The Cain Department of Chemical Engineering

Alumni Magazine

Fall 2021, Vol. 36

LSU

Dear Alumni and Friends,

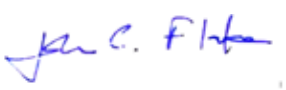
Hello from Baton Rouge! I am happy to share our annual newsletter. The 2020-2021 academic year was a challenge for everyone. Although we had a tough time with Hurricane Ida in August, this semester has brought a renewed sense of optimism. Patrick F. Taylor Hall is full of life. Students are back in class, working together, and enjoying time with each other. Senior students are accepting jobs and entering post-graduate programs. Graduate students are doing research, going to conferences, and publishing papers. These are all good signs, and I am even more optimistic about next semester.

Speaking of research, we are embarking on a new path to becoming carbon neutral by 2050. These aren't just words from our president or governor, it is a common commitment among chemical and petrochemical industry leaders in our state. Dow, BASF, Shell, and others have set the same goal—net zero CO_2 emissions by 2050. There is no doubt that this is an enormous challenge, but it is also a call to action for chemical engineers. Fortunately, LSU and Louisiana are in great positions to be world leaders in this area. Our faculty are already working on new ways to convert CO_2 to carbon products, mitigate emissions, and sequester CO_2 using energy sources without any CO_2 emissions. Louisiana is the perfect place to make carbon products from CO_2 feedstocks. Plants in Louisiana already make billion pounds of ethylene and propylene every year. We have CO_2 pipelines, hydrogen pipelines, ethylene pipelines, and all of the infrastructure needed to convert CO_2 to products like detergents, insulation, plastics, and textiles. The growth opportunities for CO_2 conversion, sequestration, and "green" or "blue" hydrogen are enormous. Consider the development of the $9.2 billion Grön Fuels complex in West Baton Rouge Parish or the recent announcement on a $4.5 billion Air Products blue hydrogen plant planned in Ascension Parish. Both of these investments are on the same scale, scope, and complexity of new automobile plants or new semiconductor fabrication sites—and this is just the beginning! Louisiana is home to hundreds of chemical plants and the conversion of these to using CO_2 feedstocks, adding processes to sequester CO_2, or generate hydrogen (without producing any CO_2) points to hundreds of billion-dollar investments over the next few decades. Are we ready? I am certain LSU ChEs will be!

Inside this newsletter, you will read about our investments in new $1 million glass distillation columns for our Dow Unit Operations Laboratory, new research projects related to CO_2 conversion, and a new class on "Sustainability in Chemical Engineering." You will also learn about some of our student successes and how donors make the difference when it comes to the quality of experiences in our department. I can't help but be proud of our students. We see their evolution from a wide-eyed freshman entering their first class to the steel-eyed confident engineer finishing "Plant Design." It doesn't happen overnight, and it isn't easy, but it is a life-changing experience—just as it has always been.

I close with a challenge to all of our alumni to go to your computer, visit lsufoundation.org, and click on "Give." I can assure you there is a student in our department who is like you when you were here. They have no idea what their future holds, but they have the drive to succeed. Make sure to put "Cain Department of Chemical Engineering" as the recipient; we'll make sure it makes a meaningful impact.

Many Thanks,
John Flake



Chair and Professor
Cain Department of Chemical Engineering

DEPARTMENT NEWS

Cain Department of Chemical Engineering Unveils Distillation Columns

The LSU Cain Department of Chemical Engineering recently completed a journey of several years with the installation of its new distillation columns. The towering structure consumes two floors of Patrick F. Taylor Hall and offers students the opportunity to work on a true commercial analog of the same equipment they will be expected to operate when they enter the workforce as chemical engineers.

"This is the largest and most advanced distillation system that I have ever seen at a university," said John Flake, chair of the Cain Department of Chemical Engineering. "We have two 6-inch diameter, 20-foot-tall packed, glass-wall columns that may be arranged in advanced configurations. Students can certainly read about distillation in a textbook and work problems, but the experience of running a steam reboiler and separating products at this scale is a much more meaningful experience. The glass walls are also very important for visualizing what is happening inside the column."

Many of the precursors for common products come through distillation columns—plastic packaging, backpacks, detergents, refrigerants, even the precursors to make LED lights, to name a few examples. This is because chemical reactions typically produce more than one product, which then needs to be separated or purified, and distillation is the most common separation process.

Broadly speaking, the unit—which is located in the Dow Unit Operations Laboratory in Patrick F. Taylor Hall—separates components, water and a series of glycols, into pure or near pure components by the differences in their vapor pressure. For example, if a mixture of 50% water and 50% glycol are fed into the unit, a stream of "very nearly" pure water is produced from the top of the tower and pure glycol from the bottom. This is accomplished by heating and vaporizing the material in the bottom of the tower and returning a portion of it back down the tower after it is cooled and condensed.

"This unit would not be out of place at a commercial pharmaceutical or specialty chemical facility that operates in the commercial world," said John Pendergast, instructor in the Cain Department of Chemical Engineering. "It is built to those specifications and design criteria. Very few students will have the ability to learn on, operate, and study the response of a facility [like the one we have here] that is very close to the unit operation of distillation that dominates the separation landscape of our industry."

Pendergast, who joined the college in 2018 following a 40-plus-year career at Dow Chemical, was the main designer of the distillation columns and put his years of expertise at Dow into this project. He previously served the company as project manager or lead process engineer on several world-scale processes and plants, and most of his career involved research into separation methods and the implementation of advanced separations that reduce energy consumption or capital consumption or both.

"The primary design criterion for the unit was/is the safety of the students and the inhabitants of PFT," Pendergast said. "The advanced features of this unit are that it can be used independently by two undergraduate groups at the same time, running realistic distillation experiments that would be seen in industry.

"In addition to that, this unit can be combined to advanced distillation sequences that are more energy efficient. The units can be used for research to study methods that improve our understanding of these advanced sequences and enable a better understanding and adoption of distillation methods that can reduce energy consumption in our industry."

