



BSE Update

BSE FAST FACTS

As of this fall semester, total enrollment in Biological Systems Engineering is 155 students, with the following breakdown in specializations:

Specialization	Students
Food & Bioprocessing	32
Machinery Systems	55
Structural Systems	18
Natural Resources	22
Undeclared	31

There are also currently 37 graduate students in the department.

The Biological Systems Engineering Department would like to extend a warm welcome back to all of our students, and an extra special welcome to our 5 freshmen students, as well as the 28 new students who transferred in from different departments!



Read about the 2015 Quarter Scale Tractor Team on page 3.



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NEWS FROM THE DEPARTMENT CHAIR - DOUG REINEMANN



Greetings to Alumni and friends of the Biological Systems Engineering Department. It has been a busy and productive year for the department. Our student club has had a banner year thanks to the strong leadership of the officers and contributions from undergraduate and graduate students. The club will be flying the BSE flag high by hosting students from our peer institutions at the Midwest Regional Rally in Madison this spring. I have enjoyed attending the monthly meetings

of our student chapter and am really impressed with their professionalism and community building activities. You can read more about their many activities and awards in this newsletter.

Our Faculty and graduate students have also been recognized with numerous awards, honors and patents. Our junior faculty are making big names for themselves and our senior faculty continue their record of excellence in teaching, research and extension. The appointment of Anita Thompson as chair of the Water Resources Management Program gives BSE a prominent campus-wide role in this very important and timely area of research and education.

We have some new faces in the department and welcome our new student services coordinator, Betsy Wood, to our team. Betsy is off to a great start filling some big shoes. I would like to offer a special note of thanks to Debby Sumwalt for her outstanding service to the department over the past 15 years. When I ask graduating seniors during exit interviews about the strengths of the department "Debby" is the most frequent response. She will be missed and we wish her all the best in her retirement.

We continue to face budgetary challenges and are looking for ways to maintain the high level of scholarly activity and high quality of

Continued on page 5.

WISCONSIN STUDENT CHAPTER

Update by President Connor Moore

The UW-Madison ASABE Student Chapter had an exciting 2015 spring semester.

This past semester started with a group of 9 students attending the Midwest Regional Rally. This year the rally was held at the University of Nebraska, Lincoln. Seven different student chapters joined together for a weekend that included industry tours, ASABE meetings, and a variety of social events.



This semester a number of ASABE students volunteered at the UW-Madison CALS Day for Kids. This was an opportunity for college students to educate young kids about science. Kids were given demonstrations that taught them about the production of ethanol, wastewater treatment, and ultra-absorbent soil.

This year, our club has received some great success and recognition nationally. We received second place overall for the AEM chapter of the year award. Our own Jenna Sanford also was recognized for her senior design project in the AGCO National Student Design Competition. Congratulations to everyone for the great accomplishments!

Throughout the spring semester the UW-Madison ASABE Student Chapter had a few social events. These events included attending a Brewers game in Milwaukee, touring the Pabst Brewery, and our annual game night.

The end of the semester wrapped up with a cookout and a farewell to all the graduating seniors.

This coming fall we are planning several industry tours, the annual Lawn Mower Clinic, and a campus wide bags (corn hole) tournament.



ASABE OFFICERS OF 2015

President — Connor Moore

Vice President — Cyrus Nigon

Secretary — Corinne Waschow

Treasurer — Grace Scarlupka

Fundraising— Thomas Larson, Calvin Winkel

CALS — Kyle Phelps

Social Chair — Connor Udelhoven

Midwest Regional Rally — Jenna Sanford,
Josiah Zanghi ²

A ROUND OF APPLAUSE FOR OUR AWARD WINNERS!



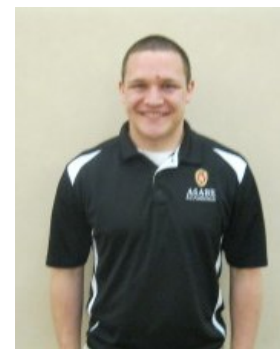
BSE graduated three PhD Students this past spring, pictured here with faculty escort Troy Runge. Congrats Shengfei, Zong, and Ocean!



Ian Atkins—2015 National Science Foundation 2015 Graduate Research Fellow



Yi-Cheng Wang—Recipient of the 2015 WI ASABE Graduate Student of the Year Award and the UW Graduate Peer Mentor award!



