Department of Chemical Engineering

Spring 2022 Newsletter

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ANOTHER GREAT SEMESTER DOWN

As the Spring semester comes to a close, the Chemical Engineering Department reflects back on a successful year and looks ahead to even brighter days.

The department has much to brag about coming out of the 2022 Spring semester. For starters, Chemical Engineering was named once again the "Best Darn Major" during E-Week festivities — this makes 7 years in a row!

We also have several staff members and students that received individual awards from the university. Our advisor, Ms. Mary Daniels, received recognition for her work with students when she won the Excellence in Advising Award. Daniels also received the Wings of Kindness Award, along with fellow members of our department: Becky Asher, administrative associate, and Steven Lam, graduate student. The department also had a Derryberry Award finalist in Emily Rhoton — the Derryberry Award is the highest honor given to students at Tennessee Tech.

We would also like to recognize Dr. Stretz as she enters into retirement after 17 years at Tennessee Tech (see page *** for her full story).

Going forward, this upcoming fall semester sees the official start of our new concentration, Energy and the Environment. The future is certainly bright for our students!

Oh yes, and don't forget, we need your support and gifts, the CHE Department resonates because of its extraordinary alumni and students.

Inside this ISSUE

Senior Emily Rhoton "Physicianeers" Her Way To Success

Emily Rhoton is a Spring 2022 graduate of the Chemical Engineering Department. Her involvement and academic career at Tennessee Tech is something the department is very proud of. Rhoton will be enrolling as a medical student at ETSU's medical school . She plans on using her medical degree to help those in less fornuate circumstances through mission work. Emily Rhoton is nothing short of ChemE excellence, and you can read her story from TechTimes here:

As Emily Rhoton, chemical engineering '22, prepares to walk across the commencement stage at Tennessee Tech University, she already has a gauge on how she plans to fuel her passion.

With her concentration in biomolecular engineering, the Gray, Tennessee native is headed to work for Eastman Chemical Company as a process improvement chemical engineer, but this isn't the end goal for Rhoton. Medical school and her passion for mission-minded work are where her desire is. She has adopted the term "physicianeer" to describe her future plans to serve others through engineering and medicine.

"I chose chemical engineering as a pathway to medical school because I want to be able to use a different approach to medical school rather than just a chemistry or biology background," she said. "I want to be able to provide innovative and sustainable solutions to rural healthcare and public health disparities internationally and locally as well."

Before Rhoton starts her process improvement position, she will be taking time to travel to Lagro, Philippines and Kampala, Uganda.

"I will be going to help with medical mission work. I will be working with Medical Missions Outreach to set up a health care clinic that will give free health care to the medically underserved community of Lagro," she said. "In Uganda, I will be serving alongside my sister with Engineering Ministries International, where I will be able to apply both my engineering and medical experiences to serve the local community."

Knowing that she wanted a different pathway to medical school was why Rhoton chose Tech to get her degree, but the other reason was her sister. Sarah Rhoton was getting her civil engineering degree at Tech and told Emily about the university.

"We both are very passionate about eventually working together as a team and using the degrees we received from Tech to go to rural areas around the world to provide clean water access and health care," she said. "I have good ambitions for a career in the United States once I graduate, but my true passion is that mission to work with my sister."

During Emily's time at Tech, she interned for Nuclear Fuel Services and Edgewater Technical Associates while also being a student member of many organizations on campus. She also participated in two Remote Area Medical Clinics.

"The faculty here at Tech have been amazing; once I told them what I wanted to do, they always looked out for me and gave me different opportunities to help improve my academic experience and better prepare me for my future plans. So being able to learn from them and then also being able to provide my perspective on stuff has been amazing," she said.

ChE Alumnus Credits Tech Degree with Post-Grad Success

Alumnus Jared Woodward finished up his undergraduate degree at Tech in Chemical Engineering and has since graduated medical school. He gives his undergraduate degree credit for prepping him for medical school. Read his post-graduation story below.

