



MICHIGAN STATE
UNIVERSITY

2014 Biosystems Engineering Showcase

April 17, 2014

MSU Union

Michigan State University

Biosystems Engineering

Biosystems engineers integrate and apply principles of engineering and biology to a wide variety of socially important problems. The MSU biosystems engineering program prepares graduates to conduct the following:

- Identify and solve problems at the interface of biology and engineering, using modern engineering techniques and the systems approach.
- Analyze, design, and control components, systems, and processes that involve critical biological components.

MSU biosystems engineering graduates are having a positive impact on the world, working in areas such as ecosystems protection, food safety and biosecurity, bioenergy, and human health.


and Agricultural Engineering

Integrating Engineering and Biology Since 1906

Participants / Schedule

Biosystems Design Project Participants

Ashley Andreski	Steven Cumming	Timothy Lauth	Royce Sperry
Evan Austin	Nichole Erickson	Cody Matthews	David Stromberg
Rick Avery	Matthew Gammans	Lisa Moncznik	Christopher Taylor
Oliver Bloom	Michael Gisler	Julia Otwell	Allison VanderKolk
Danielle Brickner	Kirk Gowen	Jessica Palmer	John Venn
Anh Bui	Vu Hoang	Andrew Plouff	Matthew Walch
Zachary Carter	Charlsey Hoehn	Kelly Rossi	Jessica Warvel
Keely Chandler	Daniel Holmes	Alex Rowland	Wilson Yee
Matthew Coleman	Alexa Jones	Rachael Sak	
Travis Collins	Robert Kraemer	Patrick Sheridan	

A Showcase of the Program and Students

April 17, 2014

Presented by Faculty and Students in the Biosystems Engineering Program
College of Agriculture and Natural Resources and the College of Engineering
Michigan State University, East Lansing, MI 48824

The MSU Union at Michigan State University

Lake Huron Room (3rd Floor)

12:30 - 2:00 p.m.	Lunch (Doors open at 12:00 p.m.)
2:00 - 2:15 p.m.	Industry Briefing on Program Assessment
2:15 - 2:30 p.m.	Break

Ballroom (2nd Floor)

2:30 - 3:15 p.m.	Senior Student Design Presentations (scheduled at 15 minute increments) <ul style="list-style-type: none">• Design of a Fiber-optic Treatment for Infant Jaundice• Wastewater Treatment Using Anaerobic Digester• Student Organic Farm Cold Storage Design• JBT FoodTech ProMix/ABC-III Viscosity Control• Biomass Power: Torrefied Wood Briquettes as Stationary Power Fuels
3:15 - 4:00 p.m.	Break
4:00 - 5:30 p.m.	Senior Student Design Presentations (scheduled at 15 minute increments) <ul style="list-style-type: none">• Design of a LED Treatment for Infant Jaundice• Algal Photoreactor System for Nitrogen Removal• Value-Added Fruit Leather Process Line - Ghana• Cherry Tomato Harvest Production Improvement• Solar Vapor-Absorption Refrigeration• Pork and Bean Process Optimization

Lake Huron Room (3rd Floor)

5:30 - 6:30 p.m.	Reception, Student-Industry Interaction & BE 230 Poster Presentation
------------------	--

Ballroom (2nd Floor)

6:45 - 8:30 p.m.	Dinner (prior reservation required)
------------------	-------------------------------------

Team Projects

Design of a Fiber-optic Treatment for Infant Jaundice

The “Bullish Biomed” team project is to design a wearable treatment for infant jaundice using fiber-optic technology in order to reduce cost of treatment, allow for easy deployment in developing countries, and minimize impact to crucial maternal bonding.

Client deliverables include a working prototype using fiber-optic technology that maximizes maternal bonding, and a complete economic analysis for reduced treatment cost and easy deployment to developing countries.



