IOWA STATE UNIVERSITY

College of Agriculture and Life Sciences

College of Engineering

Department of Agricultural & Biosystems Engineering

Dr. Steven Mickelson

Chair & Chuck R. and Jane F. Olsen Professor of Engineering

Nuffield International Contemporary Scholars 2019 Conference

My Story

My Story


Hurricanes


#1
IOWA STATE UNIVERSITY
Department of
Agricultural &
Biosystems
Engineering


grace

ABE Department Vision

ISU's Department of Agricultural and Biosystems Engineering: The **premier team** *serving agriculture, industry and society* through engineering and technology for agriculture, industry, and living systems.

ABE Department Mission

The **mission** of the Agricultural and Biosystems Engineering Department is:

- to ***promote undergraduate student learning*** in agricultural and biosystems engineering and industrial and agricultural technology,
- to ***promote graduate student learning*** in agricultural and biosystems engineering and industrial and agricultural technology,
- to ***discover and improve new technologies*** for all stakeholders, and
- to ***provide engineering and technology expertise*** in the fields of agriculture, industry and biosystems for the state, nation, and world.

ABE Program Overview – Fall 2018

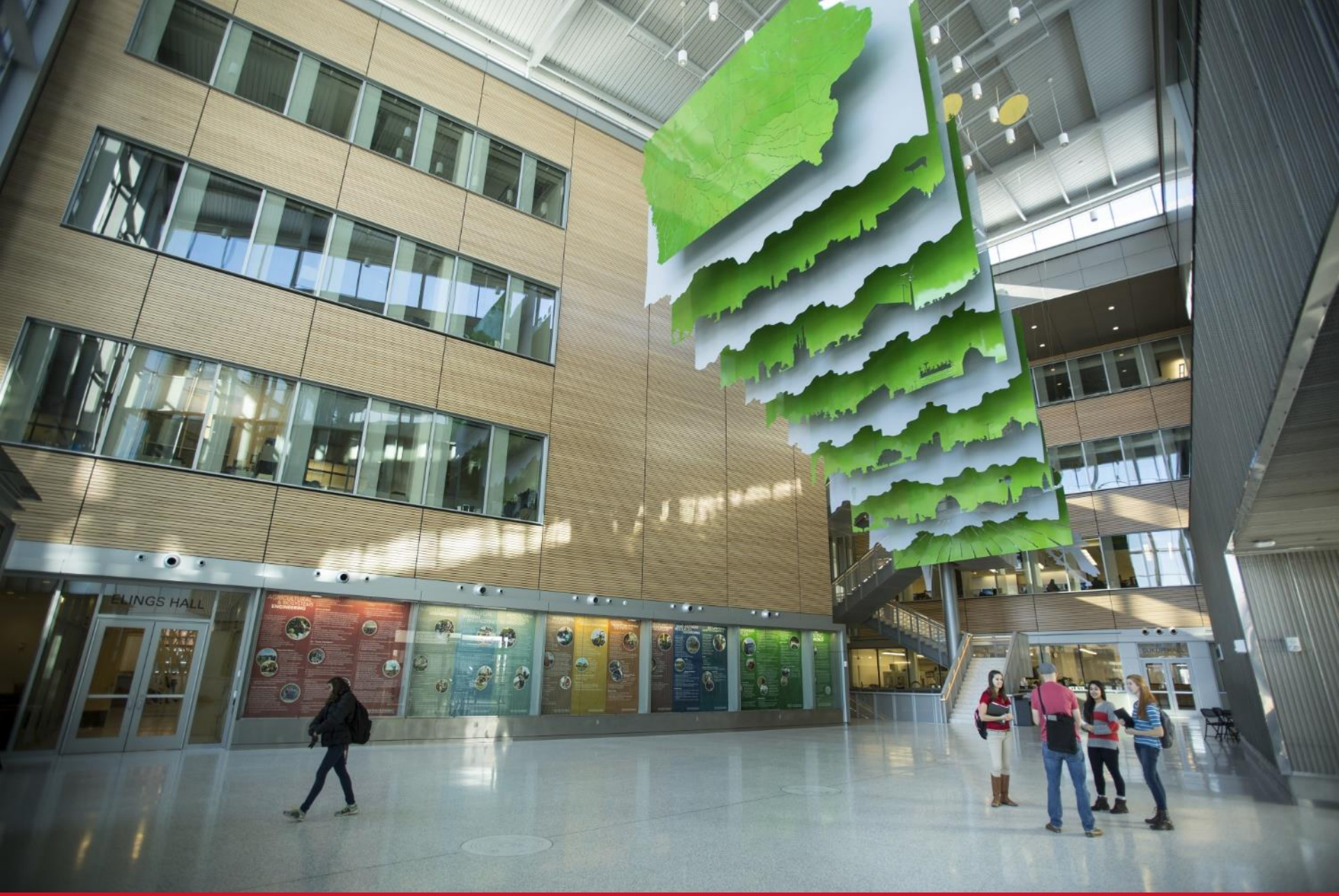
- Faculty: 34 Tenure/Tenure-Eligible, 8 NTE
- 807 undergraduates, 84 graduate students
- 4 Undergraduate Degree Programs
  - Agricultural Engineering
  - Biological Systems Engineering
  - Agricultural System Technology
  - Industrial Technology
- 2 MS and PhD programs
  - Agricultural Engineering
  - Industrial & Agricultural Technology

