



Grad student supports countless undergrads through mentoring and leadership roles

Through mentorship, community involvement and leadership roles, graduate students in engineering can have an immense impact on the undergraduate experience of dozens, if not hundreds of students.

PhD student Jonathan Welburn conducts research in food safety risk and global financial crises under Professor Vicki Bier. During his six years as a graduate student, he has mentored eight young students, many of whom are from groups underrepresented in the science disciplines. One of his former mentees is pursuing a PhD at Stanford, another is a master's student at Georgia Tech, and a third, Brian Zhou, is an investment-banking analyst at JP Morgan Chase.

Zhou, who graduated in 2015, says that Welburn supported him in determining whether to pursue a graduate degree in industrial engineering or a career in finance.

"As a founder (and previous co-president) of the Society of Mathematical Finance and a PhD student within our department, Jonathan was able to offer me valuable insight into both fields, and was willing to meet anytime and discuss at great length any questions I had about either career path," Zhou says.

Bier, who also served as Welburn's advisor and mentor during his undergraduate education at UW-Madison, says that his experience with undergraduate research helped him see the value in providing a similar experience to other undergraduates, especially underrepresented minorities. Welburn also helps support the diversity initiatives of the college, both through his mentorship roles and as a Graduate Engineering Research Scholar, participating in science nights at a local bilingual elementary school. "For minority students, having mentors that they can relate to, it helps them visualize a place for themselves," Bier says.

Welburn, who typically mentors two students at a time, does research that is highly conducive to undergraduate participation. Through the topic of risk in food safety, he works through large, often messy sets of data. This platform allows students to engage with a problem that lacks a clear solution.

(Continued on back page)

CHAIR'S MESSAGE



Vicki Bier

Greetings! As I write this letter, I look out over a changing campus. We have celebrated the graduation of many talented engineering students, and other students are headed off to internships, co-ops, summer jobs, or travel. Yet, campus is never empty: Grade-school and high-school students are here on field trips, students are arriving for summer school, others are staying on campus to conduct research, and new students are coming for orientation and advising sessions.

I'm excited to announce that this summer, I will be transitioning out of the role of department chair and turning this important position over to the capable hands of Professor Jeff Linderoth. Fortunately,

Professor Shiyu Zhou (who has served with me as associate chair for graduate affairs) has agreed to stay on in that capacity for one more year, to provide some continuity for Jeff and get him off to a good start.

As I reflect on my own experiences as chair, I'm proud to say that we have recruited and hired five exceptional young faculty members (including four assistant professors), and successfully retained three top faculty members who received extremely attractive



Jeff Linderoth

offers from other universities. We remain a national leader in applying industrial engineering to healthcare, and built on our existing strengths in human factors, optimization, and manufacturing. Our graduate program rose to No. 7 in the nation (according to *U.S. News*), and we handled roughly a 50-percent growth in undergraduate enrollment while maintaining our high quality of education. We also redesigned our design courses for both juniors and seniors, to provide more consistency in student experiences and additional hands-on educational opportunities. Finally, my colleagues and I were delighted to host many of you on campus to celebrate the department's 50th anniversary!

As always, gift funding plays an important role in our ability to accomplish all those things. As just one example of the types of unique opportunities that gift funding makes

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possible, this past year we were able to use these funds to enable seven outstanding students to attend an on-campus conference on Improving Primary Care through Industrial and Systems Engineering. The conference dealt with improving the quality of healthcare provided by general practitioners through methods such as better use of information technology.

To help give Jeff a head start on the new initiatives he will want to implement as department chair, please consider making a gift to the department's annual fund.

To do that, visit go.wisc.edu/givetoisye.

For the 2016-2017 academic year, I'll be on sabbatical, and devoting more time to my research on homeland security and emergency planning. However, you can always drop me a note just to say "Hi!" at bier@engr.wisc.edu.

If you're in Madison or planning a visit to campus, please let us know that you'll be here. Jeff Linderoth would be happy to schedule a time to chat with you about the wonderful things happening in the department and around campus! You can reach him at (608) 890-1931, or linderoth@wisc.edu.

ON, WISCONSIN!

Sincerely,

Vicki Bier, Chair
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(608) 262-2064

Professor Patricia Flatley Brennan has been named the fourth director of the National Library of Medicine (NLM), the world's largest biomedical library.

"This is an opportunity to think publicly and serve my country by making sure high quality, actionable health information is available to everyone who needs it," she says.

