



**Biological Systems Engineering**  
COLLEGE OF AGRICULTURAL & LIFE SCIENCES  
UNIVERSITY OF WISCONSIN-MADISON



## **Welcome from the Department Chair**

Dear BSE Alumni and Friends,

Happy New Year! It's been an eventful six months in our department. Our faculty, staff, and students continue to shine, and I hope you enjoy reading about just some of their accomplishments in this newsletter.

I want to extend a warm welcome to Josh Blaydes and Assistant Professor Mallika Nocco who recently joined our BSE family, and to congratulate Zhou Zhang on her promotion to Associate Professor with tenure.

In December we had a very productive meeting with our Advisory Council, and I am grateful to them for continuing to share their time, expertise, and insights with us. Some were able to attend the senior design poster session after the meeting where our students had the opportunity to showcase their hard work, creativity, and achievements over the past year. Also, our student chapter of ASABE has been very active, and they are fantastic ambassadors of our department.

Our thoughts and condolences are with the families of BSE Emeritus Faculty Fred Buelow, Calvin Cramer, and Leonard Massie, who we lost this summer.

Thank you very much to all our donors. Your generosity and support of the department is deeply appreciated.

I wish you all the very best in 2024.  
Anita Thompson, Department Chair

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## Welcome to BSE

*Financial Specialist, Josh Blaydes*



**Josh Blaydes** is the new Financial Specialist for the Department of Biological Systems Engineering. He earned his Bachelor of Arts degree in Communications from Purdue University (BOILER UP!). Since then, he has over a decade of customer service and financial experience. Before joining the UW, he was a banker for BMO Bank. He is originally from the great metropolis of Roachdale, Indiana (pop. 926). During his free time, he fishes, hunts and plays card games like Magic: the Gathering, table-top RPG's like Dungeons & Dragons, and other board games. He is married to Katie, with one 8 year old son, Elijah.

### *Dr. Mallika Nocco Joins Faculty as Assistant Professor of Water Management*

**Dr. Mallika Nocco** joined the Department of Biological Systems Engineering, University of Wisconsin-Madison in January as an Assistant Professor of Water Management. She has spent the last five years as an Assistant Professor in Cooperative Extension in the Department of Land, Air, and Water Resources at the University of California-Davis. Her research focus is on soil-plant-water relations and irrigation management collaborating with scientists, growers, policymakers, and water districts to develop strategies that balance farm livelihoods and water conservation. Mallika completed her Bachelor's Degree in 2004 from the University of Minnesota, her Master's Degree in Soil Science (2012), UW-Madison, and her PhD in Environment and Resources (2017), UW-Madison.



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## Department News

### *Dr. Zhou Zhang Promoted to Associate Professor*



The UW-Madison's Physical Sciences Divisional Committee voted unanimously to approve Dr. Zhou Zhang's promotion to Associate Professor with tenure. Zhou started at the UW-Madison in the Department of Biological Systems Engineering on March 1, 2019 and has built an impressive research program focused on: Multi-source remote sensing data fusion (e.g., hyperspectral, LiDAR, RGB), machine learning for high dimensional data analysis, UAV-based imaging platform developments for precision agriculture, crop yield prediction using remote

sensing and machine learning, and high-throughput image-based plant phenotyping.

## *Dr. Anita Thompson Among Six Honored at CALS Fall Investiture Ceremony*

The CALS Investiture Ceremony honored six department and college level professorships named in 2023. The ceremony took place on September 26 in the Memorial Union's Great Hall. The ceremony recognized the recipients and acknowledged the generous donors who made the appointments possible. A reception followed the ceremony.

### **2023 honorees:**



- **Samer N. Alatout**, Buttel-Sewell Professorship, Department of Community and Environmental Sociology
- **Julie C. Dawson**, Clif Bar and Organic Valley Chair in Plant Breeding for Organic Agriculture, Department of Plant and Agroecosystem Sciences
- **Amanda Jane Gevens**, Fritz Friday Chair in Vegetable Production Research, Department of Plant Pathology
- **Richard Hartel**, William C. Winder Professorship in Food Science, Department of Food Science
- **Mathew D. Ruark**, Wisconsin Potato and Vegetable Grower BCS Chair, Department of Soil Science
- **Anita M. Thompson**, Patrick Walsh and Noreen Warren Endowed Professorship, Department of Biological Systems Engineering

