MINERBITS

Computer Science | Missouri S&T | Winter 2020

FREEDOM AND PERSONAL CONNECTIONS COME WITH SCHOLARSHIPS

HELP US MODERNIZE THE COMPUTER SCIENCE BUILDING

The classroom is the place where students chart their futures. From the first day of class to the last, classrooms and laboratories are the start — and heart — of the learning journey.

S&T is building a new Classroom Learning Center connected to the Computer Science Building. The 15,900-square-foot addition will include four 100-seat classrooms and a 300-seat lecture hall. You can watch the progress at **facebook.com/mstcsdept**.

The buildings will meet in a lobby that we hope can become a commons area to give students and their professors a place to meet and interact in an informal setting.

We also hope to renovate a portion of our building to create a cybersecurity lab to further our research into the security and privacy of critical cyber-physical infrastructure systems.

OUR DEPARTMENT'S ANNUAL PHONATHON IS UNDERWAY

We hope you'll take time to talk with the student who calls. We also hope you'll help us raise the roof on expanding opportunities for our students by making a gift in support of our building renovations.

For information on naming opportunities, contact **Rebecca Johnson** at **johnsonnr@mst.edu** or **573-341-6161**.

give.mst.edu

DEAR ALUMNI, COLLEAGUES AND FRIENDS

Greetings from Rolla!

The exciting times continue for the computer science department. Just this morning I watched the steel being delivered for the new classroom addition. Along with the addition, we are upgrading the appearance of our building. We've started renovating the research labs and — thanks to your contributions over the past year — we have moved closer to our goal of having a student collaboration space within the building.

Our student population continues to grow, and the freshman class was up again this year. The demand for our graduates is tremendous. Before the fall career fair, career opportunities and employer relations hosted a Miner Mingle. Companies that are not generally known for hiring CS grads came and "held court" to encourage our graduates to come visit their tables.

Our thrusts in cybersecurity, data science and cyber-physical systems are internationally known. We recently were reaccredited as an NSA/DHS center of academic excellence in cybersecurity research, and our neighbors to the north (MU) received their initial designation (read more on page 2). We are looking at launching a data science degree that will bring together computing, statistics, and disciplinary expertise.

As faculty, we find ourselves being more like academic parents for our students to improve the student experience. In our curriculum, to improve student retention from first to second year, **Patrick Taylor** rolled out Problem Solving with Computers as the first class in the degree program. The course, which uses immediate feedback techniques to improve learning, better prepares students for an increased-intensity C++ class and a more advanced data structures class. More about the class is on page 3.

We've been able to reduce class sizes due to hiring three new faculty last year — meet them on page 7 — and the hiring continues this year.

We'd like to hear from you. Feel free to visit, call, send an email, or follow the department — and me — on Facebook and Twitter.

Warm Regards,

Bruce McMillin
Interim Chair and Professor of Computer Science

IN THIS ISSUE

CYBERSECURITY ACCREDITATION

To ensure cyber-physical security, the U.S. has to constantly develop new protection methods — and it also needs a workforce that is trained to address cybersecurity threats.

In March 2019, S&T was once again accredited as a National Center of Academic Excellence in Information Assurance and Cyber Defense Research (CAE-R) — the first Missouri university to earn the accreditation, which is jointly offered by the U.S. National Security Agency (NSA) and the Department of Homeland Security (DHS).

S&T was first accredited in 2008, then reaccredited in 2015. The current designation holds until 2024.

The NSA/DHS program is designed to increase understanding of information assurance and cyber defense technology, policy and practices to prevent and respond to a catastrophic cyber event. Promoting research and education in cybersecurity will reduce the vulnerabilities in national information infrastructure.

"Missouri S&T offers a unique contribution to the information assurance field with our focus on ensuring the combined cyber and physical security of the nation's electric power grid, oil, gas and water distribution systems, and transportation systems," says **Bruce McMillin**, interim chair and professor of computer science at Missouri S&T. "Our research focuses on the security and privacy of cyber-physical systems, cloud computing, mobile computing and the internet of things."

The Missouri S&T CAE-R program emphasizes graduate education and research in three areas:

- **Cybersecurity**. S&T's expertise includes protective cyber-physical and mobile systems, enterprise-level information technology security, cloud and edge security, and sensor security.

- **Data science**. Missouri S&T researchers are exploring data mining, deep learning and artificial intelligence as they relate to urban infrastructure, image analysis, computer vision, machine learning, real-time scheduling and heuristic problem solving.