ABE Overview Continued

- 6.5 main office support staff
- 4.5 student services staff
- 4 teaching lab coordinators
- 6 faculty and two staff have cooperative extension appointments
- 20 external advisory council members
- Home of the Midwest Plan Services (MWPS)
- Home of the NSF Center for Bioplastics and Biocomposites (CB^2)
- Home of the Egg Industry Center (EIC)

New Facilities : ISU Biorenewable Complex

- Moved in date: June 3, 2014
- Focus on Sustainable Design
  - Goal of LEED Gold
- $76.5 Million Project
  - Private Gifts : $14.5 million
  - State funding over a four year period: $62 million
- Approximately 106,000 Net Square Feet
- $0.5M in public art
- Sustainable features/efforts



IOWA STATE UNIVERSITY

College of Agriculture and Life Sciences
College of Engineering

IOWA STATE UNIVERSITY

College of Agriculture and Life Sciences
College of Engineering

BioCentury Research Farm

2018/2019 Departmental Highlights

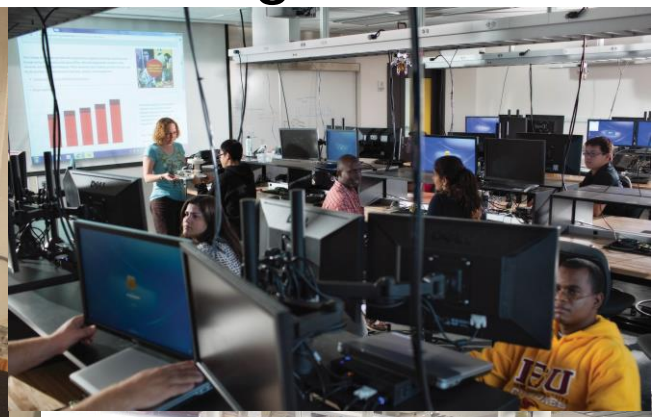
- 1st place US News - graduate programs
- 3rd place US News - UG programs
- Record student numbers (891 total)
- Grant awards: $12.5M (211 grants)
- International study abroad programs (Brazil, Taiwan, Poland, Argentina, Scotland, France, Uganda, and China)