## *BSE Advisory Council Meets in December - Visits Student 509 Poster Session*

The BSE Advisory Council (BAC), a 12-person external advisory committee, comprised of BSE graduates and other industry and community leaders met on December 5, 2023. The Council listened to Jane Duffstein, the new CALS assistant dean for undergraduate student recruitment and outreach in Academic Affairs. Planned student recruitment strategies were discussed and the BAC explored its role in supporting the department's

efforts to build student number both through having more BSE majors, but also attracting other engineering and science students into the department's courses. In 2024, the BAC will continue to work with the department through the ABET review, and the Council is also interested in developing tactics that could move BSE toward facility improvements and an eventual new building. In 2023, the BAC was instrumental in helping the department rewrite its ABET-required Program Educational Objectives (PEOs) as well as the departmental mission statement. For those interested, the new PEOs, adopted in late 2023 are:

The Biological Systems Engineering Department recognizes that our graduates will choose to use acquired knowledge and skills to pursue a wide variety of career and life goals. Whether they choose a professional career, pursue further education, or engage in volunteer work, our graduates will:

- Develop exceptional problem-solving, leadership, teamwork, and communication skills in the intersecting fields of biological systems and engineering, covering various scales, from microbial to global.
- Utilize skills to make meaningful contributions to communities in addressing pressing societal and ecological challenges.
- Be prepared for professional licensure and career development in the public, private, or nonprofit sectors.

Members of the Council also attended the BSE 509 final design project poster presentations that evening. A sample video and photos will be shared with Council members unable to attend.

### ***509 Senior Design***

Each year, seniors in the BSE program undertake BSE 508 and 509, a two-semester series of senior capstone design courses. These courses provide a platform for students to apply their engineering technical knowledge accumulated over the preceding three or four years to real-world engineering design projects. Teams of three to five students choose or develop a design project, dedicating a year to researching, comprehending and solving the problem. They investigate previous solutions by other engineers and establish a list of design requirements to guide the team without excessively restricting their creative freedom. This is typically followed by brainstorming potential solutions and employing various design selection techniques to refine the most practical design.

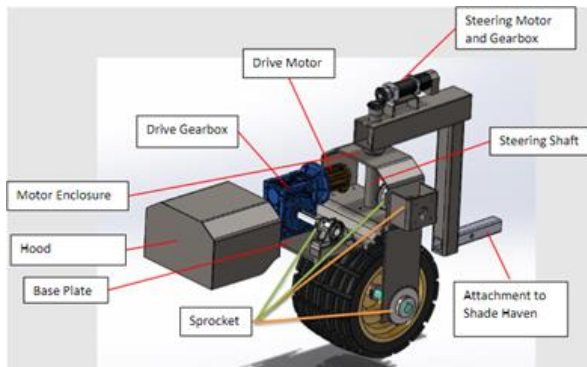
This year, teams utilized their engineering expertise for a range of projects such as designing bale spears capable of lifting, weighing, and measuring the moisture content of large round bales, running simulation models to size earthworks for flood control in a

wetland restoration design and utilizing coding skills and various sensor and motors to monitor and control the temperature of roasting coffee beans.



In the latest cohort, twenty-nine BSE seniors undertook seven diverse design projects encompassing various engineering fields within BSE. One project, sponsored by Shade Haven in Viroqua, WI, focused on creating a self-contained power unit attachment for portable shade structures used in rotational grazing of cattle. The team, consisting of Paulina Baker, Yusra Houidi, Paul Lema, and Meera Manoharan, tackled the challenge of designing an electrically powered, compact, and easily removable power unit capable of pulling and steering a 3,500 lb shade structure. The resulting design featured an electrically powered unit with a multi-stage transmission consisting of a right-angle gearbox and multiple chain and sprocket reductions and a unique steering mechanism capable of turning 180 degrees.

*The Shade Haven design team pictured from left to right: Paulina Baker, Paul Lema, Meera Manoharan, and Yusra Houidi.*



*Computed Aided Design (CAD) model of the final design highlighting the various components of the design. Image courtesy of the BSE student design team.*

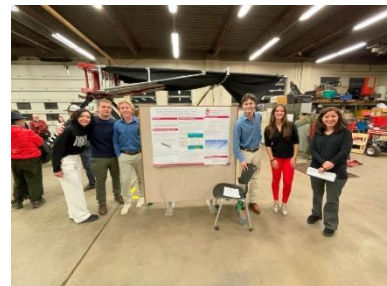
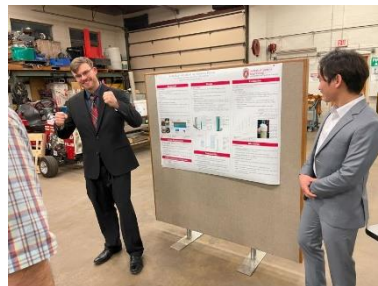
The team invested considerable effort in sizing components, liaising with industry experts, modeling structures using computer-aided design software, procuring components, and fabricating parts. Despite limited prior fabrication experience, the team dedicated themselves to learning additional practices in the BSE fabrication shop, where they plasma cut, bent parts, turned components on the lathe, and milled keyways in drive shafts.