Team Members (L to R)

Vu Hoang

Alexa Jones

Oliver Bloom



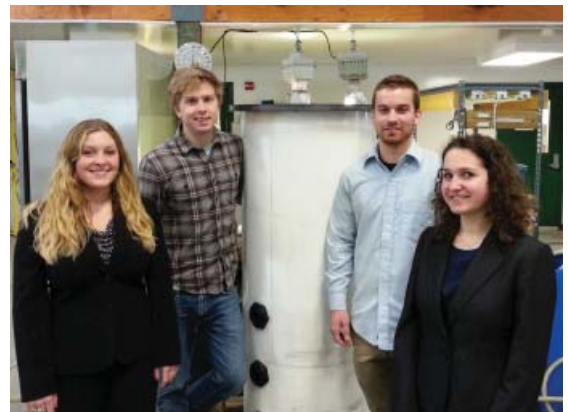
Faculty Advisor
Timothy Whitehead

Sponsor
Sygiene

Wastewater Treatment Using Anaerobic Digester

The “AD Strong” team project is to design and develop a novel, efficient pilotscale (0.45 m³) up flow and fixed film anaerobic digester to later be connected to an integrated solar-bio-nano-based wastewater utilization system.

As part of a Department of Defense project, client deliverables include a functioning pilot reactor for system performance evaluation and full technical and economic feasibility analysis.



Team Members (L to R)

Allison VanderKolk

Matthew Coleman

Evan Austin

Danielle Brickner



Faculty Advisor
Wei Liao

Sponsor
Technova

Team Projects

Student Organic Farm Cold Storage Design

To provide a diversity of vegetables over a long season, local farmers need to utilize energy efficient methods of cold storage to reduce costs and extend the revenue period while maintaining crop quality and freshness. Currently, 95% of the electricity used at the Student Organic Farm (SOF) is for maintaining cool/cold storage for crops.

The “Local Roots” team project is to design an efficient cold storage unit that will store a range of produce at a reduced energy cost for the SOF.

Client deliverables include a full analysis of SOF cold storage energy and ventilation requirements, a complete cool/cold storage unit design and a comparative economic analysis.



Team Members (L to R)

Andrew Plouff
John Venn
Robert Kraemer



Faculty Advisor
Timothy Harrigan

Sponsor
MSU Student Organic Farm

JBT FoodTech ProMix/ABC-III Viscosity Control

The “Better Batter” team project is to design a viscosity control system for the JBT ProMix/ABC-III automatic batter mixer to reduce the component cost in comparison to the current viscosity pump and pressure transducer control system.

Client deliverables for this project include design concept through lab testing, a complete modification budget with bill of material, pilot verification testing, a correlation curve of apparent viscosity and a measureable rheological property to implement into JBT’s PLC configuration.



Team Members (L to R)

Christopher Taylor
Keely Chandler
Kirk Gowen



Faculty Advisor
Gail Bornhorst

Sponsor
JBT FoodTech

Team Projects

Biomass Power: Torrefied Wood Briquettes as Stationary Power Fuels

The “Thermal Edge Innovations” team project is to produce briquettes and pellets from torrefied hardwood without binder, and perform optimization and economic comparison studies to determine which has the hygroscopic, friability, and heating value properties that best approach that of coal.

Client deliverables for this project include a briquetting prototype, mass and energy balance data for process, property analysis of torrefied biomass, a supply chain economic model and a techno-economic model.



Sponsor

Heat Transfer International
(HTI)

Team Members (L to R)

Zachary Carter
Rachael Sak
Nichole Erickson
Cody Matthews



Faculty Advisor

Christopher Saffron

Design of a LED Treatment for Infant Jaundice

The “Bright Ideas” team project is to design a portable, wearable, cost-efficient treatment for infant jaundice using LEDs as a light source that will reduce typical treatment time and not interrupt maternal-infant bonding and breastfeeding.

Client deliverables include a working prototype consisting of a wearable phototherapy device using LED lights allowing portable treatment of hyperbilirubinemia, an economic analysis of the manufacturing and treatment costs associated with the device, and a heat transfer analysis of device.



Sponsor

Sygiene

Team Members (L to R)

David Stromberg
Jessica Palmer
Timothy Lauth



Faculty Advisor

Timothy Whitehead

Team Projects

Algal Photoreactor System for Nitrogen Removal

Current closed animal feeding operations generate emissions containing ammonia and other impurities. A wet scrubber system allows for treatment of this polluted air; however, this generates nitrogen-contaminated water.