Cyrus Nigon—Recipient of the 2015 WI ASABE Biological Systems Engineering Student of the Year Award

QUARTER SCALE TRACTOR TEAM

Update by Cyrus Nigon

Badger Pulling, the UW-Madison Quarter-Scale Tractor Team, is excited for another year of designing, building, and testing a new tractor for the ASABE International Quarter-Scale Tractor Competition. The competition, held in late May in Peoria, Illinois, brings in collegiate teams from across the world to demonstrate their ability to design a tractor that is the more efficient, durable, and innovative than the rest. The team has high hopes of improving on last year's brand new design which placed 22nd in last year's competition.



The 2015 competition faced the team with multiple challenges, but the team continued to work together and ultimately proved the potential of the new design. The largest challenge for Badger Pulling was a significant rule change announced last fall which added a new event to the competition: a durability course. This course required teams to pull a weighted cart through eight laps on an oval-shaped track over 80 feet of bumps and 80 feet of 8 inch deep loose sand. To handle this new event the 2015 team incorporated 4-wheel drive, independent front suspension, and a four-link rear suspension into the design. These additions required a great deal of time and learning and ultimately added



a lot of weight to the tractor. In order to remain under the 800 pound limit, the team had to go back to the design process late in the year to trim extra weight from the machine. After many long hours in the shop late in the year, the tractor was loaded into the trailer to head to Peoria. With very limited testing and use, the team had to overcome several challenges at competition to work out the kinks and do some last-minute repairs. Fortunately, the tractor was able to compete in all but two of the events at the 2015 competition and showed 3 great potential for future improvement.

Continue reading about the tractor team on page 5.

CALS DEPARTMENTAL SCHOLARSHIPS 2014-2015

Don S. Montgomery Scholarship

Thomas Larson, Machinery Systems,
Viroqua, WI

Donale Richards, Natural Resources &
Environment, Madison, WI

Ervin W. Schroeder Biological Systems Engineering Scholarship

Reid Christ, Machinery Systems,
Independence, WI

Connor Moore, Food & Bioprocess,
Gratitot, WI

Gail Edwin and Janice Faye Janssen Biological Systems Engineering Fund

Scott Franke, Food & Bioprocess,
New Berlin, WI

Samuel Moskal, Food & Bioprocess,
Eau Claire, WI

Michael Shinnars, Structural Systems,
Antigo, WI

Troy Smith, Machinery Systems,
Grimsby, ON

Ham Bruhn Biological Systems Engineering Scholarship

Grant Herrman, Natural Resources &
Environment, Madison, WI

Eric Peissig, Machinery Systems,
Menomonie, WI

Grace Skarlupka, Food & Bioprocess,
De Pere, WI

Lisa Walsh, Natural Resources &
Environment, Sussex, WI

Josiah Zanghi, Food & Bioprocess,
Beaver Dam, WI

Gary and Barbara Krutz Scholarship Fund

Calvin Winkel, Machinery Systems,
Elkhart Lake, WI

Lynndon and Norma Brooks Scholarship

Jacob Hrebik, Machinery Systems,
Mosinee, WI

Cyrus Nigon, Machinery Systems,
Greenwood, WI

Hannah Pinter, Food & Bioprocess,
New Berlin, WI

Jennifer Sanford, Food & Bioprocess,
Oregon, WI

Orrin I. Berge Scholarship

Brian Straub, Machinery Systems,
Brooklyn, WI

Robert H. & Willa Meier Scholarship Fund

Angela Brandl, Food & Bioprocess, Cato, WI

Roxanne Conner, Natural Resources &
Environment, Madison, WI

Yandi Ma, Food & Bioprocess,
Shenzhen Guangdong, China

Roger W. Ambrose Scholarship

Samantha Milota, General Option,
Glenview, IL

Wisconsin Agricultural Engineer Scholarship

Amanda Beistle, General Option,
Brownsville, WI

Corinne Waschow, Food & Bioprocess,
Waukesha, WI

Wisconsin Biological Systems Engineering Scholarship

Joshua McAfee, Machinery Systems,
Omro, WI

Dick J. & Grace B. Stith Scholarship Fund

Caitlin Evers, Food & Bioprocess, Peoria, IL
Lindsey Shewchuk, Food & Bioprocess,
Inver Grove, MN

NEWS FROM THE CHAIR (CONTINUED FROM PAGE 1)

undergraduate and graduate instruction and extension and outreach for which we are known. The support of our alumni and friends is becoming increasingly important to help us meet these challenges. There are many ways in which our alumni and friends can support our students and faculty including internship opportunities for our undergraduates, advising student groups for senior design projects, and donations to undergraduate and graduate student scholarships. If you have questions or other creative ideas about how to support the department please let me know. My door is always open.

