ABE Newsletter

Message From The Department Head

Now approaching the end of my 2nd year as Department Head in Agricultural and Biological Engineering (ABE), the situation here on campus and in the department is looking bright in many respects. Early in the spring semester, as the urgency of COVID-19 was waning, the mask-wearing requirement was lifted on campus, and since then things have mostly gotten back to normal. While many colleges and universities are beginning to notice a significant drop in enrollment due to demographic changes, the pandemic, and other factors, MSU along with its colleges of agriculture and engineering has been largely immune from this trend till now. ABE's undergraduate student numbers have been mostly stable, but with the arrival of new faculty members, our graduate student numbers are increasing.

Speaking of new faculty members, our newest addition is Dr. Vitor Martins, who joined ABE on March 1. You can read about him and his areas of teaching and research later in this newsletter. We are very excited to have him, and now we have only one faculty position remaining unfilled. We are currently conducting interviews for that position and hope to report on our impending hire in the fall 2022 newsletter. A common thread in virtually all our new faculty hires has been capability and interest in a group of technologies I'll summarize as sensors, analytics, and robotics. You'll see a story later in this newsletter about "Ag Autonomy," which is a trend in agriculture that these skills serve well. Hiring new professors with these skills on both the biomedical side and agriculture and natural resources has given us additional cohesion within the department, all around the concept of **Engineering for Human Well-Being**.

Along these lines, our new faculty members are developing advanced new elective and graduate-level courses that are applicable to students across this spectrum of ABE interests. For example, Dr. Yuzhen Lu has begun teaching a course in imaging technologies that touches on biomedical and agricultural applications. Another key change taking place is that we have applied to change the name of the Biological Engineering undergraduate and graduate programs to Biosystems Engineering. The department name will remain unchanged, but since the Biomedical Engineering program was formalized, our undergraduate BE program has dropped to around 25 students, and we need to conduct a major effort to define and market this program to potential incoming students. Ideas behind the change are that Biosystems Engineering better describes an engineering interest in agriculture and natural resources and is more easily differentiable from Biomedical Engineering, and it also aligns better with sister programs around the U.S.

As always, we continue to attract, educate, and graduate fantastic students, some of whom you can read about later in this newsletter, and you can read about several others on our website (abe.msstate.edu). Also, you may remember that I mentioned in our last newsletter an ABE student who passed away just before graduating in May of 2021, Courtney Yates. We have been working to establish a scholarship in her name that will emphasize first-generation college students like her, and we are close to having that fund formalized. If you are interested in providing financial support to build that scholarship fund, or if you have a desire to support ABE with other needs, please reach out to me. I wish you all the best as we approach summer.

Alex Thomasson

ABE Builds Business Owners

Justin Towery, originally from Crenshaw, Mississippi, knew his future was in agriculture, but like many students was unsure of what program he should select to lead him to the career he desired. "Agricultural Engineering Technology and Business (AETB) appeared to be a well-rounded degree that I could apply in multiple areas. My advisor (Dr. Tim Burcham) and the department head (Dr. Jerome Gilbert) allowed me to branch out from the cookie-cutter curriculum and take more courses in agricultural economics and agricultural business."

While a student in the AETB program, Justin was a part of the first team from MSU to compete in ¼-scale tractor competition of ASAE (now ASABE). His team won "Rookie Team of the Year," and he considers it one of the best experiences of his undergraduate career. "It was really good working with other students on a hands-on project that we built, presented, and used to compete with other universities from across the country. We learned a lot of practical knowledge, as well as how to effectively present a project scope and results in a professional setting." Justin believes that AETB had a great faculty group to mold the program's students during his time at MSU, but he particularly remembers two professors who took a personal interest in their students' success, Dr. Tim Burcham and Dr. Alex Thomasson.

After leaving MSU, Justin's career took several twists and turns that led him to where he is today, as a business owner and key influencer of agriculture in the southern U.S. Justin originally went to work in the grain business with Bunge North America and found his niche in the trading/logistics/merchandising segment of the grain business. After Bunge, he worked for a much smaller, independent grain company, Bayou Grain & Chemical Corp. in Southeast Arkansas. "This was a great segment of my career (12+ years). The owners were poised for growth, and I was able to be a part of that cycle for the company. I also had a wonderful mentor there, who taught me a lot about the grain business, and life." After Bayou Grain and Chemical Corp. was sold, Justin began farming full time for several years. Having been in a variety of settings in agriculture, Justin was contacted by "a good friend from previous years and business relationships about two years ago, and he suggested we open our own business, K&T Agri, so we started

down the path I am traveling on. K&T works with growers and users of commodities to seek out mutually beneficial relationships, to develop effective marketing plans, to provide stable and fair market channels, and to help growers get the best value for their crops while managing risk through the process."