"I started at Tennessee Tech in 2011 with the idea that I might want to go to medical school. However, I had no idea if it was actually realistic that I could get into medical school. I was a decent student in high school, but I went to a small rural high school and felt quite unprepared for college. Because I was not sure if I could actually get accepted, I wanted to make sure I had a good backup plan in the event that I failed to matriculate into a medical school. I eventually realized that I could complete almost all of the "premed" requirements through the chemical engineering degree program at Tennessee Tech. With a chemical engineering degree, if I failed to get accepted into a medical school, I could still use my undergraduate degree to find a good job. Other traditional premed degrees like chemistry or biology do not leave you with as robust job opportunities as chemical engineering, should you fail to matriculate into medical school.

"After completing chemical engineering at Tennessee Tech, I went to the University of Tennessee and got an MS in pharmacology prior to starting medical school at the University of Tennessee, where I earned my MD degree thereafter. I am now a second-year resident in diagnostic radiology at the Medical University of South Carolina in Charleston, South Carolina.

"They say medical school is like drinking through a firehose. I think those who studied engineering prior to starting medical school were somewhat better prepared for the sheer volume of information that was thrown at them, especially at the beginning of medical school.

"My background in chemical engineering has helped me as a physician in ways that I never expected. In particular, my background in fluid dynamics and mass transfer helped me better understand the physics related to the ventilator when I was working in the ICU during the delta surge of Covid-19. Ventilators are much more complicated than you might think! I am just starting my dedicated training in radiology, but I expect the physics I learned at Tennessee tech to continue to pay dividends as I learn radiology physics in the coming years."

Department Staff Awarded at Celebration of Excellence

Tennessee Tech honored several students, faculty and staff at the university's annual Celebration of Excellence on May 2. The event paid tribute to those individuals who have demonstrated hard work and dedication to always putting students first this past year.

Pictured left to right: Mary Daniels, Steven Lam, Emily Rhoton (Derryberry Award finalist) and Becky Asher

Several award recipients were from the College of Engineering.

Mary Daniels, an Academic Advisor in the College of Engineering, was presented with the Excellence in Advising Award. In her nomination, one supporter said, "She is always available and gives the best advice. No matter the problem, I know I can always call Mary to work through the possibilities. She has helped me accomplish so many things. Without Mary as my advisor, my college path would have been filled with significantly more bumps."

Daniels was also among three engineering recipients of the Wings of Kindness Award. Established in 2019 by Tech First Lady Kari Oldham, the Wings of Kindness initiative recognizes the university's values, work ethic and culture of kindness. Becky Asher, an administrative associate in the chemical engineering department, and Steven Lam, a chemical engineering graduate student, also received Wings of Kindness Awards.

Dr. Arce Receives 2022 Scholar-Mentor Award

Since joining Tennessee Tech 20 years ago, Pedro Arce, professor and past chair of the department of chemical engineering, has personally mentored 47 undergraduate students, 27 master of science students, 22 doctoral students, 17 students with postdoctoral/special projects, and nine colleagues, as well as assisting his students in earning 57 awards. With his students and collaborators, Arce has documented his scholarly contribution in more than 150 products including journal, proceeding, book chapter, and intellectual property releases. With such a track record, it's little surprise that he has been named Tech's 2022 Scholar-Mentor Award winner.

This annual award honors a faculty member who displays outstanding mentorship, integrating scholarship, research and teaching excellence.

"When you're honored by a committee of peers – and this is one of the wonderful characteristics of this award: you're judged by eight to 10 peers, including staff members, across the university– to me, these are the most significant awards," Arce said. "It's empowering to be honored with an award when your peers recognize what you do. So, when I found out I was selected for this award, I felt extremely privileged but also grateful to all of these colleagues."

Arce's passion for mentoring came from his own experience of having a mentor while he was an undergraduate student in chemical engineering at the Universidad Nacional del Litoral in Santa Fe, Argentina. His professor, Eduardo Lombardo, had a huge impact on his college experience by not just teaching him, but guiding him to take responsibility for his own education.

"I realized that what Professor Lombardo did it was a very powerful avenue for students to really find their own way," Arce said. "I thought that, if I had an opportunity, I would like to do for my students some-

thing like what this wonderful mentor had done for me."

When Arce started teaching and mentoring students, he applied just that approach. He wanted to make sure his students were in the driver's seat of their own education and had a clear vision of what they wanted to accomplish. From the first time he meets his students, Arce starts talking to them about what they want to achieve and helping them identify the barriers to their goals. Then he helps equip the students with the tools to start dissolving those barriers.

