

## A Letter from the Department Head

I can't believe it! In July I will have been Department Head in Agricultural and Biological Engineering (ABE) for 3 years. It has been a whirlwind:

- Navigating Covid 19
- Hiring 9 new faculty members
- Rebooting our ASABE student club
- Dramatically improving grant writing success (over \$2.5M in FY-22)
- Changing Biological Eng. (BE) to Biosystems Eng. (BSE)
- Branding ABE as "Engineering & Technology for Human Well-Being"
- Making a distance M.S. degree for Ag. Eng. Tech. & Bus. (AETB)
- Creating 6 new courses to meet student needs in emerging markets
- Creating 2 new emphases each for Biomedical Eng. (BME: Biomaterials & Biomechanics, Sensors & Devices) and BSE (Natural Resources & Environment, Autonomous Agricultural System)

We've been on a steep curve of innovation, and now that we have a full complement of faculty members, we can operate like a well-oiled machine, incrementally improving rather than changing so swiftly.

MSU has been largely immune from the COVID-related enrollment drop seen by many other universities, but various factors have reduced enrollment slightly in ABE programs. High school graduate numbers nationwide will decline over the next few years. Our AETB and BME numbers are down a little, but in what is now BSE they have been low for a while. We are keenly focused on growing enrollment in BSE from about 25 today to 100 in the next 5 years; thus the name change and new emphases to be used in marketing and recruiting. We also will be vigilant about recruiting for AETB and BME. While our undergraduate numbers are down a little, our graduate student numbers are up, from 30+ in 2020 to 40+ in 2023.

We were sad to say goodbye in January to Dr. Yuzhen Lu, who left for Michigan State University, his Ph.D. alma mater, but we are excited to welcome Dr. Hussein Gharakhani. His skills and interests fit a common thread among our recent faculty hires, technologies summarized as sensors, analytics, and robotics. You can read more about Hussein and his teaching and research later in this newsletter.

It's easy to think of stories to share about our current and former students. Sophie Jones (BME senior) was inducted into Bagley College of Engineering's Hall of Fame. Four former students Joseph Chen, Charla Howard, Blake Jeter, and ABE Assoc. Prof. Lauren Priddy – were recognized as 2023 Reveille 25 honorees. Employers and graduate and professional schools are snapping up nearly 100% of our graduates shortly after graduation.

After almost 3 years as ABE head, I can say we've accomplished much, and I love coming to work every day. We serve students who are improving Mississippi, the U.S., and the world. As a reminder, we're aiming to endow a scholarship in honor of Courtney Yates (at left) who passed away in 2021 just before graduating with a B.S. in AETB. The fund is at 25% of the \$25,000 needed to endow it. Please consider this need when you consider giving. Thanks, and have a great summer!



*Alex Thomason*

## Alumni Spotlight: Gwendolyn Davis Ph.D.

Gwendolyn Davis hails from Jackson, Mississippi, and was first attracted to MSU because her father had studied here. Gwendolyn attended the IMAGE Summer Bridge Program hosted by MSU's Bagley College of Engineering. It is a summer program for incoming freshman engineering students. She says, "I'm forever grateful for that program because most of those who attended became lifelong friends!"

Gwendolyn was always interested in science and saw herself in a career in the medical field. However, she didn't start out knowing exactly what major to pursue. Early in her time at MSU, Gwendolyn had a class with Dr. Lakeisha Williams, a former faculty member in ABE, now at University of Florida. Dr. Williams was a favorite professor for Gwendolyn, who was greatly encouraged to see a female minority professor who was very accomplished and confident in the biological engineering field.



After completing her B.S. in Biological Engineering at MSU, Gwendolyn decided to pursue a Ph.D. in Physiology and Biophysics at University of Mississippi Medical Center. She was interested in physiology dating back to high school. She says, "I like understanding why things happen. In physiology, I could understand how the human body typically functions and the reasons behind abnormal processes that result from or lead to injury and disease." During graduate school, Gwendolyn had multiple opportunities to present her research at national conferences. She also received awards for poster presentations and conference abstracts. Outside of coursework, she participated in community service events and served on programming committees at the institutional and national level.

