

IOWA ENGINEER



THE UNIVERSITY OF IOWA COLLEGE OF ENGINEERING

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And something

more

Building Innovation by Design for a Thriving College of Engineering

The College of Engineering is buzzing with excitement about the 70,000 square foot building addition to the Seamans Center for the Engineering Arts and Sciences that will spring up from the John Deere Plaza, and will stretch southward toward Burlington Street, east of the Lindquist Center. The addition is currently in the final stages of design development, and the architects are doing a fantastic job

of designing an addition that will support and enhance the innovative research and educational programs that make us so successful. For example, the addition will facilitate our hands-on collaborative learning approach by providing engaging common areas outfitted with inviting furniture and interactive technologies, and by offering modern classrooms and project spaces which inspire



active learning. Indeed, a centerpiece of the new lobby area will be a state-of-the-art design studio that students will use for collaborative projects beginning in their very first semester on campus. In other new teaching spaces, state-of-the-art fluids laboratories will maintain our world-renowned leadership in this area. The addition will also enhance our thriving research enterprise by uniting important programs in IIHR—Hydrosience & Engineering and Center for Computer-Aided Design with collaborators in the existing engineering building, and by providing new state-of-the-art research laboratories for all of our research endeavors. There are so many interesting and inspiring aspects of the building expansion. Check out the feature article in this issue of the Iowa Engineer for even more details. Another great way for you to keep up with developments is to monitor our college web site (www.engineering.uiowa.edu/annex) for continuous updates. I hope that you will share in our excitement for this important building project to educate the engineer...and something more.

Alec Scranton
Dean of Engineering

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THE NEW COLLEGE OF ENGINEERING ANNEX WILL SPARK CAMPUS- WIDE CREATIVITY AND INNOVATION.

TEXT BY SUSAN SHULLAW

G

azing at the computer monitors in his office, UI College of Engineering Dean Alec Scranton clicks through a series of slides documenting the college's growth and progress over the past 10 years.

All the trend lines are marching upward: Undergraduate enrollment has risen more than 75 percent, from 1,200 in 2005 to 2,120 in 2014. Faculty research productivity has increased from \$240,000 per faculty member a decade ago to \$600,000 today. There are new partnerships with industry and K-12 education, new programs in experiential learning and cross-campus collaboration, and new research in areas critical to quality of life in the 21st century.



This impressive, college-wide growth hasn't happened by accident, Scranton explains. "We've been highly successful in reaching many of our strategic plan objectives," he says. "Now it's time to pursue a goal that we knew would result from our increased activity — a new facility to accommodate not only our enrollment growth, but expanded research, outreach, and service."

Scranton clicks on another slide and reveals an architect's rendering of the planned South Annex Addition to the Seamans Center for the Engineering Arts and Sciences, as it might appear at dusk on a summer evening.

Extending south from the existing Engineering building, the new addition transforms the outdoor John Deere Plaza into a two-level, glass-walled lobby, connecting the Seamans Center to its new three-story annex, which parallels the west façade of the Old Capitol Mall and parking structure. The annex itself is elevated above ground level, allowing pedestrians to pass or linger beneath it as they move down the hill toward Madison Street.

The 70,000-square-foot addition, which was approved by the Iowa Board of Regents in September 2014, addresses multiple strategic needs that will enable the college to maintain its momentum and growth.

EXPANDED CLASSROOMS. The college urgently requires larger, better-equipped classrooms, as does the university as a whole. The new building addition will provide two large, general assignment classrooms featuring state-of-the-art technology and designed to accommodate the "flipped" classroom concept of more active engagement and problem solving.

COLLABORATIVE LEARNING SPACES. Designing new processes, products, and devices is central to all fields of engineering. The Annex will include advanced, digitally-enabled teaching spaces to promote team-based, multi-disciplinary educational experiences.

ENCOURAGING STUDENT SUCCESS. The Seamans Center for the Engineering Arts and Sciences was completed in 2001 and provided a fresh design for integrating student study space throughout the building. The new building addition will expand and enhance these "learning commons" spaces and also provide a new engineering student services suite.

LEARNING AND DISCOVERY IN FLUID MECHANICS. The College of Engineering is home to IIHR-Hydrosience and Engineering, one of the oldest and most preeminent hydraulic research and teaching laboratories in the world. By uniting major areas of fluid mechanics, the new addition will promote interdisciplinary research in the College of Engineering and across campus.

"WE'RE PROUD THAT THIS NEW ADDITION, BUILT WITHOUT STATE



SUSTAINABILITY. Designed by BNIM Architects of Des Moines, the Annex will reflect the goals of the UI's Sustainability Initiative. "I'm hoping we can achieve LEED platinum certification," Scranton says. "We're incorporating lots of green space, with active water filtration ponds and re-use of gray water, and we're looking at photovoltaics as well."

CENTER FOR COMPUTER AIDED DESIGN (CCAD). Like the rest of the college, CCAD has experienced tremendous growth in recent years. The new building addition will fill CCAD's critical need for space, and will facilitate student participation in CCAD research programs.

ENGINEERING AND ART. The new annex will enhance the college's innovative collaborations with UI arts programs, and the centerpiece of the new engineering lobby will be the Project Design Studio, a unique, hands-on "maker" classroom unlike any other facility on campus.

Engineering student Allison Kindig finds this aspect of the building particularly exciting. She's enrolled in the UI's interdisciplinary Fabrication and Design: Hand Built Bicycle course, comprised equally of art and engineering majors.

"Besides learning technical skills, it's really interesting to see how art students and engineering students approach things," says Kindig, a Presidential Scholar and 2014 Homecoming Queen, who will graduate in May 2015 with a degree in industrial engineering. "In general, art students have really creative ideas and will find out by trial and error what works and what doesn't. Engineering students take a

more systematic approach, using math and science, which can eliminate some of the guesswork.

"We come from different fields, but we all share the same foundation, which is creativity and thinking outside the box, and that's what the new Project Design Studio is all about," she continues. "When you create a designated space for both arts and engineering, it reflects an assumption that the two fields should coexist. I think that speaks volumes, and will be a huge draw for incoming students."

Although the Annex won't be completed by the time Allison Kindig graduates, the project will be moving quickly by then. Construction is expected to start in early 2016, with completion in 2018. Total project cost is estimated at \$37 million, which will be funded through a combination of university resources and contributions from alumni, friends, and corporate partners.

