

# Agricultural and Biological Engineering Newsletter



## Message from the Department Head

Fall 2022 is here in earnest, and Mississippi State University's campus is as beautiful as ever. Football weekends are bringing a lot of excitement, and while we're not winning all our games, the team is making a good showing overall. After the previous five semesters all experienced disruption in normal operations due to Covid-19, I am extremely thankful that this semester is essentially back to normal. MSU's and ABE's student numbers have remained

strong throughout the last two years, and now, for the first time in many years, ABE has a full complement of 18 tenure-track faculty members as of September 1, 2022. Our newest addition is Dr. Jessica Drewry, who joined ABE on that date. You can read about her and her focus areas later in this newsletter. We are very excited to have her and the talents and skills she brings with her.

You'll see a story later in this newsletter about "Water Resources Research," which is a core area of strength for our department. Over the last two years, through hiring, conducting research and extension, and revising our curricular offerings, we have identified four core areas of strength in ABE: Autonomous Agricultural Systems, Biomedical Sensors and Devices, Biomedical Materials, and Natural Resources and Environment, the last of which includes research and teaching in water resources. These core strengths span our focuses on biomedical applications and agriculture and natural resources, building on our cohesion within the department, all around the concept of Engineering and Technology for Human Well-Being.

Along these lines, our new faculty members have developed new courses that are applicable to students across this spectrum of ABE interests, and we have most recently created curriculum tracks, or emphasis areas, for both our engineering degrees. In Biomedical Engineering, our students can now choose to focus on the new

emphases of Biomedical Materials or Sensors and Devices. Furthermore, we have now received approval from the Institutes of Higher Learning to officially change the name of the Biological Engineering undergraduate and graduate degree programs to Biosystems Engineering, which better describes an engineering focus on agriculture and natural resources and is more easily differentiable from Biomedical Engineering, and it also aligns better with sister programs around the U.S. We will be developing new marketing material for this program and focusing on student recruitment to build it into an exciting and popular major. Students in Biosystems Engineering will also be able to choose to focus on new emphases in Natural Resources and Environment or Autonomous Agricultural Systems. And while the name of the major is changing, the department name will remain unchanged.

I can't complete a letter to all of you without reminding everyone what great students we have, academically and personally. It is truly an honor to teach and mentor them, and I'm certain you would hear the same thing from any of our faculty members. One of those students, who I mentioned in our last two newsletters, was Courtney Yates, who passed away just before graduating in May 2021. We recently established a scholarship in her name that will emphasize first-generation college students like her, and thanks to your help, we received about \$10,000 in donations for this within roughly two months after the fund was established. To complete the endowment of this scholarship, we need to reach \$25,000 in that fund, and I'm hopeful we can do that soon, to strike while the iron is hot, so to speak. So if you are inclined to support this effort, particularly as we approach the end of the tax year, you can give online now by clicking here: <https://tinyurl.com/33zbzhep>, or you can send a check to the MSU Foundation, Attention: Office of Annual Giving, P.O. Box 6149, Mississippi State, MS 39762. I hope all of you have a restful and rewarding holiday season.

*Alex Thomassen*



## Former Student's Change in Focus Led to Career in Water

Moss Point native Mandy Farmer has always had an interest in water, in terms of both

environmental science and the movement and dynamics of the natural resource.

She began at Mississippi State in Biological Engineering with an emphasis in biomedical engineering, but the more she learned about the natural resources and environment emphasis, the more she became intrigued.

She changed her emphasis and hasn't looked back.

"I began at MSU as a freshman in 1998. I worked in the Water Quality Lab as an undergraduate assistant under Dr. Burcham. There were only a handful of BE students in my graduating class who were pursuing a degree with the natural resources and environment emphasis; we were a pretty small, close-knit group, and that's one of the things I valued most," Farmer said.

Now she is the State Hydraulic Engineer for the Mississippi Department of Transportation, supervising the agency's Hydraulics Branch which includes seven hydraulic engineers. Together, the team is responsible for the safe and efficient design of hydraulic crossings on state highways in Mississippi. When

preparing to move into the workforce, she had never considered MDOT, but a fellow student convinced her to apply for a job there.