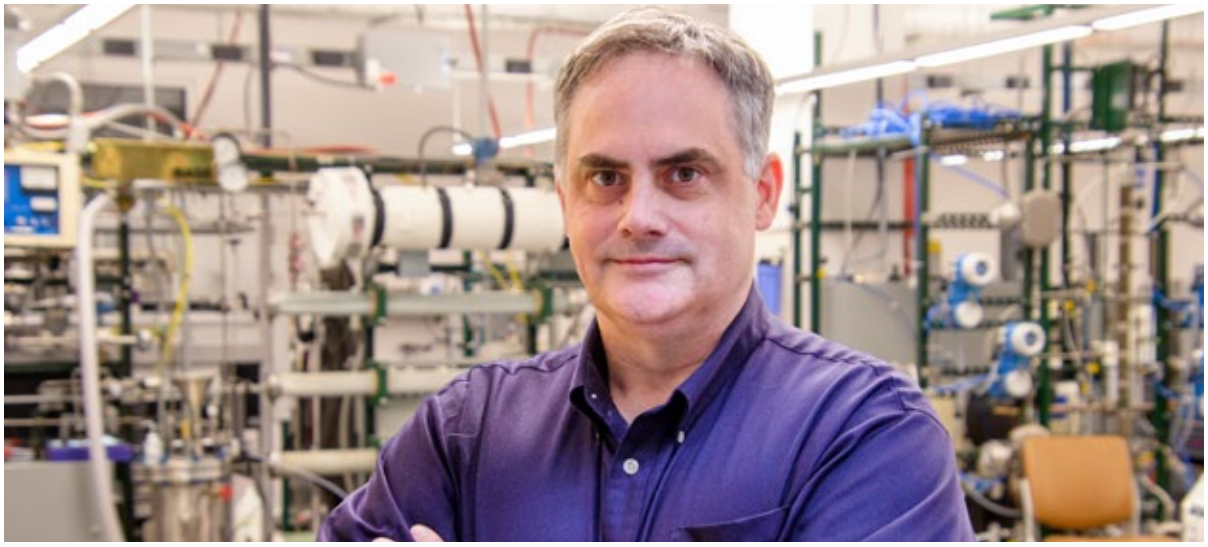
The columns were fabricated overseas by the French company Pignat, which builds educational equipment, as well as larger-scale equipment for companies like L'Oreal and Michelin. They were originally scheduled to arrive at PFT for assembly in April of this year; however, the COVID-19 pandemic contributed to delays during different stages of the process. In the end, Pignat representatives Regis Rodriguez and Mathias Fragola, along with the company's U.S. representative Harold Sheppard, were able to make their way to campus and begin final work on the unit.

"Working with an international team has its challenges, especially during COVID," said Thomas Schroeder, who oversees the operation of the columns as research specialist in the Dow Unit Operations Laboratory. "Shipping equipment to them (i.e, computers, sensors, etc.) was especially difficult, as the lockdowns [began] as we were trying to get them the equipment we purchased for the project. We had to do the [Factory Acceptance Test] over Zoom instead of in person, due to travel restrictions. That said, we maintained communication and made sure the columns were made to our specifications."

Going forward, Pendergast said the plan for the unit is to utilize the equipment in undergraduate labs this fall; develop projects that can support undergraduate and graduate research work; and seek partners from industry, as well as other sources, to gather funding for graduate research that will support research and publications that advance students at the undergraduate and graduate level.

The distillation columns were made possible, in part, by the Bert S. Turner Endowment for Excellence in Engineering Education, Valero, and other donors and individuals.

LSU, Delaware to Develop Chemical Manufacturing Processes Using CO_2 Feedstocks and Renewable Energy



Each day, many of the products we use, whether we know it or not, are produced from natural gas or crude oil using carbon- and energy-intensive processes. But what if we could make those same products using CO_2, thereby drastically reducing or even eliminating our carbon footprint?

That is the ultimate goal of a project being conducted by researchers from LSU and the University of Delaware, thanks to a four-year, $4 million grant from the National Science Foundation Established Program to Stimulate Competitive Research, or NSF EPSCOR, program.

The immediate objective for the group is to make electrolyzers that convert CO_2 into multi-carbon products more durable and efficient. A common example of an electrolyzer is one that generates hydrogen and oxygen from the electrolysis of water. This project seeks to use electricity from renewables to drive a sort of "reverse combustion reaction."

"There has been a lot of progress in CO_2 reduction over the last 15 years; we can now make valuable carbon products like ethanol and ethylene, and we can make them at high rates," said John Flake, principal investigator on the project and chair of the LSU Cain Department of Chemical Engineering.

"The problems at this stage are more practical. For example, the electrolyzer materials need to last for years, and the energy efficiency needs to be improved. The goal of our project is to accelerate the work needed to make CO_2 electrolyzers more durable and efficient. This could lead to industrial-scale CO_2 electrolysis within a decade."

Flake noted that ethylene is the most basic chemical building block used in making hundreds of products, such as plastics, detergents, and textile fibers.

"Imagine a future where detergents are made from renewable energy, water and CO_2 instead of natural gas," he said.

Joining Flake from LSU are Kevin McPeak, associate professor of chemical engineering; Orhan Kizilkaya, assistant professor at the LSU Center for Advanced Microstructures and Devices; Noemie Elgrishi, assistant professor of chemistry; and Phil Sprunger, professor of physics. From the University of Delaware are Feng Jiao, professor of chemical engineering; Yushan Yan, chair of chemical and biomolecular engineering; and Kofi Yao, assistant professor of mechanical engineering.

In addition to the researchers, more than 70 undergraduate and graduate students will be directly engaged with the work; and representatives from leading chemical manufacturers Shell, Dow, and ExxonMobil have already agreed to be involved in some capacity. Furthermore, outreach activities are planned to provide experiences related to STEM education and careers for thousands of K-12 students in Louisiana and Delaware.

"This is a great opportunity for Louisiana," Flake said. "Chemical manufacturing in the United States is a very big deal, and I think we should be thinking about the future. We already have the infrastructure (pipelines and plants to make derivatives from ethylene)...so we have a huge advantage over the rest of the world."

New Course Set to Launch on Sustainability in Chemical Engineering

by Associate Professor Kevin McPeak

I graduated from Northwestern University in 1999 with an undergraduate degree in environmental engineering. While I was very passionate about the environment, I struggled to see myself working as an environmental consultant, the job most of my peers seemed to be getting. It was near the peak of the dot-com period, and therefore, I jumped into a career as a software developer. Driven by a desire to return to physical science and engineering and ultimately impact the renewable energy field, I applied for graduate studies in chemical engineering in 2006.

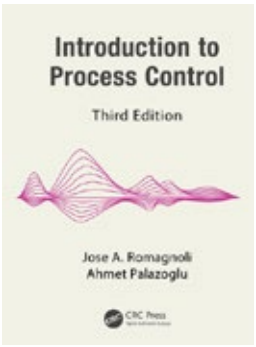
My graduate and postdoctoral studies provided me with a deep understanding of engineering principles coupled with nanoscale optics. In 2015, I started my independent research career at LSU. I built a laboratory that draws from my environmental engineering roots while leveraging my optics and chemical engineering expertise to develop light-based technologies for the 21st century. My research group is diverse in background and skill and focuses on bio-sensing, photo-driven water purification, and near-infrared photodetection applications.

Early in my teaching career at LSU, I had the pleasure of teaching a course on air pollution. I built a course centered around a group project that engaged students to collect, analyze, and form testable hypotheses based on real air quality data in the Baton Rouge and LSU areas. I intend to invoke the same spirit of hands-on learning when teaching Sustainability in Chemical Engineering. I feel strongly that the time for this course is now. I believe that this course will provide future LSU chemical engineers the background to make a difference in what will arguably be the greatest challenge of their generation.

The course (CHE 3410) will cover quantitative methods of engineering and life cycle analysis to make energy choices in a contemporary sustainability context. Students will apply the fundamental principles of thermodynamics, transport, and reaction kinetics to represent energy supply and end-use technologies.

