

CHEM-E NEWS

Summer 2022

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KANSAS STATE UNIVERSITY

Tim Taylor Department of Chemical Engineering

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Contents -

- 2022 award recipients
- Undergraduate research
- Edgar returns to K-State
- 2021-2022 graduates
- Department news

From the Department Head

The 2021-2022 academic year was again filled with change, flexibility and continued resilience within the chemical engineering family at K-State. The start of both the fall and spring semesters were each punctuated with the spread of new COVID-19 variants, adding yet another element of uncertainty for students, faculty and staff. We were able to keep nearly all of our classes meeting in person throughout the year, while also offering remote options to enable our students to stay on top of their studies. Our graduating seniors were sophomores when the pandemic began, so it was extra special for me personally to have them in the classroom face to face this past fall.

Professor Jim Edgar is returning from his three-year position as a program manager at the National Science Foundation. He has elected to step down from the department head position upon his return, so he will be able to focus entirely on research, mentoring and teaching. Jim served as department head from 2009 to 2019. During his tenure, Jim had a critical impact on shaping the department into what it is today. He was responsible for hiring more than 80% of the current faculty and supervised the \$2.5 million renovation of the Durland Hall research laboratories in 2012 and expansion of the space available to the department. He was recognized as a University Distinguished Professor in 2013 and received numerous research awards, including the Engineering Distinguished Researcher Award (2017) and the Higuchi-KU Endowment Research Award (2019). We greatly appreciate Jim's leadership over the years and are glad to have him returning this fall to our faculty. You can read more about his experience at NSF in this magazine.

At the request of our dean and our department faculty and staff, I am honored to continue in the role as department head following my three years as interim. Other changes this year include our accounting specialist Cindy Fowler moving away in October and the retirements of our accountant Debra Wahl in August and Professor John Schlup in May. While we miss all three of them, we have welcomed two new staff members to the department — Jamie Meyers, business manager, and Lexie Nichols, accounting specialist. We are glad to have them as part of the ChE team.



This fall, we invite alumni to join us via Zoom, Oct. 18, for the inaugural Highlights From the ChE Department event. More information and instructions on how to sign up will be sent out this fall. If you are interested in being more involved in the department, helping serve as a mentor to students, visiting the undergraduate assembly class or sharing with us stories of your experience as an alumni, please contact Danita Deters (danita@k-state.edu). We would love to hear from our alumni about your own experiences, and we wish you all the best for the remainder of 2022.

> Jennifu Lanthon Jennifer L. Anthony Department Head and Associate Professor

Tim Taylor Chair in Chemical Engineering Wayne and Barbara Harms - Carl and Mary Ice Keystone Research Scholar

2022 award recipients

On May 5, the department hosted its 11th annual awards banquet. This was the first in-person event since 2019. This event recognizes the department's students and faculty for their achievements and contributions.



Larry A. Glasgow Outstanding Junior in Transport Phenomena

This award is given in recognition of remarkable student achievement in the transport phenomena course series.

Christian Mendez



Richard G. Akins Student Service Award

Made possible by Richard G. Akins, this award recognizes students who provide an exceptional level of service to their fellow students and the department

Ben Proffitt



Faculty Excellence in Chemical Engineering

This is a student-nominated award given to a faculty member recognizing excellence in undergraduate education and is supported by our generous alumni.

Yachao Chen

Eric R. Gray Outstanding Senior Award

Made possible by the Gray family, this award honors a senior in chemical engineering who has displayed excellence at this early stage of their chemical engineering career. This year there were two winners.



Sierra Staatz

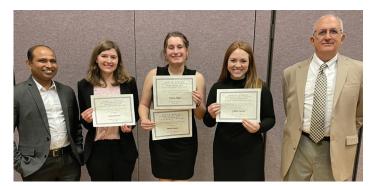


Erin Pearson

John R. Schlup Outstanding Group Performance Award

This new award was created to recognize exceptional teamwork. This year's award was given to the Unit Ops senior lab team.