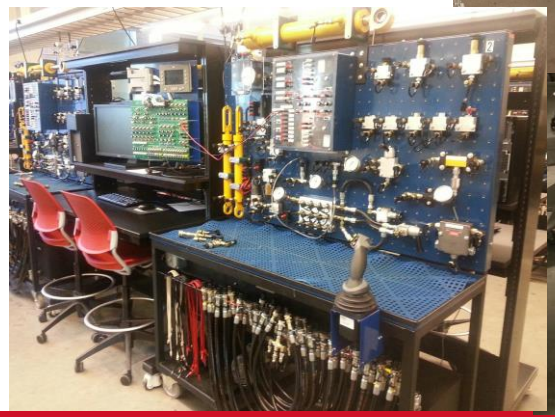
ABE Educational Programs

- Programs emphasize practical hands-on learning
- Laboratories have modern engineering tools and equipment
- Key laboratories include: diesel engines, fluid power hydraulics, biomaterials, biofuels, plastics and metals, manufacturing, automations/ robotics, electronic controls, precision ag, electronics, dyno
- Programs accredited by ABET and ATMAE
- Outstanding living/learning communities

Examples of Teaching Equipment:

- Waterjet, CNC lathes/mills, dynos, water flume, 3D metal printer, robots, fluid power trainers, 3D plastic printers, 185 double screen PCs, diesel engines, etc.





Research/Extension/Outreach

- Department Focus Areas:
  - Land and Water Resources Engineering
  - Animal Production Systems Engineering
  - Biological and Process Engineering and Technology
  - Advanced Machinery Engineering and Manufacturing Systems
  - Occupational Safety Engineering

Land & Water Resources Engineering

Matt Helmers
Professor

Adina Howe
Asst Prof

Amy Kaleita
Assoc Prof

Ramesh Kanwar
Professor

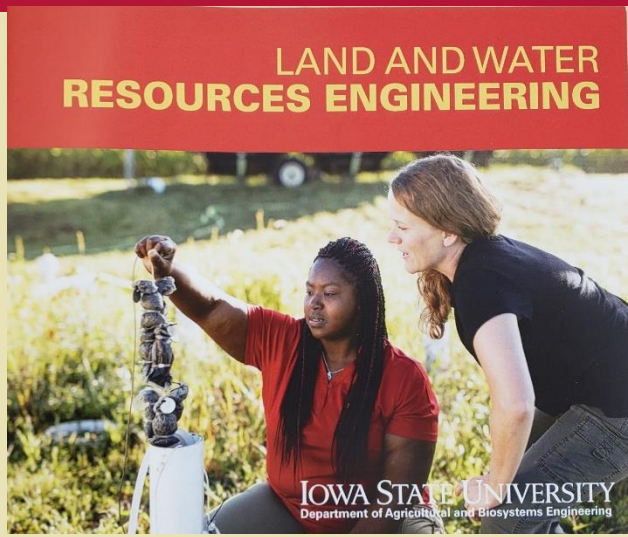
Steve Mickelson
Professor, Chair

Michelle Soupir
Assoc Prof

Sunday Tim
Assoc Prof

Josh Peschel
Asst Prof

LWRE Research Areas



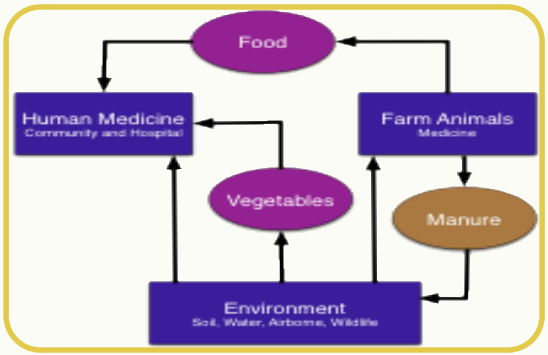
- Water Quality (surface and groundwater)
- Subsurface drainage
- Conservation decision support systems
- Hydrologic modeling
- Soil conservation
- Environmental monitoring
- International rural water resources
- Microbial drivers of and responses to environmental health
- Fate and transport of pathogens & emerging contaminants
- Remote sensing
- Virtual reality decision making

Current project highlights

Drainage Water Quality Impacts of Nitrogen Management and Land Use

Matt Helmers, Michelle Soupir, & Dan Andersen and collaborators

~$750K from IDALS, TFI, Iowa Pork Board, Leopold Center for Sustainable Ag, Iowa Nutrient Research Center, Calcium Products, Koch Agronomic Services



Antibiotic bacteria and their persistence in the environment

Adina Howe & Michelle Soupir & collaborators

~$1.2M from USDA and National Pork Board

Hydrology, water quality dynamics, and economic impacts of farmed potholes

Amy Kaleita & Michelle Soupir and collaborators

~$470K from EPA, Iowa DNR, Leopold Center for Sustainable Ag, Iowa Nutrient Research Center.

