

# SHOWCASE 2026

A hybrid event highlighting  
senior design projects and  
student achievements

**MICHIGAN STATE**  
UNIVERSITY

Department of Biosystems  
and Agricultural Engineering



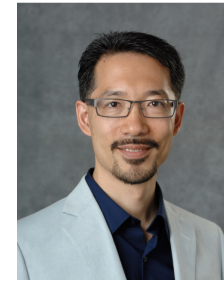
The Biosystems Engineering (BE) Showcase is a long-standing highlight of the BE calendar. The day consists of three different types of presentations by each project team – poster presentations at Design Day, in-depth design review sessions with our Industry Advisory Board members, and brief public presentations of their overall design results. Showcase brings together the entire BE community – student teams, project clients, our Industry Advisory Board, faculty, other BE students, and friends and family – to get a brief glimpse of the final design reports from these real-world, client-sponsored projects.

Congratulations to all the students for the results of their creative and diligent efforts. Also, special thanks go to Drs. Luke Reese and Sang Jeong for managing senior design and the diversity of projects. Lastly, thanks to all the faculty advisors of the project teams, to the project clients for supporting our program, and to our Industry Advisory Board – whose expert insights, support, and evaluation of the projects are always impactful, in terms of both student learning and our overall program success and continuous improvement process

*Bradley Marks, Ph.D., P.E.*

Professor and Department Chair

BE Senior Design is a unique, two-semester experience that prepares students for successful careers solving challenging problems in food, energy, environment and health. In Senior Design, teams of three to five students are paired with real-world clients to work on an actual issue the client is facing. With the help of a BE faculty mentor, these teams work with their client to come up with a solution for the problem using the technical knowledge they've accumulated during their time at MSU. Students also develop skills in teamwork, project management and communication.



The nature of the two-semester structure allows students to take a deeper dive into a project and establish a stronger relationship with their team and client, similar to an industrial co-op. The extended time on the project allows the students to become more knowledgeable about the specific problem and solutions they're working to address. In addition, students experience a more realistic ebb and flow of team and client dynamics that prepare them for the start of their professional career. As an instructor, there's nothing better than seeing your students' hard work come to fruition. It's always exciting when our Senior Design students see their work implemented by clients – and sometimes, receive job offers from them. We're honored to lead this course and eager to share all of the hard work our students have put into their projects over the course of this year.

*Sanghyup Jeong,  
Ph.D., P.E.*

Assistant Professor

*Luke Reese, Ph.D.*

Associate Professor

Full descriptions and project posters are at:  
[www.canr.msu.edu/bae/senior-design-2026](http://www.canr.msu.edu/bae/senior-design-2026)



(L to R) Joseph Pelkey, Neha Patel, Miles Morman, Megan Ransler, & Ryan Wrublewski

## Restoration and Improvements of MSU Stormwater Bioretention Basin

### Team MSU Bioretention

Sponsor – MSU Infrastructure, Planning, and Facilities  
Faculty Advisors – Dr. Dawn Dechand & Dr. Subhasis Giri

Since its installation in 2010, the bioretention basin on MSU’s campus has experienced difficulties in managing and providing adequate treatment for the stormwater flowing into the site. This project objective was to restore the drawdown time to 24-48 hours and expand the treatment volume of the site by 50%. Additionally, the environmental health of the site will be improved with a list of plantings to increase biodiversity and a maintenance plan included in the design.



(L to R) Ethan Hartwig, Drew Kraemer, Cody Fisher, & Truman Bauer

## Addressing Harmful Algal Blooms in the Soldan Dog Park Pond

### Team Soldan Paw Patrol

Sponsor – Ingham County Parks

Faculty Advisors – Dr. Dawn Dechand & Dr. Subhasis Giri

The pond at Soldan Dog Park has regularly experienced harmful algal and cyanotoxins for four years. Phosphorus from influent stormwater and sediments stimulate harmful algal blooms (HABs) each summer. A coupled biochar-aeration approach was chosen to combat the HABs: biochar bags will be applied to reduce influent phosphorus concentrations to 0.025 mg/L while pond aerators will be used to increase dissolved oxygen, reduce in-pond phosphorus concentrations, and disrupt algal growth. A quote for a 4-diffuser aeration system places the price at \$10,390 which was determined reasonable for a long-term solution. Biochar application calculated to be \$443 for the initial removal of phosphorus, with future applications ranging from \$50-\$200.



