

The View from

Oregon

Lewis College of Science and Letters plays an integral role in the mission of the university.

We provide the basic foundations in communications, the sciences, critical thinking, and global citizenship necessary for success in today's society. At the same time, our faculty and students are engaged in cutting-edge research addressing pressing problems of the world, be it pest control in Michigan, the mysteries of the universe, or our ongoing pandemic.

The year 2021 marks the 20th anniversary of Professor of Chemistry Rong Wang's career at Illinois Tech, where she has developed an active lab with several health-related projects on the frontier of scientific advancement, including the development of technology for a smart toothbrush and the utilization of silk cocoons from silkworms to restore pelvic floor tissue in women. The Department of Physics has this year built upon its close working relationships to the area's quantum science laboratories through its hire of our newest faculty member, Assistant Professor Rakshya Khatiwada, who holds a joint appointment with the physics department and FermiLab and is developing Illinois Tech's first-ever quantum computing course for undergraduates. In the humanities, Associate Professor of History Mar Hicks has been recognized for their contributions to the national discussion of ethical considerations in artificial intelligence, landing on a list of "100 Brilliant Women in AI Ethics," and has just published their second book. And in social sciences, Associate Professor of Political Science Daniel Bliss is taking advantage of our fertile backyard—the city of Chicago—for his studies through his contribution to an upcoming book on the successes and failures of our city's mayors.

Our students and alumni have also been hard at work. Their research projects range from the mitigation of cutworms devouring corn and dry bean plants in

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A study led by Illinois Institute of Technology researcher and alumna Xuhuiqun “Sissi” Zhang (Ph.D. FDSN ’20) has found that young and middle-aged adults with prediabetes have an altered gut microbiome composition, which is associated with reduced concentrations of select bioactive microbial metabolites and impaired metabolic health, as well as potential risk for diseases.

Zhang, who works as a research scientist at Illinois Tech’s [Center for Nutrition Research](#), published a paper on her team’s findings in the journal *Nutrients* in 2020.

“We aimed to understand if adults with prediabetes have specific gut microbiota profiles that may affect the [ability] to metabolize bioactive (poly)phenols, [which are naturally occurring

organic compounds], and [whether their gut microbiota profiles correlate] with impaired metabolic biomarkers,” Zhang says.

The researchers used a process called whole genome shotgun metagenomic sequencing to characterize the gut microbiome composition of young and middle-aged adults with prediabetes and insulin resistance, as well as metabolically healthy study participants. They measured fasting glucose and insulin, fasting lipids profile, blood pressure, and body composition of 36 participants to assess their metabolic health status. Targeted quantitative metabolomic analysis of blood and urine samples collected over 24 hours were used to examine microbial (poly)phenolic metabolites in response to study

participants’ consumption of a (poly)phenol-rich red raspberry test drink.

The most significant feature of the altered gut microbiome composition present in adults with prediabetes was enriched *Ruminococcus gnavus*, a proinflammatory bacterial species associated with Crohn’s disease. The researchers also found evidence of depleted *Bifidobacterium bifidum*, a common probiotic species

that helps maintain gut homeostasis. Individuals with prediabetes have also been found to have impaired gut microbiome function.

“In the next step [of our research], we would like to explore if nutritional strategy would improve cardio-metabolic health through shaping the gut microbiome,” Zhang says. [https://doi.org/10.3389/fnut.2020.00111](#)

What if



“We make basic science useful in practical applications for improving the quality of life,” says Wang, who is celebrating 20 years of teaching and research at Illinois Institute of Technology this year. “I always tell my students that I partner with them to explore new areas and find solutions by invention. I love to see the sparkles in my students’ eyes. Seeing them defend their thesis with great confidence is fulfilling.”

Originally from China, Wang studied physics as an undergraduate at Jilin University in Changchun, China, and then studied chemistry as a doctoral student at the University of Tokyo. After completing her Ph.D., Wang conducted biology research as a post-doc at Los Alamos National Laboratory in New Mexico. Her diverse roots remain evident in the broad perspective she brings to the research projects taking place in

accurate, and real-time saliva-based self-monitoring for health care,” Wang says. “Such a device will assist in the modern clinical advancements, such as teledentistry and telemedicine, by which the number or duration of onsite clinical visits will be reduced with such quantitative data in hand. New commercial products can be developed based on the biosensor, such as smart toothbrushes and wearable oral devices similar to nightguards.”

Additional Illinois Tech faculty members involved in the project include Assistant Professor of Biomedical Engineering Abhinav Bhushan; Gladwin Development Chair Assistant Professor of Computer Science Yan Yan; Industry Associate Professor of Information Technology and Management Jeremy Hajek; and from the Department of Chemistry, professors Richard Guan, Ishaque Khan, and Yuanbing Mao, Research Professor John Green, and Associate Professor of Chemistry David Minh.

PELVIC FLOOR RESTORATION WITH SOME HELP FROM SILKWORMS

Additional research ongoing in Wang’s lab includes a project utilizing cocoons from silkworms to support the regeneration and restoration of pelvic floor tissue in women to help treat pelvic organ prolapse. Prolapse occurs when muscles and tissue in the female body weaken and can no longer hold pelvic organs including the uterus, bladder, and rectum in place. Wang says the silk material can help revive the function of fibroblasts—cells that help make up the structural framework of tissue—through an in vitro electrical stimulation process. A cell-embedded fiber matrix can be injected or applied as an internal bandage or implant, and can be repeatedly used to stimulate the cells’ renewal through a medicated electrical-stimulation process. The matrices degrade in approximately 20 days and should be replaced by native tissue.