The “Algaeeners” team project is to design an algal photoreactor system to uptake and balance the nutrient absorption rate in a wet scrubber system. Client deliverables for this project include constructing a functional reactor prototype including AutoCAD drawings, bill of materials, system performance analysis, mass balance and complete economic feasibility analysis.



Team Members (L to R)

Rick Avery
Anh Bui
Patrick Sheridan
Julia Otwell



Faculty Advisor
Susie Liu

Sponsor

Quantalux, LLC & USAID
GCFSI Student Challenge

Value-Added Fruit Leather Process Line - Ghana

The “Ghana Fruit” team project is to design a fruit leather processing line from raw material to final product, along with initial product formulations.

Client deliverables for this project include a product composition and recipes for both mango and pineapple fruit leathers, a design process flow with equipment specifications and a complete economic analysis with Return On Investment and implementation costs. Team members spent Spring Break in Ghana conducting process research, product testing and presenting to Blue Skies company representatives.



Team Members (L to R)

Royce Sperry
Kelly Rossi
Matthew Gammans



Faculty Advisor
Bradley Marks

Sponsor

Blue Skies & USAID
GCFSI Student Challenge

Team Projects

Grape Tomato Harvest Production Improvement

The “Biosystems Loves Tomatoes (BLT)” team project is to increase operator productivity for grape tomato harvest at the Mastronardi Produce facility in Coldwater, MI.

Client deliverables for this project include modified harvest cart prototype with automated drive train and a harvest assist device. Full AutoCAD modification drawings will be provided as well as a full economic analysis including implementation costs and Return on Investment.



Faculty Advisor
Daniel Guyer

Sponsor
Mastronardi Produce



Team Members (L to R)
Daniel Holmes
Matthew Walch
Wilson Yee

Solar Vapor-Absorption Refrigeration

The “Cool Runnings” team project is to design an efficient, cost effective solar thermal vapor-absorption refrigeration system capable of sustaining consistent temperatures between 2°C and 8°C while being operated off the grid.

Client deliverables for this project include a functional prototype; a feasibility assessment including location compatibility, economic constraints and medical impact; design blueprints for reproduction and a mathematical model for single unit scaling.



Faculty Advisor
Truman Surbrook

Sponsor
MI Agricultural Energy
Council (MAEC)



Team Members (L to R)
Travis Collings
Jessica Warvel
Alex Rowland
Steven Cumming

Team Projects

Pork and Bean Process Optimization

“The Cool Beans” team project is to optimize the Van Camp’s Pork & Beans manufacturing process in order to improve product quality and reduce system losses. Currently a brand leader in the value category, the Van Camp’s lines produce 4 million cases per year.

Client deliverables for this project include a full assessment of the current Pork & Bean process, a statistical analysis of process variation and capability and a process optimization plan. Additionally the team will determine loss reduction solutions through experiments and full economic analysis.



Team Members (L to R)

Charlsey Hoehn
Michael Gisler
Lisa Moncznik
Ashley Andreski



Faculty Advisor
Kirk Dolan

Sponsor
ConAgra

Showcase Sponsorship



Thank you to John Bean Technologies (JBT) Corporation, a leading supplier of integrated food processing solutions, for support of a 2013/14 Senior Design project and the BE Showcase. From single machines to complete processing lines, the JBT FoodTech division enhances value and captures quality, nutrition and taste in food products.

The JBT FoodTech offering includes:

- Freezer solutions for the freezing and chilling of meat, seafood, poultry, ready-to-eat meals, fruit, vegetable and bakery products
- Protein-processing solutions that portion, coat and cook poultry, meat, seafood, vegetable and bakery products
- Shelf-stable sterilization solutions for fruits, vegetables, soups, sauces, dairy and pet food products, as well as ready-to-eat meals in a wide variety of modern packages
- Fruit and juice processing solutions that extract, concentrate and aseptically process citrus, tomato and other fruits.

For more information, visit the JBT FoodTech website at: <http://www.jbtfoodtech.com/>

Biosystems Engineering 2014 Distinguished Alumni Award

Andrew Wedel

Andrew Wedel is the General Manager of McLanahan Corporation's Agricultural Systems Division where he is part of a team that develops, designs, and supplies dairy manure handling systems focused environmental sustainability and cow comfort. Specific designs include: anaerobic digester pre-treatment systems; conveyance and separation systems; earthen, concrete, and HDPE lined manure storage structures; runoff control structures; and pump and gravity conveyance systems.