At our departmental retreat this summer we prioritized our goals for the coming year. On the top of the list is our plan to renovate our lab to provide a top quality teaching space for our expanding student body. Our goal is to create an engineering design center, equipped with state-of-the-art CAD/CAM rapid prototyping equipment to help our students turn their great ideas into great reality.

Finally, and most importantly, I would like to thank all of our alumni and friends that have supported us over the past year with your gifts, service, and other support. It makes a big difference to our program, and to our students, and is greatly appreciated. Of special note is the gift of an endowed professorship by Pat Walsh and Noreen Warren, matched by the Morgridge foundation. Our sincerest thanks go out to Pat and Noreen and the Morgridges for their support and vote of confidence in the future of BSE and UW-Madison. I would also like to thank Pat for his many years of service to UW Extension and service to the BSE department as a faculty member and department chair.

I wish you all the best in the coming year and I hope to connect with you at ASABE and other departmental and college events.

Doug Reinemann

QUARTER SCALE TRACTOR TEAM (CONTINUED FROM PAGE 3)

The focus of this year's team is to significantly improve on last year's design. By sticking with a similar drive train and suspension configuration and optimizing every system of the tractor, the team hopes to eliminate much of the extra weight that caused issues for the 2015 tractor. Building off of last year's design will also give the team an earlier start and more time to test and finish the tractor in 2016.

The Badger Pulling Team is very excited for what the coming year will bring, and is very thankful to have the support of their advisor Dr. Brian Luck, the Biological Systems Engineering Department, and numerous sponsors throughout the state and the Midwest.

Join the BSE LinkedIn group!



We have created a LinkedIn group for the University of Wisconsin Biological Systems Engineering department to:

1. Facilitate professional networking among BSE family and friends.
2. Maintain contacts with UW-BSE Alumni.
3. Post internships and permanent positions for current and former students
4. Provide profile pages of the BSE alumni and thereby inform current students about diverse career tracks.
5. Invite employers to list jobs and search for potential candidates.

Several former and current students have made contacts, set up interviews and eventually received job offers as a result of posting LinkedIn profiles. If you have already created a LinkedIn profile make sure you 'Join' to become a part of the BSE LinkedIn network.

If you have not yet created a profile, now is the time to get Linked Up!

BSE FACULTY & ALUMNI HONORS

FACULTY UPDATE



Congratulations to Dr. Xuejun Pan on receiving the CALS Excellence in International Activities Award



Congratulations to David Kammel for receiving the 2015 WI ASABE Wayne G. Russell Award. The purpose of this award is to recognize an individual or organization demonstrating exceptional commitment to helping the Wisconsin agricultural industry adopt new electric technology, farmstead mechanization, and farm equipment.



Congratulations to Alum Greg Williams for receiving two ASABE awards— both the Henry Giese Structures and Environment Award and the PEI Professional Engineer of the Year Award. In distinct ways, both awards honor Williams's impact on the design of agricultural-industrial facilities and his dedication to ASABE and the engineering profession.



Congratulations to Brian Luck, recipient of a 2015 ASABE Superior Paper Award in the Plant, Animal & Facility Systems category!

A SNAPSHOT OF OUR YEAR!



Above: Jeff Nelson and grad student Nolan Lacy welcome incoming freshmen to the department.

Right: BSE Faculty/Staff Retreat—Turning team building into fun!

Right: The ladies of AgrAbility of Wisconsin enjoyed meeting Wisconsin Secretary of Agriculture Ben Branchel



FACULTY PROFILE: ANITA THOMPSON

BSE'S ANITA THOMPSON NAMED WATER RESOURCES MANAGEMENT PROGRAM CHAIR



The Nelson Institute's Water Resources Management (WRM) program remains, even after 50 years, an extraordinary graduate program. It attracts outstanding students who learn through hands-on projects that benefit real communities, led by teams of volunteer faculty from a wide range of disciplines.