The project faced challenges, and the team learned valuable lessons in dimensional tolerancing during the fabrication process after having to rework a number of parts to obtain proper fitment for welding and assembly. Facing a time crunch, a wiring mistake during assembly caused a controller malfunction. The team rallied together, writing new code to be able to use an Arduino Mega for field testing instead of the off the shelf motor controller.



*Photo of the Shade Haven portable shade system in the folded-up position with the BSE design team prototype power unit attached to the front of the structure. Photo courtesy of the BSE student design team.*

Reflecting on the process, Paul Lema emphasized the poster presentation as the most rewarding part, considering the entire experience as the greatest learning opportunity in his undergraduate studies. "This project felt like the first time I was able to use everything I have learned in school to contribute to a real company as an engineer" Lema commented. The team plans modifications based on field testing observations and aims to submit a design report for the 2024 ASABE AGCO National Student Design Competition, showcasing their commitment to the project and client.



### ***Corn Harvest - the Focus of an Educational Event with Tribal Nation Partners***

On November 13, John Shutske and Brian Luck participated in a corn harvest event near Baraboo as part of a Tribal Nations partnership project led by researchers and educators from CALS and the UW-Madison Division of Extension. The focus of the day was on indigenous corn as an important food product produced by growers within many of the of the American Indian Nations of Wisconsin. Participants from the Ho-Chunk Nation, Oneida Nation, and Menominee Indian Tribe of Wisconsin showcased traditional methods related to hand processing corn (including braiding corn for over-winter air drying) and

preparation of hominy over an open fire using ancient methods involving wood ashes and water. Luck and Shutske helped facilitate a corn combine demonstration with an older model machine loaned to the project. The demo included a review of functions and crop flow in the machine, adjusting the combine for optimum late fall harvest, and safety. A custom fact sheet was developed as a handout for the workshop including photos and operator's manual information important for safe operation and maintenance. In total, about 50 participated including Tribal nation members, UW students, faculty and staff. It was a beautiful day and there was much to be learned about the wisdom past methods, that in many ways, optimize corn quality and storability.



### ***ASABE 2023 Presentation Excellence Award***



Former BSE PhD student, Hanwook Chung (BS '17, MS '20, PhD '23), was awarded a Presentation Excellence Award for his outstanding presentation on "Development of a Continuous, Low-Power, Wireless Core Body Temperature Monitoring System to Detect Heat Stress of Dairy Cows in Real Time" at the ASABE's 2023 Annual International Meeting. This award recognizes the top 15% of student presentations that demonstrate excellence in content, delivery, and impact.

### ***Generative Artificial Intelligence - a New and Exciting Tool in Agricultural Safety and Health***

In late 2023, John Shutske, BSE professor and agricultural safety specialist with Extension published an article in ASABE's peer reviewed Journal of Agricultural Safety and Health.

The article focuses on five specific “use cases” for generative artificial intelligence in research and Extension activities in ag safety. The five use cases include:

- Responding to technical questions using training data from a specialist’s core research, technical articles, past writings, and other core information
- Interpreting complex research articles and then using that information for Extension bulletins and other action-oriented information for farmers and others in the industry
- Summarizing recent farm incidents including injuries, fatalities, and other accounts to understand common denominators and risk factors and better target safety messaging
- Support tool for interpreting complex regulatory information, laws, and engineering design and safety standards
- Outlining content for Extension workshops, articles, presentations, and classroom lectures based on input and needs assessments from different Extension audiences

In the article, Dr. Shutske provides specific examples of how these use cases can inform the work of other in Extension as well as consultants, practicing engineers, regulators, and farmers directly. The article is available at:

<https://uwmadison.box.com/v/AgSafetyHealthLLM>

In addition to providing examples that made use of Open AI’s ChatGPT 4.0, Shutske also outlines and explains some of the pitfalls and issues connected to using AI in the form of large language models or LLMs.