Animal Production Systems Engineering

Dan Andersen
Asst Professor

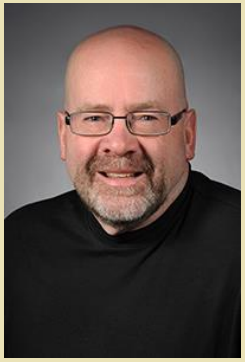
Jay Harmon
Professor

Steve Hoff
Professor

Jacek Koziel
Assoc Prof

Charles Sukup
Adj Assoc Prof

Brett Ramirez
Asst Prof



Jim Shahan
Adj Asst Prof

Hongwei Xin
Distinguished Prof

Mike Anderson
Sr Lecturer

Tim Shepherd
Lecturer

APSE Research Areas

- Air quality/odor control
- Animal behavior
- Animal health and well-being
- Animal-environment interactions
- Bio-secure carcass disposal
- Disease detection
- Precision livestock farming
- Heat stress mitigation
- Visual data sensing and analytics
- Robot assisted environments
- Manure management and treatment
- Nutrient cycling in agroecosystems

Peschel Research

Dr. Joshua Peschel
Assistant Professor and
Black & Veatch Faculty Fellow
www.peschelgroup.org

Using Visual Sensing and Sensemaking for Animal Health Prediction

IOWA STATE UNIVERSITY
Agricultural and Biosystems Engineering

Advanced Machinery Engineering and Manufacturing Systems

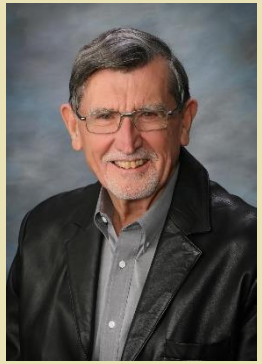
Stuart Birrell
Professor

Shweta Chopra
Asst Prof

Matt Darr
Assoc Prof

John Haughery
Asst Prof

Russ Hoffman
Lecturer



Ron Leonard
Adj Assoc Prof

Norm Muzzy
Lecturer

Tim Shepherd
Lecturer

Brian Steward
Professor

Lie Tang
Assoc Prof

Mehari Tekeste
Asst Prof

Josh Peschel
Asst Prof

AMEMS Research Areas

- Machine design, testing and manufacturing
- Sensing and perception systems
- Field automation, machine intelligence, and field robotics
- Biomass harvest, storage, and transportation
- Vehicle systems integration
- Physical systems modeling
- Precision agriculture
- Electronic systems integration
- Physical systems modeling
- Applied soil dynamics & traction
- Fluid power