Andrew holds a B.S. degree in Agricultural Engineering Technology from the University of Delaware and a M.S. degree in Agricultural Engineering from Michigan State University. He is a registered professional engineer in: Delaware, Maryland, Michigan, New York, Pennsylvania, Virginia, and Wisconsin. In 2010, Andrew received the Young Agricultural Engineer of the Year award by the Northeast Agricultural and Biological Engineering Conference.

Prior to joining McLanahan Corporation in 1996, Andrew was an Agricultural Engineering Specialist at Michigan State University where he, along with a group of ag engineers and dairy producers, researched and developed systems for handling sand-laden dairy manure.

Andrew, his wife Ann, and their three sons reside in Duncansville, PA. Their spare time is spent playing/coaching baseball, boating, ATV-ing, and chicken raising.



Biosystems Engineering 2014 Outstanding Alumni Award

Danielle Habitz

Danielle Habitz, 2014 BAE Outstanding Alumni, holds a Bachelor of Science (2008) from Michigan State's Biosystems Engineering program. Currently Danielle is a Snacks Process Engineer with Kellogg Company, headquartered in Battle Creek, MI. She has led various engineering startups throughout the United States, Europe, and Latin America including engineering leader across various food forms including product lines for cookies, crackers, wholesome snacks, and on-the-go foods. Recently she supported the international startup and equipment training for Kellogg's® Special K® Cracker chips in Belgium. Other successfully projects include Keebler® Fudge Stripes™, Kashi® Soft'n Chewy Bars, Special K® Popcorn Chips, and most recently Rice Krispies Treats® Crackle Snaps.

Danielle has played an active outreach role for several groups including The Society of Women Engineers (SWE), Western Michigan's Senior Design program, and Kellogg's Intern Leadership Committee. Danielle especially enjoys recruiting MSU intern candidates and presenting to the BE Club and introductory engineering classes.

Danielle and husband Neil, another Spartan graduate, reside in Chelsea, MI. In her free time, she frequently takes part in alumni tailgate events and spends much quality time with family and friends. Both groups along with Biosystems Engineering faculty recognize Danielle as fiercely loyal, determined, caring and passionate; attributes she consistently brings to her personal as well as her professional life. Biosystems and Agricultural Engineering thanks Danielle, 2014 Outstanding Alumni, for being an exemplary Biosystems Engineering Ambassador.



Industry Advisory Board 2013-2014

Cassandra Edwards (Chair) is the Research and Development Manager at ConAgra Foods®. ConAgra Foods® are found in 97 percent of America's households, and 25 of them are ranked first or second in their category. Cassandra holds a B.Sc. in Food Engineering and a M.Sc. in Mechanical Engineering.



Gene Ford, (Past Chair) is vice president of global technology management, R&D, at Nestlé Nutrition in Fremont, Michigan. He has more than 25 years of experience in domestic and international product development, manufacturing, logistics, and sales within the consumer food industry. Gene holds a B.Sc. and M.Sc. degrees in Agricultural Engineering and an Executive M.Sc. degree.



Michelle Crook, P.E., is an Engineering Specialist in the Environmental Stewardship Division of the Michigan Department of Agriculture. Michelle provides engineering assistance to the livestock and food processing industry and holds a B.Sc. in Environmental Engineering.



Bryce Feighner, P.E., is Chief of the Office of Waste Management and Radiological Protection in the Department of Environmental Quality (DEQ). He has a broad range of education and experience across DEQ programs. Bryce holds a B.Sc. in Agricultural Engineering and a M.Sc. degree in Environmental Engineering.



Andrew Knowles is Stein & Freezer Applications/Sales Support Manager at JBT FoodTech, a leading supplier of integrated food processing solutions. Andrew holds a B.Sc. in Biosystems Engineering and a Masters in Applied Statistics.