These are:

- Issues connected to accuracy, misleading, or “hallucinated” outputs and answers
- The use of copyrighted or other proprietary, protected information in model training and the associated IP legal implications
- Bias connected to “training data.” For example, most existing training information in ag safety came from university research, often specifically for the benefit of White (European American) farm owners and operators—meaning that models may lack context for other at-risk or underserved audiences of Extension programs

Citation: Shutske, J. M. (2023). Harnessing the Power of Large Language Models in Agricultural Safety & Health. *Journal of Agricultural Safety and Health* 29(4): 205-224. <https://doi.org/10.13031/jash.15841>

## ***BSE Students Collaborate on an International Team to Improve Technology for Forage Utilization***



*Lemcke and Studer in front of John Deere Werke Zweibrücken*

This year, Tess Lemcke (BS '21, MS '23) and Danton Studer (MS '23) had the opportunity to present their thesis work at the sponsor's location in Germany. Lemcke and Studer met biweekly with their German colleagues to align research methods, experiment design, data analysis, and writing. This trip was a chance to meet in person and further build research connections in Germany. They also had the opportunity to visit local farms, historical Heidelberg, and a vineyard with local graduate students collaborating with the Digman lab on related topics.

The team, including Emeritus Professor Shinnars, also met at the Hofgut Neumühle research farm in Alsenz. Our team has ongoing collaborative work with the research farm and continues to seek research opportunities and student exchanges. The trip culminated with final presentations at the Zweibrücken factory and research planning for the 2023 season. This trip and the collaborative work are a continued effort of the lab to evolve the dairy and livestock technology important to our Wisconsin stakeholders.



*Lemck, Studer, Shinnars, and Jason Hayer of the Hofgut Neumühle farm*

## ***Prof. Pan's Research on Dairy Waste to Prebiotics Published as a Cover-feature Story and Selected for Funding by CDR***

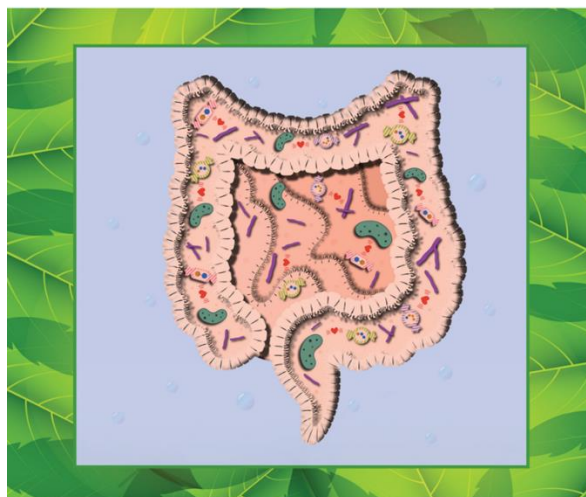
Using their patented technology, Prof. Xuejun Pan's group has successfully synthesized high-value prebiotics (galacto-oligosaccharides, GOS) from an underutilized dairy waste, lactose in whey permeate. The new technology allows a much higher yield of GOS, compared to traditional enzymatic methods (96% vs. 60%). Collaborating with Prof. Jan-Peter van Pijkeren's lab in Food Science, the group demonstrated the prebiotic effects of

the synthesized GOS via *in vitro* fermentation and *in vivo* animal (mice) tests. The GOS as a prebiotic was beneficial for growth of selective probiotic population in the gastrointestinal system and therefore contribute to the intestinal and overall well-being of the host. The GOS has great potential as a prebiotic supplement in dairy products, infant foods, and other food products. The research was recently published as one of the cover-featured stories in ACS Sustainable Chemistry & Engineering (2023, 11, 14031–14045). Further, this project recently got selected for funding the scale-up of GOS production and its utilization in dairy products by the Center for Dairy Research (CDR). The two-year (2024–2025) funds will support a postdoc to scale the process up using the pilot facilities in CDR. The success of the project would convert dairy industrial waste to treasure and make additional revenue from whey permeate for dairy farms.

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## Alumni News

### *Alumni Create Scholarship Opportunity*

Walter Schlessler (BS '98, MS '01), and fellow classmates, have generously created a new scholarship fund to support future BSE students. When sharing his motivation to give back, Walter noted "Several influential BSE faculty and staff have retired in recent years, which has caused me to reflect on both the past and future. Like many of us, I remember my time as a student very fondly and wanted to enable more people to have similar opportunities."