(L to R) Jayden Schmaltz, Stewart Tucker, Leah Jarmolowicz, & Jaclyn Cool

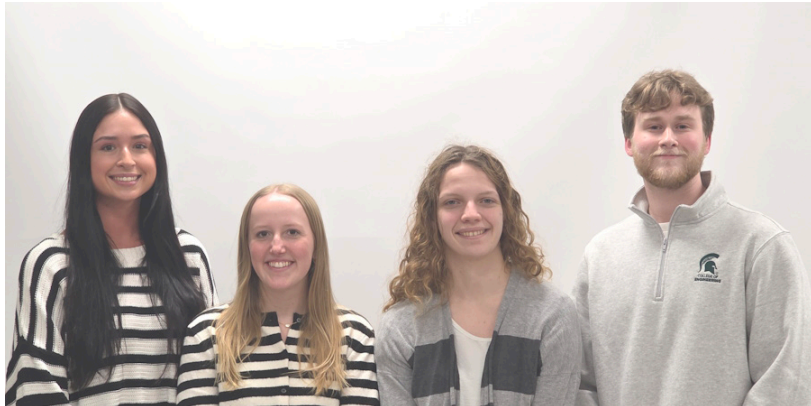
## Implementing Phosphorus Mitigation Technologies for Algal Blooms in Duck Lake (Allegan County)

### Team Duck Lake

Sponsor – Duck Lake Water Quality Committee

Faculty Advisor – Dr. Ehsan Ghane

Residents of Duck Lake have been experiencing an increased number of harmful algal blooms in recent years due to high phosphorus levels. The Duck Lake project delivers a dual phosphorus-reduction strategy combining an alum treatment for internal loading with phosphorus removal structures for watershed inflows. Together, these designs are projected to reduce preexisting lake phosphorus by 85% and to reduce phosphorus entering the lake by 30%, lowering harmful algal bloom risk and improving water clarity within the first treatment season. This approach provides the Duck Lake community with a sustainable path toward restoring water quality and a net benefit of \$1.5M.



(L to R) Ava Chavez, Emily Woodyard, Josie Cayen, & Patrick Brennan

## Evaluating the Feasibility of Corn Stover-Manure Anaerobic Digestion

### Team Consumers Energy

Sponsor – Consumers Energy (under Non-Disclosure Agreement)

Faculty Advisor – Dr. Chris Saffron

Anaerobic digestion (AD) is a process that produces renewable natural gas from organic wastes, such as dairy manure, food wastes, and agricultural residues. The team evaluated the feasibility of an anaerobic digestion system with corn stover and manure. The final feasibility study includes a comparative Life Cycle Assessment (LCA) and Techno-Economic Analysis (TEA) of the corn-stover manure AD to the current Consumers' manure only AD. The corn-stover manure system showed a 1.7 times decrease in global warming potential compared to the manure only system. The ROI of the corn-stover manure AD system was determined to be 9.0%, and the selling price was found to be \$150.87 per MMBtu. The team also generated ideas to increase the profitability of the system by utilizing by-products. The selected design utilizes a solid digestate by-product for mushroom cultivation. Future work could include the mushroom cultivation steps within economic analysis to reach the desired energy price.