FACULTY AWARDS & PUBLICATIONS

Professor Romagnoli Publishes Third Edition of Introduction to Process Control



The newest edition of Professor Jose Romagnoli's book, Introduction to Process Control, is available now!

Check out the details at:

https://www.routledge.com/Introduction-to-Process-Control/Romagnoli-Palazoglu/p/book/9780367367787

Chair Flake and Group Published in Journal of Power Sources

Congratulations go to Chair and Professor John Flake and his research group for their recent publication in the Journal of Power Sources. Their article, "Carbonized Metal-Organic Framework Cathodes for Secondary Lithium-Bromine Batteries," can be viewed at:

https://www.sciencedirect.com/science/article/pii/S0378775321002020.

Melvin Receives Longwell Teaching Award

The College of Engineering recently presented its Award for Instructor Excellence to three faculty members in recognition of those who make significant contributions to the early years of a student's journey through quality instruction in entry-level engineering courses.

The Award for Instructor Excellence includes a $4,500 one-time cash award and is open to all full-time LSU Engineering instructors or faculty at the rank of assistant professor or higher.

Petroleum engineering alumnus Harry Longwell established the Dean's Fund for Instructor Excellence to enhance the quality of instruction in entry-level courses in engineering disciplines.

The appointed selection committee used student success rates, departmental support and teaching philosophy as some of the metrics to evaluate this year's recipients.

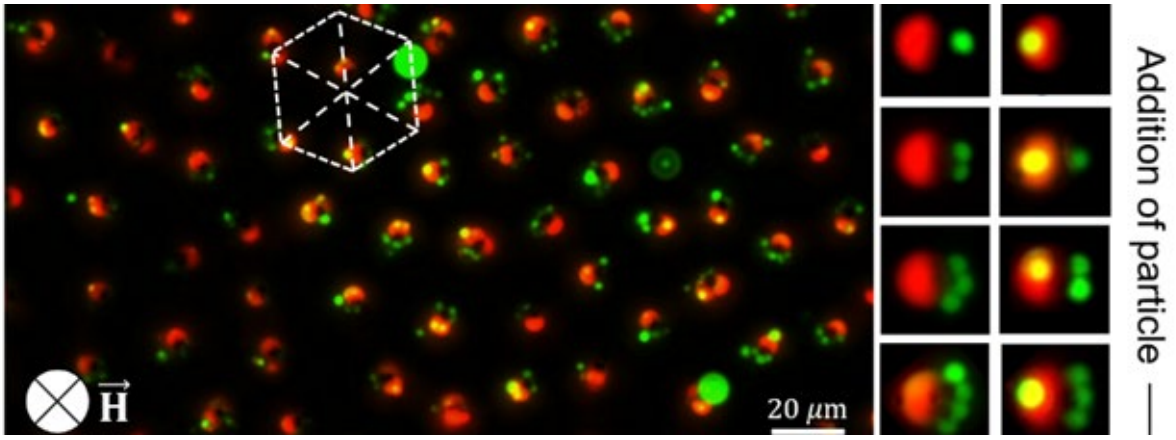
This year's recipients are:

Patti Aymond—Instructor,
-Division of Computer Science and Engineering

Adam Melvin—Associate Professor,
-Cain Department of Chemical Engineering

Ipsita Gupta—Assistant Professor,
-Craft & Hawkins Department of Petroleum Engineering

NSF Awards Bharti for Third Time in Past Year



For the third time in the past year, LSU Chemical Engineering Professor Bhuvnesh Bharti has received an award from the National Science Foundation. This time, it's a three-year award of $296,000 for his project, "Magnetic Interactions for Selective Assembly and Reconfiguration of Colloids," which could result in a change to the way we assemble structures, particularly through 3D printing.

"It's a great feeling of pride and honor to receive three NSF awards in the past year," Bharti said. "This shows that NSF recognizes, appreciates, and sees merit in the ideas proposed by LSU and my group. While the awards were made in the past year, my group has been working tirelessly on these topics for the last four years, and it is great to see fruitful outcomes of our efforts."

This project builds on previous work by Bharti and his group to program the interlinking of tiny particles—comparable to the size of a bacteria or virus—in liquid using magnetic fields. The new NSF award allows them to take their idea further by enabling the development of a new methodology of synthesizing materials using nano and microparticles and designing microrobots that can print polymeric structures in liquid.

It sounds interesting, but what does it all mean? "Colloidal self-assembly is a fascinating research topic," said Ahmed Al Harraq, a third-year PhD student working on the project in the Bharti Research Group. "In our lab, we take assembly problems and we increase their potential, literally, by exposing particles to electromagnetic fields. The results we get are often far from trivial and that goes to show how working at the interface of different science domains shows new avenues for discoveries and engineering."

"The particle-binding technique proposed here may provide a route to assemble structures that currently require complex synthetic processes," Bharti said. "For example, one of the goals of the project is to develop unique micron-sized particle structures that can swim in liquid and polymerize the liquid along their path. This simple method may allow us to develop a new 3D-printing technique where instead of using expensive printers, we may use nanoparticles to form structures using a simple magnet."

One other aspect of the award is that it gives Bharti the opportunity to work with students at the Louisiana School for the Visually Impaired—teaching them the importance of designing materials and their role in everyday life—and Baton Rouge Community College.

"I have long been involved with BRCC students," Bharti said. "In the past few years, I've visited BRCC many times and recruited students to work in my lab. The goal here is to expose the students at BRCC to research opportunities available at LSU, such that they consider transferring from the community college to LSU. The project will involve two undergraduate students, one of which will be hired from BRCC."

Plaisance Receives Prestigious DOE Early Career Award

LSU Chemical Engineering Assistant Professor Craig Plaisance was recently named one of 83 scientists—51 junior faculty at universities and 32 researchers at national labs—around the country to receive the U.S. Department of Energy's Early Career Research Program award.

The grant is $150,000 per year to be distributed over five years, covering salary and research expenses. Awardees were selected based on peer review by outside scientific experts.

Plaisance's funded project is titled, "Development of an Integrated Multiscale Methodology for Simulating Electrocatalysis at the Metal Oxide-Electrolyte Interface." Its outcome would allow researchers to accurately simulate how electrocatalysts carry out important reactions, such as oxygen evolution and carbon dioxide reduction. This would, in turn, give insight into how these catalysts work and what currently limits their performance. That information could then be used to improve these catalysts so they find widespread use in applications such as the storage of intermittent renewable energy and reduction of carbon dioxide emissions.

"Current electrocatalysts for oxygen evolution and CO_2 reduction suffer from low efficiency," Plaisance said. "In order to improve these catalysts, we need to understand how they work, and more importantly, what limits their performance. Current simulation methods are either not accurate enough to account for the interactions between the atoms and molecules [at the electrochemical interface] or they are too expensive to explore the millions of dynamical molecular configurations of this interface.