WRM requires a leader who can inspire students and foster col-

laboration, and Anita Thompson is ready for the challenge. Born and educated in Minnesota, Thompson holds a bachelor's degree in civil engineering and a master's degree and doctorate in biosystems and agricultural engineering, all from the University of Minnesota.

She has been a professor of biological systems engineering at UW-Madison since 2002. She studies sediment delivery in agricultural watersheds; how the pathogen *Cryptosporidium* (present in cattle manure) moves through soil and to groundwater; and water resources impacts associated with biofuel crop production systems.

Thompson recently shared some insight about WRM and her plans as the incoming program chair. She will assume this position in the fall 2015 semester as Ken Potter, who has led WRM for more than 12 years, enters retirement.

What is your favorite thing about WRM?

Thompson: Getting the opportunity to work with a group of students who come from such a diverse academic and professional background. I teach a small watershed engineering course and I've had a lot of WRM students take my course. They bring unique perspectives, ask great questions and approach issues from different angles. Getting the opportunity to work with a group of students like that on really practical water resources challenges is exciting to me.

What do you think is the most important thing to teach these students?

One of the real advantages of the WRM program is its interdisciplinary structure and wide-ranging course requirements for students. I think carrying through on that and teaching the importance of interdisciplinary

solutions and developing the skills to work together on these complex problems is really critical.

What is your vision for the program?

I want to see this program continue to be successful and continue to attract top students in this area. Increasing student numbers will be a priority. I want the Nelson Institute and the Water Resources Management program to continue to be the place that people interested in this type of professional work really want to go.

This program is celebrating its 50th anniversary. Are there any new or emerging issues that weren't a consideration 50 years ago when the program was founded?

One issue is that there is a greater need to address competing uses for water resources. People in urban areas need water for various reasons, there are different kinds of agricultural production systems that require it, there are manufacturing processes, and they're all tapping into the same water supply systems. Meeting all of these demands and protecting the high-quality resources that we have is going to be really important.

How do you see WRM preparing students to do that?

Certainly through their coursework and their interactions with the various faculty on campus that are involved with the program or serve as their advisors. The practicum provides the students with tools and resources that they can extend and use throughout their career. The program integrates the physical, biological and social sciences, which is necessary for us to address these issues.

Now tell us, are you a Badger fan or a Gopher fan?

Badger fan. I certainly still have an allegiance to the Gophers, and I'll cheer them on when they're not playing the Badgers, but I love the Badgers.

This article was originally published in the Spring/Summer 2015 Issue of In Common Magazine.

XUEJUN PAN:

NEW BIOMASS SUGAR PROCESS COULD BE A GAME CHANGER

By Wisconsin Alumni Research Foundation

A vial of white sugar sits on Xuejun Pan's desk beside a box of wood chips.

"It's pretty pure and sweet," he says, pointing to the sugar. "I'm not encouraging you. But it's edible."

With a new method being honed in Pan's laboratory, the process of transforming tough plant material into powder-soft sugar takes only hours. The reaction is mild, fast and groundbreaking. No harsh pretreatment or enzymes are required. Low costs and sky-high sugar yields – that may exceed 90 percent – make Pan's method one of the best in the business.

Standing in his lab in the Enzyme Institute, Pan swirls a test tube of syrupy extract. A murky layer of lignin settles at the bottom.



"Think about the future when we run out of oil. We may have solar energy, wind energy, nuclear energy and hydro. But what about the chemicals and materials currently derived from petroleum? Biomass likely is going to be the only option. Biomass-derived sugar will be the hard currency of the future bioeconomy."

The work going on here is exciting because it has been speculated that biomass holds the potential to yield 1 billion tons of sugar per year in the U.S., equivalent to 80-150 billion gallons of ethanol. However, current methods to produce bioethanol from cornstarch or sugarcane are inadequate and unsustainable to meet the global demand for renewable fuels.

To be sustainable, biofuel production should instead rely on abundant, inedible lignocellulose like switchgrass, corn stover, wheat straw, wood chips and waste paper.

