

Fall 2023

ABE Newsletter

A Letter from the Department Head

Most employers looking for engineers expect a degree from an ABET-accredited program, so it's important that we go through accreditation every few years. If successful, we are re-accredited for 6 years. We'll have a visit from Oct. 20 to 24 that will consider both Biomedical Engineering (BME) and Biosystems Engineering (BSE). We'll know the outcome before the spring newsletter goes out, so we'll update you then.

A later article in this newsletter discusses MSU's new Agricultural Autonomy Institute (AAI), which originated in ABE and is aligned with one of our expanding research areas, autonomous systems for agriculture. AAI's Grand Opening will be on October 26. Let us know if you're interested in attending.

We just had our fall Advisory Board meeting, updated the Board on ABE activities and directions, and got critical feedback. The Board has 6 members from each of our 3 majors. Terms are 3 years, so each major has 2 members dropping off and 2 coming on each year. Since the Board was formed 3 years ago, this is the first year to have new members coming on, so we welcomed 6 new members. To those rotating off, thank you for your time and effort in serving these last 3 years!

Information reported to the Board included student numbers and grant funds. At the undergrad. level, we have 301 BME students, 98 AETB, and 13 BSE. While BME and AETB are strong and essentially stable, BSE needs a robust recruiting effort. We've posted new [videos](#) on our website and social media to aid recruiting; please share them with anyone who might be interested. At the grad. level, we have 40 students among the 3 programs, up 30% over 3 years ago. Examples of ABE's great students follow in this newsletter. In grants, we were awarded \$4.29M in FY-22, up over 500% from FY-20.

Gifts from alumni and friends could meet several ABE needs. Some are on this web page, <https://www.abe.msstate.edu/giving/>, where a link makes it easy to give; please do as you are able. I'm hopeful we'll endow the Courtney Yates scholarship fund soon. We need \$18,500 to make that happen, so please consider that opportunity. Courtney was an excellent AETB student who passed away in 2021 before graduation and was awarded her degree posthumously. I am looking forward to helping first-generation students like Courtney with funds from that scholarship as soon as it is endowed. Enjoy the fall season. We'll reach out to you again in the spring.



Alex Thomassen

Alumni Spotlight: Christián Henry, Ph.D.

Christián Henry, who hails from Alabama, completed her B.S. in Agricultural Engineering Technology and Business (AETB) at Mississippi State in 2016. She then decided to pursue a Ph.D. in Forestry at Michigan State University. Now, Dr. Henry is a Staff Formulation Scientist at Syngenta Crop Protection in Greensboro, North Carolina. In this role, she leads several projects on developing fungicide formulations, not to mention collaborating with stakeholders and planning, organizing, and conducting lab experiments on the design and optimization of those formulations. Dr. Henry ensures the robustness of formulations through rigorous physico-chemical characterization and coordination with engineering teams for production scale-up of developed products.

When asked if any particular projects, research endeavors, or mentors influenced her decision to pursue a career in sustainable bioproducts, she recalls her directed-individual-study course with ABE faculty member, Dr. Fei Yu. "This study opportunity had me delve deeper into the literature and expand my knowledge beyond what regular coursework offered. That fueled my passion for research and instilled in me a desire to contribute to the scientific community." Dr. Henry also recalls her internship at the USDA-FAS Cochran Fellowship Program/Demmer's Scholars' Program, where she had the opportunity to mine, evaluate, and visually analyze program data within the Latin America and Caribbean region. "This experience broadened my understanding of research methodologies and data analysis techniques."

Beyond academics, Christián took part in various programs and organizations at Mississippi State, which bolstered her leadership skills and personal growth. These included the Day One leadership program for incoming freshmen who want to be a success, are willing to be challenged, and want to make a difference from the start of university life. She was also engaged in MANRRS (Minorities in Agriculture, Natural Resources, and Related Sciences), Ladies Social Circle, Ideal Woman, Health Service Volunteers, and TRIO Student Support Services, which supports first-generation students. "They all provided valuable experiences and connections that helped shaped my character and fostered personal growth. They not only enriched my academic experience but also instilled a sense of community engagement and a desire to give back."

Thinking back on her time at Mississippi State, she recalls the challenge of balancing active involvement in extracurricular programs with academic excellence. When asked what advice she would give to current ABE students, she replied, "plan and stay organized, seek help early, utilize campus resources, and build a support network."