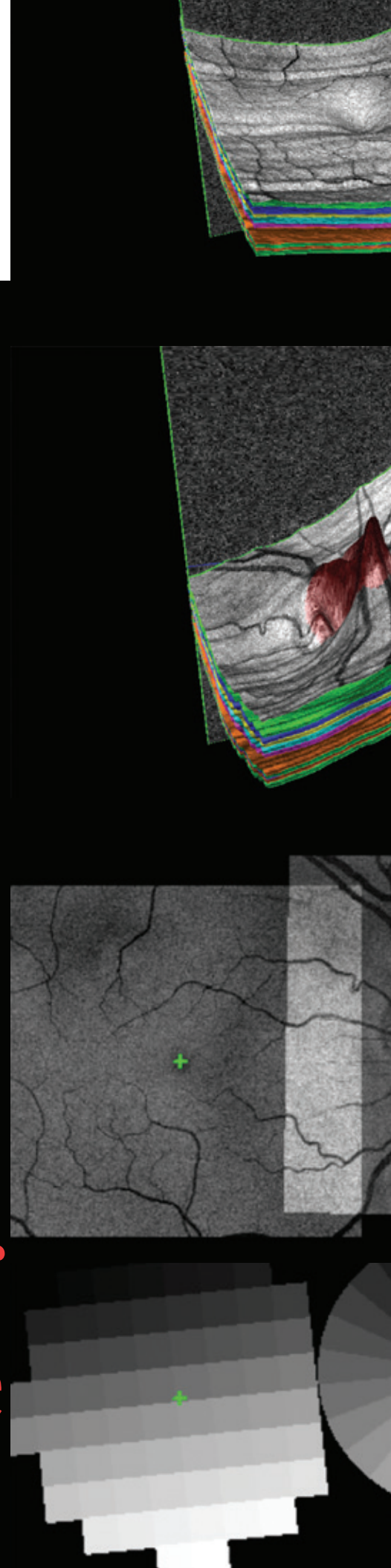
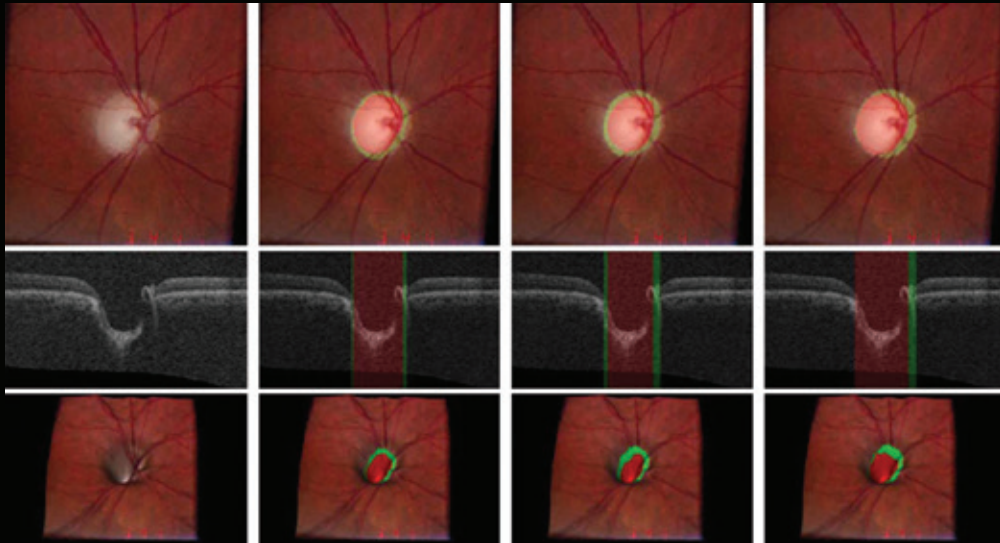
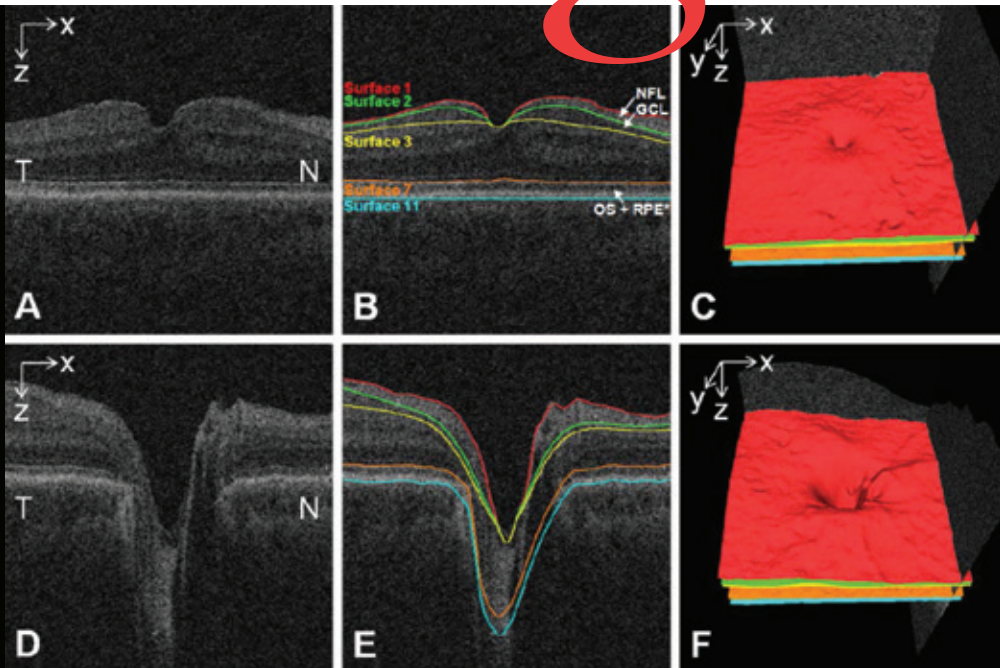
"We're proud that this new addition, built without state appropriations, will benefit the entire state of Iowa," Scranton says. "Our multidisciplinary research programs in water sustainability, the Iowa Flood Center, advanced manufacturing, digital human system integration, nanomaterials, and renewable energy systems will be housed in the new space, and all have tremendous potential for improving quality of life and enhancing the state's economy.

"We like to say that that our college educates engineers who are 'something more,'" he adds. "The Annex is the 'something more' that will enable us to better address the grand challenges of the 21st century, and to remind the rest of the world that those challenges are being solved, with artful innovation, at the University of Iowa."

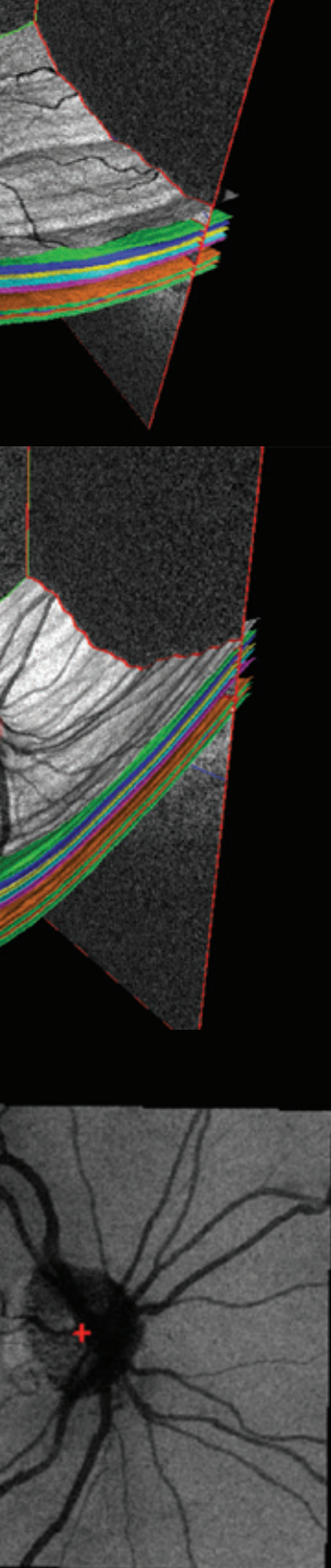
APPROPRIATIONS, WILL BENEFIT THE ENTIRE STATE OF IOWA."

ALEC SCRANTON, DEAN

Images



of a Healthier
Future



*Image credits:
Kyungmoo Lee
Mona K. Garvin
Young H. Kwon
Michael D. Abramoff
Milan Sonka*

“For our engineering students and faculty, interacting directly with physicians is critical to understanding the underlying healthcare questions. Equally important for research physicians is to understand what is technologically easy, what is too difficult, and what is worth exploring further despite the risks and challenges, since the potential payback is so important.”

Milan Sonka, IIBI director and professor of electrical and computer engineering

TEXT BY SUSAN SHULLAW

IN

June 2014, when the mammoth, 42-ton, 7 Tesla Whole Body Scanner was lowered carefully by crane into the UI’s new \$126 million Pappajohn Biomedical Discovery Building (PBDB), it was big news. Researchers at the Iowa Institute of Biomedical Imaging (IIBI), which occupies most of PBDB’s lower two floors, will use the 7 Tesla scanner and other sophisticated imaging equipment to find answers to some of biomedicine’s biggest questions by examining their smallest details.

IIBI was founded in 2007 to foster interdisciplinary, cross-campus research, education, and discovery in biomedical imaging. The Institute involves faculty and students from multiple UI colleges, including Engineering, Medicine, Liberal Arts and Sciences, and other UI health colleges.