Brennan also plans to continue her research at NIH, where she will have a lab housed within the National Institute of Nursing Research. At the WID Living Environments Lab, which includes a virtual reality CAVE, Brennan and her group used virtual household environments to study personal health information management. Brennan attributes funding she has received through gifts to the



university for playing a significant role in the success of her research and teaching efforts.

While she won't have a virtual reality lab at her disposal, Brennan plans to resume studies of human-centered design, coupling it with information in ways that aid human health. "Integrating personal health information and devices is

where we are going," she says. "We want to continue creating a world where people are drawn to health."



In early June, the department marked its 50th anniversary with a weekend-long reunion during which we welcomed many alumni to campus for a birthday bash, banquet, Bucky Badger, tours, talks, and lots of shared memories. Thanks to all who joined us!



Assisted living communities exist in many forms—including adult family homes, which care for four to eight residents with special needs; community-based residential facilities; and residential care apartment complexes—and provide valuable housing and care options for people who can't live in their own homes but do not need and aren't qualified for skilled nursing facility care.

Yet, for states around the country, assisted living communities have proved to be a regulatory challenge, especially since there is no federal authority for such regulation. Because they are so diverse and so ubiquitous (there are more than 3,000 in Wisconsin alone), states find it difficult to provide any sort of firm regulation or even quality improvement guidance.

Now, a new partnership among the Center for Health Systems Research and Analysis (CHSRA) at UW-Madison, the Wisconsin Department of Health Services, and assisted living communities across Wisconsin aims to improve the quality of assisted living communities by developing a quality improvement process that is based on existing initiatives in the industry and that also can be linked to the regulatory process. This collaboration, the Wisconsin Coalition for Collaborative Excellence in Assisted Living, has received a Wisconsin Partnership Program community impact grant, which will allow these groups to further develop and expand a system that has been in the works since 2009.

Professor Emeritus David Zimmerman, a senior scientist at CHSRA, says standards are a much-needed commodity for operators of assisted living facilities. "When the industry decided to peel off the group of residents who needed less skilled care, and put them in a different place, the money followed but the quality assurance never did," he says.

The project unites the principles of systems engineering, ergonomics and healthcare. All four assisted living associations in Wisconsin are working with researchers in the coalition, and as of December 2015, a quarter of the



From left: Kevin Coughlin (DHS), David Zimmerman (CHSRA), Edmond Ramly (CHSRA), Susan Nordman-Oliveira (CHSRA), and Jay Ford (CHSRA).

Partnership aims to improve quality, consistency in Wisconsin assisted living communities



people in Wisconsin in assisted living live in a community that has joined the coalition.

One of the coalition's major contributions is an annual survey that yields detailed resident feedback on areas such as dining and staff services. Through this data, the researchers have been able to help communities, evaluate them relative to their peers, and identify specific areas in which they can improve.

Susan Nordman-Oliveira, a researcher with CHSRA, cites one conference in which an assisted living staff member lauded the comparative performance system the researchers have developed. "One of the providers was encouraging the rest of the audience to join the coalition, and said, 'I always feel like I'm doing a bad job because I don't have anything to gauge it on. Now that I am putting in some of my data and seeing whether I fall above or below the level of other providers. I feel like I'm being rewarded, like I'm doing something right. I'm not at the bottom, and I'm going to

continue trying to move up,'" Nordman-Oliveira says.

Directors of assisted living communities also file quarterly reports that provide a summary of quality improvement initiatives and several outcome measures, such as fall prevention, infections, and rehospitalizations, as well as staff turnover. The reports also yield information that helps them set and maintain high standards.

In the future, organizers aim to expand their outreach to more assisted living communities as well as underserved communities and resident groups. By working under a common goal of quality improvement, the coalition has and will continue to harness the tools necessary to make lasting changes in the field. "If there wasn't passion in this, the project wouldn't have lived," says Nordman-Oliveira. "A lot of people care. People have given extra time to this project because they know it's important. Yes, we're a research center and the nuts and bolts and the data are important to us, but we also care."

EDUCATIONAL INNOVATION:

ISyE junior design course uses blended learning—and LEGO kits—to teach fundamental skills of design

Senior design courses are often the most crucial learning experience in an engineering student's undergraduate career. However, ISyE instructors have noticed that students sometimes struggle to finish their projects within the time constraints of the semester, often because they bring widely different skill sets to the course.

