

2016 Biosystems Engineering Showcase

April 21, 2016

Kellogg Hotel & Conference Center
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.

Participants / Schedule

Biosystems Design Project Participants

Benjamin Bailey	Michael Conklin	Robert Munro	Jack Stephan
Alexis Baxter	Paige Crosset	Nicholas Niedermaier	Lauren Strange
Joshua Boucher	Austin Ebeling	David Olson	Jacqueline Thelen
Alexander Bricco	John Everett	Shane Peterson	Charlotte Thomas
Anna Brunsman	Angela Hoang	Jason Petros	Jacob Vankeulen
Kyle Brunsman	Yifeng Hu	Sydney Preston	Christopher Walker
Larry Buckner	Natsuki Ikeda	Aubrey Proctor	Stephen Wilson
Brendan Cloonan	Christine Isaguirre	Nathan Sobczak	Austin Wissler
Joseph Commene	Michal Mulik		

Program

Riverside

12:30 - 2:00 p.m.	Lunch (reservations required, 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

Auditorium

2:30 - 3:45 p.m.	Senior Student Design Presentations (scheduled at 15 minute increments) <ul style="list-style-type: none">• Industrial Biosolids Digestion Project• Pilot-scale Compost Unit Design: Monitoring Chemical Degradation• Food Waste Management: Generating a Waste-to-Resource Product• Bio-oil Upgrading Through Continuous Electrocatalytic Hydrogenation• Designing a Sustainable Conveyor System: A Frozen Food Application
3:45 - 4:00 p.m.	Break
4:00 - 5:00 p.m.	Senior Student Design Presentations (scheduled at 15 minute increments) <ul style="list-style-type: none">• Ultrafiltration of Anaerobic Digestion Effluent for Sustainable Management• Optimizing Heat Transfer for Food Industry Application• Optimizing Purified Water Use for Pharmaceutical Tank Cleaning• Label Quality Vision Inspection System
5:00 - 5:30 p.m.	Break

Riverside

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

6:45 - 8:30 p.m.	Dinner (prior reservation required)
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Message from the Chair:

BE Showcase is an annual event to highlight the accomplishments of our students. Showcase success would not be possible without the continued support of our alumni, board members, industry partners, university administration, parents and sponsors. Thanks to everyone who contributes to the continuing BE Showcase success.



BAE Chair
Darrell W.
Donahue, PE

Team Projects

Industrial Biosolids Digestion Project

The Dow Chemical Company operates an aerobic digester to reduce the mass of the biosolids removed from their secondary clarifiers. Due to the high cost of operation, Dow has asked the “WasteWater Warriors” to improve their biosolids digestion system. The team generated design alternatives with the goal of increasing system performance while simultaneously lowering operational costs. The final deliverable was an engineering design report describing and comparing the proposed solutions. An economic analysis, process flow diagram, and a summary of expected improvements was completed in order to select the optimal design.



Team Members (L to R)
Christine Isaguirre
Michal Mulik
Alexander Bricco

Sponsor
Dow Chemical (under
Non-disclosure)



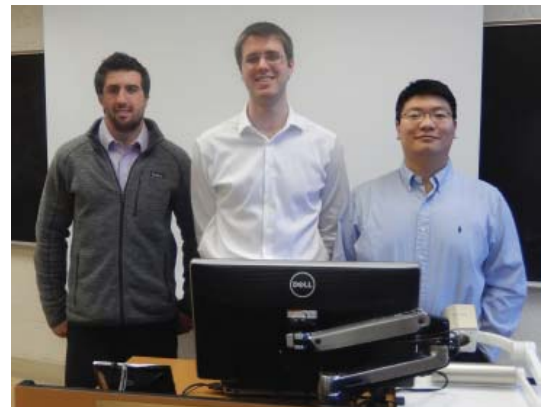
Faculty Advisor
Steve Safferman, PE

Thick Sludge, Thicker Shields



Pilot-scale Compost Unit Design: Monitoring Chemical Degradation

Dow AgroSciences is a leader in the production of common herbicides used in both the public and private sector. Residuals of these chemicals in the environment can result in negative effects, including inadvertent plant injury and more. Understanding how these chemicals degrade in natural systems, such as composting, is important to ensure these residuals are non-threatening. An in-vessel composting system was designed, built, and tested in order to give Dow AgroSciences a method to perform future chemical life-cycle tracking tests. This in-vessel unit monitors important characteristics of compost through sensor technology, and serves as a base for process sampling. Samples can be analyzed to understand how herbicides degrade during a typical composting cycle.