"Like in a chemical reaction, I like to act as a catalyst of their transformation. As they realize they are able to really do these things, they develop their confidence to learn the material and apply it on their own. Thus, they become owners of their education and learning. That, to me, is the most rewarding aspect," Arce said.

His former students have gone to take leading positions in private and national organizations and several of them serve in academia with distinction in the USA and South America.

He has spearheaded the creation of the Renaissance Foundry Model, which seeks to provide a constructionistic-centered, collaborative-focused, and interdisciplinary-based approach in courses, projects, and programs to give students critical thinking, leadership, and team-based skills in what Arce calls "a new type of engineer." Arce wants to see more people in his field who are holistic, innovative, socially impactful, and have an entrepreneur mindset.

The model is named after the people of the Renaissance who were able to make huge impacts on their society and it is a product of Arce's interdisciplinary collaboration with colleagues in business, education, nursing, chemical engineering, and the Center for Assessment and Improvement of Learning from Tech. He is grateful to the university QEP program, the TBR SERS grant program, and the Steelcase and the VentureWell foundations that have provided continued support for the development and assessment.

"The reason that the renaissance innovators were able to achieve that was because they had tremendous mentors through their life and a personalized education," Arce said. "One of the reasons I came to Tennessee Tech was because I found the philosophy and focus of the university is basically centered around the student, which is one of the aspects that I always dream about, but in higher learning organizations you don't always see that. The Tennessee Tech philosophy is actually built around the students, always striving for a wonderful balance between different aspects related to teaching, research and service."

The parallelism between the population of students from rural and economical challenging regions that Tech serves and his farming community origin, from his native Argentina, was another significant factor that was attractive to him.

The Tennessee Tech Scholar-Mentor Award follows other recognitions that Arce received because of his effort on developing the Renaissance Foundry Model and the new type of engineering professional. These include several distinctions from the American Society for Engineering Education (ASEE) and the 2021 Outstanding Chemical Engineer Alum Award from his alma matter, the David Davidson School of Chemical Engineering, Purdue University. Arce feels privileged that his alma matter recognizes his educational effort that has impacted many students at Tennessee Tech, and it is only given to a selected group of its alumni.

Arce thanks J. Robby Sanders, associate professor of chemical engineering at Tech, for nominating him for the Scholar-Mentor award, as well as J. Biernacki, TTU Distinguished Faculty Fellow and professor of chemical engineering and all his former students who supported his nomination.

"You need a village to win this award. You really need to have a motivating environment, supporting colleagues, committed students and collaboration, and I believe this is one of the wonderful things about Tennessee Tech. There are extraordinary colleagues, working daily with their students to improve, document and move forward this holistic type of education," Arce said. "I'm extremely honored to be recognized by my peers here at Tennessee Tech. Thank you."