According to IIBI Director Milan Sonka, professor of Electrical and Computer Engineering, about 40 UI faculty work regularly within the institute, along with some 50 graduate and post-doctoral students. In addition to its 7 Tesla MR scanner – one of only about 20 in the U.S. – Sonka says IIBI is unique in assembling what may be the largest group of interdisciplinary medical imaging faculty in the country.

“Bringing together collaborators on dissimilar projects in a single location yields a much deeper mutual understanding than would otherwise be possible,” he explains. “For our engineering students and faculty, interacting directly with physicians is critical to understanding the underlying healthcare questions. Equally important for research physicians is to understand what is technologically easy, what is too difficult, and what is worth exploring further despite the risks and challenges, since the potential payback is so important.”

Sonka credits former UI Engineering dean and current UI Provost Barry Butler, along with Paul Rothman, former dean of UI Carver College of Medicine, for championing the IIBI vision and current UI Engineering and Medicine deans Alec Scranton and Deborah Schwinn for continuing IIBI support. He is quick to add that scores of IIBI faculty spent hundreds of hours with architects and planners to guide the new facility’s design. “IIBI is truly the result of a ‘village’ of collaborators,” he says.

The Institute’s 30,000 square feet within PBDB is IIBI’s first real home. The sleek, ultra-modern space includes offices and meeting rooms, student work areas, and subject examination rooms, in addition to areas exclusively devoted to advanced, translational research using human, as well as, large- and small-animal imaging suites.

“Our research is highly multidisciplinary and very broad,” Sonka says, “from disease-specific research focusing on the heart, vasculature, lungs, eye, brain, and musculoskeletal system, to combining imaging with genetics and electronic patient records to someday predict disease progression and treatment outcomes, as well as contribute to personalized, patient-specific, patient-optimized treatments.” That’s a vision worth imagining.

Going



Kaitlyn Roth in Germany

Global

Engineering Students Gain International Experiences

On some campuses, the word “global education” has become the academic equivalent of “double latte”—everyone bandies it about, but only a select few choose to indulge. At the University of Iowa College of Engineering, however, “global education” is becoming a fundamental and enriching facet of the undergraduate academic experience in every department, whether students study abroad or study with their international peers on campus. During the last year, the crafting of these enhanced, “double latte” educational opportunities have been supported by the new Director of Global Experiences and Academic Advisor, Amy Brewster.

Brewster is nothing if not enthusiastic about her work. She has worked with engineering staff members, faculty, and students as well as the UI Office of International Programs to assess and address the nature of students’ experiences in global education. Brewster gained her own international experience as a Peace Corps Volunteer in Bulgaria after earning a degree in Communication Studies from the University of Iowa. She earned a Master’s Degree in Educational Policy and Administration while working at the University of Minnesota before returning to Iowa in October, 2013.

“The engineer of the future must contribute to productive collaborations among diverse colleagues from around the world,” College of Engineering Dean and University of Iowa Foundation Distinguished Professor of Chemical and Biochemical Engineering Alec Scranton says. “A global experience will provide undergraduate students with invaluable exposure to different cultures and new ways of thinking and set them on the path to success.”

The college is not new to global education. Since 1999 it has joined forces with a French university to offer the Virtual International Project Teams course, and for many years a significant number of international graduate students and faculty members have enriched the learning environment at Iowa. Four years ago, 84 international engineering undergraduates attended Iowa; in fall 2014,

TEXT BY JEAN FLORMAN



*Logan Weyandt
in Scotland*

that number had risen to 169. Although Brewster notes that remains a relatively small proportion of the total undergraduate enrollment (eight per cent), the College of Engineering has created new orientation and support systems for international students once they arrive on campus.

Recently Brewster and other university administrators traveled to three towns in China--Beijing, Harbin, and Hong Kong—to strengthen ties for both international students at Iowa and domestic students wanting to study abroad. Her visit to Hong Kong University of Science and Technology (HKUST) was particularly welcoming, in part because its provost is UI alumnus Eden Woon (BA 1967). Iowa faculty members also hope to forge ties with several Chinese universities and teach there during future summers.

Once international students arrive at the University of Iowa, they are welcomed by an array of academic and social support programs, including International Student and Scholar Services' support such as Global Buddies <http://international.uiowa.edu/connect/students/global-buddies>, the Life in Iowa program <http://international.uiowa.edu/isss/community/life-iowa>, and Friends Without Borders. <http://international.uiowa.edu/connect/students/fwb>. The college celebrates its global diversity by displaying the word "Welcome" in multiple languages and flying flags that represent the home nations of students, faculty and staff members, and alumni.

A number of college-sponsored opportunities have helped Hanbin Tao, who hails from Shanghai, China, maximize his cross-cultural experience at Iowa. An Honors student and recipient of the National Scholars Award, he has served as a peer advisor in the college, an undergraduate teaching assistant for two courses, and a research assistant.

"I would tell future international students to use their spare time to get involved in organizations and activities on campus," he says. "Research and teaching assistant experiences will help you get to know the American culture and to meet people."

That sentiment is echoed by Brazilian student Adair Gallo, a junior in chemical engineering who came to Iowa as a Brazil Scientific Mobility Program Scholar.

"Find what you like and what you want to be, and then look for people who have already gotten there," he says. "Try to learn as much as you can from them. It's possible to achieve big things if you believe you have the potential."

Brewster says it is important for international students to feel they can honestly talk about their experiences and offer ideas about how the college could make their time here even better. She has hosted two feedback sessions during which international students helped her learn how to better integrate them into College of Engineering life and the local community. In response to their feedback, the College of Engineering launched an enhanced orientation program called Engineering@Iowa: A Step Ahead, as well as a Career Development Lunch-and-Learn series to help them connect to internship and research opportunities.

The classroom setting provides the perfect context to connect international and domestic students through intense teamwork experiences. Required of all first-year students,



Hanbin Tao



Ella Wassweiler at MachuPicchu

Engineering Problem Solving I mixes international and domestic students in project teams. One positive outcome can be the enhancement of students' understanding of cultural differences and the reliance by students on their cultural strengths as they wrestle with engineering problems.

"The experience enhances their understanding of the background and knowledge of their team members and helps them rely on their individual strengths," Professor of Civil and Environmental Engineering Allen Bradley says, "which of course is made all the more significant when there are cultural differences also involved."

As part of another required course, Engineering Success, it's recommended that students seek opportunities to become "engineers and something more" including global experiences. Instructor and Director of Admissions and First-Year Experience Jane Dorman also emphasizes the tremendous value of working in diverse teams.

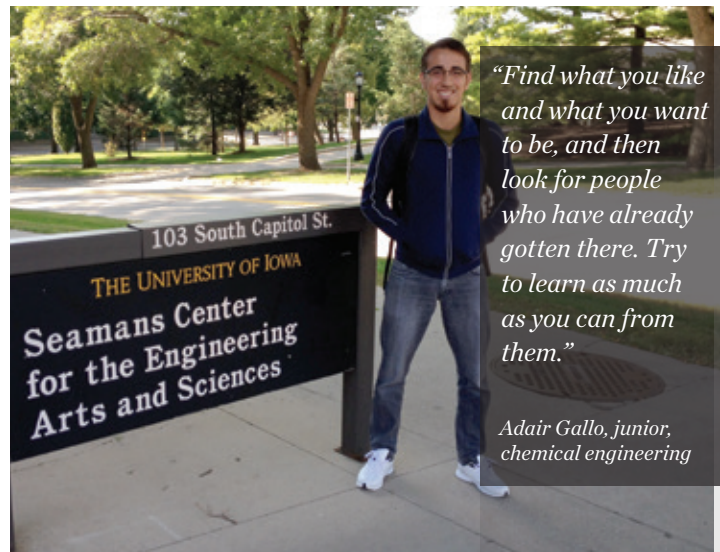
That knowledge and experience likewise is gained by domestic students when they study abroad. By partnering with the Study Abroad office to target and promote global learning opportunities specifically for engineering students, Brewster hopes to increase student interest in gaining a high-quality academic experience abroad. Promotional efforts have included the development of major-specific web resources (<http://international.uiowa.edu/study-abroad/first-steps/major-advising>), information sessions (information session titles/topics have included: Student Exchange Programs; International Grants and Fellowships; The ABCs of Learning Abroad; India Winterim Opportunities; Summer Study in Rome; Summer Study in Hong Kong; STEM internships abroad), classroom visits, and the creation of brochures and other promotional materials to advertise global opportunities targeted towards engineering students. Brewster is working hard to dispel the myth that engineering students can't study abroad, as there are numerous opportunities for both short- and long-term study that incorporate engineering courses.