ABE Faculty Spotlight



Dr. Jessica Drewry is working on multiple research projects in environmental controls for poultry housing as well as precision agriculture. Her largest project, funded by USDA, focuses on engineering solutions to reduce disease transmission in hatcheries for broiler chickens. In collaboration with

MSU's Center for Advanced Vehicular Systems (CAVS), she is using computer modeling to predict areas of high bacterial growth due to non-uniform ventilation. Her current experiments utilize hatching incubators along with computer modeling for E. coli risk assessment. Her results can ultimately be applied to large-scale commercial hatcheries.

On another project, funded by the Mississippi Soybean Promotion Board, Dr. Drewry is working to enhance the quality of soybean data so farmers can make more informed decisions based on accurate yield data and variation across the field. Key issues in this work involve calibrating yield sensors on combines and post-harvest data processing.

Dr. Drewry also serves as MSU's faculty adviser for the ASABE (American Society of Agricultural and Biological Engineers) student club. While in graduate school, she was an active member of ASABE at the University of Wisconsin. She now aspires to utilize her advisory role to profoundly influence and guide students in their academic pursuits.



Dr. LaShan Hendrix has been a faculty member of ABE since 2013. We will bid farewell to her in January 2024, when she will move to the University of Cincinnati to take on a biomedical-engineering faculty role there. She is looking forward to working in a university environment with

an academic medical center, where the close proximity to clinicians on the front line will present new opportunities for her teaching and research efforts.

Her research has focused on treatments for cardiovascular disease, specifically the relationship between vascular calcification and bone mineralization as well as polymeric delivery vehicles for cell and gene therapy. Among other courses, she has taught ABE 4523 Biomedical Materials, which covers the applications, composition, testing, and biocompatibility of biomedical materials used in implant devices. She has also served as Coordinator of Diversity Initiatives at MSU's Shackouls Honors College and received the Biomedical Engineering Society (BMES) Diversity Lecture Award in 2021.

Dr. Hendrix has been a fixture in ABE for a decade, so her departure brings sadness at her leaving but also excitement for what her future holds. We extend our heartfelt thanks to her for her dedication to students, faculty, and staff at ABE and MSU, and we wish her all the best in her future endeavors.

New Research Grants

Tagert, M.L., Lowe, J.W., Waldrep, K., Burdine, B., Wijewardane, N., Mills, B.E., "Costs and Benefits of Precision Management for Iron Deficiency Chlorosis (IDC) in a Production Setting (Year 1)," Mississippi Soybean Promotion Board, \$61,127.00. (April 2023 - March 2024).

Tagert, M.L., "MOA Subgrant for the Nonpoint Source Program – Waste Pesticide Disposal 2023," Mississippi Soybean Promotion Board, \$120,000.00. (July 2023—June 2024).

Tagert, M.L., Paz, J.O., Li, X., Lo, H., "Low-Cost Precision Agriculture Solutions for Advancing Irrigation Efficiency (Year 3)," Mississippi Soybean Promotion Board, \$80,828.00. (April 2023 - March 2024).

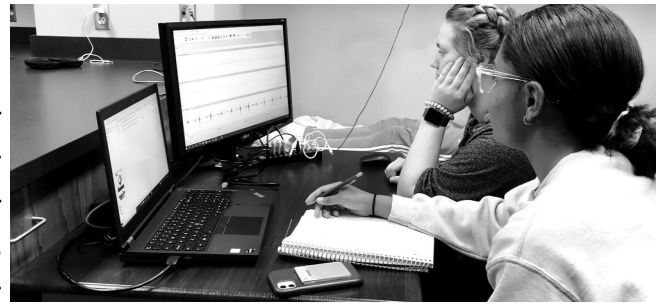
Li, X., Thomasson, A., Thompson, D., Bethel, C. "The Social and Economic Impacts of Agricultural Autonomy(A2) on Small Farms: Status and Recommendations," USDA-NIFA, \$649,335.00. (August 2023 - August 2026).

Research

Taebi Research Lab



Dr. Amirtaha Taebi's Lab develops cutting-edge sensing systems and computational methods for early non-invasive diagnosis and personalized treatment of cardiovascular diseases, with a focus on health equity. Developing personalized treatments to replace the current traditional one-size-fits-all approaches will enhance treatment effectiveness. Provided that effective treatments are available; with timely



diagnoses facilitated by our innovative methods, patients will receive earlier referrals to medical teams, leading to improved outcomes and a higher quality of life. Our research primarily centers on the analysis of body vibrations, with the aim of transforming our solutions into powerful bedside or cost-effective home monitoring tools through close collaboration with clinical and industrial partners. Our ultimate goal is to reduce mortality rates, optimize medical therapy, reduce hospital stays, and improve the lives of patients affected by cardiovascular diseases, particularly among underserved populations.