"The method we will develop will be both accurate and inexpensive. This is possible because much of the information in the accurate simulations is redundant and is inefficiently recomputed over and over. For example, 99% of the electronic structure of a single water molecule is the same no matter where that water molecule is and what surrounds it. Our strategy is to identify that 99%, compute it only once, and then spend our effort computing the remaining 1% that accounts for the dynamical interactions."

Plaisance acknowledges that this award will have a profound effect on his career going forward in terms of the recognition it will bring him within the catalysis and electrocatalysis communities. At the same time, he is mindful of the time and work it has taken to reach this level of achievement.

"I think a big thing that helped me win this award is that I approach science from a perspective of learning and thinking about things instead of short-term productivity," Plaisance said. "I think there is a lot of pressure, especially for young scientists, to focus on productivity, which leaves less time for one to learn new things and think creatively about the problems one is facing. I developed the ideas that went into this proposal over the past 15 years through what seemed at the time to be useless pondering and tinkering. But it is these things that allow you to think outside the box and develop new ways of looking at problems that no one else has thought of."

"Another big part of me winning this [award] was my time as a postdoc in Germany. At one of the lowest points in my career, Professor Karsten Reuter (director of the Theory department at the Fritz Haber Institute in Berlin) took me on as a postdoc at the Technical University of Munich. Professor Reuter is one of the world leaders in multiscale modeling of materials, and during the three years spent in his group, I was exposed to countless new ideas, many of which inspired parts of this proposal."

Joshi Elected International Member of NAE

Adjunct Professor J.B. Joshi has been elected as an International Member of the National Academy of Engineering (NAE).

Election to the NAE is among the highest professional distinctions accorded to an engineer. Academy membership honors those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature" and to "the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education." Election of new NAE members is the culmination of a year-long process. The ballot is set in December, and the final vote for membership occurs during January.

Joshi was elected for contributions in rational design of multiphase chemical process equipment and leadership in shaping the Indian chemical industry.

Nandakumar and Romagnoli Ranked Among World's Best Engineering Faculty by Stanford University

In a study conducted by Stanford University scholars and published in PLOS Biology Journal, two LSU Chemical Engineering faculty were listed as some of the world's leading academics in their respective fields—Professors. Krishnaswamy Nandakumar and Jose Romagnoli.

To evaluate scholars' academic performance, the authors used a total of six citation-related criteria, which were combined to determine a single measure, the "composite citation index." Overall, 159,684 of the top scholars—representing the top 2% globally—from the natural sciences and medicine; as well as social sciences such as psychology, education, and economics; were ranked. All ratings reflect the scholars' career-long citation impact; only citations in refereed journals are considered.

STUDENT NEWS

Because They're Worth It: LSU BE, ChE Students Intern with L'Oréal Cosmetics

LSU Chemical Engineering senior Ololade "Lola" Adeola is interning with L'Oréal, though her summer internship is taking place at the L'Oréal Research and Innovation facility in Clark, New Jersey.

L'Oréal is the world's largest cosmetics company that develops products concentrating on hair color, hair care, skin care, sun protection, make-up, and perfume. The company, founded in 1909 by Eugene Schueller in Paris, sees billions of dollars in revenue each year. Some of the company's subsidiaries are Lancôme, Maybelline, Garnier, Urban Decay, Yves Saint Laurent, Prada, and more.

Over the years, L'Oréal has committed to creating less waste, managing water sustainability, fighting climate change, respecting biodiversity, preserving natural resources, foregoing animal testing, and investing in nature.

L'Oréal NLR is the company's largest global manufacturing plant. The facility is one of five in North America, with its 450 employees producing more than 250 million color cosmetics annually. The 800,000-square-foot facility uses a nearby hydroelectric plant for its energy and, in 2017, installed a 3,528-panel solar array that provides the plant with 10% of its power. The plant has also attained a 100% loowaste recovery rate, meaning nothing is sent to a landfill.
Adeola has always had an interest in the cosmetics industry and is working on a makeup remover formula that is more effective and eco-friendly.

"This has been one of the best internship experiences I've had thus far," she said. "I'm innovating a makeup remover formula to increase the efficacy of the removal of makeup while sticking to ingredients committed to protecting the environment and enhancing sustainability."

Adeola, who is from Baton Rouge, wanted to apply for an internship with any cosmetics company at first but said L'Oréal's dedication to protecting the environment was a huge attraction.

"I was really drawn to L'Oréal after learning the history, mission, and vision of the company," she said. "I've already been inspired just in the past few weeks of working here. I've modified my daily practices. Instead of buying multiple plastic water bottles, I've switched to using a canteen. I'm more mindful of my plastic and paper use now."

Over the past year, Adeola, who is also a biology major, has served as an LSU Thermodynamics student instructor and tutor, as well as a L'Oréal USA 2020 Diverse Future Leader.

"As an SI and tutor, I enjoy communicating scientific content to those with little knowledge on the subject matter," she said. "Specific expertise includes mentoring black and minority students in STEM, collaboration and team building on various group projects, and teaching complex engineering concepts to students who struggle with the subject matter."

In 2020, Adeola was one of 50 candidates chosen from 400 to participate in the inaugural L'Oréal USA Diverse Future Leaders Sophomore Fellowship, where L'Oréal develops a unique community of diverse students from across the U.S. and provides them with access, education, and mentorship within the business world so they may become future leaders of the corporate world.

Lucky for the cosmetics world, Adeola plans to work in the cosmetics industry after graduating.

"Hopefully I'll work full-time for L'Oréal," she said. "I truly enjoy what I'm doing and can't see myself working in any other field."

Luis Briceno-Mena & Gokul Venugopalan Published in Patterns

Congratulations to PhD students Luis Briceno-Mena (lead author) and Gokul Venugopalan on their recent publication, “Machine Learning for Guiding High-Temperature PEM Fuel Cells with Greater Power Density,” in Patterns (Cell Press). This work combined experiments with modeling and data analysis tools to build a framework for the study and development of new high-temperature proton electrolyte membrane fuel cells for vehicle transportation. The framework employed machine-learning tools (e.g., support vector regression, dimension reduction, and clustering) that seamlessly linked materials characteristics with fuel cell device performance, allowing for the accelerated discovery of material property attributes and fuel cell operating parameters that achieve greater power density while concurrently addressing costs.

Access the full article at: https://www.cell.com/patterns/fulltext/S2666-3899(20)30257-9?fbclid=IwAR35FNG0o-0ZtE9jK0CakMJ1yPrq16Sjx16bY2ZmbsAzQqDBtAd-O0fyy-itg.

ChE PhD Candidate Subarna Kole Published in the Journal of Materials Chemistry A

Subarna Kole’s recent article, "Bipolar Membrane Polarization Behavior With Systematically Varied Interfacial Areas in the Junction Region," was published in the Journal of Materials Chemistry A. Bipolar membranes are electrolyte separators used in electrochemical water treatment, energy conversion, and chemical manufacturing (e.g., electrodialysis, unitized regenerative fuel cells, and carbon dioxide electrolyzers).