Brewster has wrapped study abroad and international student experiences into a branded Global Engineering presence at the college. In the future, an enhanced web site and active social media presence will keep students, faculty, and others aware of and interacting with the Global Engineering efforts. The new web site will be regularly updated with bios of international and student abroad students, along with descriptions of how their global experiences—in Iowa or abroad—have made a positive difference in their lives.

A new Global Engineering Advisory Board will cast the college's net even wider by pitching the program to engineering alumni and employers who can provide UI students with exciting global connections far beyond campus.

"I'm especially excited about our new Global Engineering Advisory Board which will kick off during the spring semester," Brewster says. "We'll bring together students, alumni, employers, and faculty to provide ideas and advice as we continue to build Global Engineering opportunities. They also will help our students to create rich cross-cultural connections with each other and around the world."

And that's worth celebrating with a double latte.



Adair Gallo

Adair Gallo, junior, University of Iowa College of Engineering international scholar from Brazil, didn't take long to engage in the classroom and Iowa City community as a result of being selected as a Brazil Scientific Mobility Program (BSMP) scholar.

Originally from Toledo, Brazil, Adair studied chemical engineering for four years at the State University of Western Parana. This prepared him well for his year at the University of Iowa, where he has taken courses in sustainable systems, quality control, alternative energy systems, design for manufacturing, operations management, and manufacturing systems. In addition to engineering-related coursework, Adair has particularly enjoyed the business and entrepreneurship courses he has taken.

During his time at the University of Iowa, Adair has appreciated the opportunity to meet and form relationships with people of different cultures from all over the world. When not in class or studying, Adair can be found at the recreation center, spending time with friends, going to the cinema and parties, or at home drinking chimarrao (a traditional South American Yerba mate tea beverage). Adair has come around to American football—he can be found streaming Hawkeye football games from his computer on football!

George D. Ashton Inducted into Distinguished Engineering Alumni Academy

Dr. George D. Ashton was inducted into the College of Engineering's Distinguished Engineering Alumni Academy during Commencement ceremonies December 20, 2014, in Iowa City, IA. In addition, Ashton delivered the "Charge to the Graduates" keynote speech to 102 graduating seniors.

Ashton joins 73 other graduates of the college who are members of the academy.

Engineering alumnus George Ashton is an international expert on the study of ice jams, ice control, flooding, snow drifting, snow loads, and river ice.

Ashton received a BSCE degree in civil engineering from the University of Iowa in 1961, an MSCE in civil engineering from the University of Arizona-Tucson in 1963, and a PhD in mechanics and hydraulics from the University of Iowa in 1971. From 1962 to 1964 he was a lieutenant in the U.S. Army. From 1964 to 1967 he worked as a structural engineer for Bechtel Co. in San Francisco.

After earning his PhD, he joined the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, New Hampshire and held various research and management positions with his research concentrating on river ice processes and problems. From 1990 to 1998, he was chief research and engineering directorate.

He retired in 1998 and now works as a private consultant in Lebanon, New Hampshire, dealing primarily with river ice problems. Ashton has received the Straub Medal from the University of Minnesota, the Hilgard prize from American Society of Civil Engineers (ASCE) the Stevens Award from ASCE and most recently the 2002 Ice Research and Engineering Award by the International Association for Hydraulic Research.

He is the author of numerous papers and book chapters dealing with ice problems. He was Editor of the *Journal of Cold Regions Science and Technology* from 1995 to 2006.

The Distinguished Engineering Alumni Academy was created in 1996 to honor University of Iowa engineering alumni for their personal contribution toward engineering achievement, leadership, and service to the profession and to society.

UI AIChE Student Chapter Recognized at 2014 National Conference

Members of the University of Iowa Department of Chemical and Biochemical Engineering were recognized at the 2014 American Institute of Chemical Engineers (AIChE) Student Awards ceremony held during the annual conference November 14-17.

Daniel Yocius was one of 15 winners of the Donald F. and Mildred Topp Othmer National Scholarship Award. The award of \$1,000 is given to chemical engineering students for their outstanding academic achievement and involvement in student chapter activities.

The AIChE's Safety and Health Division awarded the University of Iowa the Ted Ventrone, Ephraim Scheier and Walt Silowska Award. The award recognizes teams from this year's Design Competition entries that have made the most appropriate application of inherent safety in their design solutions.

The UI student chapter of AIChE received an Outstanding Student Chapter Award. This is the 10th year in a row for the group to receive this recognition.

The ChemE Jeopardy team successfully defended its national title against LSU and UC-Berkeley in the finals.



ChemE Jeopardy team: Jacob Crome, Daniel Yocius and Catherine Suchanek (not pictured: Zach Behrendt).

Robert G. Hering, Dean Emeritus of the College of Engineering

FEBRUARY 18, 1934 – NOVEMBER 13, 2014

“With inspired leadership and a deep commitment to quality, Bob Hering transformed the College of Engineering into a thriving academic center reaching international distinction. As dean, he pioneered one of the earliest collegiate instructional computer networks, established one of the nation’s first biomedical engineering programs and an innovative center of research excellence in computer-aided design, and inspired ambitious diversity programs benefiting women and minorities.”

Dr. Hering earned his BMSE from the University of Illinois in 1956, an M.S. from the University of Southern California in 1958 and his PhD from Purdue University in 1961.

He joined the University of Illinois Department of Mechanical Engineering as an assistant professor in 1961, and promoted to associate professor in 1964 and full professor in 1968.

In 1971, he was named professor and chairman of Mechanical Engineering at the University of Iowa. Quickly rising through the ranks, he was named acting dean of the College in 1972 and Dean in 1973. At the time of his retirement in 1992 Dr. Hering was the longest tenured engineering dean in the nation.

During his tenure, he helped Iowa build one of the strongest colleges of engineering in the country,

- a college that boasted a student body that averaged in the 95th percentile in ACT scores among all U.S. College freshmen and ranked first, as a group, at the University of Iowa;
- quality faculty members, three of whom had been elected to the National Academy of Engineering, and
- tripled enrollment in nine years with women making up 21 percent of the total, higher than the national average at the time.

Under his leadership, the college received full-term accreditation for all six engineering programs on three consecutive inspections; the establishment of the Biomedical Engineering Department; creation of the Iowa Center for Computer-Aided Design; and advancement of student access to state-of-the-art computer technology by establishing the Iowa Computer-Aided Engineering Network.

Dr. Hering was named a Fellow of the American Society of Mechanical Engineering and a Fellow of the American Institute of Aeronautics and Astronautics. He was a member of Sigma Xi, Tau Beta Pi, Pi Tau Sigma and Sigma Tau. In 2005, he was inducted into the college’s Legacy of Iowa Engineering.

“With inspired leadership and a deep commitment to quality, Bob Hering transformed the College of Engineering into a thriving academic center reaching international distinction. As dean, he blended vision, passion, and determination into a formula for 21st Century academic excellence. He pioneered one of the earliest collegiate instructional computer networks, established one of the nation’s first biomedical engineering programs and an innovative center of research excellence in computer-aided design, and inspired ambitious diversity programs benefiting women and minorities. Hering’s masterful advocacy skills earned the College of Engineering an enviable level of respect among colleagues at peer institutions many times larger than Iowa.”