Erin Pearson Sophia Shaar Gillian Falcon Sierra Staatz



From left, Md Helal Uddin, teaching assistant professor; Erin Pearson; Sophia Shaar; Gillian Falcon; John Schlup, chemical engineering professor. Not pictured: Sierra Staatz

Open House 2022 | Engineering awards

The department had a very successful Open House in 2022. Co-chairs were **Gillian Falcon** and **Patrick Hinkel**, and the faculty advisor was **Md Helal Uddin**. The following is a list of the awards received:

Degree Program Display

1st place - Chemical Engineering's "Endless Opportunities through Chemical Engineering"

David and Virginia Braun Innovation Award

"Valorization of Food Waste" by Erin Pearson, Gillian Falcon, Sophia Shaar, Sierra Staatz

Yellow Brick Award

Chemical Engineering

Outstanding Student Organization Award

3rd place - "Wacky Chemistry" by Chem-E-Car

4th place - "K-State Biodiesel Initiative" by the Biodiesel Initiative Club

Finalist for Saint Patrick

Ashton Gohman

Knights of Saint Patrick

Gillian Falcon

Ashton Gohman

Mary "Katie" Ketel

Javen McCreight

Raymond Nellis

Carter Oeding Erin Pearson

Sierra Staatz



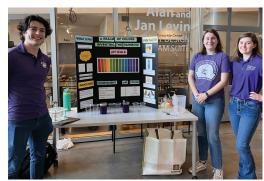
From left, Sophia Shaar, Erin Pearson, Gillian Falcon, Sierra Staatz



From left, Sophia Shaar, Sierra Staatz, Patrick Hinkel, Gillian Falcon, Erin Pearson



Open House chairs, Patrick Hinkel and Gillian Falcon



From left, Patrick Hinkel, Sophia Shaar and Erin Pearson



From left, Patrick Hinkel, Carter Oeding, Sophia Shaar, Sierra Staatz, Erin Pearson, Gillian Falcon, Ashton Gohman, Yvette Rito



REMADE student organization members, from left, Katherine Knight, civil engineering, Eli Janzen, chemical engineering doctoral student, Matthew Davis, biomedical engineering

4 | Chemical Engineering | Chem-E News 2022 | 5



UNDERGRADUATE RESEARCH

BIOFOULING RESEARCH

Anaerobic microorganisms can be used to break down waste and are implemented in anerobic membrane bioreactors (AnMBRs) for low-energy, sustainable wastewater treatment. These bioreactors require membranes for separation of treated water from waste products. However, microorganisms stick to and clog these membranes during operation in a process called biofouling. Over time, this inhibits the flow of treated water through the reactor and is a main limitation in AnMBR implementation.

Over the past year and a half, chemical engineering undergraduates **Abigail Salberg** and **Tyler Bertsch** have worked in the lab of Ryan Hansen, associate professor of chemical engineering, and in collaboration with Prathap Parameswaran, associate professor of civil engineering, and his

lab to develop new methods to study membrane biofouling. They have established a novel technique to remove, isolate and identify microbes that initiate biofouling, and are advancing image analysis methods to quantitatively measure membrane biofilms. With these capabilities, the research team is working to better understand the types of microorganisms, membrane characteristics and reactor operation conditions that drive the biofouling process in order to learn how to stop it.

Both students are also using their academic research experience as a pathway toward careers in environmental engineering.

"The research I've done in Dr. Hansen's lab on membrane biofilm formation sparked my interest in wastewater systems "My involvement on this project helped me land a summer internship with Burns & McDonnell where I'm now helping design a wastewater treatment plant."

Abigail Salberg



and the roles that microbes play in them. My involvement on this project helped me land a summer internship with Burns & McDonnell where I'm now helping design a wastewater treatment plant. These combined experiences give me confidence that an exciting career in water systems is in my future!" Salberg said.

Salberg and Bertsch were supported through the National Science Foundation Research Experiences for Undergraduates program.

AUTONOMOUS PLANT FACTORIES

Patrick Hinkel worked as an undergraduate researcher in the research group of Davood Pourkargar, assistant professor of chemical engineering. His research is focused on optimal control of integrated plant factories and renewable energy systems.

Specifically, Hinkel developed a computational modeling and an optimization-based nonlinear output feedback control framework for zero-waste integrated semi-closed greenhouse systems and residential buildings with renewable energy resources. His computational modeling platform integrates the greenhouse microclimate, plant growth, residential buildings, renewable energy generation and battery storage system dynamics, describing the impact of the environmental conditions and decision variables on crop development and energy management.

The resulting model was then employed as the basis for a nonlinear control design in the presence of time-varying environmental conditions and disturbances in the manipulated inputs and measured outputs. The proposed control architecture integrates state/parameters estimation and model predictive control to optimize crop growth and operating costs through regulating greenhouse environment properties at desired conditions. Hinkel also used optimization-based methods to estimate the unmeasurable states and unknown parameters required by model predictive control using the feedback from the measurement sensors.

