, often requiring derivatization steps and expensive tandem mass spectrometry methods for analysis. Prabhavie Opallage and Miyuru De Silva in the Dunn group recently developed a cost effective high-speed capillary electrophoresis (HSCE) platform suitable for rapid amino acid analysis in resource limited regions. The HSCE uses a short length (8 cm), ultra-thin wall (15 micron) capillary for electrophoretic separations. The thin wall efficiently dissipates heat, mitigating the effects of Joule heating. Since amino acids generally lack a strong chromophore, refractive index detection using back-scatter interferometry enables direct detection without derivatization steps. The Dunn group recently demonstrated the capabilities of this platform by separating a mixture of three inorganic ions (K^+, Na^+, Li^+) and eight amino acids (Lys, Arg, Ala, Gly, Val, Thr, Trp, Asp) at clinically relevant levels in under 40 seconds (manuscript under review).

By The Numbers

Astronaut Scholars
Tyler Nguyen 2019 – 2020
Eleanor Stewart-Jones 2019 – 2020
Jonah Stiel 2020 – 2021

Goldwater Scholars Nominees
Jonah Stiel - 2020

Beckman Scholars
Anton Barybin – 2020
Emily Hughes – 2020

ChemScholars
Anton Barybin
Brian Faintich
Alexandria Gambill
Braeden Huslig
Thang (Tommy) Nguyen
Jonah Stiel
Katherine Vander Laan

Degrees (Spring, 2020)
Michael Phillip Antonelli, B.A.
Jocelyn Sara Brooks, B.A.
Madison Elizabeth Brown Orr, B.A.
Corbin Trevor Brown, B.A.
Dane Brunner, B.S.
Ryan Montogmery Chandler, B.S.
Mara S. Cunningham, B.A.
Kevin Michael DeCock, B.A.
Brock D. Elgin, B.A.
Yuan Fang, B.S.
Eric Andrew Gustafson, B.S.
Delnaz Faraz Joshi, B.S.
Bryce K. MacDonald, B.S.
Garet Levi Melton, B.A.
Joshua Conner Mengell, B.S.
Tyler M. Nguyen, B.S.
Alexis C. Paige, B.S.
Thuy Quoc Cam Pham, B.A.
Nicholas Patrick Schroeder, B.S.
Rahul Kumar Sen, B.S.
Eleanor Stewart-Jones, B.S.
Jonathan E. Super, B.S.
Nicholas Brian Taylor, B.A.
Claire C. Wakefield, B.A.
Braelyn Monae Page (12/19), B.A.
Robert Logan Zickefoose, B.A.

Promotions
James Blakemore promoted to rank of Associate Professor with tenure

Honors and Awards
Prof. Kristin Bowman-James
2021 ACS Award, Inorganic Chemistry

Prof. Sue Lunte
College of Fellows
American Institute for Medical and Biological Engineering

Prof. Meredith Hartley
American Thyroid Association

Liz Coleman
College Staff Excellence Award

Sabatticals
Prof. Jon Tunge (sp 2020)

OUR CHANT RISES

Over $8 million in research grant expenditures

The Department awarded over a $215,000 in student scholarships and awards in 2020.

- 47 Departmental Undergraduate Awards
- 53 Departmental Graduate Awards

139 Current Chemistry Majors

26 Rising Star Scholars (Chemistry Majors)

Over 100 Graduate Students

NASA Fellowships
Emily Kurfman

KU Representative at the 70th Annual Lindau Nobel Laureate Meeting
Zeke Piskulich

NSF Graduate Research Fellowship
Zeke Piskulich

NIH Chemical Biology Training Grant Program
Hayley Blockinger
Wade Henke
Emily Kurfman
Jaycee Mayfield
Jacob Theismann
Matthew Zupan

Degrees (2019 - 2020)
Tal Aharon, Ph.D.
Kevin Allegre, Ph.D.
Charuni Amarasekara, Ph.D.
Jason Applegate, Ph.D.
Matthew Barclay, Ph.D.
Kaitie Cartwright, Ph.D.
Andie Jo Cassity, Ph.D.
Nathan Erickson, Ph.D.
Arghya Ganguly, Ph.D.
Nilan Kamathewatta, Ph.D.
Brent Lee, Ph. D.
Joshua Parham, Ph.D.
Achala Punchi Hewage, Ph.D.
Sijin Ren, Ph.D.
David Sconyers, Ph.D.
Joshua Shipman, Ph.D.
Kavisha Ulapane, Ph.D.
Sasanka Ulapane, Ph.D.
Harshani Wijerathne, Ph.D.
Yang Yang, Ph.D.