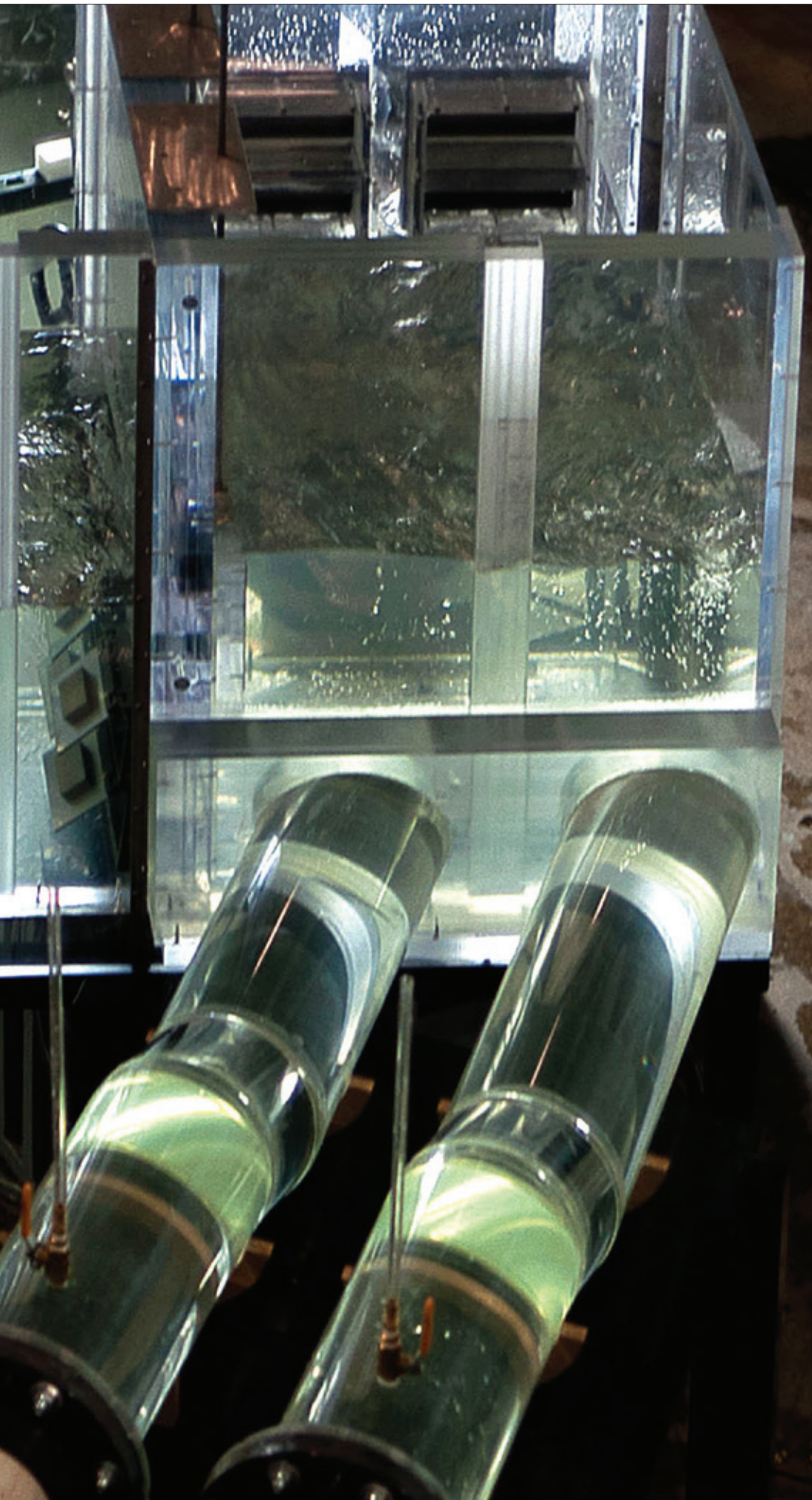
IIHR Researchers Receive ASCE Hydraulic Prize

Three IIHR researchers were recently recognized by the American Society of Civil Engineers (ASCE) with the 2015 Karl Emil Hilgard Hydraulic Prize. The winners are IIHR Research Engineer A. Jacob Odgaard, Director of Engineering Services Troy Lyons, and Hydraulic Engineer Andrew Craig. Their winning paper, “Baffle-Drop Structure Design Relationships,” was published in the *ASCE Journal of Hydraulic Engineering* in September 2013. The paper outlines the design specifications for the baffle-drop structure, a crucial component in the design of the Thames Tideway Tunnels project for the city of London.

The Hilgard award is given annually to the author or authors of a paper concerning a problem related to water flow and is determined by ASCE’s Environmental and Water Resources Institute.

Craig, Lyons, and Odgaard will accept the award at the World Environmental and Water Resources Congress May 17–21 in Austin, Texas. The Hilgard Award was instituted in 1939 through an endowment created by Karl Emil Hilgard (1858–1938), a German-Swiss hydraulician and bridge engineer for the Northern Pacific Railroad.

The vortex dropshaft pictured here is also part of the Thames Tideway Tunnels project for the city of London.



New on the College website

Because of a long and growing history of excellence in military-related research, the UI Center for Computer-Aided Design (CCAD) has added the Military category to its web site — making it easier to identify areas of interest and expertise. The Military Simulation and Simulators web page — <http://www.ccad.uiowa.edu/military> — covers simulators, man-in-the-loop simulators, warfighter simulation, simulation for design and prototyping, military and EMS vehicle driving simulators, Air Force (avionics) simulation, and training simulation. CCAD’s military simulation technology has proven to reduce cost and time (up to 33%) in design, testing, fielding, and training.

Photo by Aneta Goska/Courtesy of IHHR



Appointments

David M. Cwiertny has been appointed inaugural Editor-in-Chief of *Environmental Science: Water Research & Technology*, published by the Royal Society of Chemistry.

Eight recent alumni of the College of Engineering have been appointed to three-year terms on the Young Alumni Advisory Board.

Ian Flynn (BSE 2011 industrial engineering), director of engineering, Raining Rose, Cedar Rapids, IA

Kayla Kamber (BSE 2012 industrial engineering), industrial engineer/lean tech, Mars Chocolate North America, Chicago, IL

Michael J. Lee (BSE 2008 mechanical engineering), product line manager, Schneider Electric, Cedar Rapids, IA

Alyssa Neiers (BSE 2010 biomedical engineering), Medical Murray, North Barrington, IL

Alyssa Azzano Reinhardt (BSE 2011 chemical engineering), chemical process engineer II, Genencor, Cedar Rapids, IA

Liz Risius (BSE 2013 electrical engineering), integration engineer/technical project manager, Epic Systems, Madison, WI;

Stephanie Swiatlo (BSE 2013 biomedical engineering), engineer I, Baxter Healthcare, Round Lake, IL

Nicholas Turner (BSE 2011 civil engineering), project engineer, JEO Consulting Group, LLC, South Sioux City, NE

Grants, Contracts, Patents

William Eichinger, William D. Ashton Professor of Civil Engineering, professor of civil and environmental engineering, and faculty research engineer at IIHR—Hydroscience & Engineering, received an \$81,876, subcontract for

“Mapping of Truck-Generated Salt Spray under bridges.”

Witold Krajewski, Rose and Joseph Summers Chair in Water Resources Engineering, and director of the Iowa Flood Center, received a \$53,040 contract from Northeast Iowa Resource Conservation and Development for “Rainfall and soil moisture monitoring in the Turkey River Watershed.”

Pavlo Krokmal, Donald E. Bently Faculty Fellow of Engineering, associate professor of mechanical and industrial engineering and researcher at the UI Center for Computer-Aided Design, received a \$156,647 grant from the U.S. Department of Defense, Defense Threat Reduction Agency. Krokmal will study multiscale networks with stochastic interactions: resiliency and recovery optimization under large-scale attacks.