When asked about future plans, she says, "I want to continue learning!" She now works in research and development at Medtronic. "Here, I can combine my love for physiology with my interest in medical technology. I'm interested in how advancements in technology will improve our understanding of medicine and how that will impact early detection and management of disease."

Thinking back on her time at MSU, she remembers struggling to balance academics with extracurricular activities. She enjoyed participating in sporting events, social clubs, service organizations, and the like. "I had to learn how to manage my time and to be organized to know what I could and couldn't do." When asked what advice she would give to a current student in BME, she replied, "Stay the course! An engineering degree can be very challenging at times, but it's also very rewarding. It is okay if you don't have everything figured out now. You just have to be willing to take the first step."



## New Faculty

**Hussein Gharakhani** completed his B.S. at the University of Tabriz and M.S. at the University of Tehran, both in Agricultural Engineering. After his undergraduate studies he established a small company in the Science and Technology Park of Tabriz and worked on multiple projects, mostly in agricultural machinery. Later he joined the R&D group at Iran Tractor Manufacturing Company and conducted research on diesel

engines, generators, power transmission systems, etc. In spring 2018 Hussein started his Ph.D. program at Texas A&M University, where he began working with embedded computers and robotics. He served as a teaching assistant for two semesters, and one of his classes involved sensors and controls for biological systems. That class improved his skills in this area and enabled him to work on multiple projects involving collecting data on plants with Raman spectroscopy, collecting images of plants from unmanned ground vehicles and unmanned aerial vehicles (drones), and ultimately to focus on robotic cotton harvesting. In spring 2021 he followed his academic advisor from Texas A&M to Mississippi State University to complete his Ph.D. program there, where he continued working on various aspects of robotic cotton harvesting, including an end-effector to grasp cotton, arm manipulation to position the end-effector, and a perception system to detect cotton bolls and localize them in 3D space. He joined ABE in January 2023 as a faculty member and is excited to continue his research and start teaching in the classroom. His goal is to perform cutting-edge research in agricultural robotics and to help students develop the knowledge and skills needed to solve engineering problems in biological systems.



**Drs. Maryam Mohammadi-Aragh, Daniel Chesser, and Wes Lowe** are collaborating on research with USDA-ARS scientists to modify poultry litter in order to reduce *E. coli* and antibiotic-resistant bacteria in chickens. Pine biochar and Poultry Litter Treatment (PLT) are two amendments being studied with respect to how they affect physio-chemical properties of litter such as ammonia volatilization, pH, moisture content, and water activity. These ABE faculty members intend to provide poultry producers with practical information on how to utilize litter amendments to mitigate pathogens and improve litter quality. They recently had a manuscript on this work accepted for publication in *Avian Diseases*: Evaluating the effects of pine and Miscanthus biochar on *Escherichia coli*, Total aerobic bacteria, and bacterial communities in commercial broiler litter.

## ABE Faculty Spotlight

**Dr. Lauren Priddy** is collaborating with an interdisciplinary team of MSU and international scientists to develop new biological implant materials and study their fate in the human body. Traditional, non-degradable implant materials are sufficient for many orthopedic applications, but they have associated risks of stress shielding, bone weakening/resorption, and implant loosening/failure, which can increase pain and fracture risk, impair bone healing, and may ultimately require implant removal. There is thus an urgent need to engineer degradable orthopedic implants that mimic the structure and function of bone. Dr. Priddy's collaborative research utilizes *in vitro*, *in silico*, and *in vivo* models of degradation and osseointegration to evaluate the efficacy of hydroxyapatite coating to slow degradation of additively manufactured, porous magnesium scaffolds.



**Dr. Vitor Martins** received a grant from NASA titled, "Landsat-Sentinel-2 virtual constellation for water reflectance product in optically complex aquatic systems: algorithm development and validation." The grant funds collaborative research with Dr. Eric Sparks (MSU Coastal Research & Extension Center) involving NASA Landsat 8/9 OLI and ESA Sentinel-2 MSI satellites, which are good medium spatial-resolution data sources for water applications. The research will focus on data harmonization from both satellites' optical sensors into a single data set, creating an unprecedented repeat frequency of 3 days, and providing a much better opportunity to obtain cloud-free mapping of constituents in Mississippi's optically complex inland and coastal waters than previously available. The mapping process will require solving complex radiative transfer calculations to derive water reflectance data.