Even in the midst of a very successful career, Justin considers his family his greatest success. He married his college sweetheart, Jennifer, and they have two children, Alexandra (a freshman at MSU) and Lawson (attending in Fall 2022).

Our New Faculty

Dr. Vitor Martins, originally from Belo Horizonte, Brazil, obtained a B.S. in agricultural and environmental engineering from the Federal University of Viçosa, and M.S. in remote sensing from the National Institute for Space Research, both in Brazil. He then came to the United States where he earned a Ph.D. in agricultural and biosystems engineering from Iowa State University (ISU). While at ISU, Dr. Martins developed a novel deep learning framework to generate 1-m land cover mapping from satellite/aerial images, which involves a series of challenges on training data collection and efficient image processing. After his Ph.D., he joined the Center for Global Change and Earth Observations at Michigan State University as a Postdoctoral Fellow, working on a NASA-funded project to map burned areas on 3-m PlanetScope Cubesat data.

Dr. Martins is interested in satellite imaging and machine learning for land cover and water quality mapping. He believes that spaceborne sensors such as low-cost CubeSats are opening opportunities for near real-time alert systems. With satellite technologies and artificial intelligence, he plans to contribute to ABE's mission in developing future engineering leaders who will apply multiple data sources and inter-disciplinary knowledge to solve complex environmental problems in their communities around the world.

World Food Prize MS Youth Institute

On April 1, 2022, two of our AETB faculty members, Dr. Wes Lowe and Dr. Daniel Chesser, spent some time with 20 students from the World Food Prize Mississippi Youth Institute discussing world food security. It is the mission of ABE that our research in agriculture plays a role in increasing world food security.

Autonomous Agriculture Research

The ABE department has made a concerted effort to build expertise in "autonomy," including sensors, analytics, and robotics for applications from agriculture to biomedicine. This article covers a few examples of ongoing agricultural autonomy work in ABE.
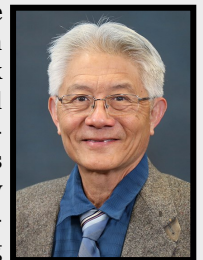
Dr. Xin Zhang: Ag Autonomy enables farm machines to work autonomously, precisely, and consistently to improve farm profitability and minimize environmental risk. Dr. Zhang is working on ground-based and aerial sensing as well as analytical techniques enhanced with artificial intelligence. These will serve as robotic perception systems to enable autonomous agricultural machines to detect objects, segment farm scenes, and reach a target of interest to complete assigned tasks in real-time. In this research Dr. Zhang collaborates with multiple MSU agricultural and engineering departments outside ABE as well as faculty members at Georgia Tech University. She is actively pursuing research funding from USDA and NSF to promote her Ag Autonomy research.

Dr. Nuwan Wijewardane: With the agricultural labor force shrinking worldwide, agriculture faces the challenge of maintaining production for a still-growing population. This situation has created a need for Ag Autonomy to replace or complement human labor in agricultural production. Sensing of soil and plant properties is critical to farm management, but it typically requires labor for sample collection in the field and analysis that commonly occurs in a chemistry lab. Advanced on-the-go sensing is needed to replace manual sample collection and conventional laboratory chemistry. Dr. Wijewardane is contributing to Ag Autonomy by researching mid-infrared spectroscopy as a means to sense plant traits and soil properties, and by integrating new sensing techniques into autonomous ag machines. He works collaboratively with MSU's Plant and Soil Science department, the MSU Soil-Plant-Atmosphere-Research (SPAR) Facility, and USDA-ARS. On top of this, Dr. Wijewardane has created a new ABE course in spectroscopic sensing.

Dr. Wes Lowe: Agricultural production is becoming more focused on data, with sensors that digitize field conditions and enable agronomic decisions to be optimized. Dr. Wes Lowe wants to automate these decisions to help growers be more efficient and able to concentrate on the most important tasks affecting their profitability and environmental risk. Dr. Lowe's group is working on several projects that evaluate current autonomous technologies to better understand how they compare to traditional manual processes. He is working closely with multiple industry partners including Raven, Ag Leader, and CNH, and his group is evaluating their autonomous offerings in real-world scenarios that push the technologies to their limits. These evaluations will be utilized to develop recommendations for using the new autonomous systems and to assess cost-benefit. Dr. Lowe has been funded by Cotton Incorporated and the Mississippi Soybean Promotion Board to develop autonomous technologies that address issues in row-crop production including the lack of skilled labor to perform required tasks.