Keith Schilling, research scientist at IIHR—Hydroscience & Engineering, received a \$55,000 contract for “Measuring the effectiveness of stacked nutrient reduction practices using a paired watershed approach at the sub-watershed scale – Rapid Creek Watershed.”

Thomas Schnell, associate professor of mechanical and industrial engineering and director of the Operator Performance Laboratory, received a \$50,000 contract from Fairchild Controls, Inc., for LIDAR connectivity and testing on MI-2.

Larry Weber, Edwin B. Green Chair in Hydraulics, professor of civil and environmental engineering and director of IIHR—Hydroscience & Engineering, received a \$50,000 subcontract for Nutrient trading in Iowa: a pilot study in the Catfish Creek Watershed.

Weiyu Xu, assistant professor of electrical and computer engineering, received a \$38,337 grant from the Iowa Energy Center for “Data security and privacy in smart grid: a computational approach.”

Recognition

Er-Wei Bai, professor and departmental executive officer of electrical and computer engineering, was featured in a profile in the December issue of IEEE Control Systems Magazine, the largest circulation technical periodical worldwide devoted to all aspects of control systems.

K. K. Choi, Carver Professor of Mechanical Engineering, professor of mechanical and industrial engineering, and researcher at the UI Center for Computer-Aided Design, was named a Fellow of SAE International. He will be honored at the SAE 2015 World Congress and Exhibition the week of April 20, 2015, in Detroit, MI.

Hongtao Ding, assistant professor of mechanical and industrial engineering, was selected to receive the 2015 SME Outstanding Young Manufacturing Engineer Award.

Robert Hart, graduate student in mechanical engineering, has been selected for the 2015 Obermann Graduate Institute. As an Obermann Graduate Fellow, he will participate, along with other Fellows, in a one-week intensive institute exploring how to combine public engagement with their research and teaching.

Anna Hoppe, doctoral candidate in biomedical engineering, received the Review Choice Award in the Biomedical Imaging and Optics: X-ray, CT, and Nuclear Medicine Track poster session at the 2014 Biomedical Engineering Society (BMES) Conference in San Antonio, TX. Her poster was entitled “An Image Processing Protocol for Assessing Longitudinal Growth of Coil Embolized Cerebral Aneurysms and Their Corresponding Coil Masses.”

Engineering students **Michelle Knirr**, **Qingyang Su**, and **Rae Ann Corrigan** were recognized for creating superior essays for the Statics Writing course. The essays

were part of a presentation made by Scott Coffel, director of the Hanson Center for Technical Communication, at the October 2014 American Society of Engineering Education (ASEE) North Midwest Section Conference held at the University of Iowa.

Ching-Long Lin, professor of mechanical and industrial engineering, faculty research engineer at IIHR—Hydroscience & Engineering, and researcher at the Iowa Institute for Biomedical Imaging, has been elected a Fellow of the American Physical Society (APS) Division of Fluid Dynamics (DFD), one of the highest honors in the professional society of fluid mechanics. Lin is honored “for his contribution to multiscale flow physics and computational techniques, including pulmonary tracheobronchial and acinar flows, image-based data-driven human lung models, lattice-Boltzmann methods, coherent structures in atmospheric boundary layer and four dimensional data assimilation.” Lin was recognized at the annual APS DFD meeting November 23-25 in San Francisco.

Gohar Manzar, doctoral student in biomedical engineering, took first place in the 40th anniversary Abboud International poster session. Manzar’s poster was titled “An Epigenetic Modifier Enhances the Differentiation of Human iPSC cells from a Type I Diabetic Patient into Pancreatic β cells. Manzar received \$1,000 for the honor. Her mentor is Nicholas Zavazava, MD, PhD, in UI Internal Medicine.

Thomas Myres, senior majoring in electrical engineering, was selected to receive a \$3,000 scholarship as part of the Institute for Electrical and Electronics Engineers (IEEE) PES Scholarship Initiative. Myres is one of 184 students selected from 95 U.S. and Canadian universities for the 2014-2015 academic year. He is a member of Tau Beta Pi, national engi-

neering honor society, and has served as an intern at Next Era Energy Resources.

Ibrahim Ozbolat, assistant professor of mechanical and industrial engineering and co-director of the Advanced Manufacturing Technology Group in the UI Center for Computer-Aided Design, is featured in an article titled "Bioprinting comes alive (but not the way you imagine it)." The article in *Plastics Today*, a major publication for the plastics industry, covers Ozbolat's research at the UI on bioprinting blood vessels, and pancreatic, bone, and cartilage tissues that is advancing that technology. Also, a video produced by the American Society of Mechanical Engineers, featuring Ozbolat, was recognized as the third most viewed video during 2014.

Gene Parkin, Donald E. Bently Professor of Engineering, professor of civil and environmental engineering, and director of the UI Center for Health Effects of Environmental Contamination, has been named a Fellow of the Association of Environmental Engineering & Science Professors (AEESP). The honor is bestowed upon members who have exhibited exceptional long-term excellence in environmental research, teaching, and/or service to the environmental engineering and science community. Parkin is recognized as a world-wide expert in environmental engineering. He is co-author of one of the most widely used textbooks in the field, *Chemistry for Environmental Engineering and Science*, and is particularly well known for his scholarly contributions in the area of wastewater design and treatment, and the use of iron in remediation of chlorinated solvents.

Edward Sander, assistant professor of biomedical engineering and researcher at the Iowa Institute of Biomedical Imaging, was selected by the National Science Foundation to receive a Faculty Early Career Development (CAREER) Award. The award, in the amount of

\$500,000 over five years, is for a project titled, "Directing Epithelial-Mesenchymal Tissue Self-Structuring and Remodeling with Multi-scale Mechanical Interactions and Principles of Mechanobiology."

Milan Sonka, professor of electrical and computer engineering, associate dean for graduate programs and research, and director of the Iowa Institute of Biomedical Imaging, has been elected a Fellow of the Medical Image Computing and Computer Aided Intervention (MICCAI) Society, one of the highest honors in the international professional society for medical image analysis. Sonka was honored "for excellent contributions to quantitative medical image analysis." He is one of only 27 MICCAI Fellows worldwide. Sonka was recognized at the annual MICCAI meeting September 14-18, 2014, in Boston, MA.

Electrical Engineering student **Daniel Vial** was recently interviewed by *Blogsphere*, the on-line blog for the American Geophysical Union (AGU) at the union's recent conference. The interview focused on Vial's study of mussels that are equipped with heart rate monitors to purify water with their excrement. Like human heart monitors, the gadgets glued to the mussels' shells provide information about activity and metabolism. But in the mussels' case, this information is helping researchers understand how mussels cleanse the water of agricultural runoff.

Yin Yu, doctoral student in biomedical engineering and research assistant at the Advanced Manufacturing Technology Group in the UI Center for Computer-Aided Design, has been elected a Full Member in Sigma Xi, The Scientific Research Society. Yu focuses on printing living cells for organ fabrication. He holds an MS degree in biomedical engineering from the University of Iowa and an

MD degree from the Medical College of Nantong University. His research interests are stem cells and organ printing. Full Membership in the society is conferred upon any individual who has shown noteworthy achievement as an original investigator in a field of pure or applied science or engineering.

Publications

George Constantinescu, Shinjiro Miyawaki, Bruce Rhoads, Alexander, Sukhodolov: an article, "Numerical evaluation of the effects of planform geometry and inflow conditions on flow, turbulence structure, and bed shear velocity at a stream confluence with a concordant bed," *Journal of Geophysical Research: Earth Surface*, 119:10, 2079-2097.

David M. Cwiertny, editorial: "To new beginnings and a better alternative," *Environmental Science: Water Research & Technology*.

David M. Cwiertny, Shane A. Synder, Daniel Schlenk, Edward P. Kolodziej, an article: "Environmental Designer Drugs: When Transformation May Not Eliminate Risk," *Environmental Science & Technology* 48:20, 11737-11745.