- **Cyber-physical security**. Research in this area relates to physical systems that rely on computer networks, such as power grids and autonomous vehicles. S&T researchers' expertise includes smart grid technology, sensing and real-time systems.

REPROGRAMMING CS 1500

Some students' first experience with computer programming is CS 1500, Computational Problem Solving. The class teaches the art of computational thinking rather than just the details of a specific programming language.

But now that computer science is becoming a must for all engineering and science disciplines, the faculty created a new course to meet the growing needs of S&T students.
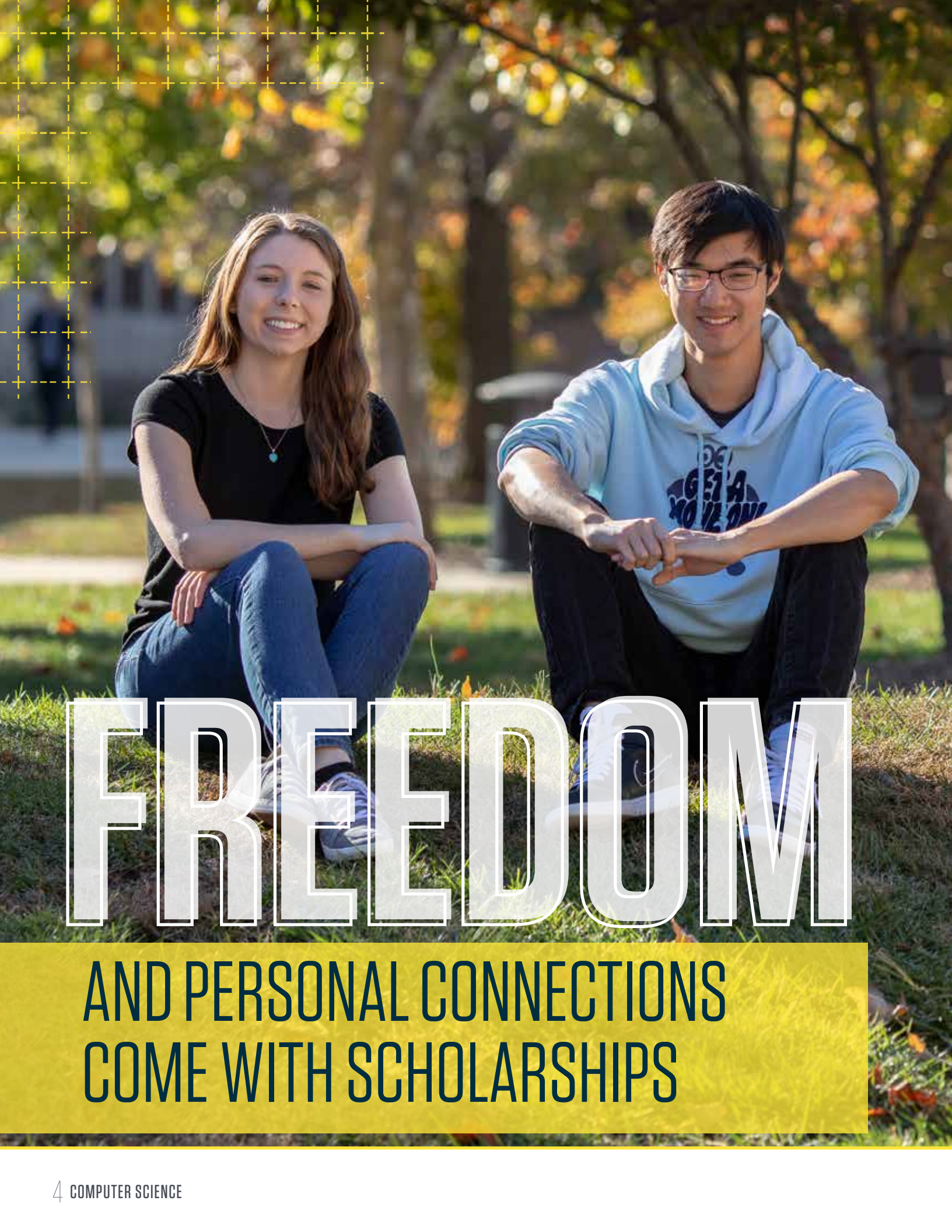
"The faculty designed this brand-new curriculum to better prepare students for upper-level computer science courses," explains **Patrick Taylor**, an assistant teaching professor in computer science. "It now includes many interactive exercises with activities inspired by educational research. We also have regularly scheduled programming practice labs, done in a way no one on campus has done before."