ISU- Soil-Machine Systems Engineering Innovation and Support

Performance

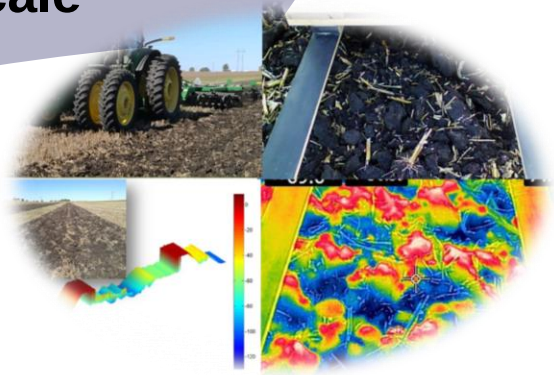
Soil compaction and Yield Study

Tekeste et al., 2016

Machine Field Scale

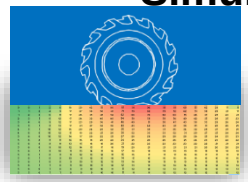
Indoor Controlled Tests

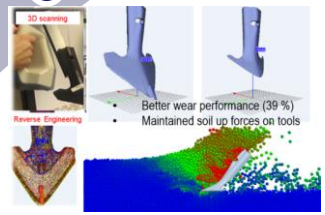
Wear



Tillage Analytics

Simulation and Modeling

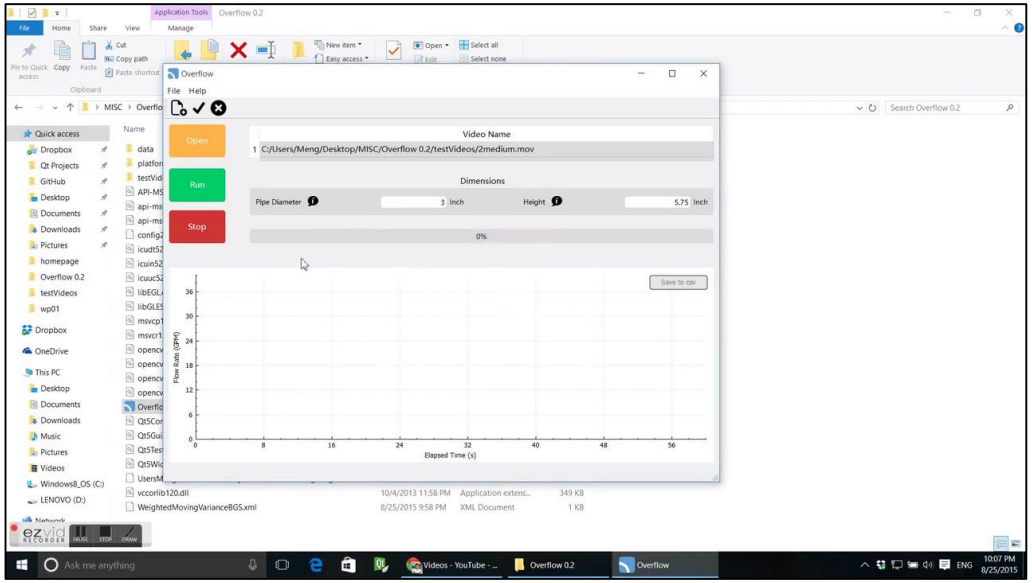




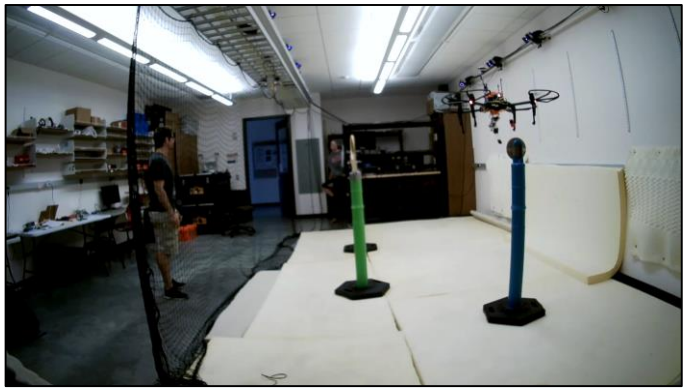
Tekeste et al., 2019

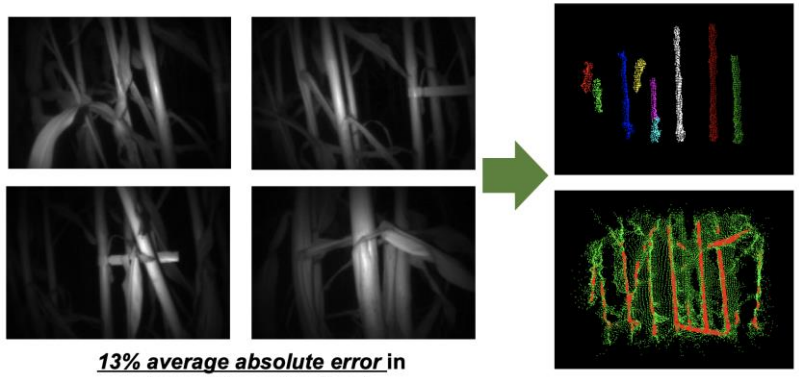
Peschel Research

Real-Time Measurement of Water Flow

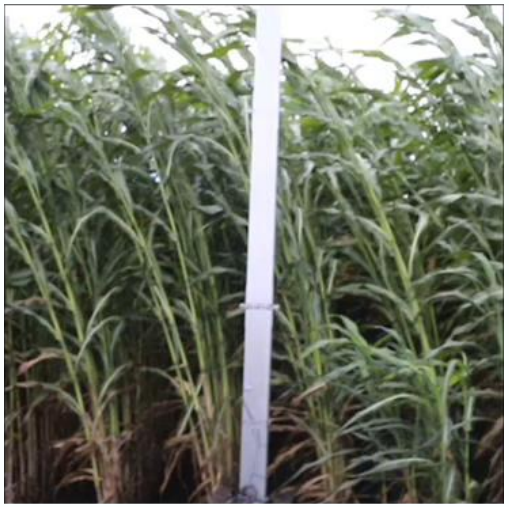


Using UAVs to Physically Manipulate Objects



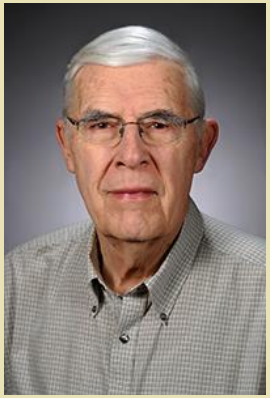


13% average absolute error **in stem width estimation[1]**



Robots in the Field for Sorghum and Corn Phenotyping