Graduate Research
Zeke Piskulich

A century ago Tolman showed that the activation energy can be understood as the excess energy needed to surmount the barrier to a reaction (as opposed to the view of the activation energy as the barrier height). Prof. Ward Thompson and I have developed a new method using fluctuation theory from statistical mechanics that lets us calculate these activation energies for a rate constant from molecular simulations at a single temperature directly, instead of numerically as is done in the Arrhenius approach. Our results take advantage of Tolman's interpretation to not only better understand the origin of activation energies, but also decompose them into contributions from different forms of energy (i.e., van der Waals, electrostatic, and kinetic). We have shown this method is applicable to essentially any dynamical timescale, and that it can be used to make predictions over a wide range of temperatures. Recently, we have demonstrated that, with this method, room temperature simulations can be used to predict the water diffusion coefficient down to 125 K, deep into the supercooled regime. We have also shown that we can predict the infrared spectrum of liquid water over over its entire range of stability from a single, room temperature simulation. We are currently applying the method to understand the temperature dependence of dynamics in complex systems, including the water hydration layer of proteins and liquids in nanoscale silica pores. The essential ideas of the approach were reviewed in a recent Feature Article, Z.A. Piskulich, O.O. Mesele, and W.H. Thompson, "Activation Energies and Beyond," *J. Phys. Chem.* A 123, 7185 (2019).

The Tunge group visits China in Oct 2019 for a conference at Central China Normal University. L to R: Ebbin Joseph, Alex Davies, Prof. Tunge, Mary Maliszewski, Chelsea Comadoll, Shrikant Londhe, and Dr. Kaitlyn Cartwright.

Underaduate Research
Logan Forshee
Megan Hegarty

Undergraduates Logan Forshee (left) and Megan Hegarty (right) are a dynamic duo conducting research in the laboratories of Prof. Jon Tunge. Logan began performing undergraduate research in the Spring of 2019 and Megan joined in the Fall of 2019. Since that time, they formed a team with graduate student Kaitie Cartwright (2020 PhD). Together they have developed a new catalytic 3-component coupling reaction. The coupling of 3 molecules in a single reaction requires one to achieve a delicate balance between the rates of reaction of each of the components. Through the combination of a transition metal catalyst and a photoredox catalyst (a dye), Megan and Logan have done just that! Their reaction harnesses visible light to promote electron transfer reactions that balance the rates of reactions by turning reactants "on" or "off" with an electron.

Logan says: "The most exciting part of this project for me is having the ability to deep dive into a project and truly begin to understand the chemistry you're working with. It's exciting to see patterns across different substrates and start to gather a good idea of the reaction you're working with. I was fortunate enough to receive an Undergraduate Research Award in 2020 for my work on this project. Along with that, I have received awards from the chemistry department including the 2020 and 2019 Leland & Jill Weigel Scholarship as well as the 2018 Badgley & Weik School in Chemistry Scholarship. Additionally, this past summer, I was fortunate enough to present this research at the 2020 American Chemical Society National Conference in an online format."

Megan says: "This research project has been a great learning experience for me. This last year was my first working in a research lab, and I've learned an incredible amount, both about the process of doing research and about our research itself. I've gained an understanding for catalysis and other organic chemistry processes that I would not have been exposed to otherwise. I was selected to research in Dublin over the summer with the KU-DCU REU exchange program, which was unfortunately cancelled due to coronavirus. I was also granted the Synder Award to further my research this school year. In addition, I've received multiple scholarships from the Chemistry department during my time at KU. Joining this research lab has led to great personal growth for me as a chemist."

L to R: Emily Mikeska, Chelsea Comadoll, Jacob Theismann, Liz Grotemeyer, Josh Sanders

Wow – what a year it has been for us all! As the Chemistry Graduate Student Organization, our mission remains to (1) facilitate communication between graduate students and the chemistry department, (2) promote professional development for chemistry graduate students, and (3) build social ties within the department while advocating for science within our community. This mission became so critical over the last six months. We had a strong start to the year in January when we held a bake sale, followed by a T-shirt fundraiser in February where we partnered up with a local screen printer on Mass Street and sold ChemGSO shirts to the department. At the time, our plan was to use these funds quickly for various professional development and extracurricular activities with the graduate students, but COVID unfortunately had other plans.