In August, Taebi lab welcomed Mohammadali Monfared, a doctoral student, to augment their research team. Subsequently, Aysha Mann, a master's student, achieved a significant milestone with the acceptance of her first journal manuscript for publication in the ASME Journal of Medical Diagnostics and Therapy. A second paper, co-authored by undergraduate student members Haleigh Davidson and Brooke Scardino, has also been successfully published in the aforementioned journal.

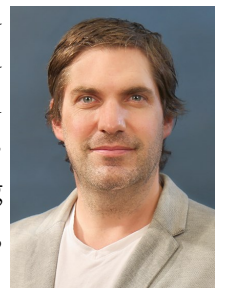
In May, the research team achieved notable success as their proposal for the development of a portable and easily accessible cardiac monitoring device got support from the National Science Foundation I-Corps Site program at Mississippi State University. The group also received a 1-year Quick Grant from ORED for developing an AI-driven smartphone-based cardiac monitor.



NERD Research Lab

Dr. David Vandenhoeve's "NERD Lab" (aka Neural Engineering Research Division) is dedicated to exploring brain-related research across a spectrum of inquiries. NERD aims to address questions concerning the nature of neural mechanisms that underlie decision-making processes. Electroencephalography (EEG) is the cornerstone of the lab's brain-imaging technology, complemented by additional techniques including virtual reality and sophisticated machine learning methodologies, which enable data analysis to unravel the brain's fundamental operations.

The NERD lab also emphasizes practical applications in the realm of brain science. For instance, the research team has begun working with Brain-Computer Interface (BCI) technologies, which seek to decode individuals' intentions based on EEG signals, offering potential applications such as thought-controlled wheelchairs. Additionally, the lab is actively engaged in the identification of biomarkers associated with various mental disorders, including ADHD, depression, and anxiety. While the applied research of the lab aligns more directly with the field of biomedical engineering, it is essential to recognize that both the fundamental and applied research endeavors synonymously contribute to the advancement of our understanding of brain function. Thus, the lab's overarching goal is to uncover novel approaches for the treatment of brain-related diseases and disorders, ultimately leading to improved healthcare outcomes.



Agricultural Autonomy Institute

Mississippi State University recently launched the Agricultural Autonomy Institute (AAI), whose chief goal is developing Mississippi's economy by forming an industry in autonomous systems for agriculture. Generous seed funding from the Robert M. Hearin Foundation was used to establish AAI as the first institute in the U.S., likely the world, dedicated strictly to autonomous systems for agriculture. Over the long term, AAI intends to position Mississippi as the Silicon Valley of agricultural autonomy. ABE's department head, Dr. Alex Thomasson, serves as the founding Director, and Madison Dixon as Associate Director. Over the last three years, Thomasson led a collaborative Agricultural Autonomy Working Group of roughly 40 faculty members across two MSU colleges and several of its centers and institutes, all while conducting his own research in the field.

At a time when the world's population is still growing fast and the climate and unpredictable events like wars dictate high production that can be shipped to areas in need, the main driver behind agricultural autonomy is the unavailability of farm labor. Workers are lacking in part because many jobs on the farm are "dull, dirty, and/or dangerous," particularly the kinds of tasks that autonomous systems are ideal for. AAI's scope of research and development includes applications in production agriculture, post-harvest processing, and tools and methods for agricultural research. In farm production, one might imagine a manager in an office overseeing a fleet of harvesting machines in various fields around the farm; in processing, a robotic cutting device carefully cutting catfish and mitigating the dangers associated with manual cutting; and in research, a drone collecting plant-height data on 1,000 corn plots in 30 minutes, whereas a group of graduate students would require a day to do the same job.

AAI has three key objectives: (a) to conduct research and to develop intellectual property for licensing and entrepreneurial startups; (b) to recruit corporations to Mississippi in terms of contracted research and creation of new facilities for research, manufacturing, distribution, and service; and (c) to build the needed workforce through educational programs at MSU and in collaboration with community colleges in Mississippi. A secondary driver behind agricultural autonomy is the need to maximize precision and efficiency on farms in order to maximize farmer benefit and minimize environmental risk. For example, fertilizer should ideally be placed only where needed in the field and in the appropriate amount. Historically this idea has been referred to as Precision Agriculture (PA). Autonomous systems can improve upon PA because they have the potential to identify plant needs very precisely. In addition to growing Mississippi's economy, providing advanced farm-related jobs and equipping workers for these jobs, and maintaining food security, AAI is committed to advancing sensing and analytical capacities of autonomous machinery systems, thus enabling decisions and actions at the level of a square meter or even a single plant.