Taylor says the redesign was necessary to enhance the emphasis on the basics of programming and the application of learning to real-world problems, keeping students ahead of national trends in computing and technology.

"Over the past years, we assessed the performance of first-, second- and third-level courses to determine what could be improved," says Taylor. "The data suggested that students were making it further along in the curriculum, while not having a strong enough foundation in the art and process of programming and computational thinking."

To improve the curriculum, the department called on the faculty, an undergraduate curriculum committee and others — anyone who truly cared about student outcomes, says Taylor.

"In the past, we taught one programming language before more advanced classes," Taylor explains. "Many universities cover two different programming languages before more advanced classes; so, we decided to follow suit and take it a step further, ensuring a strong foundation for students and improving retention."

ALUMNI NOTES

• **Patricia Morreale**, MS CSci'86, executive director of Kean University School of Computer Science, was elected a fellow of the American Association for the Advancement of Science.

• **Montie Gauss,** CSci'73, MS CSci'74: "I married Caryn Brinkmeyer, an education graduate of Missouri State University, in 1973 and began working for Alcoa, Davenport Works in Riverdale, Iowa, in 1975. I retired after 30 years of working in computer analysis, industrial engineering and production management in 2005. Caryn and I have two sons and a daughter, who have blessed us with nine grandchildren. Caryn retired in 2006 from teaching preschool. Since retirement, we have focused on traveling and enjoying our family. Since graduation, we have enjoyed being involved in an informal alumni group of Rolla graduates who lived in House C of the MRHA, that meets annually or more frequently. We still live in the Quad Cities area of Iowa. Contact us at **gaussmc@aol.com** to catch up."

• **Gerry Howser**, Phys'74, MS CSci'12, PhD CSci'14, a professor of computer science at Kalamazoo College, published a textbook titled *Computer Networks and the Internet: a Hands-on Approach.*

• **Daniel Reed**, CSci'78, a computational science scholar at the University of Iowa and a former Microsoft executive, was named senior vice president of academic affairs at the University of Utah.

FREEDOM

AND PERSONAL CONNECTIONS COME WITH SCHOLARSHIPS

"It's a relief to know I won't have debt when I graduate."

Scholarships provide financial help for students (not to mention mom and dad), and they can make attending the college of one's dreams a reality.

But scholarships mean more than financial assistance. They allow freedom to make choices and can establish a meaningful personal connection between a university and a student.

Henry Wong, a senior in computer science, started college with some out-of-state scholarships to help with non-resident tuition. After he came to Rolla, he learned that more assistance is available by serving the school in a variety of roles.

Wong mentors incoming students to help them navigate the opportunities available to them. He is active in ACM, chairs SIG-Data (the ACM special interest group in data science) and managed S&T's first hackathon. His involvement has resulted in additional scholarships, something he appreciates as he looks toward graduation.

"It's a relief to know I won't have debt when I graduate," he said. "I'll have the freedom to choose what I do with the money I earn."

Sometimes, scholarships can put a student on a different road.

Catherine Sauer, a junior, wasn't headed to Missouri S&T when she graduated from high school. She had scholarships for the University of Missouri-Kansas City. Through her high school robotics club, though, she heard about former students who had attended S&T and went on to work for big companies. The school's reputation turned her head.

"Scholarships are important, and the money should be used for the best degree possible," she said. "I feel a sense of responsibility to do well, because I want to make the most of the opportunities that have been given to me."

The scholarship money is a big help to Sauer, who is paying her own way through school. She found some of the scholarships through S&T's scholarship matching program, but she also searched for others on her own.

"Looking for scholarships, especially those that can be hard to find, shows initiative," she says. "Showing that I went to the trouble of searching them out may have helped me land some funding."

Bruce McMillin, interim chair and professor of computer science, assumed administration of scholarships in the 2019–20 academic year. He believes offering a small scholarship can be the personal touch that may encourage undecided students to enroll at Missouri S&T when they might have gone elsewhere.

"The scholarships are a reflection of S&T's personal interest in each student," he says.

NATIONAL FELLOWSHIP PROGRAM OPENS NEW RESEARCH PROJECTS

Graduate Assistance in Areas of National Need (GAANN) is funding five fellowships within Missouri S&T's computer science and electrical and computer engineering departments to prepare five Ph.D. students for careers in big data, machine learning, and security and privacy. The program provides a stipend of up to $34,000 a year for students with demonstrated financial need.

To date, three students have been accepted into the program, with a fourth starting in early 2020. GAANN Fellows work with the guidance of faculty members to do research based on the individual student and the student's research advisor. Their research projects cover a wide range of applications.

