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Experimenting for Success

The value of undergraduate research

By Beth Bohn
Point to any one of the many pictures that cover the large bulletin board in Anita Cortez’s office, and she’ll have a story to tell.

“He’s headed to medical school. She’s a dentist in Dallas, and her husband is a distinguished architect. He earned his master’s at the University of Wisconsin and is interviewing at several veterinary schools. She won a National Science Foundation Graduate Fellowship on her first try.” The stories go on and illustrate how participating in undergraduate research was the first step for these Kansas State University students to become professors, veterinarians, surgeons, lawyers, consultants, obstetricians and more.

“Undergraduate research provides so many valuable experiences to students and can be the pathway to their careers,” said Cortez, who is director of K-State’s Office of Undergraduate Research & Creative Inquiry. “Undergraduate research is a valued experience. It’s important for entry into graduate or professional school, but it is also valuable for all students.”
A university priority

Offering undergraduate research experiences is not unique to K-State, but it has long been a point of emphasis and pride at the university. Promoting and increasing undergraduate research opportunities is part of K-State 2025, which is the university’s strategic plan to be a Top 50 public research university by 2025 and the reason the Office of Undergraduate Research & Creative Inquiry was established.

“The Office of Undergraduate Research & Creative Inquiry is a vehicle for awareness about undergraduate research for both students and faculty,” Cortez said. “It’s the place faculty can turn to for help in involving undergraduates in their research, and it’s a starting place for undergraduates interested in getting involved in research.”

The office also awards student grants for research and research-related travel every semester, along with offering workshops, seminars and many other resources.

All K-State colleges offer undergraduate research opportunities, with some colleges now awarding grants and scholarships to help give more student opportunities to do research. Some programs, such as the Developing Scholars Program, Bridges to the Future, McNair Scholars Program and the NSF-funded Kansas Louis Stokes Alliance for Minority Participation, or KS-LSAMP, are specifically designed to interest underrepresented and first-generation students in research and graduate school. Other programs focus on the humanities, such as the Chapman Center for Rural Studies, which lets undergraduates research, write and publish Kansas history.

One of the largest providers of undergraduate research opportunities is the Johnson Cancer Research Center at K-State, which presents around 50 students each year with its Cancer Research Award. The awards are funded by private donations to the center. K-State also offers Research Experience for Undergraduate programs and a Summer University Research Opportunity Program to K-State students and students from other universities.

Filling a need

At least 7 percent of K-State’s nearly 23,000 students are estimated to take part in undergraduate research activities. It’s a number that university officials hope to grow as a way of enhancing the undergraduate educational experience and ensuring the university continues to attract and retain the best students and faculty.

“Undergraduate research sets us apart as an institution of higher education,” said Peter Dorhout, K-State vice president for research. “Our goal isn’t to train students for a job — it’s to educate them for a career.”

That’s why Kathlyn Gomendoza is involved in undergraduate research and chose to attend K-State. A senior in biology and pre-medicine, Gomendoza is using her undergraduate research experiences to build a resume for medical or graduate school.

Before her classes begin most mornings, the honors student is in the lab, setting up her experiments for the day. She’ll return to the lab to start her experiments when she has time between classes or when they end for the day. Along with a full class schedule, Gomendoza will put in about 15 hours a week in the lab of Lorena Passarelli, professor of biology. Gomendoza has been a member of the lab since her first year at K-State in 2014.

“Undergraduate research is extremely worthwhile in the long run,” Gomendoza said. “Not only do you receive a hands-on experience in an environment beyond a classroom or textbook, but you are able to see the real-life applications to the concepts that you have learned.”

In Passarelli’s lab, Gomendoza studies baculoviruses, which are virulent to insects but not to humans. They are used to produce vaccines against human papillomavirus and influenza virus and are being studied as a potential vector for therapeutic agents. Her research has earned an undergraduate research fellowship from the American Society for Microbiology and honorable mention for the prestigious Goldwater scholarship, for which research is a key requirement. Gomendoza also was selected to present her research to state lawmakers in Topeka at Undergraduate Research Day at the Capitol.

Lisa Wilken, an assistant professor of biological and agricultural engineering, is a strong advocate for undergraduate research at K-State and has been recognized with the Distinguished Faculty Award for Mentoring of Undergraduate Students in Research for her efforts. Wilken said undergraduate research provides students with opportunities and skills that enhance their education.
“I believe any student interested in research can benefit from it,” Wilken said. “I find those who are most successful are inquisitive, highly motivated, detail-oriented and hardworking. Students who are also receptive to participating in professional development opportunities and continuing their education often have the most impactful experiences.”