The problem, Pan explains, is that lignocellulose is a complex material made of cellulose wrapped in tough hemicellulose and lignin. For this reason, lignocellulose is more difficult than starch to break down and convert (hydrolyze) into fermentable sugars. Harsh acids, blazing heat and other pre-treatments traditionally have been required before introducing pricey enzymes.

Needed is a cost-effective, single-step approach to extract the sugar.

"We're reducing process time from days to hours," Pan says. "At the very beginning when we were presenting, there were doubts. Could it really be true?"

Key to his approach is the use of inorganic bromine salt (lithium bromide or calcium bromide) to break down lignocel-

lulose and unleash fermentable sugars. Other labs have investigated other salts, but poor performance and byproducts dog the results.

Pan's reaction method works on raw biomass at stovetop temperatures, hydrolyzing cellulose and hemicellulose and releasing monosaccharides for subsequent biofuel or chemical production. Lignin separates from the product sugars and can be filtered out for use in coproducts. The bromine salt can be recovered and reused.

"Success of this technology could be game changing," Pan says. "If you can get easy, low-cost sugar, you'll be a winner in the game."

Support from the Accelerator Program is now being used to scale up the process to the point that it will be practical for industry. Demonstrating that the salts can be cheaply separated and recycled will be crucial.

Pan says that guidance from Accelerator Catalysts has helped him make technical modifications as well as polish an entirely new skill.

"I don't have experience in marketing technology," he says. "Catalysts helped me understand what industry is interested in."

With several patents under his belt, Pan's biomass conversion methods are part of WARF's Clean Technology portfolio.

UGANDA: THE BENEFITS OF BIOGAS

By Silke Schmidt

Generating enthusiasm for a new kind of technology is key to its long-term success. Rebecca Larson, a CALS professor of biological systems engineering, has already accomplished that goal in Uganda, where students at an elementary school in Lweeza excitedly yell “Biogas! Biogas!” after learning about anaerobic digester systems.

Larson, a UW–Extension biowaste specialist and an expert in agricultural manure management, designs, installs and upgrades small-scale anaerobic digester (AD) systems in developing countries. Her projects are funded by the Wisconsin Energy Institute at UW–Madison and several other sources. Community education and outreach at schools and other installation sites are an important part of these efforts.

Children get excited by the “magic” in her work, she says. “It’s converting something with such a negative connotation as manure into something positive,” Larson notes. In an AD system, this magic is performed by bacteria that break down manure and other organic waste in the absence of oxygen.

The resulting biogas, a form of energy composed of methane and carbon dioxide, can be used directly for cooking, lighting, or heating a building, or it can fuel an engine generator to produce electricity.

Larson’s collaborators in Uganda include Sarah Stefanos and Aleia

McCord, graduate students at the Nelson Institute for Environmental Studies who joined forces with fellow students at Makerere University in Kampala to start a company called Waste 2 Energy Ltd.

Along with another company, Green Heat Uganda, which has built a total of 42 digesters, Waste 2 Energy has helped install four AD systems since 2011.

“Most of these digesters are locally built underground dome systems at schools and orphanages,” Larson explains. Lweeza’s elementary school is a perfect example.

The AD systems use food waste, human waste from pit latrines and everything in between. The biogas generated by the digester is run through a pipeline to a kitchen stove where the children’s meals are prepared. Compared to traditional charcoal cooking, the AD systems greatly reduce the school’s greenhouse gas emissions.

Larson and her team are now focusing on enhancing the efficiency and environmental benefits of these systems. Their goals are to improve the digester’s management of human waste, reduce its water needs, increase the amount of energy it produces and generate cheap fertilizer to boost food crop yields.

“Our overall goal is to create a closed-loop and low-cost sustainability package that addresses multiple local user needs,” Larson says.

The beauty of the project is that all these needs can be met by simply adding two new components to the existing systems: heating elements and a solid-liquid separator.

To help visualize the impact of the fertilizer, Larson set up demonstration plots that compare crop yields with and without it. Down the road, a generator could be added to the system to provide electricity in a country where only 9 percent of the population currently has access.

As a next step, Larson hopes to replicate the project’s success in Bolivia. She is finalizing local design plans with Horacio Aguirre-Villegas, her postdoctoral fellow in biological systems engineering, and their collaborators at the Universidad Amazonica de Pando in Cobija.