Kole's work revealed that a 2x increase in interfacial area in the bipolar junction region significantly improved the energy efficiency of water-splitting in bipolar membranes. This is the first report of bipolar membranes prepared from alkaline stable polymers and all-perfluorinated polymers, the latter being important for membrane cleaning with chlorine solutions. The project was sponsored by NSF and included co-authors from the National Renewable Energy Laboratory (NREL).

Full article available at: https://pubs.rsc.org/en/Content/ArticleLanding/2021/TA/D0TA-10602J?fbclid=IwAR3hIGaj0oJmbfcoMtzC-qvXf-7ceivqM-5x6egW_mYRIaDdkY0wMiKcLrfQ#!divAbstract.

LSU HSSR Program Participants Place at Competitions

In the summer of 2020, 18 high schoolers from across South Louisiana participated in the LSU College of Engineering High School Summer Research (HSSR) program created by Chemical Engineering Associate Professor Adam Melvin, with help from Recruiting and Outreach Manager Andy Osborn. Though doing the program virtually was a challenge this past year, two students in particular were able to excel and go on to present their work at fairs and competitions.

Baton Rouge Magnet High School sophomore Kalina Namikas, who was mentored by LSU Biological Engineering Assistant Professor Kevin Hoffseth, created a program that would mimic the structure of bone and could be used as a model to show how different medicines affect it.

"The structure of bone is affected by lots of different factors, such as age, gender, and genetics," Namikas said. "It was based on parameters and info that I found in research. I put those into the program, where I can change the parameters. So, if I know how medicine affects the parameters, we can see how it would affect the bone structure."

Namikas did an HSSR poster presentation in July via Zoom, then went on to the Junior Science and Humanities Symposium (JSHS) in January 2021, where she placed third. She also presented her work at the Regional Science Fair, qualifying for the Regeneron International Science and Engineering Fair (ISEF), which will take place at the end of May.

Namikas, who is interested in biology, said, "The HSSR program definitely introduced me to how biology is involved in biological engineering. My dream job would be to work for a big organization like the World Health Organization (WHO)."

Another student, St. Joseph's Academy junior Alexis Harvey, placed second in the HSSR program for her project under LSU Mechanical Engineering Assistant Professor Shyam Menon titled, "Shock-wave-Induced Droplet Breakup," which considers fuel droplets in an oxidizing environment and uses computational fluid dynamics simulations to characterize ignition and combustion processes resulting from shock-induced droplet breakup.

"An example of this is when jets come into contact with rain drops in the air or when rotating detonation engines ignite and combust, which is how they operate," Harvey said.

Harvey presented her project at the SJA Science Fair, where she placed first in the Embedded Systems division. She then went to regionals and placed first in her division. Her project is currently being judged at the state fair-level. Harvey also presented at the Louisiana Symposium Fair, finishing fourth in the finals, and will now attend the nationals in early April, which will be a four-day Zoom event. She was also excited to receive the American Meteorologist Society Award.

Harvey will again participate in the HSSR program at LSU this summer and continue her work from last year, though she will make variations on her project.

"HSSR has been an amazing opportunity," she said. "My favorite part about HSSR was watching the different steps unfold. As I did my project, I did three series of my project. Just being able to go from the different steps to creating a regular, simulated tube to a shock tube to actually analyzing a droplet within a shock tube was really amazing, and I can't wait to create a real shock tube this summer with the HSSR program."

Melvin said that doing the HSSR program virtually this year was challenging, since the students were unable to work in the labs, but there is an advantage. "I can honestly say that the success of the 2020 cohort was strongly based on the mentors finding ways for the HSSR students to still be engaged in research, even in a remote setting," he said. "The college was also very supportive of our efforts and worked with the students and mentors to get them access to virtual machines and/or software needed to continue the projects. One benefit to what we learned with the virtual research in 2020 is that some projects that are more theoretical/computational in nature can be performed remotely. This could allow for students all across Louisiana to participate in the program, not just the ones who live close to LSU."

The HSSR program is an outreach initiative aimed at engaging high-achieving high school students in real research in the fields of engineering, computer science, and construction management.

Students Share Gratitude for Legacy of Generosity

Decades of consistent giving can make a profound difference for LSU students. Roy Gerard's first gift to LSU and the College of Engineering was in 1986. In 1988, he decided to begin the Gerard Family Undergraduate Scholarship Fund in Chemical Engineering, leveraging Shell Oil Company's matching gifts program, a contribution from his brother, and an IRA rollover.

Thirty-five years later, Gerard's generosity has touched alumni and students all over the world, as his endowed scholarship has grown to become the largest in the Cain Department of Chemical Engineering.

Jamie Keller is a current recipient of the Gerard Family Scholarship. She expressed her gratitude to Gerard by saying, "Your generosity is helping to make my goals a reality...I hope that one day, I too will be in a position to bring a smile to another needy student."

Gerard followed many of his family to LSU, including an uncle, three cousins, two sisters, and a brother. "It was an easy decision," he said.

Gerard earned his bachelor's in chemical engineering in 1953 and his master's in 1958. He continued toward a long and illustrious career in the energy industry, retiring in 1992 as a vice president at Shell Oil Company after 35 years. He served as the first president of Shell Saudi Petrochemical Company and managed Shell's Westhollow research center for eight years. All the while, Gerard supported students and built his endowment through consistent gifts to his family scholarship, utilizing Shell's matching funds.

In 1996, Gerard was inducted into the LSU College of Engineering Hall of Distinction, recognizing him as an LSU alumnus who has made a significant contribution to the engineering profession. His philanthropic engagement over the years has created immense opportunity for students, faculty, and other priorities within the college.

The Gerard Family Undergraduate Scholarship helps the chemical engineering department recruit top students and endears recipients to LSU. John Flake, professor and chair of the Cain Department of Chemical Engineering, sees the outcomes of Gerard's consistent generosity.

"The Gerard Family Undergraduate Scholarship has made a tremendous impact in the lives of many of our students," Flake said. "The support allows students to focus on the most difficult and time-consuming portion of their chemical engineering education without working or financial anxiety. There is no doubt in my mind that the

generous donations of Mr. Gerard will continue to impact the lives of our students for years to come."

The Gerard Family Scholarship endowment continues to gain momentum each year. Since 2014, there have been 28 recipients. Some of them have gone on to become engineers in the energy industry, graduate students, research scientists, chemical salespeople, and more.

Some of the recent recipients shared their gratitude.

- Kelly Robertson - "Receiving the Gerard Family Undergraduate Scholarship during such unprecedented and uncertain times [due to] the COVID-19 pandemic has been a blessing not only to me, but to my family as well. To comply with COVID-19 policies, my parents' business took a hit early on in the pandemic that has persisted through the following months. Because of your generosity and support for engineering students at LSU, I have been able to focus on the most important part of college, my academia, without having to worry about the financial aspect. I will always be grateful for the kindness you have shared with me and my university."

- Darby Maloch - "I have accepted a full-time job in Houston starting this summer, and I am so grateful that I am debt free due to scholarships. You helped me to make my goals a reality. Thank you, again, for believing in me and showing your support through this scholarship!"