Despite the limitations on all of us right now, we are still being active. Community outreach has been a large focus for us this year. Our department began volunteering with the Boys and Girls Club at a local school from January to March. We are currently planning an exciting collaboration with the chemistry teachers at both Lawrence High School and Free State High School to connect our graduate students in mentorship with students who are interested in pursuing STEM. Another great program underway is the ChemGSO Buddy System, put in place this Fall to support the sense of community within our department and foster friendships between our incoming graduate students and the more senior students.

If you would like to receive more information on how to get involved with ChemGSO and our current graduate students, please contact us at kuchemgso@gmail.com and/or follow us on Facebook (@KUChemistryGSO).

Alumnus Dale Boger Wins 2020 Tetrahedron Prize

Professor Dale Boger, Richard and Alice Cramer Professor of Chemistry at Scripps Research Institute, was recently named the recipient of the 2020 Tetrahedron Prize for Creativity in Organic Chemistry. Awarded by the Elsevier and the Board of Executive Editors of Elsevier's Tetrahedron journal series, the Tetrahedron Prize includes a $15,000 award, gold medal and a certificate, which will be presented to Professor Boger during the 2021 ACS Fall National Meeting in Atlanta, GA (Aug. 22-26, 2021).

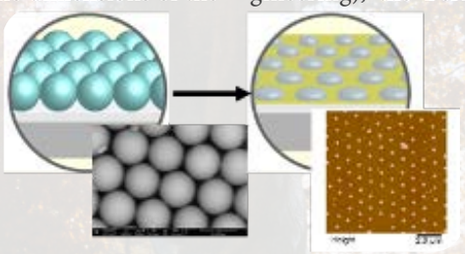
Receiving his B.Sc. in chemistry in 1975 (with highest distinction and honors in chemistry), Professor Boger is not only an alumnus of the University of Kansas, he is also a former faculty member with the Department of Medicinal Chemistry from 1979-1985. He is now the Richard and Alice Cramer Professor of Chemistry at The Scripps Research Institute, La Jolla, CA, USA. Professor Boger worked with Dr. Albert Burgstahler for three years as an undergraduate, and he also recognized Drs. Earl Huyser, Rich Givens, Bob Carlson and Dick Schowen as being instrumental in launching his career in chemistry.

The Tetrahedron Prize is awarded annually to a deserving chemist for creativity in Organic Chemistry or Bioorganic & Medicinal Chemistry. Professor Boger was chosen as the 2020 recipient for his important advances in the areas of heterocyclic chemistry and organic synthesis, particularly in regard to the synthesis of natural products.

Congratulations to Professor Dale Boger on this prestigious award!

Research Highlight - Controllable Metal Structures

The Berrie research group investigates nanoscale properties at interfaces. A recent focus of the group has been on development of controllable metal structures with potential applications in biosensing and optical materials. Graduate students Nilan Kamathewatta and Sasanka Ulapane, along with KU undergraduate Sam Steuart and NSF-REU participant Ashley Borkowski (now a current KU graduate student), published work where they created extended arrays of metal nanostructures with dimensions and spacings that can be tuned precisely.1 The method involves deposition of a close-packed layer of silica nanospheres, followed by formation of a self-assembled monolayer resist layer around the spheres. Removal of the spheres allows subsequent electroless deposition in the exposed areas on the surface to create the metal nanostructures. Spacing between the features is controlled by the size of the silica spheres used for the lithography, while the dimensions of the metal nanostructures are tuned through control of the solution conditions during the metal deposition. The structures have potential utility in the investigation of multivalent interactions useful in the development of biosensors and biochips. Controlling the nanostructure characteristics can tune their optical properties, which can be exploited to allow sensitive detection of binding at the interface through shifts in the plasmon resonance. In other collaborative work with the groups of Mark Richter (KU Molecular Biosciences) and Candan Tamerler (KU Mechanical Engineering), the Berrie group has demonstrated control of the binding of the enzyme Putrescine Oxidase to gold through the use of a metal binding peptide.2 The use of such peptides for the selective localization of the enzyme on these recently developed nanostructures opens new opportunities for fundamental investigations of multivalent interactions, coupled reaction dynamics, and cell signaling, as well as development of more sophisticated hybrid bionanodevices.