A. Jacob Odgaard, chapter: "River Channel Stabilization with Submerged Vanes," *Advances in Water Resources Engineering*, Vol. 14, pp.107-136.

Hans J. Johnson, Matthew M. McCormick, Luis Ibanez: a book, *The ITK Software Guide Book 2: Design and Functionality Fourth Edition Updated for ITK version 4.7.*, 2014.

Weiyu Xi, Er-Wei Bai, Myung Cho: an article, "System identification in the presence of outliers and random noises: A compressed sensing approach," *Automatica*, 50:11, 2905-2911.

James Buchholz, Kevin Wabick, James Akkala, Azar Eslam Panah: confer-

ence, "Mechanisms of Vortex Evolution in Unsteady Stalled Flows," *Bulletin of the American Physical Society*, Vol. 59:20

Hongtao Ding, Yung C. Shin: an article, "Dislocation density-based grain refinement modeling of orthogonal cutting of titanium," *Journal of Manufacturing Science and Engineering*, 136:4, 441003.

Andrew Kusiak, Guanglin Xu, Zijun Zhang: an article, "Minimization of energy consumption in HVAC systems with data-driven models and an interior-point method," *Energy Conservation and Management*, Vol. 85 (1), 146-153.

Priyadarshini R. Pennathur: chapter 6, "Information Modeling for Cognitive Work in a Health Care System," *Cognitive Systems Engineering in Health Care*.

Priyadarshini R. Pennathur: an article, "Following the trail: understanding information flow in the emergency department," *Cognition, Technology & Work*, 16:4, 565-584.

Sharif Rahman: an article, "A Generalized ANOVA Dimensional Decomposition for Dependent Probability Measures," *SIAM/ASA Journal on Uncertainty Quantification*, 2:1, 670-697.

H.S. Udaykumar: an article, "Essentials of Micro-and Nanofluidics," *AIAA Journal*, 10.2514/1

Presentations

Fred Stern, George D. Ashton Professor of Hydroscience and Engineering, professor of mechanical and industrial engineering, and faculty researcher, IIHR—Hydroscience & Engineering, was a keynote speaker at the 11th International Conference on Hydrodynamics, held October 19-24, in Singapore. The topic of his presentation was, "Recent Progress in CFD for Naval Architecture and Ocean Engineering."

1950's

Grant Myers (BSEE 1957, MS 1958, PhD 1965) visited the College of Engineering recently. He is professor emeritus of electrical engineering, University of Nebraska-Lincoln, having served there from 1975-1993.

Roger (BSCE 1958) and Carol **Stoughton** of Sacramento, CA, along with **Gerald Myers** (BSE 1960) of Naples, FL were in Iowa City on October 3, to attend a City High reunion.

Upcoming Alumni Events

For more information or to RSVP, email engineering-adm@uiowa.edu

March 24**Alumni Reception**

Denver, CO, Posner International Center, 5:30-8 p.m.

April 15**Alumni Reception**

Minneapolis, MN., McNamara Alumni Center, 6-8 p.m.

October 9**Party after the Parade**

6:30-8:30 p.m., College of Engineering.

October 10**Homecoming Tailgate Open House**

2.5 hours prior to game time.

October 31**Family Weekend Tailgate Open House**

2.5 hours prior to game time.

Alumni Volunteer Opportunities**April 16****Research Open House**

9 a.m. – 4 p.m.

The College seeks volunteers to serve as research poster judges. A minimum one-hour time commitment is needed. Technical expertise is not required.

1960's

Arthur J. Carlson (BSEE 1962, MS 1964, PhD 1966) of Surprise, AZ, visited the Seamans Center October 10, 2014.

Terry Fleener (BSME 1963) was inducted into the U.S. Rugby Hall of Fame. Fleener has served the USRF in multiple roles: first president of the Eastern Rockies RFU; Founding member of the Western Rugby Union; first Board of Directors of the USARFU; first president of the Pan American Rugby Association; a founding member of the North America West Indies Rugby Association and chairman of the Pacific Rim Rugby Championship, Ltd. He has been a founding member, player and administrator with the Denver Barbarians RFC since 1967.

George Opsahl (MS 1969) of Lake Oswego, OR, was a guest at the College on September 18.

Gene (BSME 1963) and **Bobbie Orne** of Vernon, CT, visited the College on October 2. Gene is retired senior engineer with Pratt & Whitney Aircraft.

Philip Parsons (BSCE 1966), founder and president of Parsons Engineering Products, Minneapolis, MN, has sold his company. The company specializes in water pollution control.

Dennis A. Rhoads (BA 1961, BSME 1962) of Arroyo Grande, CA, attended Homecoming activities at the College.

1970's

George Gassman (BSME 1974) of Marshalltown, IA, was in Iowa City on December 23 to visit the College. He is distinguished principal technologist with Emerson Process Management.

David C. Larson (BSIE 1977, MBA 1982) of Bettendorf, IA, vice president-strategy and business development for Deere & Company, Moline, IL, has retired.

Vivekanand (Vic)

Mahadevan (MS 1977) has been appointed director of Sphere 3D.

Venkat Narayanan (MS 1973)

of Deer Park, IL, is retired Director of Software, Motorola. While visiting the College on December 1, he shared fond memories of Professor Beenhakker, chair of industrial and management engineering in 1973 and Narayanan's mentor.

1980's

Jerry Eimen (BSEE 1989) of Simpsonville, SC, and **Ken McLeary** (BSEE 1989) of Ankeny, IA, stopped by the college with their children December 30. Einman is an engineering manager with Sealed Air Corporation. McLeary is employed with Siemens Industry, Inc., and is responsible for business development.

Michael McGrath (BSE 1985) of Marshall, MO, signed the guest book in the Dean's Office on December 1. He is employed with the Missouri Department of Transportation as an area engineer.

Jim Seaba (BSME 1984, MS 1986, PhD 1990) is senior technology advisor with ConocoPhillips, Calgary, AB Canada.

Mary K. Stietz (BSE 1987) of South St. Paul, MN, was a guest at the College on October 17. She is senior QA specialist with Cardiovascular Systems, Inc.

1990's

Matt Finnegan (BSE 1996) has been named president of Kern River Gas Transmission Company in Salt Lake City, Utah. Matt most recently served as general manager of the Walter Scott, Jr. Energy Center in Council Bluffs, IA, for MidAmerican Energy Company. Kern River and MidAmerican are both subsidiaries of Berkshire Hathaway Energy Company.

Fitzgerald Steele (BSE 1997, MS 2000), director of marketing at Integrated DNA Technologies, has been named to the Iowa Children's Museum Board of Directors.

2000's

Anne Buchele (BSE 2009) is a planner with Walt Disney World.

Jordan Cannon (BSE 2008, MS 2009, MBA 2014) is a senior engineering manager at Rockwell Collins, Defense & Space, Cedar Rapids, IA.

Mark Moeller, P.E. (BSE 2004) is employed with Fox Engineering Associates, Ames, IA. He provides design services for a variety of water and wastewater treatment projects for the firm.

Ofer Sivan (BSE 2003) was named to the *Corridor Business Journal's* 2014 list of Forty Under 40.

Ori Sivan (BSE 2004), senior associate at Alvarez & Marsel, Miami, earned his MBA from University of Florida – Warrington College of Business in May 2014.

Jeff Skrentner (BSE 2005, MS 2006) was named Senior Quality Engineer at Smiths Medical, Oakdale, MN.

Jenna Soyer (BSE 2007, MS 2009) is municipal relations coordinator at East Central Intergovernmental Association. She will provide financial, community and economic development, and management and planning technical assistance to the elected officials and staff of member local governments in Cedar, Clinton, Delaware, Dubuque and Jackson counties.

2010's

Zacharu Alderman (BSE 2014) is a graduate teaching assistant, University of Arkansas.

Joshua Behrendt (BSE 2014) is a mechanical management trainee at BNSF Railway.