- Gloria Alvarado - "I lived in Venezuela for the first 12 years of my life. This scholarship has helped me remain motivated and determined to reach my utmost potential in any activity I may undertake."

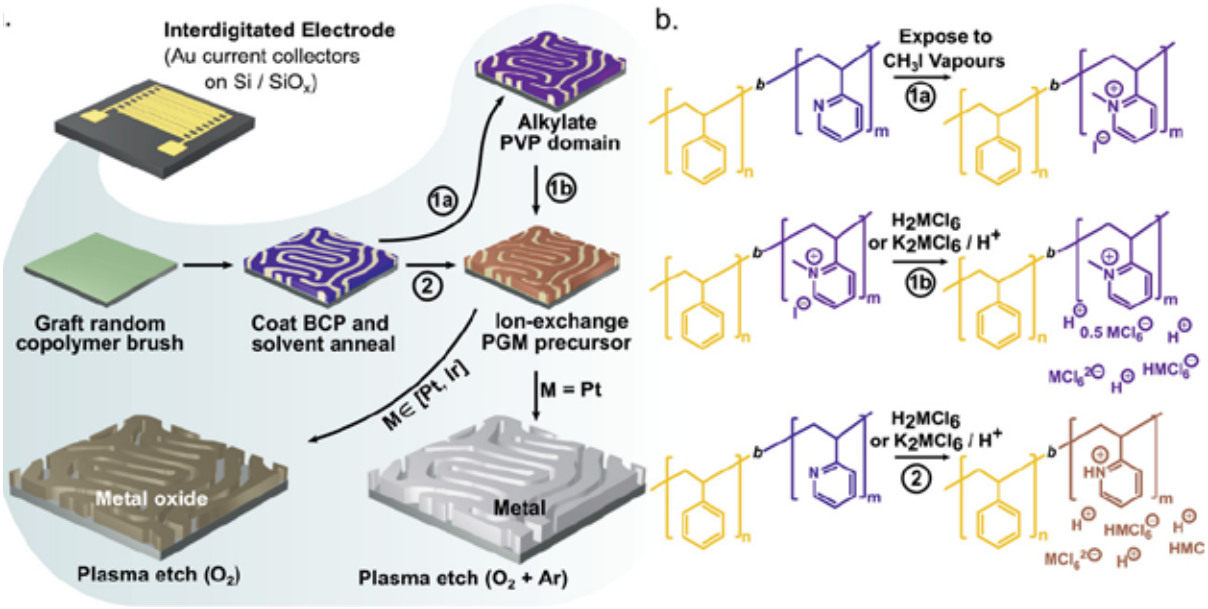
- Anna Sheffield – "It is by perfect happenstance that your scholarship ended up helping to cover my cost of schooling in the end! I feel that this is one of many signs that I truly made the right decision to pursue chemical engineering. I will remain appreciative of your support, and the support of the LSU engineering community as a whole, throughout my chemical engineering career."

- Nihal Agrawai – "Chemical engineering is an extremely tough curriculum, and I value every moment I can devote to learning."

In 2018, Gerard said, "I feel like I owe LSU. I had a scholarship there when I was in graduate school. I always felt a need to find a way to help."

Gerard was encouraged by his wife of 58 years, Minnie, to become involved with philanthropy and charitable work. Passionate about such work, Minnie, now deceased, even helped to fund and build Northwest Assistance Ministries, a Houston-area nonprofit that provides a variety of critical services to more than 100,000 people each year.

Bhattacharya Publishes Paper on Electrocatalysts Generated from Copolymer Templates



LSU Chemical Engineering PhD candidate Deepra Bhattacharya recently published his first paper as lead author in the publication Small, an academic journal dedicated to science at the nano- and microscale. He is advised by former Assistant Professor of Chemical Engineering Chris Arges.

The paper, titled "Electrolysis on a Chip with Tunable Thin Film Nanostructured PGM Electrocatalysts Generated from Self-Assembled Block Copolymer Templates," centers on Bhattacharya's research into fabricating electrocatalysts of four distinct geometries using various block copolymers as templates—three being lamellar morphology of different feature sizes and one cylindrical.

The lamellar templates produce structures that look like nanowires, and the cylindrical morphology appears as circular disks. The templated platinum and irdium oxide electrocatalysts—characterized by the Advanced Photon Source synchrotron facility at Argonne National Laboratory, in addition to LSU's Shared Instrumentation Facility, Nanofabrication Facility, and the Center for Advanced Microstructures and Devices (CAMD)—were found to have near-flawless nanostructure over several square-millimeters of area. The performance of these electrocatalysts was then assessed by examining their propensity to oxidize and evolve hydrogen gas in a lab-on-a-chip setup analogous to an electrochemical hydrogen pump, which is a commercial device used for hydrogen separations and compression.

What Bhattacharya and other Arges Lab group members found were several exciting research avenues and a more efficient experimental approach.

"Electrochemical energy conversion devices, such as fuel cells and electrolyzers, are vital technologies to transitioning to the much-coveted hydrogen economy, where fossil fuels are no longer our primary source of energy," Bhattacharya said. "This work can help achieve ambitious targets by the U.S. government to reduce greenhouse gas emissions by 50% in 2030 [over 2005 levels]. An important research priority for the fuel cell and water electrolysis community is to reduce platinum group metal (PGM) loadings within the devices through better catalyst utilization. PGMs are rare and expensive. Better electrocatalyst utilization can be achieved through nano-scale engineering of the structures and tuning electrocatalyst-electrolyte interfaces.

"We report a simple, inexpensive lab-on-a-chip experimental setup that allows for high throughput experimental analyses that relates electrocatalyst composition and nanostructure, as well as electrolyte and electrode type, to catalytic reactivity. The

lab-on-a-chip platform uses 100 times less PGM than traditional experimental setups for gas-phase fuel cell and electrolysis assessments. Conventional methods of testing such materials deploy fundamentally different experimental setups that often lead to findings that do not hold true in real-world applications or involve expensive and time-consuming tests. Our interdigitated electrode platform, which is simple, compact, and inexpensive, is similar in architecture to real-world devices and allows for quick comparative electrochemical analyses of novel materials. This platform hast the potential to substantially speed up materials research in the area and generate data for machine learning activities."

Access the full paper here.

Co-authors on the paper with Bhattacharya were Subarna Kole, chemical engineering PhD candidate at LSU, Orhan Kizilkaya, in the Center for Advanced Microstructures and Devices at LSU, Joseph Strzalka, in the X-ray Science Division at Argonne National Laboratory; Polyxeni Angelopoulou and Georgios Sakellariou, with the Department of Chemistry at the National and Kapodistrian University of Athens in Greece, Dongmei Cao, in LSU's Shared Instrument Facility and Arges.

The work was funded by the U.S. Department of Energy Office of Science, Separation Science Program.