Jeffrey Mathews is Principal Engineer for PepsiCo Beverages. Pepsi Beverages Company (PBC) handles approximately 75 percent of PepsiCo's North America beverage volume. Its diverse portfolio includes some of the world's most widely recognized beverage brands, including Pepsi, Mountain Dew, Sierra Mist, Aquafina, Gatorade, SoBe, Lipton, and Amp Energy. Jeffrey holds B.Sc., M.Sc. and Ph.D. degrees in Chemical Engineering/Paper Science and Engineering.



Juanita McCann, P.E., is Agricultural Engineer for USDA - Natural Resources Conservation Service. She works with landowners in the design and installation of animal waste storage facilities, agrichemical handling facilities, mortality composting facilities, waterways, and grade stabilization structures. Juanita holds a B.Sc. in Agricultural Engineering.



Valerie Novaes, is Project Engineer in the Water Resources Department for Tetra Tech, a leading provider of consulting, engineering, and technical services worldwide. Valerie holds a B.Sc. in Biosystems Engineering and is currently completing a M.Sc. degree.



Mitch Miller, is the Senior Processing System Engineer for the General Mills-Yoplait Plant, Reed City, Michigan. General Mills is among the world's largest food companies with U.S. shoppers on average placing at least one General Mills product into their shopping cart each time they visit the grocery store. Mitch holds B.Sc. and M.Sc. degrees in Agricultural & Biosystems Engineering.



Industry Advisory Board 2013-2014

Dave Prouty is President of Heat Transfer International which manufactures custom designed process equipment, specializing in biomass gasification/ electric power generation systems that convert solid and semisolid biomass into a combustible syngas. Dave holds a B.Sc. in Mechanical Engineering.



Steve Richey is Director, Morning Foods, Process Engineering at Kellogg Company, the world's leading producer of cereal and a leading producer of convenience foods. Steve holds B.Sc. and M.Sc. degrees in Agricultural Engineering.



Steve Steffes, P.E., is Vice President Operations New York with Perrigo, the world's largest manufacturer of over-the-counter store brand pharmaceutical products. Steve was a commissioned officer in the U.S. Army Corps of Engineers. Steve holds a B.Sc. degree in Chemistry and German and a M.Sc. in Environmental Engineering.



Larry Stephens, P.E., is owner of Stephens Consulting Services, P.C., a 30+ year old engineering firm located in Haslett, MI. Larry holds a B.Sc. degree in Civil Engineering and a M.Sc. in Environmental Engineering. Larry has been very active in the decentralized wastewater treatment industry in Michigan on both the regulatory and the private sides for nearly his entire career.



Muluken Tilahun is Associate Principal Engineer at Kraft Foods, the world's second largest food company with annual revenues of \$49.2 billion and 127,000 diverse employees around the world. Muluken holds a B.Sc. degree in Engineering and M.Sc. degrees in Agricultural Engineering and Mechanical Engineering.



Andrew Granskog, P.E., (ex-officio) is State Engineer for USDA Rural Development Community Programs which finances \$50 million in rural water and sewer infrastructure projects per year in Michigan. Andrew has been at USDA for twelve years, was in private consulting for ten years prior and holds B.Sc. and M.Sc. degrees in Agricultural Engineering.