His work led to a first-author paper at the 2022 IEEE Conference on Control Technology and Applications and two presentations at the 2022 AIChE Annual Meeting.

GREENHOUSE GAS MITIGATION

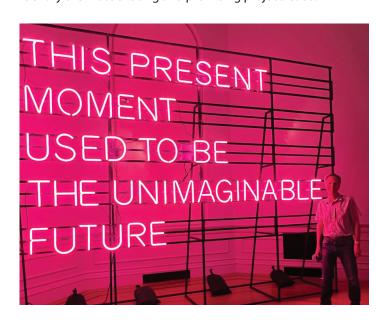
Stephanie Ma is working with Chuancheng Duan, assistant professor of chemical engineering. Ma's research focuses on understanding CO₂ reduction catalysts using in-situ diffuse reflectance infrared spectroscopy, or DRIFTS. In-situ DRIFTS was employed to open the black box of catalytic CO₂ reduction process and probe active intermediate species and main products formed at an operating temperature ranging from 100°C to 700°C, which helps to predict the CO₂ conversion mechanisms. The catalysts Ma has studied can also be used for building fuel cells and electrolyzers, so this research could help Kansas to further deploy and economically use cheaper renewable power, decrease power dependence on nonrenewable fuels and provide stronger economic incentives to use carbon capture technologies. She was selected to represent K-State to participate in the 2022 Kansas Undergraduate Research Days at the Capitol to present her research achievements.

6 | Chemical Engineering

EDGAR RETURNS TO K-STATE

James Edgar, Tom H. Barrett University Faculty Chair in Chemical Engineering and university distinguished professor, is returning to K-State after serving as a manager of the Electronic and Photonic Materials Program at the National Science Foundation for three years.

During his time at NSF, Edgar helped to evaluate research and education proposals submitted by college faculty from across the United States in the fields of materials science and engineering, chemistry, physics, chemical engineering and electrical engineering. In his role, Edgar would recruit subjectmatter experts to assist in reviewing the proposals and to identify the most exciting and promising project leads.



"Working at NSF was a tremendous opportunity to learn about cutting-edge research on new materials being developed for exciting fields like microelectronics, optoelectronic, photovoltaics and quantum computing," Edgar said. "The most gratifying aspect of the position was to mentor and support faculty in the early stages of their careers. Their fresh perspectives, new approaches to research and teaching, and tremendous enthusiasm and energy give me great hope for the future of science and technology."

Edgar also gained a new appreciation for what makes a successful proposal.

"The ability to communicate your ideas, to be able to explain why your project will make an impact, really is key," he said.

"Some researchers are clearly experts in very advanced and specialized topics, but they have difficulty explaining the importance or relevance of their work even to someone technically competent in an adjacent field."

Edgar said the best proposals have a hypothesis, a specific expectation of what the research will reveal, as opposed to simply trying different experiments just to see what happens.

"Projects should have some risk, where there is a chance that the outcome could be amazing, but there is also a chance that nothing unexpectedly insightful is revealed – which means that

> "The ability to communicate your ideas, to be able to explain why your project will make an impact, really is key."

> > - JAMES EDGAR

a good risk mitigation plan is also important," he said. "Finally, it helps to present the proposal in terms of an emotionally engaging story, rather than something that reads like a recipe or to-do list."

While located in Alexandria, Virginia, Edgar took advantage of the opportunity to tour the museums of the Smithsonian Institution in nearby Washington, D.C.

"Visiting museums in D.C. was a great way to learn about our country's history, including from African American and Native American perspectives," Edgar said. "The Museum of Natural History provides a fascinating look at the huge varieties of life that have existed on earth. My favorite museums were the art museums, whose artists' creativity is as impressive as it is inspiring."

Edgar is glad to be back at K-State and looking forward to resuming teaching and working with students after years away from the classroom.

"I believe my time at NSF has given me new insight that would be useful to engineers just starting their careers, and I am excited and eager to be more involved in my research on the crystal growth of boron containing compounds."

This fall, Edgar will be teaching Chemical Engineering Thermodynamics.