**Dr. Nuwan Wijerwardane** received a grant from USDA-NIFA to use spectroscopy for early detection of viral infection in sweetpotatoes. Spectroscopy has shown promise in applications like soil chemical and physical property estimation, plant tissue nutrient measurement, and detection of plant diseases. However, the use of this technique to detect sweetpotato viral infection has not previously been studied. The goal is to identify spectral signatures that are indicative of potyvirus infection in sweetpotatoes under greenhouse conditions. A successful outcome would enable detection of infections before the onset of visual symptoms, enabling early treatment and better management.





## BY THE NUMBERS

ABE has three undergraduate Bachelor of Science (B.S.) degree programs:

- Biosystems Engineering (BSE)
- Biomedical Engineering (BME)
- Agricultural Engineering Technology and Business (AETB)

In 2022, we had 118 undergraduate degrees awarded:

- BE 26
- BME 76
- AETB 26

Within the B.S. AETB program, we have four concentrations (sequences of courses that focus on particular topics of interest to students). These concentrations are reported on the students' diplomas at graduation:

- Enterprise Management (EMGT)
- Natural Resources and Environmental Management (NREM)
- Precision Agriculture (PRAG)
- Surveying and Geomatics (SGEO)

In 2022, the 26 AETB graduates were distributed as follows:

- EMGT 9
- NREM 2
- PRAG 9
- SGEO 6

ABE's overall 6-year graduation rate is well over 80%.

## Highly Diverse Student Body

ABE has one of the most diverse student bodies in the university in multiple aspects. A particular fact we are proud of is that, across all three undergraduate programs, we are almost evenly divided between male (55%) and female (45%) students.

## Graduate and Professional School Applicants

A significant number of ABE graduates choose to go on to graduate school. In 2022, 21 of our graduates were awarded either a fellowship or assistantship to continue their studies at the graduate level.

A significant number of ABE graduates choose to go to professional school. In 2022, 32 applied to medical or dental school, with a large majority being accepted into their program of choice. The following professional schools now have 2022 ABE graduates studying in their programs.

- University of Mississippi Medical Center
- University of Mississippi Medical Center School Of Dentistry
- University of Alabama Birmingham
- University of South Alabama
- University of Tennessee Health Science Center
- Louisiana State University New Orleans
- Kentucky College of Osteopathic Medicine
- William Carey University

## ABE Graduate Degrees

ABE's research programs help to produce student with graduate degrees in six programs as the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) levels:

- M.S. Biosystems Engineering
- M.S. Biomedical Engineering
- M.S. Agriculture, with Concentration in Engineering Technology
- Ph.D. Engineering, with Concentration in Biosystems Engineering
- Ph.D. Engineering, with Concentration in Biomedical Engineering
- Ph.D. Agricultural Science, with Concentration in Engineering Technology

Across these programs, we had 7 M.S. graduates and 7 Ph.D. graduates in 2022

### A Message from Professor and ABET Coordinator Dr. Steven Elder

We need your feedback to help us maintain accreditation. ABET is the Accreditation Board for Engineering and Technology, and their accreditation of our program certifies that we have a high-quality program of instruction that provides critical outcomes for graduates of our engineering degree programs. As a recipient of the ABE Departmental Newsletter, you are invited to take a very short survey on the Program Educational Objectives (PEO's) within our engineering majors. Please follow this link: [https://msstate.co1.qualtrics.com/jfe/form/SV\\_a61Sl488pbkaWz4](https://msstate.co1.qualtrics.com/jfe/form/SV_a61Sl488pbkaWz4)

Thank you!

For more information please contact Dr. Elder at [selder@abe.msstate.edu](mailto:selder@abe.msstate.edu).