"One student is doing research using sensors to measure pollutants along a trajectory," says **Sanjay Madria**, Curators' Distinguished Professor. Madria leads the program at Missouri S&T. "The work could ultimately have multiple uses.

"Say you're going for an afternoon run. You could check the sensors along your route before you leave to see if pollen or CO2 levels are too high for comfort. The sensors could also be used in battlefield applications or during disasters," Madria says.

Other GAANN students are studying blockchain and cybersecurity. Another is researching radio frequency machine learning.

"The main objective of the GAANN program is to prepare the students to continue their research at national research labs or as Missouri S&T faculty," Madria says.

Previous Missouri S&T students who were involved in the GAANN program participated in internships with the Air Force Research Laboratory and Oak Ridge National Laboratory, among others. They have gone on to work in major tech companies such as Google, Sandia National Laboratories and Boeing. One started her own business. Another, **San Yeung**, CSci'14, Ph.D. CSci'19, has joined the Missouri S&T faculty as an assistant teaching professor in computer science.

HACKERS 'R' US

Imagine a hacker. What comes to mind for many of us is a criminal using computers to break into companies or government agencies to steal sensitive information or plant malware. But the hackers who head to S&T's PickHacks competition come to brainstorm new ideas to solve real-world challenges, not to infest your computer network.

At a hackathon, a large number of people come together to participate in collaborative project building, usually over several days. In March 2019, hundreds of college and high school students descended upon Missouri S&T's Havener Center for what one organizer calls a 36-hour "invention marathon."

Christopher Gu (above, right) and **Luis Ocampo**, CSci'19, organized last year's event, which included corporate sponsors and attracted students from five countries and 50 universities.

"A hackathon is not just for computer science or other technical majors," says Ocampo, a junior in information science and technology. "When you are making any product, you need people with programming skills, but you also need artists, entrepreneurs, marketers and anyone else who can contribute to the build."

Gu, a junior in computer science, likens a hackathon to an "invention marathon" in which participants create a product or service through a series of brainstorming sessions. Each team's goal is to identify a problem and work together to solve it.

The students say they want to use the event to bring big-name companies to campus and prepare students for future careers. Gu says he wants S&T to become even more of a destination for organizations to find talented workers and to raise awareness of S&T as a top science and technology school.

Gu and Ocampo credit their enthusiasm for the hacking community for helping them advance professionally while still in school. Gu interned with Microsoft last summer as a program manager intern, and Ocampo joined Accenture as a consulting analyst.

"One of the reasons companies are so drawn to hackathons in the first place is you have these students who are willing to take an entire weekend to build projects," says Ocampo. "They have the motivation and the incentive to innovate new things that they could do for a company as well."

To learn more about PickHacks, or to apply to attend, pickhacks.io/.

1   2   3

MEET OUR NEW FACULTY

This past fall, three new faculty joined the computer science department.

1. **Nan Cen**, an assistant professor of computer science, comes to Missouri S&T from Northeastern University. Cen was a graduate research assistant and earned a Ph.D. at Northeastern University in electrical and computer engineering. Cen's research interests include visible light networking, the internet of things and 5G networks.

2. **Tony Luo**, an associate professor of computer science, comes to Missouri S&T from the Institute for Infocomm Research's Agency for Science, Technology and Research in Singapore. Luo earned a Ph.D. in electrical and computer engineering from the National University of Singapore. His research interests include the internet of things, security and privacy, and mobile edge computing.

3. **San Yeung**, CSci'14, PhD CSci'19, joined the faculty as an assistant teaching professor. During school, Yeung served as a graduate student instructor, teaching Introduction to Programming C++. His research interests include smart education, personalized learning, computing for social issues and applications, green computing, smart computing with artificial intelligence, and data science.

GRADUATION DOESN'T MEAN GOODBYE

It's easy to stay in touch with your department. We'd love to hear about new appointments, degrees earned, job promotions and other family or professional news.

Get in touch with your department by emailing csdept@mst.edu. Tell us what you're doing with your degree in computer science so we can feature your accomplishments among our alumni achievement stories.

Follow us on Facebook
/SandTComputerScience

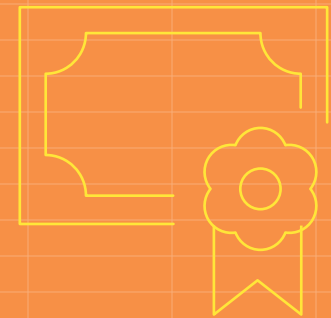Connect with us on Twitter
@SandTCompSci

MEET OUR NEW STAFF

Next time you visit the computer science offices, a new face will greet you.