The scholarship's first recipient will be selected for the 2024–2025 academic year and will support undergraduate students at sophomore level or above, who have financial need and demonstrated interest in Machinery Systems Engineering. The group encourages all BSE alumni to join their effort to secure funds in total of \$25,000 or

more, by making a gift. Scholarship funds at this level then become self-sustaining and provide financial support to students in perpetuity.

To make a gift, please visit [supportuw.org/giveto/MachineryBSE](https://supportuw.org/giveto/MachineryBSE). For questions contact Scott Fletcher, Senior Director of Development ([Scott.Fletcher@supportuw.org](mailto:Scott.Fletcher@supportuw.org)) or Walter Schlessler ([SchlesslerWalterM@JohnDeere.com](mailto:SchlesslerWalterM@JohnDeere.com)).

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## Obituaries

**Frederick H. Buelow** (*Mar 13, 1929 - Aug 22, 2023*)

Upon completing his bachelor's degree from North Dakota State in Agricultural Engineering, Fred went on to earn his Master's degree in Mechanical Engineering from Purdue University and his PhD in Agricultural Engineering from Michigan State. He joined the Agricultural Engineering faculty at Michigan State in 1956 and became an Assistant Dean there in 1966. Fred came to the University of Wisconsin-Madison in 1967 as Chairman of the Department of Agricultural Engineering. While at Madison, Fred worked with his colleagues to gain professional accreditation for the Agricultural Engineering Department. He especially enjoyed teaching classes and mentoring his graduate students from all over the world.



**Calvin O. Cramer** (*May 18, 1926 - Aug 8, 2023*) Following his service in the Army during World War II, Calvin returned home to complete his bachelor's, master's, and PhD degrees here at the University of Wisconsin-Madison. He began teaching at the UW-Madison in 1954, as an instructor and joined the faculty of the Department of Agricultural Engineering in 1959. He taught the design and construction of agricultural buildings, later expanding to courses in the area of construction administration particularly residential construction. He was voted by his students as the best departmental instructor many times. He was a member of the American Society of Agricultural and Biological Engineers for over 65 years, and in 1986, was awarded "Engineer of the Year" by the Wisconsin Section.

**Leonard R. Massie** (Dec 16, 1937 - Jun 3, 2023) Leonard attended the University of Wisconsin-Madison where he earned a bachelor's degree in Agricultural Engineering and Civil Engineering, a Master's degree in Agricultural Engineering, and a PhD in Civil & Environmental Engineering with a minor in Economics. In 1961, he joined the UW-Madison faculty working in Agriculture Extension. He achieved status as a full professor in 1977. Leonard loved working with students and farmers throughout the state of Wisconsin and the Midwest. He retired in 1996 after 35 years on the faculty.



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## BSE Graduate Student Organization

*Getting Lost in the Maze of Maize!*



On October 21st, the BSE Graduate Student Organization (BSE GSO) held a fall semester social corn maze event at Treinen Farm (Lodi, Wisconsin)! Treinen Farm's award-winning 15-acre maze is one of the top corn mazes in the U.S. It was an excellent opportunity for community building among students by putting their brains together to solve the maze and various puzzles in the middle of a Wisconsin cornfield. It was very fitting because of our position as agricultural engineers, although rumor has it that some of the grad students are still lost in the maze to this day...! In the past, BSE GSO hosted a pizza social, bowling night, and ice cream social. BSE GSO will continue to host social events for graduate students and postdocs to keep building departmental spirit and a safe space for all. So, keep your eyes and minds open!



Also, BSE GSO is currently looking for graduate student leaders. If you are interested in organizing these events, please contact Derek Ho ([dkho2@wisc.edu](mailto:dkho2@wisc.edu)) for more information! It is a great opportunity to work with BSE staff and develop fun social event ideas!

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# Student Chapter of ASABE

*So many memories have been made in 2023 by UW-Madison's ASABE Chapter!*

The American Society of Agricultural and Biological Engineers (ASABE) is a student organization that welcomes students interested in agriculture, food, and biological systems. The club's primary focus is to facilitate connections and foster relationships between students, faculty, and nearby companies. This engagement allows students to explore the multitude of opportunities available to them for future employment. The ASABE Pre-professionals Club at the UW-Madison organizes various activities such as monthly meetings, social events, fundraisers, and service opportunities, creating a platform for students and faculty to connect and get to know each other. Through these interactions, students can gain valuable insights into the industries they are interested in, while simultaneously developing important life skills like leadership and teamwork.