(L to R) Connor Moritz, Josh Hirschenberger, Eliza Ajro, Defne Karalar, & Maria Sufyan Abbasi

## Supporting Sustainability: Organic Patient Food Waste Digester for Henry Ford Health – Destination Grand

### Team Sustainable Organic Digester

Sponsor – Henry Ford Health (under Non-Disclosure Agreement)

Faculty Advisor – Dr. Wei Liao, PE

Team Sustainable Organic Digester partnered with Henry Ford Health (HFH) to advance their broader environmental and sustainability goals at their new hospital facility, Destination Grand. The proposed 2-stage anaerobic digester design is sized and sited specifically offering operational efficiency, heat and energy generation, and a safer fertilizer-ready digestate. Operating at 90% efficiency, the design uses over 600 lb/d of organic patient food waste to generate over 100 kWh/d of usable energy. Environmental benefits include substantial reductions in carbon dioxide emissions by 98% and ~ 3,770 lb of digestate/d for fertilizer use. Savings accrue by diverting food waste away from landfills to avoid transportation and tipping fees and generating on-site heat and electricity. HFH would recoup \$0.12 per gallon of waste by not sending it to a landfill.



(L to R) Amber Boomer, Nicholas Bray, Sydney Chapman, & Clayton Whetstone

## Non-Invasive Frameless Immobilizer for MRI Guided Focused Ultrasound

### Team Henry Ford Health

Sponsor – Henry Ford Health (under Non-Disclosure Agreement)

Faculty Advisor – Dr. Daniel Morris

This project aims to improve patient comfort during MRI-guided focused ultrasound procedures used to ablate small, targeted areas of the brain responsible for movement disorders. Current stereotactic head frames are invasive as they require screws fastened to the skull. This deters patients from a life-changing procedure. We developed a non-invasive frameless mask as an alternative to improve patient comfort while maintaining the required stability. The design consists of a modified radiosurgery mask that attains displacement values of <math><5\text{ mm}</math>, demonstrating positive proof of concept. Further refinement can achieve the target displacement value of <math><2\text{ mm}</math>.



(L to R) Lilliana Duus, Elizabeth Diez, Aubree Crane, & Daniel Klungle

## Using Fluorescein Sodium for Real-Time Identification of Cerebrospinal Fluid Leaks in Saline

### Team Stryker

Sponsor – Stryker (under Non-Disclosure Agreement)

Faculty Advisor – Dr. Vangie Alocilja

This project explores the use of a sodium fluorescein intrathecal injection to identify cerebrospinal fluid (CSF) leaks during neurosurgery. Neurosurgeons opt out of using irrigation during spinal surgery due to the optical similarity of saline and CSF. Under blue light, CSF mixed with sodium fluorescein will fluoresce neon green, becoming visible to a surgeon if a leak occurs. This visibility allows the surgeon to seal the dura, preventing future complications. This method encourages irrigation with Stryker's surgical power tools, ensuring tool longevity and effectiveness. Focus was put on minimizing fluorescein concentration, and therefore patient risk, while maintaining CSF leak visibility.



(L to R) Summer Luick, Kealey Kolp, Carter Ostrowski, & Katherine Heinecke

## Ensuring Ice Cream Quality Through Palletization Management

### Team Tillamook

Sponsor - Tillamook (under Non-Disclosure Agreement)  
Faculty Advisor - Dr. Kirk Dolan

At Tillamook's Decatur, IL plant, the ice cream products have experienced quality degradation from thermal abuse during palletization. Through experimentation and verification with a COMSOL heat transfer model, the failure points for temperature and time have been determined. The team has suggested the installation of a thermal camera with a stack light system to alert plant operators. This project will decrease failures by 4% and increase profits by over \$1 million.



(L to R) David Lau, Sophie McCowan, Gillian Kuehnle, & Gianna Fiore

## E.W. Grobbel Temperature Control Chamber for Pickle Fermentation

### Team Pickle Pals

Sponsor - E. W. Grobbel (under Non-Disclosure Agreement)  
Faculty Advisor - Dr. Kirk Dolan

E.W. Grobbel is a company that works diligently to produce quality food products. Team Pickle Pals designed a temperature control chamber to reduce temperature fluctuations during pickle fermentation. The chamber stabilizes temperature fluctuations to standardize fermentation times and reduces waste from over fermentation. The final chamber design will encompass 16-fermentation barrels with four per pallet and a cost of \$3,960 per unit.