This article and pictures were originally published in Grow Magazine.



BSE GETS CONNECTED!



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[www.facebook.comUWMadisonBSE](http://www.facebook.com/UWMadisonBSE)



We want to feature YOU in the next BSE Update!

Email your alumni update to bse@wisc.edu

Or send it in to BSE Update 460 Henry Mall, Madison, WI 53706

Please include your degree(s), date(s), and any news to share!

\$1 MILLION GIFT ESTABLISHES PROFESSORSHIP

The Biological Systems Engineering Department recently announced the establishment of its first endowed professorship. Emeritus professor and former BSE Department Chair Patrick Walsh and his wife, Noreen Warren, have committed a gift of \$500,000 to establish a named professorship in the department.

The gift will receive a “Morgridge Match,” which doubles its value to \$1,000,000. In fall 2014, John and Tashia Morgridge promised \$100 million to match new gifts toward professorships at UW-Madison. Their donation is the largest-ever gift by a single donor to the university. Walsh and Warren’s gift qualified for this matching fund opportunity.

The professorship is to be used at the discretion of the department to support critical faculty contributions to the department’s teaching and research missions.

CONTRIBUTORS TO BSE FROM OCTOBER 2014—SEPTEMBER 2015

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THANK YOU, DONORS!

FUNDING UPDATE

PLEASE CONSIDER MAKING A CONTRIBUTION TO ONE OF THE BSE FUNDS LISTED BELOW:

Biological Systems Engineering Fund

Biological Systems Engineering Student Activities Fund

Biological Systems Engineering Student Scholarship Fund

Biological Systems Engineering Sense of Community Fund*

*The purpose of this fund is to establish and reaffirm a sense of community among the faculty, staff and students of the Department. Uses can include, but are not limited to, receptions and entertainment or costs associated with meals and refreshments. This includes functions related to retirements (excluding retirement gifts), welcome receptions, and any other occasion that the Chair considers to be team or morale building in nature or that allows the Department to function as a productive community."

We sincerely wish to thank our alumni and friends who have generously supported the College of Agricultural and Life Sciences Department of Biological Systems Engineering. Your gifts today are more important than ever as the University faces challenging budget constraints. Gifts made to the Department of Biological Systems Engineering help us with scholarship, facilities improvement, endowed professorship and graduate fellowships, and carry on our tradition as leaders and innovators in the Biological Systems Engineering field.

An invitation to join the prestigious Bascom Hill Society is extended to those who provide support of \$50,000 or more to the department or to a specific project or program of their choice. You can pledge your commitment over a 10-year period, provide for a gift in your will, or give a gift of annuities or appreciated stock. If you have specific questions about giving, please contact Barbara McCarthy at the UW Foundation (Phone: 608-265-5891; e-mail: barb.mccarthy@supportuw.org).

Department of Biological Systems Engineering Funds

Two options to make a gift:

1. Visit the BSE website at **bse.wisc.edu** and select "Support BSE" in the left column.
2. Make checks payable to University of Wisconsin Foundation and return this form to:

**University of Wisconsin Foundation
US Bank Lockbox
PO Box 78807
Milwaukee, WI 53278-0807**

I/we would like to join other alumni and friends in support of the Department of Biological Systems Engineering.

I/we wish to pledge \$ _____ over _____ years. Please remind me of my pledge in _____ (month).

I/we contribute \$ _____. (Contribution is enclosed.) My company will match this gift; company form enclosed.

I/we wish to have my contribution support _____ fund.

Name: _____ E-Mail: _____

Address: _____

City: _____ State: _____ Zip: _____

Please charge my gift of \$ _____ to my: MasterCard Visa American Express

Card number _____ Expiration date _____

Cardholder's name as it appears on credit card (please print): _____

Cardholder's Signature: _____ Date _____



The **All Ways Forward** campaign is the fourth comprehensive fundraising campaign in the history of the University of Wisconsin-Madison. With a goal of bringing in \$3.2 billion by the end of the decade, it is also the largest campaign in university history.

All Ways Forward will help to shape and ensure UW-Madison's lasting impact. Gifts to this campaign will fund initiatives and programs that will keep UW-Madison the world-class institution it is today. To learn more or make a donation please visit www.allwaysforward.org.

Thank you for your support.

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