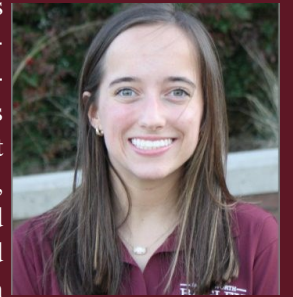
Our Student Spotlights

Clara Cobb, a senior in the AETB program, possesses a natural affinity for problem-solving. A native of Stanley, North Carolina, Clara's decision to come to MSU was driven by the welcoming atmosphere of Starkville and her admiration for the campus. During her time in the ABE department, Clara has collaborated closely with Dr. Wes Lowe on the development of a camera system designed to identify problematic weeds within row crop fields. In addition to her academics, Clara maintains an active presence in several organizations, including serving as a CALS Ambassador. Notably, she recently earned induction into Gamma Sigma Delta, the esteemed honor society that recognizes outstanding achievements of students in agriculture-related disciplines. One of the most cherished aspects of Clara's MSU experience has been the people. Her friendships and mentorships have transformed Starkville into her second home, enriching every aspect of her college journey. Looking ahead to graduation, Clara plans on beginning a master's program here at MSU, with the aspiration of establishing her own farm-to-table operation.



Tanner Jones, a senior BME student from Murfreesboro, Tennessee, has grown to be passionate about research during his time at MSU, nurtured under Drs. Lauren and Matthew Priddy. Currently, Tanner is involved in a project with the potential to revolutionize lumbar implant testing, eliminating the need for cadavers. Tanner's love for research stems from its practical application of the knowledge he has accumulated throughout his undergraduate journey. Alongside his academic and research endeavors, Tanner is actively involved in several student organizations across MSU's campus, including Project ENspire, EcoCAR, and Students for a Sustainable Campus. Upon graduation, Tanner hopes to start a graduate program abroad, where he plans to specialize in bioelectronics and medical instrumentation.

Jessica Green, a resident of Athens, AL, is a junior majoring in BSE. Jessica's affinity for biological courses during her high school years led her to choose BSE as her major. Drawing from her upbringing near the river, she fondly recalls camping in the woods, coastal travels with family, and weekend hikes, which have significantly shaped her passion for understanding and enhancing ecosystems. Jessica expressed, "It was always a part of who I am, and I love learning how to help our ecosystems thrive. MSU's BSE program is a perfect fit to help me achieve my goals academically and in my career post-graduation." In the upcoming semester, Jessica intends to embark on a collaborative research endeavor with Dr. Brian Davis from the Forest and Wildlife Research Center, focusing on aquatic invertebrates and algae identification and research. Beyond her academic pursuits, Jessica is actively involved as a Bagley College of Engineering Ambassador, an intern for the University Christian Student Center, a member of the MSU Enneagram Club, and a participant in MSU's chapter of the Society of Women Engineers (SWE). Looking ahead, Jessica envisions either entering the workforce or pursuing a master's degree in Aquatic Ecology or a related field upon her graduation.



Dani Janus, a native of Starkville, Mississippi, is one of the brightest seniors in our BME program. Dani's choice of program was largely influenced by her father, who encouraged her to delve into biomedical engineering as it proved a unique avenue to seamlessly merge her academic passions of mathematics and science. With a combination of extracurricular engagements and research endeavors, Dani claims that MSU has equipped her with the resources and confidence essential for her future success. In addition to her academics, Dani is a member of the MSU Women's Choir, Project ENspire, Tau Beta Pi Engineering Honor Society, Catholic Campus Ministry, and the Shackouls Honors College Drama Productions. Looking forward, Dani is determined in her pursuit of higher education through graduate school, aspiring to carve out a career path that seamlessly integrates her dual passions for forensics and biomedical engineering.

Thevathayarajh ("Theva") Thayananthan, a BSE doctoral student studying under Dr. Xin Zhang, is from Jaffna, Sri Lanka. His research is in the area of agricultural autonomy, and he is focused on robotic berry picking, which requires artificial-intelligence-based image detection of berries as well as robots with delicate and precise end-effectors (i.e., picking fingers). Theva was recently awarded two honors in recognition of his outstanding academics and research. First, he won the Best Paper Award along with a monetary award of \$1,000 at the SPIE Conference on Autonomous Air and Ground Sensing Systems for Agricultural Optimization and Phenotyping in Orlando, FL, in May 2023. Second, he was selected for the 2023-2024 SEC Emerging Scholars program, an esteemed opportunity involving travel to a conference aimed at cultivating next-generation professors. This award also provides opportunities for receiving additional scholarships over the course of the year. Such recognition aligns with Theva's career aspirations of becoming an engineering faculty member and researcher who conceptualizes innovations to tackle a wide array of agricultural challenges.