Enter ISyE 350, a lab-based course that gives *juniors* a full design experience, but also provides them the full range of knowledge and experiences they will need to be successful in their senior capstone design course.

At the beginning of the semester, juniors are split into teams based on their varying skillsets. They receive a LEGO MINDSTORMS robot kit, which includes a micro-computer, servos, monitors, conveyor belts and other tools that students might need to assemble their project.

Every semester, Professor Rob Radwin, who developed and teaches the course, presents students with an open-ended problem to tackle, using the materials provided in the LEGO kits.

In fall 2015, their client was a fictitious online dairy company fulfillment center, and their challenge involved incoming online orders of cheese that needed to be packaged at different stations and shipped out to the right customers. Each team had to design an automated system, which involved analyzing, developing, programming and constructing a working model of their design for the client, who presumably would select the best design. "It's very complex: They have to take in orders, design an algorithm that's going to be efficient, and not make errors," Radwin says. "Everyone has a different approach—each group comes up with a different way of doing the same problem, and then they have to try to prove their method is the best."

One team developed a series of ramps that would deliver the cheeses, represented by small blocks, to their appropriate locations. Team member Logan Dirkx says that its design, which involves a rotating funnel, is the most cost-effective

and efficient way of approaching the problem. "The most important factor was having everything be dispersed concurrently," Dirkx says. "This naturally led to a ramp system, which allowed us to funnel everything from one location."

In his team's solution, the cheeses all pass through a funnel. Then, separate programmed ramps rotate to deliver each cheese to the correct location.

Dirkx and his teammates found the class worthwhile and say it provided them hands-on experience without the high-stakes pressure of the senior capstone course.

In ISyE 350, students have the entire semester to develop their prototype, which often requires learning new skills. For instance, in order to program the system to deliver orders to the correct stations, the students use the programming language Robot C. Although ISyE students have taken at least one programming course,

ISyE 350 requires that they directly apply these skills to a real-life situation.

In the course, Radwin uses blended learning, relying on digital media to present students the conceptual ideas and design tools they will need to move forward with their design projects. The night before each course meeting, they can access online lectures, which cover topics such as measuring a customer's needs, generating design concepts, or systematically evaluating the best design—then attend class the next day with the fundamental knowledge they need to solve a very tangible problem.

While LEGOS, duct tape and cardboard arguably are rather low-tech materials, they are everyday tools that help the students master higher-level concepts. "This semester is the most complex problem I've given them," Radwin says. "And the students already have working prototypes, which is the earliest students have completed them in this course, which is in its third year. Even though we seem to be making the problems harder and harder each semester, they're actually getting better at doing this."



A project developed in ISyE 350 uses programming tools from the LEGO kit and cardboard ramps to deliver products to various destinations.

INFORMS student chapter broadens the dialogue on operations research

Associate Professor Laura Albert McLay gives a presentation to INFORMS students.

Student organizations within engineering allow students to connect—developing the soft skills required to communicate complicated ideas in a real-world setting. For the new INFORMS (Institute for Operations Research and the Management Sciences) student chapter on campus, making these connections has been instrumental in their campus experience. Graduate student Erkin Otles, the communications officer of the organization, attests to the importance of INFORMS for the students involved.

“Being a part of INFORMS is a really good opportunity to step back from what you’re doing specifically in your research, and learn about what other students are doing, learn new methods, and be social with other students,” he says.

The INFORMS chapter, which has been active since May of 2015 and was approved by the national chapter in May of 2016, began with the efforts of a few graduate students, including Otles and chapter president Suzan Afacan. As graduate researchers under Associate Professor Laura Albert McLay, they had attended INFORMS conferences and were somewhat befuddled that UW-Madison, with its high reputation in advanced research, did not have a chapter of its own. So they decided to take the challenging leaps required to create a student organization connected to a national society. And it was more difficult than they had expected.

“When you come in to an already established club, you have that member base, you already sort of know what is expected of you, and building off of that isn’t too difficult—the manpower and resources are already there,” Otles says. “This was totally different. We had to build out what we were doing, and then convince everyone that what we were doing was a good idea, and jump through the other departmental hoops as well.”

The group meets several times a semester, discussing research, making presentations to prepare for the INFORMS conference, conducting 30-second elevator talks, and speaking to visiting engineers. All of these activities help them prepare the soft skills they need to effectively highlight their research experience, says McLay, who advises the chapter.