"I honestly never thought about the possibility that the Department of Transportation would hire a Biological Engineer. I figured they only considered Civil Engineers, but my ABE senior design partner began working in the Hydraulics Branch of the Bridge Division at MDOT while I was still in graduate school. She convinced me to apply for a job at MDOT. I was hired the day after my interview and have been there 18 years," she said.

Farmer, a licensed Professional Engineer, lives in Madison and has two kids, Joe, a senior at MSU, and Ivy Mae, a fourth grader and future MSU Bulldog.

# Our Faculty

## Our New Faculty



**DR. JESSICA DREWRY** earned a B.S. in Chemical Engineering and an M.S. in Agricultural and Biosystems Engineering from the University of Arizona. In collaboration

with researchers from Sandia National Laboratories, she developed a computational model to optimize pond designs for algal growth to support biofuels production. She then earned a Ph.D. in Biological Systems Engineering from the University of Wisconsin-Madison focused on using computational modeling to improve ventilation for dairy housing. As a postdoctoral researcher, also at the University of Wisconsin-Madison, she focused on applied research and extension in precision agriculture and machinery systems. As an Assistant Professor in ABE with a full Extension appointment focused on poultry production and precision agriculture, Dr. Drewry is excited to work with producers in Mississippi to give them the data and tools they need to make informed decisions. She is passionate about helping them find solutions to improve the economic and environmental sustainability of their operations and is also excited to train and mentor students to solve today's pressing challenges in agriculture.

## Faculty Accolades



**DR. LAUREN PRIDDY**, associate professor, is a new Access, Diversity and Inclusion Fellow. ADI Fellows are selected following an application and interview process and work at least 20 hours

per month in support of the program. ADI Fellows work to increase diversity among faculty and staff, provide additional support to first-generation, limited-income students, and enhance international student experiences.

## New Research Grants

Allen, P.J., **To, F.D.**, Bosworth, B., Albon, G., "Understanding fish sentience, electrical stunning effects, and electrical stunning capabilities in the catfish industry with application to the slaughter process," MAFES, Mississippi State University, \$25,460.00. (January 2022-December 2022).

Gholson, D., Larson, E.J., Spencer, G., Mills, B.E., **Lo, H.**, "Row Crop Irrigation Science Extension and Research (RISER) Program," Mississippi Corn Promotion Board, \$85,337.00. (March 2022-February 2023).

**Lowe, J.W., Chesser, G.D.**, Dinh, T.T.N., Schilling, M.W., Theradiyil Sukumaran, A., "Prototype of a steaming system to pasteurize whole muscle meat cuts," MAFES, Mississippi State University, \$50,000.00. (January 2022-December 2022).

**Lu, Y.**, Theradiyil Sukumaran, A. "Sinusoidal-Illumination Imaging (SII): A Potential Tool for Enhanced Detection of Muscle Defects and Microbial Spoilage of Poultry." USDA-NIFA, \$274,500. (January 2022-December 2023).

**Lu, Y.**, Theradiyil Sukumaran, A., Dinh, T., "Structured-Illumination Imaging for Enhanced Meat Quality Assessment," Mississippi State University, Mississippi State University, \$50,000.00. (January 2022-December 2022).

**Lu, Y.**, Williams, C., Kamruzzaman, M., Kudenov, M., **Wijewardane, N.**, Chen, J., Jones, D., Villodon, A. "Advancing Optical Technologies for Enhanced Quality Evaluation, Grading and Sorting of Sweetpotatoes," USDA-AMS, \$750,000 (April 2022-December 2025).

**Priddy, L.**, Jaffe, M., Jahr, H., Priddy, M., "Comprehensive Evaluation of Hydroxyapatite Coatings to Improve Degradation Characteristics of Additively Manufactured Porous Magnesium Implants," Office of Research and Economic Development Advancing Collaborative Research Program, Mississippi State University, \$45,000. (June 2022-May 2024).