CONGRATULATIONS 2021-2022 GRADUATES

Summer/Fall 2021









Spring 2022















Paige Houchen















Pearson





James Radenberg







Not pictured: Summer/Fall 2021, Rida Alabdullah, Saeed Alqhamdi, Ahmad Bashaikh, Gabriel McFall, Michael Saverino; Spring 2022, Brittany Bahr, Dylan Brenneman, Josh Habiqer, Alexander Miller, David Pena, Rachel Price, Zachary Thurston, Joshua Weber, Russell Wharton

8 | Chemical Engineering Chem-E News 2022 9

Department News

Hansen awarded patent for hydrogel membrane research



Ryan Hansen, associate professor of chemical engineering, was part of a team of three honored by the Office of the Vice President for Research and K-State Innovation Partners after being awarded a U.S. patent during the first quarter of 2022.

Hansen, who is also a Steve Hsu Keystone research scholar and Warren and Gisela Kennedy Keystone research scholar, joined Thomas Platt, assistant professor in biology and then-postdoctoral fellow Andre Jacobus van der Vlies in applying for the awarded patent, "Hydrogel Membrane and Methods for Selective Retrieval of Microbial Targets."

"It's a great accomplishment to have one's research recognized by a patent issued from the U.S. Patent and Trademark Office," said David Rosowsky, vice president for research. "I congratulate these current and former K-State researchers on this recognition and this important next step in the commercialization process."

K-State Innovation Partners strives to assist K-State's faculty, staff and students in developing and protecting their discoveries and inventions to return the greatest advantage to the creators, K-State and the general public.

Anthony named department head of chemical engineering



Jennifer Anthony, Wayne and Barbara Harms — Carl and Mary Ice Keystone research scholar and associate professor at Kansas State University, has been named head of the Tim Taylor Department of Chemical Engineering. She also holds the title of Tim Taylor chair in chemical engineering.

The announcement was made in June by Matt O'Keefe, dean of the Carl R. Ice College of Engineering.

Anthony had been serving as the interim head of the department since July 2019.

"Jennifer Anthony has done a tremendous job leading the department in an interim capacity the last three years,"

O'Keefe said. "I am confident her leadership will foster ongoing collaborations and grow the department's reputation of excellence in teaching, research and service, and most importantly, student success."

Anthony received her bachelor's degree in chemical engineering with an environmental program emphasis from the University of Colorado at Boulder, and completed both her master's and doctoral degrees at the University of Notre Dame. She was a postdoctoral scholar at the California Institute of Technology before joining the K-State faculty in 2005.

Her research primarily involves novel materials such as nanoporous molecular sieves and ionic liquids with a focus on the role of solvent in molecularly designing materials for specific applications. These efforts include a variety of experimental methods designed to aid understanding of their fundamental properties and to investigate potential applications for the materials.

Anthony has co-authored more than 25 publications, together receiving more than 3,000 citations. She and her research group have given more than 70 presentations at local, national and international conferences.

She replaces James Edgar, university distinguished professor, who spent three years as a program manager at the National Science Foundation, Division of Materials Research, Electronic and Photonic Materials program in Alexandria, Virginia. Edgar returned to K-State as a faculty member in the department following his NSF appointment.

Schlup retires after 38 years



After 38 years of teaching, research and service with the Tim Taylor Department of Chemical Engineering, Professor **John R. Schlup** retired in May 2022.

Schlup received dual
Bachelor of Science degrees
in chemical engineering
and chemistry from Kansas
State University and a
doctorate in chemical
engineering from the
California Institute of

Technology. He worked in process research and development with Corning Glass Works for more than two years following his graduate work before returning to K-State to teach materials science and engineering courses while developing a research program emphasizing materials processing. His teaching focused on materials science and engineering service courses, and he has taught 17 different graduate and undergraduate courses, including blended courses for online delivery.

Schlup served on the internal advisory board for the Bioprocessing Industrial Value-Added Program (BIVAP) and on the advisory board for the department of chemistry at K-State. He was recognized with the Segebrecht Distinguished Faculty Achievement Award for 2017 as well as a College of Engineering Multicultural Engineering Program Faculty Engagement Award the same year.

Between 1999 and 2018, Schlup worked with departmental curriculum matters and guided the department's assessment/accreditation process. Since fall 2018, he has served as the graduate program coordinator for the department. He also served as an ABET PEV for chemical engineering programs since 2012.

Schlup has dedicated his career to the betterment of chemical engineering undergraduate and graduate education, both at K-State as well as the broader profession. The department sincerely thanks him for his 38 years of service, his dedication to its program, his experienced insight and his encouraging mentoring of faculty and students alike.

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10 | Chemical Engineering Chem-E News 2022 | 11



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Evan Kalis, senior in biomedical engineering, and Yuriana Arroyo-Bocanegra, senior in chemical engineering, collaborate in a chemical engineering lab.