(L to R) Varshitha Korivi, Sasha Stoyanovich, Luke Caruso, & Evan Malbouef

## Automation of COD and TOC Waste Stream Monitoring for Proper Disposal

### Team Perrigo

Sponsor – Perrigo (under Non-Disclosure Agreement)  
Faculty Advisor – Dr. Yan “Susie” Liu

Perrigo is seeking out a detection system that identifies adverse waste stream conditions and automatically diverts the waste stream based on an undesirable sugar concentration at their liquid fill plant in Allegan, MI. COD and TOC sensors will be utilized to detect their presence and automatically divert the fluid into designated waste tanks for a cost avoidance of \$210,000+ in 10 years and an improved relationship with the City of Allegan’s Waste Water Treatment Facility.



(L to R) Miguel Martinez-Garcia, Danielle Edington, Diana Mejia, & Joshua Dixon

## Optimizing Agrivoltaic System Design for Michigan Farmer Income

### Team Mitten Solar

Sponsor – MSU Extension  
Faculty Advisors – Dr. Ajit Srivastava & Aluel Go

Team Mitten Solar developed an optimization tool that identifies the most profitable balance between crop production and solar energy generation for Michigan farms from a solar-developer perspective. Using real-world performance data, incentive structures, and a representative farm profile, the model determines the optimal allocation of land between crops and high-density solar arrays. The tool enables farmers to evaluate multiple agrivoltaic scenarios and select the configuration that maximizes revenue while fitting their site conditions and management goals.

## The Advisory Board

The purpose of the Industry Advisory Board is to facilitate the exchange of ideas between Board members, faculty, and students of the BE program. Its function is to improve continuously the BE program quality by keeping it current and relevant to industry needs. Regular and adjunct board members also serve as external project evaluators.

## Board

Ellen Bornhorst, PhD ~ PepsiCo  
Holly Bowers ~ Consumers Energy  
Jessica Bruin ~ Mars Snacking  
Lisa Buchholz ~ Corteva Agriscience  
Matt Burt (Chair) ~ AbbVie  
Shelley Crawford ~ Jiffy  
Michelle Crook, PE ~ MDNR  
Laura Doud, PE ~ MDOT  
Cassandra Edwards ~ Tillamook Creamery  
Gene Ford ~ Standard Process  
Jeremy Hoeh, PE ~ EGLE  
Eric Iversen, PE ~ PEA Group  
Andrew Johnson ~ JBT Marel  
Kevin Kowalk, PE ~ EA Engineering, Science, and Technology (MI) PLC  
Mitch Miller ~ Lactalis USA  
Amber Mostiller ~ E. W. Grobbel  
Vikas Relan ~ Henry Ford Health  
Michael Wozniak, PE ~ MDARD  
Rob Yoder ~ BDI, Inc.  
Dave Young ~ Perrigo

## Ex-Officio

Todd Forbush, Techmark, Inc., (ASABE Rep)



If you are interested in sponsoring a BE 485/487 capstone project for the 2026\_27 Senior Design teams, please contact Dr. Sanghyup Jeong, PE at [jeongsa1@msu.edu](mailto:jeongsa1@msu.edu) or Dr. Luke Reese at [reesel@msu.edu](mailto:reesel@msu.edu).

---

## UNDERGRADUATE SCHOLARSHIPS

### **Agah Endowed Scholarship**

The Agah Endowed Scholarship is awarded to students who look to make a difference as to how the world's food and water supplies are used, restored, and preserved.

### **F. W. Bakker-Arkema Endowed Scholarship**

F.W. Bakker-Arkema was a professor of agricultural engineering at MSU for over 30 years. His scholarship recognizes students that contribute to the cultural and intellectual diversity of biosystems engineering through their leadership experiences.