Ex-officio

Leo Kempel, Acting Dean, College of Engineering

Dan King, Undergraduate Advisor, Biosystems & Agricultural Engineering

Fred Poston, Dean, College of Agriculture and Natural Resources

Luke Reese, Industry Liaison, Biosystems & Agricultural Engineering

Ajit Srivastava, Professor and Chair, Biosystems & Agricultural Engineering

Charlsey Hoehn, Undergraduate Student Representative

Xiaoqing Wang, Graduate Student Representative

2014 Scholarship Recipients

Undergraduate Awards

F.W. Bakker-Arkema Endowed Scholarship

Carly Head

A.W. Farrall Scholarship

Paige Crosset

Rachel Kurzeja

Clarence & Thelma Hansen Scholarship

Daniel Buhr

Robert Bruhn

Christopher Walker

Howard & Esther McColly Scholarship

Jason Graham

Nathan Mejeski

Jacqueline Thelen

George & Betty Merva Scholarship

Mackenzie Tocco

Allison VanderKolk

DeBoer Family Scholarship/Fellowship Fund

Nicole Kruse

Ryan Ziegler

Galen & Ann Brown Scholarship

Robert Bruhn

Alfred & Mary Murray Scholarship

Natsuki Ikeda

Graduate Awards

College of Engineering Outstanding

BE Graduate Student Fellowship

Rui Chen

***BAE Endowed Fellowship
for Graduate Student Excellence***

Sean Woznicki

Outstanding BE Research Fellowship &

Fitch H. Beach Award

Zhenhua Ruan

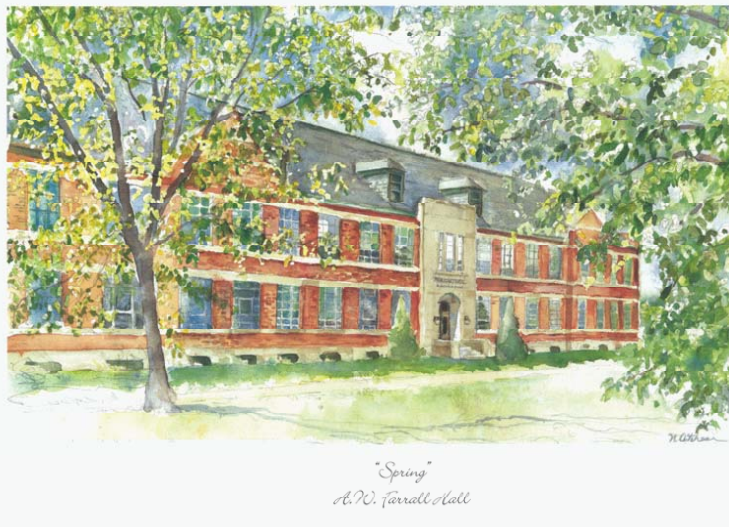
Merle & Catherine Esmay Scholarship

Mahlet Garedew

Bharathi Murali

Bill & Rita Stout Scholarship

Melissa Rojas-Downing



Special Thanks

Message from the Chair:

BE Showcase is an annual event to showcase the accomplishments of our students. BE faculty and staff are committed to maintaining excellence of our programs. Showcase would not be possible without the on-going support of our alumni, board members, industry partners, university administration, parents and sponsors. Thank you to everyone who contributes to the continuing BE Showcase success.



BAE Chair
Ajit Srivastava

2013-14 Project Sponsors	Industry Evaluators
Sygiene	Steve Steffes, Perrigo Company Muluken Tilahun, Kraft Foods Ralph Elias, Terumo Cardiovascular Systems
Technova	Michelle Crook, PE, MDA, Env. Stewardship Div. Bryce Feighner, PE, MDEQ
MSU Student Organic Farm	Andrew Granskog, PE, USDA - RD Todd Forbush, Techmark, Inc.
JBT FoodTech	Andrew Knowles, JBT FoodTech Bob Stacy, JBT FoodTech
Heat Transfer International	Dave Prouty, Heat Transfer International (HTI) Jeff Mathews, PhD, PepsiCo
Quantalux, LLC & USAID GCFSI Student Challenge	Larry D. Stephens, PE, Stephens Consulting Ser., P.C. Valerie Novaes, Tetra Tech
Blue Skies & USAID GCFSI Student Challenge	Steve Richey, Kellogg Company Danielle Habitz, Kellogg Company
Mastronardi Produce	Juanita McCann, NRCS
MI Agricultural Energy Council	Gene Ford, Nestle Nutrition Mitch Miller, General Mills - Yoplait
ConAgra®	Cassandra Edwards, ConAgra Foods Daniel Holcomb, ConAgra Foods

Staff:



Design Project Instructor
Dana Kirk
BE 485/487



**Design Project Instructor
and Technical Advisor**
Luke Reese
BE 485/487



**Showcase Event
Coordinator**
Barb DeLong

Michigan State University
Biosystems & Agricultural Engineering
524 S. Shaw Lane, Room 216
East Lansing, MI 48824
517-355-4720

www.egr.msu.edu/bae

College of Agriculture and Natural Resources
www.canr.msu.edu

College of Engineering
www.egr.msu.edu