KU Nanofabrication Facility

The KU Nanofabrication Facility (KUNF) is one of the Core Labs supported by the University of Kansas Center for Research, housed in the new Integrated Science Building (ISB, soon to be renamed Gray-Little Hall). Since moving to ISB, the KUNF now boasts one of the largest university cleanrooms, which allows for a wider range of manufacturing capabilities than any others in the region. The additional space allows for new equipment expansion and improves process workflows for users.

Director Ryan Grigsby is the primary support person, with the assistance of Indika Warnakula (GRA with KU Chemistry) and Connor Ahlquist (undergraduate hourly staff). Mr. Grigsby and his support personnel assist researchers who need to manufacture micro-and nanofluidic devices. The facility primarily caters to those making devices for biomedical research, but has the equipment and resources to accommodate broad research applications with micro-and nanofabrication needs. Members of the research groups of Professors Erik Holmstrom, Susan Lunte, Jenny Robinson and Steven Soper are the primary users of the cleanroom.

Grant funding from The Center for Molecular Analysis of Disease Pathways (funded through an NIH COBRE), along with other funding sources, helped pay for building the cleanroom in ISB and providing new equipment, including a new stereolithographic 3D printer, equipment to manufacture photomasks, and several pieces of metrology equipment, including a variable pressure SEM, a tensiometer, and a digital microscope. There are numerous other design details which have improved upon the previous space formerly available in the Multidisciplinary Research Building (MRB). For more information about the KUNF, check out their web site: nanofab.ku.edu.

The ChemClub

During the 2020-2021 school year, the KU Chemistry Club is continuing to provide top quality community outreach and professional development services despite the ongoing pandemic. Chem Club is proud to have recently performed its first ever virtual Carnival of Chemistry, which delivered the joy of chemistry straight to the homes of local youths. Children of all ages were invited to follow along at home as club members demonstrated readily available chemistry experiments such as using vinegar to turn milk into plastic. Chemistry Club has also been pursuing the professional development of its members through virtual presentations and tours. In these unusual times, it has been possible for us to invite speakers who would normally be too far afield to consider. There are more exciting events and speakers coming later this school year, so follow us on social media to learn more! Our Facebook accounts are "KU Chemistry Club" and "KU Carnival of Chemistry", @ KUChemClub on Twitter, and KUChemClub on Instagram. We would like to give a massive thank you to our club advisor, Dr. Roderick Black, without whom the club could not possibly function.

The Ralph N. Adams Institute

An annual highlight of the Adams Institute's activities has been the Ralph N. Adams Lectureship, established at KU in 2017 to maintain cognizance of Buzz's contributions as a scientist, mentor and humanitarian. The inaugural Adams Lecturer in 2018 was Mark Wightman, UNC Chapel Hill, and the second was Bob Kennedy, University of Michigan, in 2019. Due to the pandemic, the third Adams Lecturer (Jonathan Sweedler, University of Illinois) will wait to visit campus until 2021.

Each year, Leedy/Kuwana graduate student travel awards are given to outstanding analytical chemistry graduate students to enable them to present their research at scientific conferences. This past year, these awards enabled three graduate students to present their research at Pittcon 2020 in Chicago: Kelci Schilly (Lunte group), Chase Stucky (M. Johnson group) and Xin Zhou (Zeng group). The Adams Institute serves as the host institute for the NIH COBRE Center for Molecular Analysis of Disease Pathways, which focuses on the development of enabling (analytical) technologies to study the biological mechanisms of diseases including cancer, cardiovascular disease and neurological disorders. The two main goals of the COBRE are to help new faculty members establish their research programs and to enhance the research infrastructure of the state of Kansas. Several analytical faculty have been financially supported by this program and funds were also used to help recruit Dr. Meredith Hartley to KU. The grant has also allowed us to purchase several pieces of major analytical instrumentation for core labs on campus, including the Genome Sequencing lab, the Synthetic Chemical Biology lab and the Adams Nanofabrication lab. More information on the Adams Institute and COBRE CMADP is available online (adamsinstitute.ku.edu and cmadp.cobre.ku.edu).