Mangaoil Honored With 'Engaged Citizen' Distinction

Congratulations to LSU Cain Department of Chemical Engineering graduate Mae Anne Mangaoil of Baton Rouge, one of CCELL's Fall 2020 Engaged Citizens.

When reflecting on her volunteer work, Mangaoil shared the following statement.

"To me, doing service is like giving someone your extra pair of glasses so they could also see and enjoy the beauty of the world around them like you do. There is nothing more rewarding than seeing other people smile and be thankful because of you. That's why I think that it is very important for every individual in the community to be involved and be an engaged citizen."

Some of her volunteer efforts include Habitat for Humanity of Greater Baton Rouge, LSU Tigers for Autism Awareness, and LSU Office of Multicultural Affairs sponsored MLK Day of Service.

Read more about the Engaged Citizen Program at: https://www.lsu.edu/academicaffairs/ccell/stories/ecpgrad_fall2020.php.

STUDENT AWARDS

2021 ChE Awards Banquet

We held our annual ChE Awards Banquet on Thursday, April 22, 2021. Three of our faculty were finalists for the Dow Excellence in Teaching Award, Mike Benton, Krishnaswamy Nandakumar, and Craig Plaisance. The award is given to the faculty who seniors graduating in the spring and fall semesters believe was the most outstanding teacher they had during journey to their ChE BS degree. A Dow representative, Kristin Ellis, was on hand to congratulate the finalists on behalf of Dow. Benton took home the prize!

Additionally, the banquet honored several of our best and brightest students.

Those honored include:

AIChE LSU Student Chapter Senior Award
Gloria Alvarado

Chemical Engineering Junior Award
Gloria Alvarado

Jesse Coates Award
Gloria Alvarado

American Institute of Chemists Award
Henry Kantrow

Chair's Award

Jaxon Adkins
Nihal Agrawal
Nathaniel Anderson
Logan Baranowski
Madison Casabat
Roman Corripio
Alexander Faulkner
Matthew Freeburgh
Dylan Holmes
Henry Kantrow
Jaime Keller
Trent Larocca
Alyssa Lingle
Darby Maloch
Thu Nguyen
Mark Pittman
Marie Polk
Kelly Robertson
Estelle Seghers
Anna Sheffield
Molly Sides
Gabriel Smith
Rayne Torry
Jack Wei

Wetzel Award
Dedunu Herath

Fall 2020 Latin Honors and University Medalist Recipients

Raquel A. Domingos
– Cum Laude

Abigail Renee Ferrell
– Summa Cum Laude and University Medalist

Conrad H. Skinner
– Magna Cum Laude

Two ChE Students Among 2021 Ogden Honors College Graduates

One-hundred and forty-eight Ogden Honors College students graduated on Thursday, May 6, 2021. Sixty-two were awarded College Honors, LSU's highest graduation distinction, which includes the Upper Division Honors Distinction.

Among those awarded College Honors were ChE majors Henry Kantrow and Estelle Seghers. Thank you for your dedication, hard work, and determination throughout your academic career here at LSU ChE.

Henry J Kantrow,
Thesis - "Controlling the Orientation of Fluorescent Dyes Using External Electric Fields"

Estelle Elizabeth Seghers,
Thesis - "Plant-Wide Control System Proposal of Ethylene Cracking Plant Simulation"

Spring 2021 Latin Honors and University Medalist Recipients

Thomas J. Abrahams
– Magna Cum Laude

Nihal Agrawal
– Summa Cum Laude

Gloria Alvarado
– Summa Cum Laude and University Medalist

Nathaniel Anderson
– Summa Cum Laude

Melvin Paul Argrave IV
– Cum Laude

Emily Gonzales
– Magna Cum Laude

Henry Kantrow
– Summa Cum Laude and University Medalist

Jaime Keller
– Summa Cum Laude

Jacob Lagrange
– Magna Cum Laude

Darby Maloch
– Summa Cum Laude

Mark Pittman
– Summa Cum Laude

Marie Polk
– Cum Laude

Kelly Robertson
– Summa Cum Laude

Estelle Seghers
– Summa Cum Laude

Anna Sheffield
– Summa Cum Laude

ChE Senior Kelly Robertson Among Tiger Twelve Senior Recognition Class of 2021

LSU announced the Tiger Twelve Senior Recognition Class of 2021 at a ceremony on Thursday, May 6, 2021.

Since 2003, LSU has presented the Tiger Twelve honor to 12 students graduating each calendar year. Students selected as members of the Tiger Twelve are undergraduate seniors who contribute positively to the life of the campus, surrounding community, and society and who demonstrate commitment to intellectual achievement, inclusive excellence, leadership in campus life, and service. All must carry at least a 2.5 cumulative grade-point average. This year's class GPA average is 3.79.

The 12 seniors represent five LSU colleges and schools. Six of the 12 are members of the Roger Hadfield Ogden Honors College.

The Tiger Twelve Class of 2021 includes:

Samantha L. Beekman

Justin Franklin

Alaysia Jenal Johnson

Matthew Johnson

Alexander P. Landry

Nhung H. Ngo

Sarah Procopio

Kelly Robertson

Simone Sale

Brooklyn M. Squiers

Maya S. Stevenson

Nathaly Ysaccis Betancourt

ChE Summer 2020-Spring 2021 Graduates

Doctor of Philosophy in Chemical Engineering

Daniel Alexis Norena Caro
JinGyun Lee
Yan Ma
Tochukwu Ofoegbuna
Varada Menon Palakkal
Benjamin Beau Peterson
Sharif Mohammad Mizanu Rahman
Khashayar Ramezani Bajgiran
Saurin Hiren Rawal
Daniel Edward Willis
Yao Wu
Wenbo Zhu

Master of Science in Chemical Engineering

Md Ashraful Abedin
Yusheng Guo
Nathan Philip Holley
Qi Lei
Behnam Safavinia

Bachelor of Science in Chemical Engineering

Esraa Samir Hassan Abdellatif
Thomas Joseph Abrahams
Emmanuel Adedamola Adebanjo
Jaxon Cade Adkins
Nihal Agrawal
Mohamed Abdul Maje Al Balushi
Atallah Albarnawi
Gloria E. Alvarado
Nathanial R. Anderson
Fitsum Semere Areaya
Melvin Paul Argrave, IV
Logan T. Baranowski
Taurean Elyece Bennett
Gena C. Bergeron
Ryan G. Berzas
Justin David Blanchard Jr.
Joshua Blake Bourgeois
Nathan Mark Bourque
Hope Bovard
Jake Anthony Broggi
Taylor D. Brown
Lacey Renae Brugier
Matthew Donald Bryant
William Burns
David Joseph Campagna
Madison A. Casabat
Emma Campbell Chaney
Roman B. Corripio
Kyle Costanza
Kathryn Grace Craft
Jonathan P. Culivan
Connor Henry Cutrera
Landon S. Daigle
Tran Dang
Ammar Hassan Daws
Marie Claire Olivier Dekeyzer
Rachel D. Dickens
Ian Joseph Distefano
Jimmy Thanh Doan
Raquel A. Domingos
Morgan Rae Donaldson
William Dowden
Victor Charles Earl
Samuel Wilson Eaves
Aaron Wilson Faulkner
Alexander Steven Faulkner
Abigail Renee Ferrell
Matthew P. Freeburgh
Thomas Robin Golan
Emily M. Gonzales
Anagh Goswami
Leo Luca Grizzaffi
Helen Hanlon Grossman
Daniel J. Guilbeau
Maury Hales