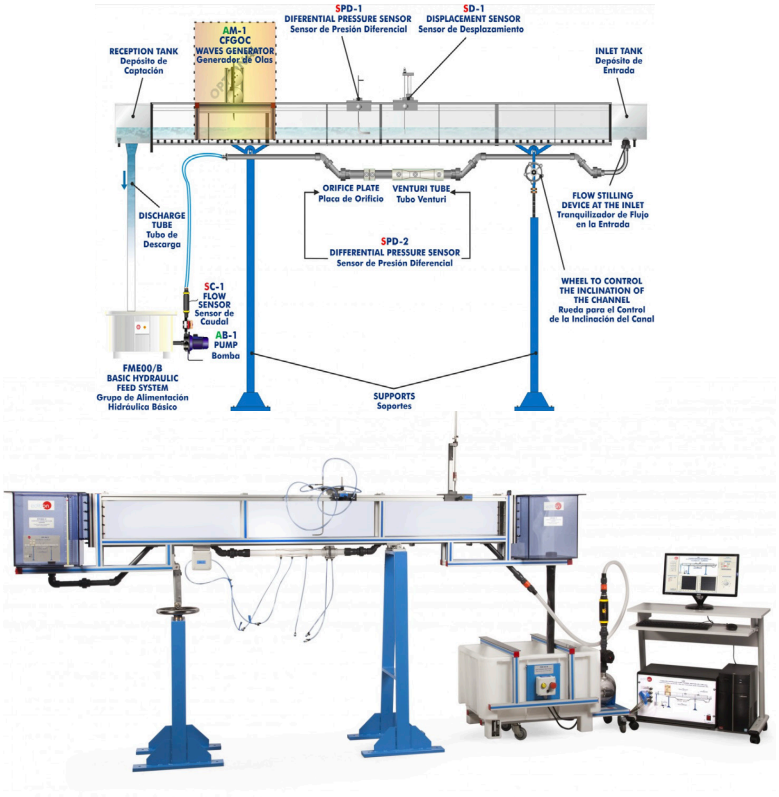
Dr. Biernacki Receives Research Award

Dr. Joseph J. Biernacki received the 2022 TTU Scholastic Research Award for his NSF funded 2021 paper entitled: "Designing 3D Printable Cementitious Materials with Gel-Forming Polymers," co-authored with his graduate student Hajar Taheri-Afarani and colleagues Edward Garboczi (National Institute of Standards and Technology) and William Carol (TTU Department of Chemistry). The primary focus of Dr. Biernacki's research group is to pioneer low cost and sustainable high-tech additive manufacturing of affordable and adequate housing using transformative construction practices. Consider, for example, what our Nation would be like if new construction materials and technologies led to innovations that made affordable, adequate housing accessible to 100% of the population by 2040. Realizing such a vision (for our society) will require collaborative research and development at the intersection of many disciplines including materials science, robotics, applied mathematics, artificial intelligence, environmental sciences, economics, business, and engineering, among others. Local and federal government agencies and humanitarian organizations have worked on the U.S. housing crisis for decades; however, current construction methods that rely on expensive materials including wood, traditional concrete and concrete block, and use labor-intensive practices, result in high production costs and long building schedules, all contributing to inaccessible, unaffordable housing to a large portion of our society. Furthermore, a domestic solution would be scalable to the global crisis that places some 1.6 billion people, including 640 million children, as being inadequately housed.

Modern cement-based materials have been optimized for production practices which utilize casting molds (formwork) to make beams, walls, arches and other building elements. Such traditional materials are not suitable for printing applications which eliminate the use of the very costly molds. To achieve printable cement-pastes, Biernacki's group has explored the use of plant-based hydrogel-forming polymers, having demonstrated controllable paste printing and identified design and selection characteristics for gel-forming polymers that produce printable cement-based pastes. Importantly, Biernacki has also forged an extended interdisciplinary collaboration between TTU and partners at two National Labs (ORNL and NIST at Gaithersburg, MD and NIST at and Boulder, CO) and two universities, Purdue and Vanderbilt. Furthermore, the nominated work and partnerships have resulted in three additional 2021 paper submissions, a total of nine related 2021 presentations (Exhibit 2 – Related Publications) and the award of prestigious beam-time on the ORNL/Spallation Neutron Source (SNS) for research completed in 2021. These socially relevant, scientifically and technologically important activities, establish TTU as a significant contributor among the international community of researchers in the field. The 2021 nomination paper is the product of Dr. Biernacki's 2017 NSF funded proposal which provided the intellectual framework for the research of the principle author Hajar Tahari-Alfarani (TTU, PhD 2021) and two additional PhD students, Babajide Onanuga and Abdul Salam Mohammad, thus supporting and impacting the broader R2 mission of the TTU.

WE NEED YOUR SUPPORT

The Department kindly asks for your donations and support. We are trying to purchase a computer controlled flow channel for the department to use. The piece of equipment is pictured here. This piece of equipment allows for the observation of water flow due to its transparent glass sides. By donating, you could help the Chemical Engineering Department to make this purchase and similar purchases in the future. Thank you in advance for your kind donations. Please see the steps and link to donate to Chemical Engineering below. Wings Up!



How to Donate to Chemical Engineering at Tech

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Step 1) Scan the QR code below or go to https://www.tntech.edu/engineering/support.php

Step 2) Choose "**Chemical Engineering**" under "What part of Engineering do you wish to support?"

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