Team Members (L to R)
Joshua Boucher
Benjamin Bailey
Yifeng Hu

Sponsor
Dow AgroSciences
(under Non-disclosure)



Faculty Advisor
Dawn Reinhold



Team Projects

Food Waste Management: Generating a Waste-to-Resources Product

Meijer is a regional supermarket chain interested in reducing their environmental impact. This project involves designing a food waste management system at one of Meijer's distribution centers capable of producing a waste-to-resource product. The Waste Watchers conducted an environmental and cost analysis to determine the current impact of the project sponsor's food waste disposal practices and recommended alternative systems. The team also designed a complete composting system to manage the company's food waste and generate a finished compost product. The final design included a feedstock recipe and end product quality, as well as a cost analysis.



Team Members (L to R)

Larry Buckner
Austin Wissler
Nathan Sobczak
Lauren Strange



Faculty Advisor

Ajit Srivastava, PE

Sponsor

Meijer (under
Non-disclosure)



Bio-oil Upgrading Through Continuous Electrocatalytic Hydrogenation

This project is coordinated with Tenneco, an automotive ride control and emissions products company. This project aims to electroreduce bio-oil produced through fast pyrolysis. Successful reduction of the bio-oil will increase energy content and decrease unwanted properties, such as reactivity. Electroreduction of bio-oils has primarily focused on neat model compounds and their mixtures in batch divided hydrogen fuel cells (H-cells). These cells are characterized by high voltages and unwanted molecular hydrogen production. Configuring a continuous hydrogen fuel cell, will minimize voltage and hydrogen production, improve efficiencies and reduce capital cost.



Team Members (L to R)

Stephen Wilson
Angela Hoang
Aubrey Proctor
Jack Stephan



Faculty Advisor

Christopher Saffron

Sponsor

Tenneco



Team Projects

Designing a Sustainable Conveyor System: A Frozen Food Application

JBT's SuperCONTACT freezer is designed to freeze a thin layer of tissue at the base of marinated poultry products prior to their discharge into a spiral freezer, which completes the freezing process. Currently, a disposable polyethylene film is used to convey products across the system's cold plates to the next freezing step, which creates unnecessary waste and downtime. Froz-hen was assembled to design a reusable solution that will improve economic efficiency, maintain the production and quality of the SuperCONTACT system, and promote sustainable operations by reducing landfill waste and the environmental costs associated with producing the polyethylene film.



Team Members (L to R)

David Olson
Austin Ebeling
Jacqueline Thelen
Nicholas Niedermaier



Faculty Advisor
Brad Marks, PE

Sponsor

JBT FoodTech (under
Non-disclosure)



Ultrafiltration of Anaerobic Digestion Effluent for Sustainable Management

MSU Land Management operates an anaerobic digester. Effluent is drained from the digester daily and it is stored in a holding tank. A few times a year the holding tank is drained for application on agricultural lands. However, not all of this effluent can be land applied due to run off potential and odor. Remaining effluent must be exported at a high cost. The "Nutrient Moo-vers" team has designed a system to separate some of the liquid from the effluent so that it can be better managed. The remaining nutrients can be land applied for plant growth.



Team Members (L to R)

Robert Munro
John Everett
Shane Peterson
Charlotte Thomas



Faculty Advisor
Wei Liao, PE



Faculty Advisor
Tim Harrigan

Sponsor

MSU Land
Management



Team Projects

Optimizing Heat Transfer for Food Industry Application

The Efficientneers are working on creating a new design, for the shape and the material of a metal heating element that will yield a ten percent reduction in cooking time for a packaged food product while maintaining a more homogenous heat transfer across the heating element. This will be done on a computer model (COM-SOL) that will show the optimization of the new design alternative compared with the original model. Project deliverables include these simulations on COMSOL, a sensitivity analysis on a range of material properties, and an economic analysis with an investment return rate of the final design.



Team Members (L to R)
Natsuki Ikeda
Brendan Cloonan
Christopher Walker
Michael Conklin



Faculty Advisor
Kirk Dolan



Faculty Advisor
Phil Hill

Sponsor
Major Food
Manufacturer
(under Non-
disclosure)



Optimizing Purified Water Use for Pharmaceutical Tank Cleaning

Perrigo a leading global healthcare supplier is working to reduce plant-wide water use. The purpose of this project is to improve water efficiency while cleaning and sanitizing tanks used for pharmaceutical manufacturing. The team, Pharma Cleanse, is working to identify areas associated with tank cleaning that could be improved upon to save water. In doing so, the team will provide the client with a detailed analysis regarding economics, testing procedures, testing results, and a scaling plan. After testing and data analysis, the team will also provide the client with a set of recommendations going forward.