Dorhout said participating in undergraduate research teaches students an important life lesson: learning how to deal with failure.

“To quote one of my favorite ‘Star Wars’ characters, Yoda, ‘Failure is really the best teacher,’” Dorhout said. “By that, I mean, when you test your hypothesis, when you pose a question and you try to answer it, you’re testing whether you were right to begin with. More often than not, you were wrong, but you discover or learn something along the way. That’s a valuable experience. ‘To the stars through difficulties,’ our state motto, reminds us just how resilient we Kansans are.”

Failure is really the best teacher.

Why faculty get involved

Their own experiences as undergraduate researchers are why many K-State faculty members have made research opportunities available to students. They also say undergraduate researchers are valuable additions to their research groups.

Wilken earned her bachelor’s degree at K-State and was an active undergraduate researcher while doing so. Now as a faculty member, she has advised 17 undergraduate student researchers since 2013. Her students have authored or co-authored five conference papers and two journal publications, and they have earned 25 oral or poster achievements and 17 research awards.

“All of my undergraduate researchers are expected to present their work at university competitions, professional meetings or other venues,” Wilken said. “I want to provide undergraduate students opportunities well beyond maintaining the lab. Once students are trained, I assign each of them their own project. This creates a feeling of ownership, fosters accountability and leads to intellectual independence.”

Stefan Bossmann, professor of chemistry, said the university’s undergraduate research program was one of the factors in his decision to join the K-State faculty in 2004.

“Being able to draw upon the pool of bright, young minds we have at K-State is important,” Bossmann said. “It allows researchers to have a larger lab for less cost compared to hiring a technician, etc. Having undergraduate researchers is a must. If you have 10 gifted undergraduates, you really can work more in depth than you can with graduate students alone.”

Bossmann typically has 10 to 12 undergraduates in his research group each semester. He calls the students integral members of his lab, which focuses on the targeted delivery of drugs to tumors.

“It’s important to see that the undergraduates in my research group do real research,” Bossmann said. “Many of them excel, while some think they may want to do something else. It is important that they find out what they want to do; it’s not about me forcing them to do things. It should really guide them to the best professional life for them.”

A path to success

Obduilia Covarrubias is one of the doctoral students in Bossmann’s lab. Covarrubias also is an NSF Graduate Fellowship recipient, thanks to undergraduate research. A first-generation student, she transferred to K-State from Seward County Community College, where she got involved with Bridges to the Future, a K-State program that seeks to interest community college transfer students in the STEM fields and research, as well as the Developing Scholars Program. As an undergraduate researcher, Covarrubias also earned the NSF Undergraduate Research Mentoring Fellowship.

Her research projects as an undergraduate were in biochemistry, biology and plant pathology, which she said helped her find her passion to do research on cancer and human viruses. It’s why she decided to join Bossmann’s lab and seek a doctorate in chemistry.

“My current doctoral research is not part of my undergraduate research directly, but all the experiences and basic skills I learned as an undergraduate researcher — lab techniques, developing a research idea, troubleshooting and communicating research findings, written or spoken — have been very helpful in graduate school and made the transition much easier,” Covarrubias said.

Covarrubias works on drug delivery systems to combat pathogen diseases. After earning her doctorate, she would like to continue this research by working at a government agency such as the Centers for Disease Control, Department of Defense or possibly the NSF or National Institutes of Health.

Caleb Wurth, who earned a bachelor’s degree in feed science and management from K-State in 2013, said his four years of undergraduate research through the Developing Scholars Program helped set him apart in the job market. Today, after working for a major global food processing and commodity trading company, he is the assistant director of Southeast Asia for the U.S. Grains Council, which develops markets for U.S. grains, co-products and ethanol.

“As the corporate world is becoming more and more competitive, my research experience gave employers concrete validation of my abilities to think critically, identify real-life issues and execute a program,” Wurth said. “Through each of my undergraduate research projects, I was able to partner with industry leaders in the field. The connections made and the relationships you forge with industry set you apart from those who merely read about it in a textbook.”

Obduilia Covarrubias, doctoral student in chemistry, and Stefan Bossmann, professor of chemistry, consult about research in Bossmann’s lab.