### **A.W. Farrall Scholarship**

The Farrall Scholarship is the most prestigious undergraduate scholarship awarded by the Department of Biosystems and Agricultural Engineering. It is named in honor of A.W. "Doc" Farrall, who chaired the department from 1945-1964 and helped establish the first agricultural engineering Ph.D. program in the nation. Farrall Scholars excel both academically and professionally, and are leaders in the biosystems engineering community.

### **DeBoer Family Scholarship**

The DeBoer Family Scholarship is awarded to students who excel academically and demonstrate a passion for biosystems engineering

### **Carleton Scholarship**

The Walter M. and Lillie M. Carleton endowed scholarship is awarded to students who excel in Biosystems Engineering. Dr. Walter Carleton was the recipient of the first PhD degree in the U.S. awarded in a standalone Agricultural Engineering department - in 1948 (now the Department of Biosystems and Agricultural Engineering). Dr. Carla Carleton, daughter of Walter and Lillie Carlton, and retired faculty member of the MSU College of Veterinary Medicine, was instrumental in establishing this fund in perpetuity. This is the first year awarding this scholarship.

### **Clarence and Thelma Hansen Scholarship**

The Clarence and Thelma Hansen scholarship is awarded to Michigan natives and U.S. students who have demonstrated academic achievement, leadership, and experience working in agriculture.

### **George E. and Betty L. Merva Endowed Scholarship**

Dr. George Merva was a faculty member in the Department of Biosystems and Agricultural Engineering for 30 years. This endowment, named in his and his wife's honor, recognizes upperclassmen who have demonstrated leadership and academic success.

### **George A. Mynsberge Experiential Learning Fund for Research**

See Graduate Scholarships

### **John and Julianna Merva Endowed Scholarship**

Dr. George Merva's father, John, was an immigrant from Slovakia, who, despite receiving no formal schooling and working full time in ore mines, was able to teach himself three languages. In this spirit, the John and Julianna Merva Scholarship is awarded to an undergraduate student who has balanced leadership and academic success, while also working to cover their educational expenses.

### **Howard F. and Esther L. McColly Scholarship**

The Howard F. and Esther L. McColly Scholarship honors Dr. Howard McColly, who served on the faculty of the Department of Agricultural Engineering for more than 21 years, and his wife, Esther. The scholarship is awarded to students who have demonstrated academic achievement, leadership and service to the profession.

### **Michigan ASABE Section Scholarship**

The Michigan Chapter of the American Society of Agricultural and Biological Engineers (ASABE) awards a scholarship to one college freshman and one college sophomore each year. Recipients must be registered as pre-professional members of ASABE.

## FRESHMEN SCHOLARSHIPS

### Robert J. Gustafson Scholarship

The Gustafson Scholarship is awarded to students with a high academic ability and/or financial need, with a first preference for incoming freshmen students.

### Alfred & Mary Murray Scholarship

The Murray Scholarship is awarded to students with a high academic ability and/or financial need with a first preference for incoming freshmen students.

## 2025-2026 Undergraduate Scholarship Recipients

### Agah Endowed Scholarship

Connor Moritz

### F.W. Bakker-Arkema Endowed Scholarship

Isabelle DeLaet  
Joshua Dixon  
Kathleen Grundel  
Lise-Mari Lahoud  
Diana Mejia Erazo  
Carter Ostrowski