Biological and Process Engineering and Technology



Carl
Professor

Tom Brumm
Assoc Prof

Shweta Chopra
Asst Prof

Sam Cook
Lecturer

Charlie Hurburgh
Professor

Dirk Maier
Professor

Manjit Misra
Professor

Gretchen Mosher
Assoc Prof

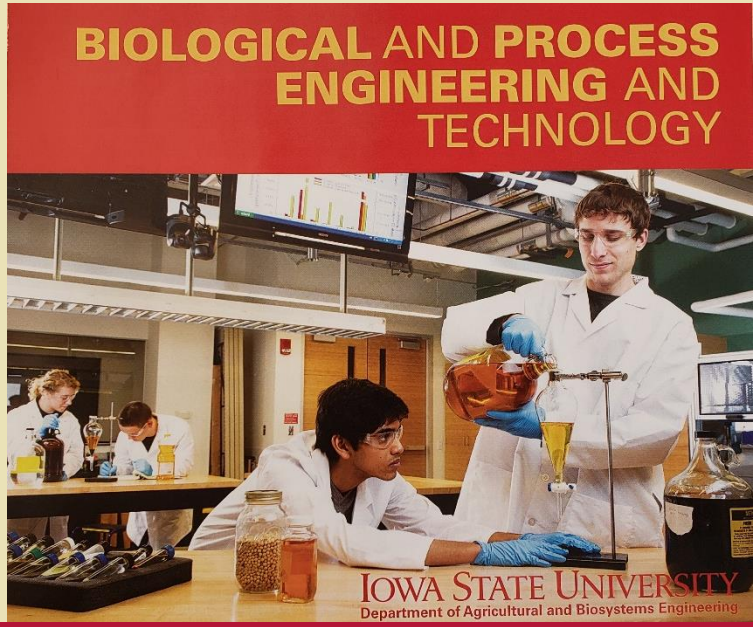
Raj Raman
Professor

Kurt Rosentrater
Assoc Prof

Chenxu Yu
Assoc Prof

BPET Research Themes

- Food security
- Worldwide post harvest losses
- Grain quality, marketing and distribution
- Integrated process-based compliance
- Process technology and life-cycle analysis
- Seed science and technology
- Food preservation technologies
- Risk assessment
- Business processes in ag supply chains
- Analytical technologies
- Renewable chemicals
- Bionanotechnology
- Post-harvest engineering



Current project highlights

Measurement Systems for Grain and Grain Product Analysis.