Team Members (L to R)
Joseph Commene
Sydney Preston
Jacob Vankeulen
Jason Petros



Faculty Advisor
Susie Liu



Faculty Advisor
Jade Mitchell

Sponsor
Perrigo (under Non-
disclosure)



Team Projects

Label Quality Vision Inspection System

Perrigo is a leading global healthcare supplier. They use vision systems as a quick and reliable inspection tool during manufacturing processes. Inconsistencies with the vision systems used to inspect packaging cause downtime, create excess re-work, and utilize unplanned maintenance resources. Envision Engineering has been tasked with designing a solution to Perrigo's vision system problems pertaining to label quality (e.g., wrinkles, tears, bubbles, etc.), and label presence (e.g., missing label). By designing a comprehensive solution Envision Engineering aims to increase product quality and decrease risk associated with flawed pharmaceutical packaging.



Team Members (L to R)

Anna Brunzman
Paige Crosset
Alexis Baxter
Kyle Brunzman



Faculty Advisor
Dan Guyer

Sponsor

Perrigo (under Non-disclosure)



Staff:



Design Project Instructor
Dana Kirk, PE
BE 485/487



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



**Showcase Event
Coordinator**
Barb DeLong

Industry Advisory Board 2015-2016

Kevin Blue is the Director of Manufacturing Engineering for Meijer® supporting Engineering, Resource Conservation, Lean Manufacturing and Maintenance. Prior to Meijer®, Kevin led the Center of Excellence and Industrial Manufacturing for Amway® Corp. Meijer® a multi-billion dollar retailer, is the nation's 19th largest privately held company and employs over 65,000 employees across six states. Kevin holds a B.S. in Engineering and M.S. in Engineering Management.

Lisa Buchholz is the Global Leader of Analytical Regulatory Sciences for Dow® AgroSciences in Indianapolis, Indiana. Prior to joining Dow® AgroSciences, Lisa worked for Covance® and Pfizer® Global Research & Development. Dow® AgroSciences employs over 9,000 worldwide and had \$6.4 billion in 2015 global sales. Lisa holds a B.S. in Biological Sciences.

Michelle Crook, PE, is Senior Project Engineer for the Michigan Department of Natural Resources. She provides engineering project management and oversight for DNR projects. Michelle holds a B.S. in Environmental Engineering.

Cassandra Edwards (Past Chair) is Production Manager for Bimbo Bakeries, USA® in Beaverton, OR. Prior to Bimbo Bakeries®, she was the Research and Development Manager at ConAgra Foods®. Cassandra holds a B.S. in Food Engineering and a M.S. in Mechanical Engineering.

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

Gene Ford is Vice President R&D, Head of PTC Fremont, 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 B.S. and M.S. degrees in Agricultural Engineering and an Executive M.S. degree.

Andrew Granskog, PE, (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.S. and M.S. degrees in Agricultural Engineering.

Ashley Julien, EIT, is an Environmental Engineer in the Michigan Department of Agriculture and Rural Development Environmental Stewardship Division. She supports the MAEAP program with determining appropriate solutions for engineering challenges including wastewater management, manure and fuel storage, and chemical safety. Ashley holds a B.S. in Civil Engineering and M.S. in Biosystems Engineering.

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

Jeffrey Mathews, PhD, 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.S., M.S. and Ph.D. degrees in Chemical Engineering/Paper Science and Engineering.

Mitch Miller (Chair) 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.S. and M.S. degrees in Agricultural & Biosystems Engineering.

Industry Advisory Board 2015-2016

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.S. and M.S. degrees in Agricultural Engineering.

Larry Stephens, PE, is owner of Stephens Consulting Services, P.C., a 30+ year old engineering firm located in Haslett, MI. Larry holds a B.S. degree in Civil Engineering and a M.S. 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.

Kirk Walter is Senior Operations Director at Perrigo® Company PLC, a leading global healthcare supplier that develops, manufactures and distributes over-the-counter (OTC) and prescription (Rx) pharmaceuticals, nutritional products, and active pharmaceutical ingredients (API). Kirk holds a B.S. degree in Manufacturing Administration and a M.S. in Business Administration.

Richard (Rick) Woodford, PE is State Conservation Engineer for USDA - Natural Resources Conservation Service. He provides technical assistance in the field of soil and water conservation, implements NRCS' engineering policy and procedures for establishing technical engineering standards throughout Michigan. Rick holds B.Sc. and M.Sc. degrees in Civil Engineering.

Rob Yoder, CFPS, is Southeast Region Fluid Power Specialist for BDI, Inc. a large industrial Distribution Company based in Cleveland, OH. Rob provides Fluid Power technical solutions to BDI customers, and Fluid Power product sales support to all local branch sales personnel in the southeast region of the U.S. Rob holds a B.S. degree in Agricultural Engineering Technology.