Dr. Filip To: Dr. To is using artificial intelligence to detect and remove plastic contaminants from cotton fiber, which can cause defects in cotton goods. Pieces of plastic in cotton can be traced from textile mills back through the supply chain to the region of production or even an individual farm, and the mills may choose to discount the price or even refuse to purchase cotton from that source in the future. Thus, plastic contamination is a big problem for U.S. cotton growers. Dr. To's work is sponsored by USDA-ARS, and he works closely with the Cotton Ginning Lab in Stoneville, MS, where he tests cotton samples for contaminants during ginning in real-time. The system evaluates images of cotton with artificial intelligence, and when plastic is detected, an actuator is activated to remove the contaminant. Dr. To's research goal is to develop a technology that will result in contaminant-free cotton bales. He and his graduate students have already developed a prototype they will test at the ginning lab. Another area of Dr. To's research involves controlling the moisture of cotton in a gin to minimize fiber damage. As cotton is flowing through a gin, a sensor will monitor the moisture level, and the drying system will be controlled to maintain the ideal moisture level for ginning. Dr. To's research in Ag. Autonomy is aimed at benefitting cotton growers, the ginning industry, and the worldwide textile industry by minimizing contamination and fiber damage in cotton.

By the Numbers

Research Collaborators

INTERNATIONAL PAPER

Cotton Incorporated

Ag Leader Technology

MSPB — MISSISSIPPI SOYBEAN PROMOTION BOARD

RAVEN

OsteoCentric TECHNOLOGIES

Medtronic

BioHorizons — SCIENCE · INNOVATION · SERVICE

PURENERGY — A NAES Company

2021 Graduations

124

Bachelor's (106)

AETB: 29

BE: 20

BME: 57

Master's (8)

AETB: 4

BE: 1

BME: 3

PhD (10)

AETB: 5

BE: 3

BME: 2

Current Enrollment

448

Bachelor's (412)

AETB: 89

BE: 24

BME: 299

Master's (18)
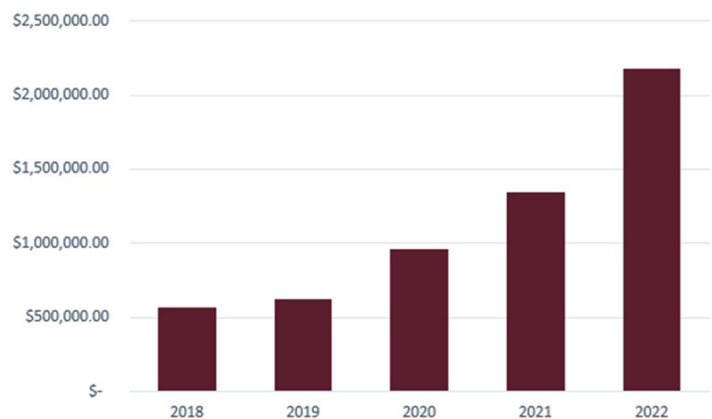
AETB: 8

BE: 1

BME: 9

PhD (18)

AETB: 2

BE: 8

BME: 8

Total Research Awards

2018 — $565,653.45

2019 — $620,504.80

2020 — $957,266.60

2021 — $1,345,845.00

2022 — $2,174,665.00**

** - (as of April 2022)

ABE Total Research Awards FY2018 - FY2022

2021 Professional Placement

12 Students Accepted to Medical School Since 2020

8 Students Accepted to Dental School Since 2020

21 Graduate Students on Fellowship/Assistantship

6 Study Abroad Experiences

2020-2021 Student Employment

AETB

89% employed long-term

11% continuing education

BE

71% employed long-term

29% continuing education

BME

47% employed long-term

44% continuing education

6-Year Graduation Rates

70.2% Department Graduation Rate

2021 Faculty Development

17 Tenure Track Faculty Members

36 Journal Publications

6 Published Conference Papers

2021 Student Distribution

BE

41.2% Female & **58.8%** Male

BME

57.4% Female & **42.6%** Male

AETB

5.2% Female & **94.8%** Male

Our Students

Awards

Professional Awards

Chris Robinson, a senior in Biomedical Engineering, has represented the ABE Department well this year and was named a finalist for the Rhodes Scholarship and the Harry S. Truman Scholarship. Chris was also named a Hall of Fame inductee and Engineering Student of the Year by the MSU Bagley College of Engineering and Outstanding Senior Engineer by the Mississippi Engineering Society.