Alexandria Carli (BSE 2011) is a maintenance engineering supervisor at PepsiCo-Frito Lay in Charlotte, NC.

Charles Collins (BSE 2014) is a project engineer with CT Mechanical, Lombard, IL.

Luke Connolly (BSE 2014) is a designer at USA Fire Protection, Lake Forest, IL.

Anthony Crivolio (BSE 2014) is a design engineer at Cloud Packaging Equipment, Elk Grove Village, IL.

Kevin Dobbins (BSE 2014) is a mechanical operations management trainee with Union Pacific Railroad, DeSoto, MO.

Alyssa Dodd (BSE 2014) is an associate engineer with Polaris Industries.

Mohamed Elkhair (BSE 2011) is a systems engineer with Exelon Nuclear, Morris, IL.

Daniel Gillen (BSE 2014) is a DSQS environmental effects engineer with Rockwell Collins.

Barrett Gray (BSE 2014) is a robot technician at Matrix Design, LLC, South Elgin, IL.

Joseph Hammond (BSE 2014) is a technical services problem solver at Epic.

Mitchell Horras (BSE 2014) has been hired as a Staff Engineer at Manhard Consulting, a civil engineering firm headquartered in Vernon Hills, Illinois.

Joseph Irwin (BSE 2014) is an associate engineer with Gas Technology Institute.

Amanda Jones (BSE 2014) is in the operations leadership development program, Anderson Corporation, Minneapolis, MN.

Kelsey Kaufman (BSE 2013, MS 2014) is employed with Raytheon Integrated Systems.

Justin McAninch (BSE 2014)

is a product engineer with Pella Corporation.

Adam Miller (BSE 2014) is a mechanical design engineer with Winegard Company, Burlington, IA.

Alex Murphy (BSE 2014) is a mechanical designer with GPI/Greenman-Pedersen, Arlington, VA.

Graham Newman (BSE 2014) is a sales engineer with Emerson Process Management, Marshalltown, IA.

William O'Connell (BSE 2014) is a product development engineer with Navistar, Inc., Lisle, IL.

Kyle Owen (BSE 2014) is a project engineer at cGMP Consulting, Inc.

Robert Rutherford (BSE 2014) is a mechanical engineer with Cetek, Inc., Davenport, IA.

Tanya Ziyad (BSE 2014) is a design engineer with Viking Range, LLC.

Civil engineering alumni

Andrew McCoy, P.E. (BSE 1999, MS 2003, PhD 2006), **Morgan Mays, P.E.** (BSE 2010), **Ronald Knoche, P.E.** (BSE 1996), and **Aaron Granquist, P.E.** (BS 1996, BSE 2000, MBA 2010) participated in a panel discussion about careers in civil engineering on November 13, 2014.

Many chemical engineering alumni returned to campus for the 30th anniversary celebration of the establishment of Omega Chi Epsilon. Attending were **Rhett Livengood** (BSE 1985); **Karen Haman** (BSE 2009); **Alec Scanton** (BSE 1984); **Abby Neu** (BSE 2012); **Joy Hanshaw** (BSE 1984); **Elliott Glenn** (BSE 2014); **Jeanne Peacock Hergert** (BSE 1998); **Matt Taylor** (BSE 2014); **Todd Congdon** (BSE 1992); **Joel Jensen** (BSE 1985); **David amEnde**; **Trace Irwin Campbell** (BSE 2004, PHR 2008); **Andy Campbell** (BSE 2004, MBA 2008); and **Ian Smith** (BSE 2014).

Robert M. Arthur (PhD 1963) of Fond Du Lac, WI, October 12, 2014

Mark J. Bartelme (BSE 1988) of Melbourne, FL, August 24, 2014

Lawrence C. Bartlett (BSChE 1949, MS 1953) of Rochester, NY, August 31, 2014.

Wesley E. Benson (BSE 1951) of Saint Marys, OH, October 21, 2014.

Paul Bohnsack (BSEE 1951) of Bettendorf, IA, October 22, 2014.

Roger Byrne (BSCE 1958, MS 1961) of Austin, TX, July 30, 2014.

Ali Bulent Cambel (PhD 1950) of McLean, VA, October 7, 2014.

Robert M. Carter (BSME 1943) of Cedar Rapids, IA, September 6, 2014.

Charles E. Dare (BA 1961, BSME 1962, MS 1963, PhD 1968) of Rolla, MO, October 27, 2014.

Richard H. DeJong (BSEE 1959) of Jacksonville, FL, July 26, 2014.

Ronald W. Dunmire (BSME 1961) of Cedar Rapids, IA July 26, 2014.

Raymond S. Gauler (BSChE 1948, MS 1949) of Muscatine, IA, October 11, 2014.

Edward Glazer (BMSE 1941) of San Diego, CA, September 28, 2014.

Leo J. Haman (BSE 1984, MBA 1986) of Cedar Rapids, IA, July 29, 2014.

D. Duane Hansen (BSChE 1940) of Memphis, TN, July 2, 2014.

James W. Hodson (BSCE 1959) of Rockdale, TX, September 11, 2014.

Herbert D. Huff (BSME 1960) of Jefferson, IA, July 15, 2014.

Robert E. Kennedy (BSChE 1969) of Mc Queeney, TX, July 4, 2014.

Marvin F. Knox (BSEE 1961) of Brooklyn Park, MN, August 19, 2014.

Emil J. Koval (MS 1967, MBA 1978) of Cedar Rapids, Iowa, October 1, 2014.

Glen J. Kremer (BSE 1950) of Lansing, IL, November 9, 2014.

Royce W. Ladd (BSME 1932) of Seminole, FL, July 20, 2014.

Edward I. Levin (BSCE 1953) of Pasadena, CA, October 17, 2014.

D.T. Lundy (BSCE 1951) of La Grange Park, IL, July 1, 2014.

Charles J. Marshall (BSME 1947) of San Diego, CA, October 5, 2014.

John C. McKercher (BA 1958, BSEE 1958) of Saint Cloud, MN, August 19, 2014.

Milon J. Meyer (BSME 1965) of Richland, WA, July 28, 2014.

William H. Morrow (BSME 1949) of Carmichael, CA, October 13, 2014.

Maureen Olsen (BSChE 1964, MS 1970, of Iowa City, IA, November 7, 2014.

Norman D. Pagel (BSEE 1958) of Avila Beach, CA, September 30, 2014.

Robert J. Parden (BSME 1947, MS 1951, PhD 1953) of Saratoga, CA, July 20, 2014.

W. Lowell Quirk (BSEE 1944) of Minnetonka, MN, June 27, 2014.

Carl F. Reeder (BSChE 1950) of Cedar Rapids, IA, October 29, 2014.

W. K. Ken Rogers (BSME 1950) of Urbandale, IA, September 30, 2014.

William E. Sabin (BSEE 1973) of Cedar Rapids, IA, October 13, 2014.

Ronald T. Shinbori (BSChE 1963) of Bettendorf, IA, June 23, 2014.

Bruce L. Sturdevant (BSME 1948) of Englewood, CO, September 11, 2014.

Richard M. Truesdale (BSEE 1950) of Marion, IA, July 28, 2014.

Charles C. Wright (BSChE 1947) of Frederica, DE, October 7, 2014.

Commencement December 2014

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B.S.E. DEGREES



5

DOUBLE MAJORS

BSE Mechanical Engineering/BA computer Science (2)
BSE Electrical Engineering BS Physics
BSE Biomedical Engineering/BSE Mechanical Engineering
BSE Civil Engineering/BA Art

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M.S. DEGREES

IOWA ENGINEER

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COMPLETED MINORS

Business Administration (15)
Computer Science (1)
Environmental Sciences (1)
French (2)
Mathematics (29)
Music (1)
Philosophy (1)
Psychology (2)
Spanish (1)

46

RECEIVED CREDIT FOR
CO-OP OR INTERNSHIP
EXPERIENCE

1

CERTIFICATE IN
SUSTAINABILITY

9

PH.D. DEGREES