

# CHEM-E NEWS





# CHEM-E NEWS

Summer 2022

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**KANSAS STATE**  
UNIVERSITY

Tim Taylor Department of  
Chemical Engineering

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## 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](mailto: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.

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*

## 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 Staats*



*Erin Pearson*



## Richard G. Akins Student Service Award

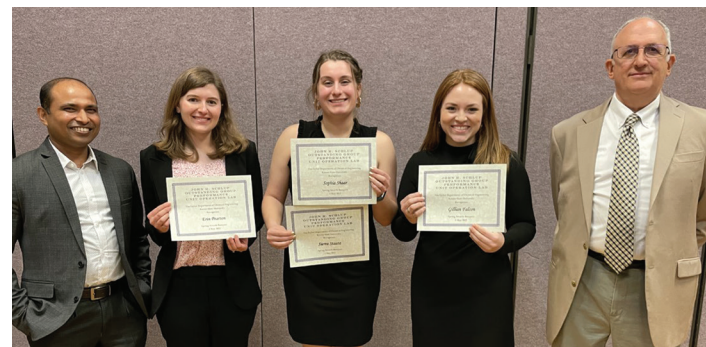
Made possible by Richard G. Akins, this award recognizes students who provide an exceptional level of service to their fellow students and the department

*Ben Proffitt*

## 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 Staats*



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



## 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*

## 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 Staats

### 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

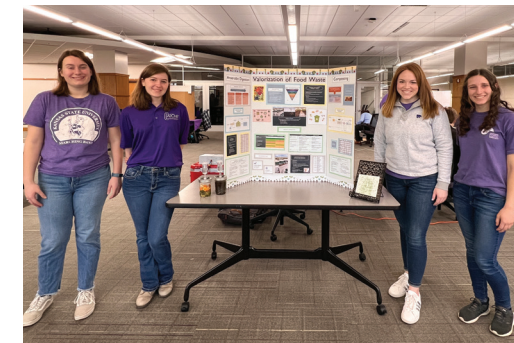
Javen McCreight

Raymond Nellis

Carter Oeding

Erin Pearson

Sierra Staats



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



From left, Sophia Shaar, Sierra Staats, 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 Staats, 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





# UNDERGRADUATE RESEARCH

## BIOFOULING RESEARCH

Anaerobic microorganisms can be used to break down waste and are implemented in anaerobic 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 CO<sub>2</sub> reduction catalysts using in-situ diffuse reflectance infrared spectroscopy, or DRIFTS. In-situ DRIFTS was employed to open the black box of catalytic CO<sub>2</sub> 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 CO<sub>2</sub> 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.



# 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 subject-matter 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



Natalie  
Burton



Bob  
Morris



Abdulaziz  
Alessa



Rachel  
Berland



Hallie  
Buyle



Denea  
Clark



Will  
Dalton

## Spring 2022



Grace  
Deweese



William  
Erickson



Gillian  
Falcon



Brett  
Ferguson



Ashton  
Gohman



Lilian  
Gray



AJ  
Hausser



Patrick  
Hinkel



Paige  
Houchen



Mary "Katie"  
Ketel



Javen  
McCreight



Raymond  
Nellis



Carter  
Oeding



Troy  
Parks



Erin  
Pearson



Ben  
Proffitt



James  
Radenberg



Sophia  
Shaar



Jordan  
Shook



Sierra  
Staatz

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







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*Revised August 14, 2020.*

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