Colby Freeman, a senior in Biological Engineering is the founder of MSU's Energy Club. Colby and his team recently competed at the international carbon removal student contest hosted by SpaceX, CEO Elon Musk's foundation. The team won a $250,000 prize for their "BECreative Energy" concept and will compete in the $100 million XPRIZE Carbon Removal competition.

Graduate Student Defenses

Chris Marty, M.S., Engineering Technology: "Evaluating the effects of pine and miscanthus biochar on water activity and Escherichia coli populations in commercial broiler litter" **(Fall 2021) (Advisor: Dr. Wes Lowe)**

Matthew Rowland, M.S., Engineering Technology: "Assessing the Potential for Lightning-Induced Damage in Commercial Broiler Houses in Mississippi and Alabama" **(Fall 2021) (Advisor: Dr. Daniel Chesser)**

Jessica Simmerman Wolfe, M.S., Engineering Technology: "Evaluation of the Utility and Performance of an Autonomous Surface Vehicle for Mobile Monitoring of Waterborne Biochemical Agents" **(Fall 2021) (Advisor: Dr. Daniel Chesser)**

Moniba Shabbir, M.S., Biological Engineering: "Hydrology and water quality analysis in the Big Black River watershed, Mississippi" **(Fall 2021) (Advisor: Dr. Prem Parajuli)**

Joshua Tandio, M.S., Biological Engineering: "Design of Plastic Containment Eliminator in Seed Cotton" **(Fall 2021) (Advisor: Dr. Filip To)**

Karen Persons, Ph.D., Biomedical Engineering: "Electromechanical fatigue properties of dielectric elastomer stretch sensors under orthopaedic loading conditions" **(Spring 2022) (Advisor: Dr. Steven Elder & Dr. Reuben Burch)**

Ashma Sharma, Ph.D., Biomedical Engineering: "A comparative study of the functionality of porcine dura a tissue engineered dura mater for clinical application" **(Spring 2022) (Advisor: Dr. Steven Elder & Dr. Lakeisha Williams)**

Spotlight

Cole Bingham is a junior in AETB. A native of Trumann, AR, Cole first became acquainted with MSU by coming to countless football and basketball games with his best friend. Growing up on his family's farm, Cole was always intrigued by agriculture. "I was first introduced to ABE as a high school student attending the Mid-South Farm and Gin show in Memphis, TN. I met Dr. Chesser, and he told me all about the department and AETB program." Cole originally came to MSU to study Civil Engineering, but after his first semester he decided to change his major and a meeting with Dr. Chesser led him to join the AETB program. In addition to his studies, Cole has been heavily involved on campus. He is a member of the CALS Ambassadors and a member of the Lambda Chi Alpha fraternity. Cole has determined that his passion is for the business side of the agriculture industry. "Learning this has helped me decide that after graduation I want to obtain a graduate degree in Agribusiness Management before pursuing a career in industry."

Ashleigh Dunaway is a senior in Biological Engineering. Originally from Ocean Springs, MS, Ashleigh was drawn to MSU's culture and academics. When deciding on a major, "I chose Biological Engineering (BE) because I loved biology and physics in high school and was interested in environmental restoration." She learned about ABE's distinguished status in environmental research from her brother who was a BME graduate in 2016. In the summers Ashleigh has gained professional experience working at MSU's Coastal Research and Extension Center (CREC), where she assisted in coastal conservation research. After graduation Ashleigh will remain there for work in CREC's Coastal Conservation and Restoration department. She will pursue a master's degree in BE and work on designing "living shorelines."
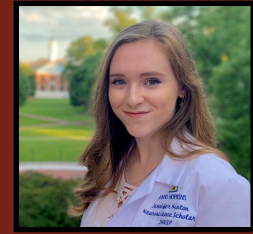
Jennifer Hinton is a senior in Biomedical Engineering. Growing up in Horn Lake, MS her dream was to write music for movies. However, all the years of severe noise exposure from band and choir worsened her congenital partial hearing loss and gave her tinnitus as well. "With my ears ringing nonstop, I had to consider a new career... As my condition declined in my last year of high school and my search for treatment came up empty, I realized how many people like me struggle to cope without a cure or certain treatment for tinnitus." Jennifer then investigated MSU's reputable BME program. "I decided to switch to BME to help solve the problem of tinnitus." Jennifer has participated in the Johns Hopkins Neuroscience Scholars Program for three summers. Jennifer will graduate in May 2022 and plans to work in an engineering position before attending graduate school to combine the skills she's developed in BME with the research skills and auditory knowledge from her internships. "I want to dedicate my career to improving the quality of life for those like me who struggle with hearing loss or tinnitus."