Left Photo L to R:
Sue Lunte, Don Leedy, Robert Kennedy, Bob Dunn at Dr. Kennedy's 2019 Adams Lecture (9/6/2019)

Right Photo L to R:
Ted Kuwana, R. Mark Wightman, Don Leedy at Dr. Wightman's 2018 inaugural Adams Lecture (11/15/2018)

Anna Bricker
(1918-2020)

Anna Bricker passed away in her home in Lawrence, KS on June 10, 2020, at the age of 102 years old.

Ann married Clark Bricker, who would later become an extremely popular professor in the Department of Chemistry, on Christmas Day in 1942. Clark was doing classified work at the time and was only permitted a few days off. Later, Ann received a security clearance just to type his thesis. Ann and Dr. Bricker moved to Lawrence, KS in 1963 to start his academic position at KU . Prof. Bricker was renowned for his clarity in the classroom, winning the prestigious HOPE award for outstanding teaching four times! He passed away on June 14, 1994, three days shy of his 76th birthday.

Ann was a force of nature and lived independently until the age of 100, before finally moving into assisted living. She served as a member of the Lawrence Memorial Hospital Auxiliary for 35 years and eventually served as its president. Active in the community, she volunteered for LINK, providing meals for those in need, and for Meals on Wheels. She was active in the local PEO sisterhood promoting educational opportunities for women, and held positions of responsibility in her church.

Ann is survived by her and Clark's children: Susan Bricker Emery, Chambersburg PA; David E. Bricker and wife Diane, Santa Fe NM; grandson Matthew Bricker, his wife Lauren and their children Liam and Skylah of Denton TX; and sister-in-law Helen Blasser and her daughter, Gretchen of Shrewsbury, PA. Son Bruce and wife Shannon preceded her in death.

Bob Carlson
(1938-2020)

Emeritus Professor Robert G. Carlson passed away on November 26, 2020 at the age of 82. Professor Carlson was an exceptionally talented researcher and gifted educator. His generous and collegial approach helped shape our department and his dedication in the classroom contributed to generations of students fulfilling their ambitions.

Professor Carlson received his B.S. degree in chemistry from the University of Illinois in 1959 and his Ph.D. from M.I.T. in 1963. He joined the faculty of the Department of Chemistry at KU later that same year. Professor Carlson developed a vibrant research program in synthetic organic chemistry, which earned him a prestigious Alfred P. Sloan Fellowship (1970-1972). He also quickly became one of our most dedicated and popular educators, winning numerous awards for his excellence in the classroom. He was recognized twice with the Mortar Board Outstanding Educator Award (1982 & 1999) and received the exclusive Kemper Fellowship for Excellence in Teaching. He took great pride in advising students and was always extremely generous with his time. He will be missed by all of us here in Chemistry, KU, and the Lawrence community.

Professor Carlson is survived by his wife of 58 years, Nancy Beatrice Carlson; their children Christina Ann Carlson and Kenneth Lynn Carlson; and grandchild Natalie Anne Carlson.

Goodbye Friends...

KU DEPARTMENT OF CHEMISTRY
College of Liberal Arts & Sciences

Department of Chemistry
University of Kansas
Room 1140, Gray-Little Hall
1567 Irving Hill Road
Lawrence, KS 66045

Help Support Chemistry at KU

While the pandemic has changed the way KU delivers a world-class education, our Chemistry students and faculty continue to passionately pursue their goals to advance discovery and change the world. Your support of KU Chemistry is always needed, but even more important right now. Scholarship support helps make a KU degree possible for students from underrepresented minority populations. Support for research advances great ideas and helps find answers to complex questions. Faculty support provides a lift for those working hard to teach, mentor, and do research in an exceptionally difficulty budget environment. We welcome your support of the department and appreciate your investment in KU Chemistry. The easiest way to make a gift is to go to www.kuendowment.org/givenow. There will be a field for you to designate that you'd like your gift to support KU Chemistry students, faculty, or research. If you'd like to know more about how you can make a difference in the lives of our students or faculty, contact Dan Simon, Team Lead & Senior Development Director at KU Endowment (dsimon@kuendowment.org or 785.832.7378). Thank you for your support and Rock Chalk!

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Gifts made by check should be payable to:
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