Priddy, M., **Priddy, L.**, Bain, J., Griggs, J., "Residual stresses and bone remodeling: a two-step simulation framework for improved finite element modeling of dental implants," Mississippi Center for Clinical and Translational Research, \$40,000. (August 2022-July 2023).

**Simpson, C.L.** "BRITE Relaunch: Examining the Role of Mechanotransduction in Smooth Muscle Cell Phenotype Modulation," NSF, \$559,949. (January 2022-December 2024).

**Wijewardane, N.K.**, "Towards Field Application of Mid Infrared Spectroscopy for In Situ Soil Sensing," MAFES, Mississippi State University, \$49,355.00. (January 2022-December 2022).

## Recent Graduate Student Defenses

### **Tim Cook, M.S.** **Biomedical Engineering**

A mechanical and finite element analysis of bone screw thread design.  
(Advisor: Steve Elder)

### **Ursula Offiah, M.S.** **Biomedical Engineering**

Novel 3D bench top model for vascular calcification research.  
(Advisor: LaShan Simpson)

# Water Resources Research Spotlight

## VITOR MARTINS

The eutrophication of aquatic systems caused by increased nutrient loads affects not only aquatic life but also drinking water and human health. Continuous monitoring of water quality in reservoirs and lakes can help decision-makers tackle this problem. Dr. Martins is working on satellite remote sensing of inland waters to enable continuous real-time monitoring of algae blooms and sediment pollution across the U.S., with a focus on Mississippi. His research involves in-situ water quality and radiometric data collection to build novel bio-optical models with empirical, semi-analytical, and machine learning approaches. Based on his work, the next generation of satellite-based monitoring systems will be more accurate and will allow further assessment of climate scenario impacts on water quality and quantity. In this research Dr. Martins works closely with MSU faculty members and international researchers, and he is tracking funding opportunities from agencies like NASA, USDA and NSF.



## MARY LOVE TAGERT

Dr. Tagert is working on a Mississippi Soybean Promotion Board project to advance irrigation efficiency using sector control variable rate irrigation (VRI). In Northeast Mississippi, many fields have been brought into irrigation in recent years, and the primary irrigation method is sprinkler irrigation, commonly with a center pivot system. Most late model pivot control systems give the producer the ability to irrigate different sectors, or pie-shaped slices of the pivot circle, at different rates by adjusting the speed of the pivot. Dr. Tagert's team is evaluating a production field for sector control VRI, implementing an irrigation prescription that was developed based on soil moisture sensors and other data sources. They will measure water applied, yield, and water saved. As part of this project, they are also mapping on-farm water storage systems in each county to better quantify how many acres of farmland are under irrigation in this part of the state.



## PREM PARAJULI

Dr. Parajuli's research is focused on developing solutions to multi-faceted water quality problems. The goal of his research is to benefit watershed stakeholders by encouraging them to adapt best management practices (BMPs), which will improve agricultural productivity and ensure healthy agro-ecosystems by addressing emerging water quality issues related to climate change, land use change and other factors. He and collaborators are working on projects evaluating surface and ground water interactions and BMP evaluations in Mississippi Delta watersheds. Some of this work was funded by USDA/NIFA. His team is also working on a project funded by Mississippi Based RESTORE Act Center of Excellence (MBRACE) for evaluating hydrology and water quality in coastal watersheds (e.g., Wolf River Watershed). In addition to working with MSU collaborators, Dr. Parajuli is working on a number of research proposals in collaboration with other universities.



## JOEL PAZ

Freshwater supplies for irrigated agriculture in the Mississippi Delta are rapidly diminishing due to multiple factors including the continuous expansion of irrigated acres and the demands placed on water resources as a result of increasing urbanization. Irrigated crop production in the Mississippi Delta has resulted in significant groundwater pumping from the Mississippi River Valley Alluvial Aquifer (MRVAA). Dr. Joel Paz and Mohsen Nekooei, Ph.D. student, are working with scientists at USDA's Sustainable Water Management Research unit to develop robust datasets, models, and data visualization tools to determine the impact of alternate water supplies on aquifer recharge and groundwater levels. An integrated modeling framework will be developed to examine different scenarios that affect crop yield, water use, and surface water in the Delta, as well as groundwater decline in the MRVAA.