“The students work so much on a topic that’s so narrow, and they don’t spend a lot of time talking up front about what they’re doing,” she says. “It takes some time to have those

conversations and say what’s really innovative about their research, so that maybe someone in another engineering discipline could understand. Those are things they need to develop when they’re in the job market: talking to a variety of people, and even to just their friends on campus too.”

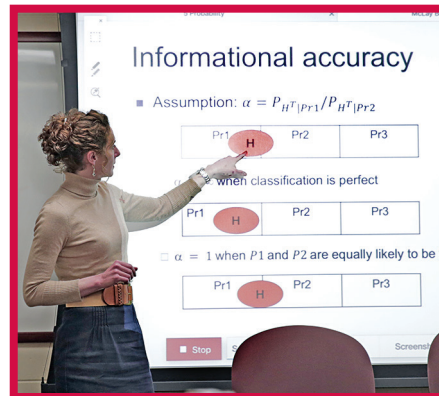
The INFORMS connections stretch much further than campus, connecting students to an expansive network of engineers and employers in their field. Students not only attend conferences and present their research, but connect to the INFORMS job center, as well as message boards and subgroups within the society. In this way, student members can begin to build longstanding career connections.

The UW-Madison INFORMS officers are encouraging more students from disparate fields to join the chapter, thus broadening the dialogue. They are also encouraging more undergraduate membership, in order to form mentorships.

Their goals are all-encompassing, and include public outreach, which started with the 2016 spring Engineering EXPO. They collaborated with the UW-Madison chapter of the Institute of Industrial Engineers to show school kids the various practical uses of operations research through interactive activities. They used classic problems like the traveling salesman problem, which involves figuring out how to best make a trip that hits every major city in a

region while minimizing the traveling costs. INFORMS students also helped organize the 2016 ISyE Poster Symposium by working with the UW-Madison Human Factors & Ergonomics Society (HFES), which hosts the event.

The INFORMS student chapter is staying open to the possibilities, and developing important skills that will inform their engineering careers for years to come.



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Carayon honored with Eisenberg Patient Safety and Quality Award

The Joint Commission and the National Quality Forum (NQF) on April 7, 2016, announced the 2015 recipients of the annual John M. Eisenberg Patient Safety and Quality Awards. The awards were presented at NQF's Annual Conference in Washington, D.C. **Pascale Carayon**, the Procter & Gamble Professor in Total Quality, was the award's only individual recipient.

The patient safety awards program, launched in 2002 by NQF and The Joint Commission, honors the late John M. Eisenberg, MD, MBA, former administrator of the Agency for Healthcare Research and Quality (AHRQ). Eisenberg was also a member of the founding board of directors of NQF. In his roles both as AHRQ administrator and chair of the federal government's Quality Interagency Coordination Task Force, he was a passionate advocate for patient safety and healthcare quality,



Pascale Carayon, with David W. Baker, executive vice president for healthcare quality evaluation, The Joint Commission (left) and Helen Darling, interim president & CEO, National Quality Forum (right).

and personally led AHRQ's grant program to support patient safety research.

Carayon was honored for her passion and far-reaching impact on patient care. She has advanced the field of patient safety and quality using human factors engineering concepts and methods, and the Systems Engineering Initiative for Patient Safety model that grew out of human factors engineering.

Through her vision and research, Carayon has significantly enhanced the body of knowledge underlying innovative approaches to patient safety, and has improved patient safety efforts. She has also mentored new leaders in this arena both nationally and internationally.

NSF grant will fund research into cloud-computing tools for manufacturers

UW-Madison researchers have been awarded a National Science Foundation (NSF) \$300,000 grant to develop cloud-based quality-data management systems for manufacturers.

Professor **Shiyu Zhou** and professor of computer sciences Xiaojin Zhu will lead the three-year research endeavor. Their research will use and improve cloud-based platforms for accessing, sharing and visualizing manufacturing data.

The goal is to develop methods for streamlining and centralizing the large amount of data typical of manufacturing enterprises so manufacturers can improve efficiency and decision-making.

The project will also contribute to workforce training by offering students opportunities to engage in interdisciplinary research dealing with manufacturing, computing, sensing and machine learning.