“The use of autologous [patient’s own healthy] cells to treat, for example, connective tissue wounds or disorders, is relatively safe and simple,” Wang says,

“effectively avoiding complications in other approaches, such as immunological rejection of cells derived from other individuals; complicated control of isolation, expansion, and differentiation conditions of stem cells; or heterogeneity between cells of the same type but from different origin.”

The project began with the use of spider silk proteins, but the team later replaced them with silkworm silk proteins, which Wang says are “abundant and cheap” and have proven effective for use in cell stimulation. The cocoon research is funded by a \$440,000 grant from the National Institutes of Health; collaborators on the project include Anne

Sammarco at Rush University Medical Center and Margot Damaser at Cleveland Clinic Lerner Research Institute. The team is also developing edible, transparent silk films for potential use as corneal scaffolds, contact lens material, and scaffolds for gum healing.

Beyond smart toothbrushes and silk-inspired tissue rejuvenation, Wang and her student researchers are also collaborating on a project with the United States Food and Drug Administration aimed at understanding foodborne virus adhesion to different surfaces. FDA Staff Scientist Carol Shieh is the principal investigator; Wang is the co-PI. They received a \$50,000 grant from the FDA through October 2021. Wang and her lab have so far supported the project through research determining the design of a surface’s chemical composition and nanostructure, which she says helped informed options for ways to control viral adhesion and transmission to and from food contact surfaces.

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Since fall 2020, IIT Research Institute

As young girls growing up in Kathmandu, Nepal, [Rakshya Khatiwada](#) and her sister would climb atop the roof of their family home, gaze up into the night sky full of stars, and “formulate ideas about how the universe worked,” Khatiwada says. The two preferred this activity over watching television. They also both grew up to earn doctorates in physics.

Khatiwada is now the newest faculty hire in the Department of Physics, having joined Illinois Institute of Technology in August 2020 with a joint appointment as an assistant professor at Illinois Tech and an associate scientist at [Fermilab](#). She holds bachelor’s degrees in physics and mathematics from Lincoln University and a Ph.D. in physics from Purdue University. She completed a postdoc at the University of Washington in Seattle before joining Fermilab for her second postdoc.

Today, Khatiwada is engaged in quantum information science research, an area Illinois Tech is expanding into with her help. Quantum information science combines computing and sensing with quantum mechanics, a core physics theory regarding the physical properties of atoms and subatomic particles. Khatiwada is serving as a principal investigator on a \$4.5 million, five-year project under the Quantum Science Center led by Oak Ridge National Laboratory, one of five national quantum initiative centers funded by the Department of Energy to bring together national labs, industries, and academia to work on quantum science research. The project involves quantum sensors that are used for both

fundamental science and quantum computing. Fermilab is a partner in the Quantum Science Center.

“The project’s goal is to use state-of-the-art electronics developed at Fermilab to control and read out a large array of novel quantum sensors and devices, which have application in quantum computing and detector development for dark matter physics, among other areas,” Khatiwada says. “Right now, we are in the process of finalizing the specifications of a cryostat, a dilution refrigerator, which is the test-stand that will house the large array of quantum sensors and devices.”

ALUMNI SUCCESSES

MEAT INDUSTRY ROCK STAR

In a facility located in Chicago's historic stockyards district, Liang Bennett (BCHM '15, M.S. FST '16) is putting her Illinois Institute of Technology food safety training to good use, overseeing all regulatory compliance for Chicago Meat Authority (CMA), a meat-processing company working with hundreds of meat buyers and producers. With the title "technical assurance manager," Bennett supervises quality assurance and food safety and serves as a liaison to the federal government.

"I am the main point of contact for government agencies such as the United States Department of Agriculture's Food Safety and Inspection Service," Bennett says. "I also oversee our research and development team for any new product development."

Prior to joining CMA in 2018, Bennett worked with raw and ready-to-eat foods, bakery operations, coffee, confections, and the beverage industry. In 2019 she was recognized by the North American Meat Institute (NAMI) and the International Production & Processing Expo as one of 30 people under age 30 demonstrating exceptional leadership in the meat industry. She was also named one of 10 Leaders of Tomorrow by the Food Marketing Institute and NAMI during their Annual Meat Conference in 2020.

"I love what I do," Bennett says. "The meat industry is incredibly fast-paced, and there are so many learning opportunities here. I enjoy seeing a project through from start to finish and being able to walk across all of the processing steps, from examining raw material integrity, determining quality and food safety parameters, and scaling up pilot plant trials to full-blown plant runs, to finished product packaging and testing. Being able to hold the finished product and understand I had a part in its inception is pretty incredible."

Liang Bennett uses a caliper to measure the thickness per Chicago Meat Authority's quality inspection procedure.

BUILDING BRAND AWARENESS

As a communications specialist at GoodMorning.com, one of Canada's largest independent online mattress retailers and fastest-growing companies, Brook Bell (HUM '16) says every day is an adventure.

"As an independent company, we built everything from the ground up," he says. "We are constantly researching, testing, and vetting the latest trends and figuring out what our own best practices are."

Bell, who now lives in Edmonton, Alberta, Canada, handles offsite review management, onsite review moderation, moderation of social media profiles, and more in his current role.

"I am passionate about understanding our brand's audience—what they love,

who they follow, who they need to be influential to make meaningful content and messaging that they connect with," he says. "I will forever pursue the challenge to build brand awareness, trust, and a brand's reputation with consumers in the ever-changing media landscape, regardless of the medium (traditional, web, social media, etc.)."

Bell plans to continue on in communications and hopes to advance to a manager or director position in the future. Outside of work, he says he enjoys going for runs and spending time with his girlfriend and his dog, a shorkie named Jenny.

RADIATION SAFETY PRO

Since graduating with his master's degree in health physics, Sandor Demeter (M.S. HP '16) has applied his subject matter expertise to his work in multiple areas. An associate professor of