### W & L Carleton Endowed Scholarship

Katherine Heinecke

### DeBoer Family Scholarship/Fellowship Fund

Eliza Ajro  
Luke Caruso  
Sudhiksha Damodara  
Summer Luick  
Sasha Stoyanovich

### A.W. Farrall Scholarship

Gillian Kuehnle

### Clarence & Thelma Hansen Scholarship

Rebecca Ferns  
Chase Moore  
Jayden Schmaltz  
Jade Shaw

### Howard & Esther McColly Scholarship

Josie Cayen  
Leah Jarmolowicz

### George E. and Betty L. Merva Endowed Scholarship

Nicholas Bray

### John and Julianna Merva Undergraduate

Rylie DuBois  
Kiera Modder  
Leah Wilson

### Alfred & Mary Murray Scholarship

Gavin Gwisdalla  
Hayley Hopkins  
Will Minnaar  
Lauryn Turner

### George A. Mynsberge Experiential Learning Fund for Research

Megan Ransler  
Stewart Tucker



## 2025-2026 Graduate Scholarships

### Outstanding BE Research Fellowship & Fitch H. Beach Award

The Outstanding BE Research Fellowship & Fitch H. Beach Award is presented to one of the top Ph.D. students in the BE graduate program who has excelled in research productivity, and whose work suggests a high-level of direct impact on society. The recipient represents at the college level against similar nominees from other disciplines in the College of Engineering. Funding is based on placement in the competition at the college level and is funded by the College of Engineering and the BAE Endowment for Graduate Studies.

### Most Outstanding BE Graduate Student Fellowship

The Most Outstanding BE Graduate Student Fellowship is awarded to top students in the BE graduate program. It recognizes their recipients' breadth of excellence and direct and indirect contributions to the BAE Department through professional productivity, service to the department and university, and contributions to the extended community. This honor is funded by the BAE Endowment for Graduate Studies, which was from former and current BAE faculty and other donors wishing to support graduate education.

### Galen & Ann Brown Scholarship

The Galen & Ann Brown Scholarship supports graduate students working in the engineering domains that can be related or applied to the fruit and/or vegetable industries, a field to which Dr. Galen Brown dedicated his career. This scholarship is funded by the family of Galen and Ann Brown and others who respected and/or worked with Galen.

### Katherine & Merle Esmay Scholarship

The Katherine & Merle Esmay Scholarship supports international graduate students with a clear passion and plan to return to their home country to implement their knowledge gained through their MSU BAE degree. It is funded by the family of Merle and Katherine Esmay and others who have the passion to make a difference around the globe, like Merle did.

### George A. Mynsberge Experiential Learning Fund for Research

Candidates for the Mynsberge Experiential Learning Scholarship must conduct experiential learning research/outreach in water resource recovery, water quality, and/or wastewater treatment. The selected student(s) will work with a BAE faculty member for the experiential learning experience. The award has an expectation that the student presents their experience at a research conference hosted by MSU or a professional society.

### M. Kent Taylor Assistantship Fund

The M. Kent Taylor Assistantship Fund supports graduate students in the academic pursuit of alternative, sustainable energy technologies to reduce the carbon load on the atmosphere and oceans.

## Graduate Scholarship Recipients

### College of Engineering Outstanding BE Graduate Student Fellowship

Kieron Moller (2024/25)

### Outstanding BE Research Fellowship & Fitch H. Beach Award

James Franco (2024/25)

### Galen & Ann Brown Scholarship

Boyang Deng

### Katherine and Merle L. Esmay Fellowship

Josue Kpodo

### George A. Mynsberge Experiential Learning Fund for Research

Emilia Emerson

### M. Kent Taylor Assistantship Fund

Muhammad Talha

Interested in supporting scholarships for Spartan biosystems engineers? [Click here](#) to make a donation.

---

*This page was intentionally left blank*

---

## About the MSU Biosystems Engineering Program

BE graduates are expected to succeed in diverse careers where they integrate and apply principles of engineering and biology to globally important problems in food, energy, environment and health. This success is attained through a curriculum that focuses on:

- Identifying and solving problems at the interface of biology and engineering, using modern engineering techniques and systems approaches.
- Analyzing, designing, and controlling components, systems and processes that involve critical biological components.
- Demonstrating vision, adaptability, creativity and a practical mindset when solving problems.
- Developing communication skills for technical and non-technical audiences.
- Working with diverse, cross-disciplinary teams.
- Integrating sustainability into all facets of biosystems engineering.
- The importance of continued professional growth and ethical conduct.

**MICHIGAN STATE**  
UNIVERSITY

Department of Biosystems  
and Agricultural Engineering

524 S. Shaw Lane, Room 216  
East Lansing, MI 48824  
517-355-4720  
BAE-Info@anr.msu.edu  
www.canr.msu.edu/bae