# Our Students

AGRICULTURAL ENGINEERING TECHNOLOGY AND BUSINESS

## Recent Awards

**Kailey Clinton** (BME Senior) - Bagley College of Engineering Student Hall of Fame 2022 and the Spirit of State Award 2022.

**Malley Gautreaux** (BME Senior) - Second place poster presentation award in the Undergraduate Division, 4th Annual Mississippi Academy of Sciences Summer Science and Engineering Symposium.

**Sophie Jones** (BME Senior)- Top-rated poster presentation in both the Biological Sciences and Engineering and the Community Engagement Research categories at MSU's Undergraduate Research Symposium.

**Dipesh Nepal** (BE Ph.D. Student)- Travel Assistance Grants for Graduate Students Award from the MSU Graduate School.

**Vivek Venishetty** (AETB Ph.D. Student) - Travel Assistance Grants for Graduate Students Award from the MSU Graduate School.

**Katelin Waldrep** (AETB M.S. Student) - Second place M.S. Poster Presentation, American Society of Agronomy 2022 Southern Branch Regional Meeting.

### **KAITLYN GORDON** (Jasper, Alabama)



When Kaitlyn was considering MSU, the welcoming atmosphere on campus made her feel right at home. MSU also offered the opportunities, resources, and environment she needed to excel as a student, making her decision much easier. She notes that MSU offers the college experience of a large university but maintains the small-town feel. She was drawn to the AETB program because of the technical yet hands-on approach to problem solving that it offers. "I have thoroughly enjoyed my time at MSU and the overall college experience—making friends, attending a variety of events, ringing my cowbell on Saturdays, and attending as many MSU baseball games as possible. Drs. Chesser, Lowe, and Paz have all played a vital role in my success by inspiring, encouraging and holding me to a standard of success, and for their efforts, I am truly thankful. I hope to eventually get my graduate degree, hopefully here at MSU. I just completed my co-op with North American Coal this summer."

BIOLOGICAL ENGINEERING



### **JONATHAN HARJONO** (Jakarta, Indonesia)

Jonathan was drawn to MSU by family members who had studied at MSU and told him it is a good engineering school with a diverse international student population. Growing up in a busy metropolitan city and then moving to the small and quiet town of Starkville required a big adjustment, but Jonathan appreciates the tight-knit community and slower lifestyle that Starkville offers. His undergraduate major was computer science, but he was drawn to a master's degree in biological engineering – studying under Dr. To – by an interest in applying artificial intelligence (AI) to practical problems, whether it be improving quality of life or solving problems in industry. "My favorite part about my time at MSU is the many people I have met and the community and network that I have cultivated." He is the founder, president, and instructor of the MSU Taekwondo Club. He also plays drums and percussion in the worship band at First Baptist Church in Starkville and is active in the college student ministry.

BIOMEDICAL ENGINEERING



### **KHAOULA KAMAL** (Tupelo, MS)

When visiting MSU, Khaoula found a "family" who welcomed her, and that fact played a significant role in her choice to study here. Upon arrival she quickly became engaged and is now a Senator and the Sub-Chair for Academic Affairs in the Student Association, as well as a member of the MSU Biomedical Engineering Association. "The plethora of clubs and organizations on campus called my name!" She also serves as the first student on the Mississippi Rural Health Association Board, where she communicates with physicians and other health care providers on critical issues in Mississippi. Khaoula's passion for medicine was ignited by a tragic event; her father was killed and brothers injured in a terrible car accident. Now she strives to understand and improve medical treatment mechanisms to increase the rate of recovery from physical trauma. As a freshman last year, Khaoula received the Outstanding Honors Freshman of the Year Award and subsequently served as a congressional intern to Senator Roger Wicker on the Commerce, Science, and Transportation Committee.