Charles Hurburgh, Erin Bowers and collaborators

~$450K from USDA-GIPSA, 7 instrument manufacturers, and commercial testing/analysis clients

Center for Bioplastics and Biocomposites

NSF

BioPolymer Development

David Grewell and group

National NSF Center

26 industry partners

Renewable coating, composites, adhesives and plastics

+$1M/year for 5 years

+$1M for 3 years USDA bio-adhesive project

Post Harvest Engineering and Feed Technology

Dirk Maier, Sam Cook and group

~360K from USDA and USAID to reduce post-harvest loss and improve feed value chain in Ghana and Rwanda.

Occupational Safety Engineering

Steven Bell
Lecturer

Steven Freeman
University Prof

James Wright
Lecturer

Nir Keren
Assoc Prof

Gretchen Mosher
Assoc Prof

Charles Schwab
Professor

OSE Research Themes

- Agricultural health and safety
- Safety decision making
- Interaction between safety and quality
- Safety management
- Risk analysis and mitigation
- Scholarship of safety education
- Loss prevention
- Virtual reality applications for safety (behavioral)
- Farm safety
- Occupational safety
- Food systems safety

Current project highlights

Safety Training in the Republic of Georgia

Steve Freeman, Gretchen Mosher, & Stephen Simpson, and collaborators

~$190K from Millennium Challenge Account Georgia, (MCA Georgia)

Prevention of Grain Dust Explosions

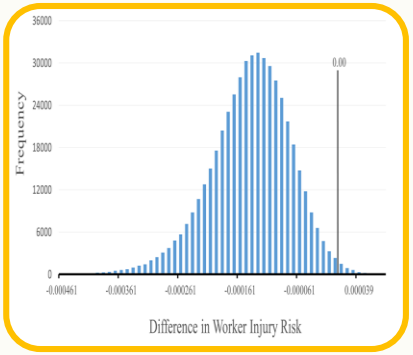
Gretchen Mosher and collaborators

~$266k from Susan Harwood Targeted Topics Training Department of Labor, OSHA

Utilizing Virtual Reality to Explore Crash, Near Miss Scenes, and Roadway Infrastructure

Nir Keren

~$142k from US Department of Transportation



Agro-ecosystem Approach to Sustainable Biofuels Production …..(AFRI-CAP)

Charles Schwab, Mark Hanna & Gretchen Mosher and collaborators

~$25M from National Institute of Food and Agriculture - USDA

New Facilities Coming Soon!

- Chassis Dynamometer Laboratory
- Feed Mill and Grain Science Complex
- Soil-Machine Dynamics Laboratory
- Poultry Teaching/Research Facility

US New and World Report Rankings

	2013	2014	2015	2016	2017	2018	2019
UG	4	4	2	1	1	3	?
Graduate	6	4	3	2	1	2	1

Key Elements in Becoming #1

- Obtaining modern facilities and laboratory equipment
- Maintaining and recruiting outstanding faculty and staff
- Growing our undergraduate and graduate student numbers and degree programs
- Increasing industry engagement
- Communicating our impacts successes internally and externally
- Adding a National Academy of Engineering faculty members
- Award winning faculty, staff, and students
- Support from the colleges and university administration
- Dreaming and living big!

ABE's Five Year Goals

- Maintain the #1 ABE department status in the US for both undergraduate and graduate programs
- Hire faculty to keep student to faculty ratio below 25:1 for all degree options
- Hire quality tenure-track faculty in key research/teaching/extension areas (precision livestock farming, advanced manufacturing, biomanufacturing, ecological engineering, animal production biosecurity, applied big ag data analytics)
- Have three ABE faculty member in the National Academy of Engineers
- Increase graduate student numbers to 4 students/TT faculty member

Questions?


#1
IOWA STATE UNIVERSITY
Department of
Agricultural &
Biosystems
Engineering