Ex-officio

Darrell W. Donahue, PE, Professor and Chair, Biosystems & Agricultural Engineering

Leo Kempel, Dean, College of Engineering

Dan King, Undergraduate Advisor, Biosystems & Agricultural Engineering

Linda Lay, Undergraduate Student Representative

Yingqian (Tammy) Lin, Graduate Student Representative

Fred Poston, Dean, College of Agriculture and Natural Resources

Luke Reese, Industry Liaison, Biosystems & Agricultural Engineering

Industry Evaluators

Marialuci Almeida, PhD, Kellogg

Diana Bach, Meijer

Shane Bennett, PE, Dow Chemical Company

Holly Bowers, Consumers Energy

Dylan Comer, JBT FoodTech

Thomas Cornish, Perrigo

Ben Darling, MSU Land Management

Sara Linder, Dow AgroSciences

Erik Petrovskis, PE, Meijer

Chris Rivard, Perrigo

Jim Wallace, PE, PhD, McLanahan Corporation

Amy Yoder, Anuvia Plant Nutrients



2014-2015 Industry Advisory Board

2016 Alumni Awards

Biosystems Engineering 2016 Distinguished Alumni Award

Amy Yoder

Amy J. Yoder is President & CEO for Anuvia Plant Nutrients. Anuvia Plant Nutrients is a sustainable company focused on transforming various organic materials into a multi-nutrient, slow release fertilizer. Amy holds a bachelor's degree in Agricultural Technology and Systems Management from Michigan State University (1989) with an emphasis of study in Crop and Soil Science. A native of Eaton Rapids, Michigan, she grew up raising cattle along with 800-acres of corn, soybeans and wheat.

During her professional career, Amy has held a variety of sales, marketing and executive positions throughout the agricultural and related industries. She has worked in all aspects of these industries from basic AI research, commercial sales and marketing, manufacturing, distribution, generics, and even the consumer markets. Prior to Anuvia, her executive roles were with Arysta Life Science, United Industries, a division of Spectrum Brands, BioLab, and United Agri Products.

Amy has served on boards of various agricultural associations and universities including Compass Minerals (public), Vive Crop Technologies (private), Clemson University Foundation (non-profit), and Sigma Alpha National Foundation Board (non-profit). She was recognized as Atlanta's "Business Woman to Watch" in 2007.

Amy is active in Clemson University and Sigma Alpha sorority and lives with her husband Robert in Orlando, Florida.



Biosystems Engineering 2016 Outstanding Alumni Award

Paula Steiner

Paula Steiner is an Engineer for the United States Department of Agriculture, Natural Resource Conservation Service (USDA-NRCS). She holds a bachelor's degree in Biosystems Engineering from Michigan State University (2004) and a master's degree in Biosystems Engineering from Michigan State University (2009). From 2007 to 2009 she was a staff engineer for NTH Consultants Ltd. working primarily with animal waste storage structures. Paula currently works for USDA-NRCS in the Mason USDA Service Center providing engineering assistance for conservation practices on private agricultural land across southeastern Michigan. Commonly implemented conservation practices include waste storage structures and waste transfers, agrichemical handling facilities, fuel storage, stormwater runoff management, and wetland restoration. Paula assists the field staff with training, design, and implementation of structural/engineering conservation practices.

Paula has been actively involved with the Michigan Chapter of the American Society of Agricultural and Biological Engineers (ASABE) for 8 years. She has served in multiple positions on the executive board including chair and vice chair of membership.

In her free time, Paula likes to read, spend time with her family and her Alaskan malamute, Malachi, and practicing Shorin-ryu Karate.



2016 Scholarship Recipients

Undergraduate Awards

F.W. Bakker-Arkema Endowed Scholarship

*Alexis Kontorousis
Karis Middleton*

A.W. Farrall Scholarship

*Renee Schwartz
Matthew Vasher*

Clarence & Thelma Hansen Scholarship

*Daniel Buhr
Bradford Chapman
Kyle Forbush
Katelyn Skornia*

Howard & Esther McColly Scholarship

*Amanda Godar
Carly Gomez*

John & Julianna Merva Undergraduate Excellence Fund

Justine Williams

DeBoer Family Scholarship/Fellowship Fund

*Lauren Costantini
Emma Heckelsmiller
Anna Oslapsis
Rebecca Prouty
Linnea Riddell
Joshua Shah
Philip Steinbrunner
Christopher Wells*

George E. and Betty L. Merva Endowed Scholarship

Ryan Ziegler

Graduate Awards

College of Engineering Outstanding BE Graduate Student Fellowship

Yingqian Lin

Outstanding BE Research Fellowship & Fitch H. Beach Award

Zhiguo Liu

Merle & Catherine Esmay Scholarship

*Fariborz Daneshvar
Khang Huynh*

Galen & Ann Brown Scholarship

*Francisco Garces-Vega
Yuzhen Lu*



Showcase Sponsor



Thank you to John Bean Technologies (JBT) Corporation, a leading supplier of integrated food processing solutions, for support of a 2015/16 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/>

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