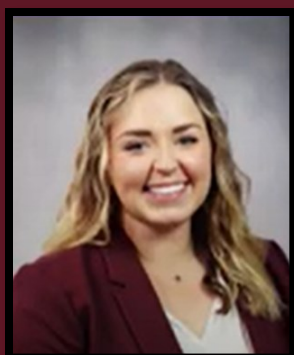


# Our Graduate Students



**Yajas Gamagedara**, a graduate student from Sri Lanka, earned his bachelor's and master's degrees in Agricultural Engineering from the University of Peradeniya. In spring 2022, he started Ph.D. studies in Biological Engineering under Dr. Nuwan Wijewardane. His research involves mid-infrared spectroscopy and modeling to estimate soil dynamic and hydrological properties in Mississippi and Texas. By the end of his project, USDA-NRCS field offices in Mississippi and Texas will be able to use MIR spectroscopy to derive these soil properties in-office instead of performing time-consuming and costly conventional field or laboratory measurements.

**Katelin Waldrep** is an AETB graduate student from Cherokee, AL. She earned her B.S. in AETB in May 2021 and plans to graduate with her M.S. in May 2023. She has been conducting multiple research projects under Dr. Mary Love Tagert, and her thesis focuses on managing iron deficiency chlorosis – a common problem for North Mississippi soybean growers – by way of a cropping-system approach. Katelin earned 2nd place for her poster presentation at the 2021 American Society of Agronomy Southern Branch Regional Meeting and 3rd place for an oral presentation at MSU's 2021 fall graduate research symposium. She was also a finalist at MSU's fall 2021 3-Minute Thesis Competition, where she was the only M.S. student, the other seven being Ph.D. students. She is passionate about applied research that helps growers improve efficiency and economic returns, and she recently began work as a research associate at the North Mississippi Research and Extension Center (NMREC) in Verona, MS. Katelin plans to continue working at NMREC and perhaps to pursue a Ph.D., which would enable her to build her own research program.



**Chamika Silva**, a graduate student from Sri Lanka, earned a bachelor's degree in Agricultural Technology and Management with a focus on Agricultural Engineering at the University of Peradeniya. He earned a master's degree in Agricultural and Biosystems Engineering at Sri Lanka's Postgraduate Institute of Agriculture and is now pursuing a second master's degree in the AETB program under Dr. Nuwan Wijewardane. Chamika's research focuses on mitigating the effect of moisture on soil spectra during spectroscopy. He is also using plant spectral data to develop predictive models for nutrient content as an alternative to traditional wet laboratory methods.

# Our Undergraduate Students (BME Focus)



After **Sophie Jones** of Birmingham, AL, established herself as a standout BME student, the senior was recently inducted into the Bagley College of Engineering Student Hall of Fame. Sophie participates in Alumni Delegates, the student organization that supports the Alumni Association, and she served as a New Maroon Camp Counselor, showing incoming freshman what they have to look forward to at MSU. When she was considering where to study, Sophie visited several other universities but was drawn by the “warm and kind spirit of MSU that made the campus feel like home.” While her favorite course was a leadership class with MSU President Keenum, Tissue Engineering was a close second. In the future she plans to work as a tissue engineer, focusing on research and development.

**Xavier Person**, another BME senior, has roots in Brandon, MS, and Collierville, TN. He has worked in the lab of Dr. Lauren Priddy since fall 2020, studying antimicrobial therapies for treating bone infection. Specifically, Xavier's research involves characterizing chitosan-based biomaterials for local treatment of osteomyelitis. As part of his work in the lab, he co-authored a review of the utility of immunological markers in tracking injury and infection. This article was published in the *Journal of Orthopaedic Research* in 2022. Xavier will present his research at MSU's Undergraduate Research Symposium in April.



**Jennifer Kemp** is also a BME senior — with no fewer than three minors!: leadership studies, global engineering leadership, and mathematics — and hails from Carthage, MS. In addition to her voluminous studies, Jennifer is President of BEAM (Biomedical Engineering Association of Mississippi State University) as well as being involved in several other student organizations including ACCESS Peer Mentors and Zeta Tau Alpha sorority. She likes being involved in several activities at once because, she says, “I feel like I work well under a little bit of pressure.” Jennifer is also involved in research in Dr. David Vandenhoeffer's so-called “Neural Engineering Research Division (NERD)” lab. She plans to study Physiology in graduate school at University of Mississippi Medical Center.