Steven M. Haley
Marvin Hamilton
Eban Andrew Hanna
Paul Maurice Hebert
Dylan Matthew Holmes
Melissa Joy Holmes
Kha N. Huynh
David Brian Janis
Hayden Johnson
Garrett Michael Jones
Henry J. Kantrow
Jamie Lynn Keller
Cody Scott King
Jubril A. Kogas
Jacob S. Lagrange
Joseph Patterson Lane
Trent Thomas Larocca
Kevin V. Le
Parker Andrew LeBlanc
Alyssa C. Lingle
Emily Nicole Loisel
Noah Tyler Lott
Savannah Lynn Loupe
Caroline Gail Lowery
Darby L. Maloch
Mae Anne Mangaoil
Daniel R. McClure
Devin Mitchell McDowell
Andrew M. McGuire
Ashley Kaitlyn Mercer
Haley M. Newman
Charles Trong-Minh Nguyen
Thu Vo Truc Nguyen
Nicolas D. Noiset
Abdullah Ahnaf Noor
Emily Nicole Ortego
Bethany April Oubre
Schuyler J. Pablico
Patrick J. Phelan
Jonah L. Pitre
Mark Joseph Pittman
Marie Polk
Brett M. Prejean
Eric Allan Reviere
Isela Rivera-Andrade
Larry Dennis Robert, II
Kelly E. Robertson
Emma R. Roger
Anthony Rafael Salvaggio
Trey Sampson
Olivia M. Sanchez
Mason Louis Schexnaydre
Casey Lane Schibler
Eric Mathew Schindler
Estelle Elizabeth Seghers
Anna B. Sheffield
Andrew Donald Shelton
Alex Robert Sherman
Molly Elizabeth Sides
Conrad H. Skinner
Connor P. Smith
Gabriel Joseph Smith
Brandon Kyle Snyder
Bryant Soto
Allison K. Terry
Ethan M. Thibodeaux
Rayne Elizabeth Torry
Quynh-Thy Trinh
Mohammed Shaibaz Uddin
Michael Mwita Van Pelt, I
Jonathan Henry Vazquez
Bradley David Watson
Jack Y. Wei
Paige Wilson
Matthew J. Zeringue

ChE Scholarship Recipients 2020-2021

American Society of Sugar Cane Technologists Scholarship
Gloria Tan

BASF Recruitment Scholarship
Lauren Bristol
Caroline Webre

BASF Team Chemistry Scholarship
Lauren Cooke

BP Scholarship for Energy in Engineering #2
India Atkinson

Chevron Energy Leaders Scholarship in Engineering
Nahomi Arias Acosta
Elender Bourque
Jacob Carden
Joseph Dupre
Christopher Ferrier
Dedunu Herath
Paola Meneses De Faria
Keran Nguyen
Sierra Price

Clara & Frank R. Groves Sr. Engineering Scholarship
Seth Talbot

ConocoPhillips Scholarship in Engineering
India Atkinson
Adam Elkhanoufi

Earl and Maryanne Evans Scholarship for Engineering Excellence
Eva Coman

ExxonMobil Diversity Scholarship
Gloria Alvarado
Kyle Jefferson
Karina Ramirez
Michele Rua Cabrera

Gene Perdue Lowe Scholarship
Marigny Broussard
Jacob Carden
Evan Casper
Jacob Colvin
Jacob Dobson
Dedunu Herath
Taylor Kelley
Stephen Leblanc
Brennan Lovell
Dawson McCulloch
Cole McCullough
Bryce Rochelle
Christian Shamburger
Nathan Zeringue

Gerard Family Undergraduate Scholarship
Nihal Agrawal
Gloria Alvarado
Jaime Keller
Darby Maloch

Kelly Robertson
Anna Sheffield

Halliburton Scholars Program
Jourdan Cheek
Morgan Donaldson
Sarah Glass
Marian Luzier

Hargrove Foundation Scholarship
Gloria Alvarado

Leo Broering Memorial Scholarship
Abigail Ferrell

LSU Pre-Engineering Pathway Gold Seal STEM Scholarship
Brant Dos Ramos

Mable and Boykin W. Pegues Scholarship
Rachael Coates
Christopher Ferrier
Hannah Porta

Mark and Laurie Sutton Scholarship
Justin Chambers
Catherine Harper

NACME Scholarship Block Grant
Ololade Adeola
Tristan Dorgan
Brittany Williams

O. Dewitt Duncan Jr. Endowed Scholarship
Nathaniel Anderson
Olivia Arcemont
Joseph Lahaye
Mark Pittman
Estelle Seghers

Patrick F. Taylor Scholarship in Engineering
Cameron Kerley

Paul M. Horton Memorial Undergraduate Scholarship
Nahomi Arias Acosta
William Dowden
Gloria Tan
Andrew Vu

R. L. Hartman Memorial Scholarship
Ololade Adeola

Ryan D. Fontenot Scholarship
Trevor Thrasher

S&B Engineers and Constructors Scholarship
Ololade Adeola
Fitsum Areaya
Jude Aucoin
Taurean Bennett
Justin Blanchard
Janice Bourgeois
Lacey Brugier
Matthew Bryant
Kayla Carey
Emma Carpenter
Gabriela Coronel Hernandez
Kyle Costanza
Kathryn Craft
Tran Dang
Rebecca Degeneres
Tristan Dorgan
Griselda Espinoza
Abigail Ferrell
Marvin Hamilton
Terra Harris
Paul Hebert
Dylan Holmes
Natalie Hughes
Bruce Huynh
David Janis
Tyler Johnson
Victoria Johnson
Hayden Johnson
Rachel Kitchen
Jubril Kogas
Jacob Lagrange
Joseph Lahaye
Joseph Lane
Marian Luzier
Mallory Madere
Mae Mangaoil
Mason Miranda
Lauren Mistric
Anh Nguyen
Thu Nguyen
Schuyler Pablico
Nathan Penalber
Kelly Robertson
Emma Roger
Trey Sampson
Britain Saunier
Casey Schibler
Erwin Simmons
Trevor Thrasher
John Tooraen
Paige Wilson
Hongyu Yi

Scholarship for MEP Students in Chemical Engineering
Mason Miranda
Karina Ramirez

Suzanne and Jamal al-Barzinji Engineering Scholarship
Nihal Agrawal

Thomas H. Hopkins Scholarship
Evan Casper

Traditions Scholarship in Engineering
Nihal Agrawal
Darby Maloch
Estelle Seghers

W.R. Aldrich Scholarship
Michele Rua Cabrera

LSU College of Engineering

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