In July a group of six students attended the Annual International Meeting (AIM) in Omaha. They networked with Agricultural and Biological Engineers from around the world and learned about educational opportunities in various fields of interest.

Students, Micah Robinson, Gabby Whisler, Jenna Kouba, and Zach Jannusch participated in the AGCO National Student Design Competition, with a project titled, "Machine Learning Models using Remote Sensing for County-level Corn Yield Prediction in the Midwestern U.S." and placed 3rd! The team was advised by Prof. Zhou Zhang.



At the start of the fall semester, the newly elected 2023-2024 ASABE Executive Board worked diligently to prepare for the exciting semester ahead of them. In September, we had our Kick-Off BSE Department Welcome Grill-Out where faculty and students enjoyed a great meal and some friendly corn hole. Following the Grill-Out, ASABE held its first general meeting of the semester where members from the UW Quarter-Scale Tractor Team, a CALS study abroad representative, and three UW-Madison BSE alumni working as Quality or Production Managers at Ardent Mills shared unique opportunities with ASABE members. The alumni working at Ardent Mills provided an in-depth look at the diversity of pathways at Ardent Mills within the Food and Bioprocess Engineering specialization.

From this networking opportunity, one of our Executive Board members, Eden Britt, secured a 2024 summer internship with Ardent Mills. To conclude September, ASABE members collaborated to design and build a Homecoming Parade Float with a nearly life-sized waving Bucky Badger! Over 20 student and faculty members helped craft the float and celebrated UW-Madison's Homecoming at the Friday night parade.





In October, we held our October general meeting where a speaker from the USDA shared insights on the benefits of cover crops and precision agriculture, including the reduced need for heavy and widespread pesticide use. To wrap up October, ASABE held a fun pumpkin carving social for members!



In the blink of an eye, November was here, which meant it was time for our 44th Annual Lawn Mower Clinic (LMC). We serviced a total of 70 machines with the help of 32 student volunteers, five faculty volunteers, and three company sponsors. This event is our organization's largest fundraiser and we are deeply thankful for all of the support we receive year after year from the amazing Madison-area community.

We were able to reach our fundraising goal which goes toward supporting our members financially to attend leadership/networking conferences and our outreach efforts at events such as Engineering Expo. At our November general meeting members had a chance to talk with representatives from Wisconsin ASABE and hear about opportunities for increased student involvement in the state section. In addition, they heard from Mary Pat Tubb, a General Manager at John Deere. She spoke on her successful career path and offered valuable career advice to the meeting attendees. To close out our Fall 2023 semester, ASABE is hosting a gingerbread house-building competition for members to showcase their design skills and holding a final general meeting in December. Upon returning to campus after winter break, the UW-Madison ASABE Executive Board is excited to partner with the Wisconsin ASABE Section to host the Winter Wisconsin ASABE Chapter meeting at UW-Madison in February!

All of the events this semester were memorable and successful due to the contributions from the ASABE Executive Board listed below, the BSE faculty, and all the ASABE members! We cannot wait for the exciting events on the horizon for next semester!

#### **UW-Madison Student Chapter of ASABE Executive Board 2023-24**

**President:** Jaya Suneja

**Vice President:** Seeham Cece Bnyat

**Treasurer:** Lindsay Blanchfield

**Secretary:** Eden Britt

**Fundraising:** John O'Neill/Riley O'Flanagan

**Outreach:** Cami Guelig/Emma Farrell

**Social:** Paulina Baker

**Grad Student Reps:** Collin Klaubauf/Micah Robinson

**Public Relations:** Sam Anhalt

**CALS Rep:** Chloe Sroga

# Recent Graduates

## Biological Systems Engineering - Bachelor's Degrees

Bensch, Constantin  
Gerritson, Marissa Ann  
Konter, Erin Michelle

Kudronowicz, Mitchel Jon  
Loehr, Andrew Thomas  
O'Brien, Carter James

O'Neill, John Riley  
Sroda, Lauren  
Van Dorsten, Karly Mari

## Biological Systems Engineering - Graduate Degrees

**Master's degree (faculty advisor)** Studer, Danton (Digman)

**Doctoral degree (faculty advisor)** Chung, Hanwook (Choi)  
Wang, Weizheng (Gunasekaran)

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## Our Donors (May 2023 - November 2023)

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Bryan Yanke



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<https://secure.supportuw.org/give/?id=53fe2478-2879-4f05-bffd-e736d24f0602>

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University of Wisconsin-Madison | College of Agricultural and Life Sciences | Biological Systems Engineering

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