Werner, Holden receive ergonomics best paper award

Assistant Professor **Nicole Werner** and **Richard Holden**, a PhD alumnus who studied industrial engineering and psychology, received an award for the best paper published in *Applied Ergonomics* in 2015. The paper, "Interruptions in the wild: Development of a sociotechnical systems model of interruptions in the emergency department through a systematic review," offers an understanding of interruptions and how they factor into complex real-world environments. The researchers received the award during the Ergonomics & Human Factors Conference in Daventry, United Kingdom, on April 20, 2016.



Nicole Werner



Richard Holden

Student chapter of industrial engineers honored

The UW-Madison student chapter of the Institute of Industrial Engineers, the nation's largest, has been recognized as a top university chapter with 50 or more members. The local chapter was praised by IIE for its recruiting efforts and active members.

Chapter president Tyler Robey says the UW-Madison group is an extremely active organization that hosts regular professional, social and volunteering events for its members. The chapter also maintains a website and social media presence and assists its members in finding jobs and internships. "Our officer board puts in a great amount of effort to ensure that events are beneficial and exciting for our members," Robey says. "The department has a solid group of underclassmen and I'm excited about the future of the organization."



"It hopefully reinforces what they learn in class, and makes them excited about data," Welburn says. "It's nice to try and see what their personal interests are, and let them emphasize that in what we do. Because then it's their own project."

But working with students has always been a two-way street for Welburn. Undergraduates are able to engage in a topic that interests them, applying their classroom experience to a viable problem.

Welburn, in turn, gets to interact with an eager and diverse range of students who contribute results to his own research. For example, one of his now-former students, Steve Hoerning, served as a co-author on a recent paper Bier's group published.

"I definitely learn a lot from them as well," Welburn says. "I learn new things simply in the process of explaining the research, and my interest is reinforced by those conversations."

However, Hoerning, who is now a PhD student in operations research at Stanford University, says that Welburn's commitment to his students goes well beyond research.

"He has a contagious intellectual curiosity, and we spent a lot of time discussing a wide range of topics," Hoerning says. "He helped me network with professors and graduate students inside and outside of the department. He encouraged me to take challenging courses that I otherwise might have avoided. If I had not met Jon in my sophomore year, I don't believe I would have pursued a doctorate."

By mentoring undergraduates, Welburn is also able to consider his long-term options: Although Welburn has chosen to take a job as a policy analyst after he defends his dissertation in August 2016, his experience also would allow him to excel in a faculty position if he decides to pursue that option later in his career. After all, he has served as a teaching assistant under Bier, as well as an instructor for the largest class in the department, ISyE 313: *Engineering Economic Analysis*, through which he extended his outreach to engineering students from across the college.

In addition to his teaching duties, his roles in various societies, and his position as a mentor, he also has served as a grad-student mentor

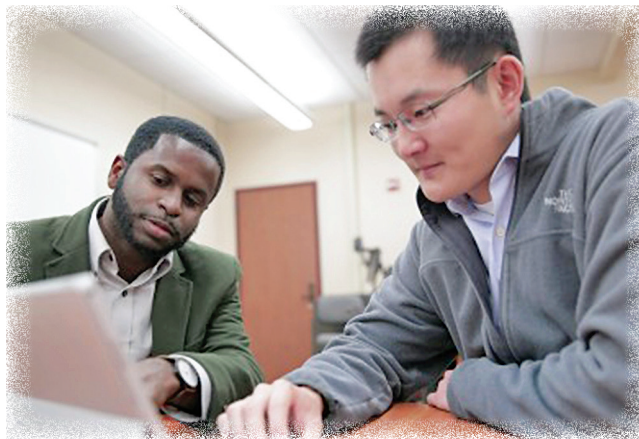


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for the Madison team that participated in the College National Fed Challenge, and as a judge for an undergraduate paper competition at the Great Lakes Regional Conference of the Institute of Industrial Engineers.

"Jonathan has the kind of personality where he always wants to try something new, even if it requires much more work," says Bier.

Welburn's passion, service-mindedness and willingness

to learn have positively influenced countless undergraduate students, providing them with a role model and more often than not, a friend. Welburn still stays in contact with his previous mentees, checking in with them every other week either through Skype or email. Yet, despite his role in their lives, he remains humble, insisting that he simply offers a guiding hand for students who are already on their way up.

"Jon is one of the individuals here at UW-Madison who has made the most positive impact on me as an undergraduate student," Zhou says. "I am sure that he will continue to make a positive impact as a mentor to others in the future as well."