Brianna Kalbfleisch joined the staff as an office support assistant IV. She comes to S&T from Kansas City, Mo.

Welcome Brianna!

CONGRATULATIONS, ELAINA!

Last spring, Missouri S&T's Staff Council honored **Elaina Manson**, office support assistant, with a Staff Excellence Award during Staff Recognition Day. She was presented with a certificate and a plaque during a campuswide awards ceremony. Congratulations!

New space for S&T students
TO LEARN AND COLLABORATE

This fall, students at Missouri S&T can take class in a 300-seat lecture hall in the new Classroom Learning Center. The facility, along with a major area of the center's main lobby, are funded through a $550,000 gift from **Robert M. Williams Jr.**, ME'74, president and CEO of St. Louis-based Williams Patent Crusher and Pulverizer Co.

The lobby, which will be housed in the original Computer Science Building, is envisioned as a "student commons" area where learners and their faculty counterparts can interact more informally between classes or over coffee or lunch — akin to the current set-up in nearby McNutt Hall. The department also hopes to construct a cybersecurity lab. Funding opportunities remain for both projects.

The two-story Classroom Learning Center will add 15,900 square feet of space, including four 100-seat classrooms and three student learning commons in addition to the lecture hall. The addition will alleviate strain on current classroom space. At this time, Missouri S&T has only one classroom large enough to accommodate between 76 and 100 students.

"Missouri S&T's enrollment has increased over the past 20 years, and with this growth has come a significant need for a large auditorium," says **Richard W. Wlezien**, vice provost and dean of the College of Engineering and Computing. "We are grateful to Robert Williams and his family for providing Miners with a place where great minds can come together to grow, thrive and excel."

The lecture hall and main lobby space will be named in recognition of Williams and his wife, **Kathy**; son **Robert M. Williams III**, who works for the family business in information technology; and daughter **Ashley Williams**, ChE'09, who is a project and design engineer for the company.

At press time, the addition's foundation and elevator shaft walls are complete, as is the plumbing and most of the structural steel. Utilities installation is underway. Soon, the exterior walls will be framed and covered. Construction is expected to be substantially complete in July, in time for fall classes.

DIVING DEEPER INTO EDUCATION

When college swimmer **Matt Wagner** transferred to S&T to pursue a Ph.D. in computer science, he only had one year of NCAA eligibility left to be on the swim team. He thought his collegiate swimming career was over. Fortunately, S&T head swimming coach **Doug Grooms** encouraged Wagner to compete for one more year while pursuing his Ph.D.

He is now an assistant coach for the men's swim team at S&T.

"As a coach, you really get to see the bigger picture and understand how a training regimen is created," Wagner says. "I've gotten to learn a lot more about the technique of different strokes and the real minutiae behind being a great swimmer."

> "I ended up choosing Missouri S&T over other schools because I felt like they cared and actually wanted me to come here."

He says that the most rewarding part about coaching the swim team is helping others reach their goals. He knows he is helping Miner swimmers become the best athletes and people they can.

Wagner also stays busy as a Chancellor's Distinguished Fellow in computer science. He taught a course in fall 2019 and is involved in research with his advisor. Wagner's research focuses on blockchains, cyber-physical systems and security and integrity.

"I ended up choosing Missouri S&T over other schools because I felt like they cared and actually wanted me to come here," Wagner says. "I believe Missouri S&T is a great place where you can be who you want to be and become the person you want to be."

JUMPSTARTING COMPUTING CAREERS

In an effort to better assist students with the transition from learning to working after graduation, CS faculty have proposed a new senior capstone-style course to get students involved with actual industry projects while learning what it takes to contribute to a workplace team.

"A restructure of senior students' courses can align all course content, provide a richer student experience and better satisfy the desires of industry partners," says **Michael Gosnell**, MS CSci'14, assistant teaching professor in computer science. "It should help transition students more naturally from learning about software

design practices to working to develop software products across the lifecycle."

Historically, the department has required two to three courses for all senior students that focus on additional education. With the format, Gosnell hopes to combine two software engineering courses and structure them into a newly approved year-long Software Engineering Capstone sequence.

"Bringing in external companies can provide a host of unique perspectives," says

Gosnell. "These real-world problems with an actual customer add accountability and challenges with customer interactions, which are hard to replicate when students choose projects themselves. There is often a financial component to external projects as well, which can be used to help with project costs and buying external services or capabilities students might be expected to work with when scaling to industry."

Interested in sponsoring a project? Email **cs-dept@mst.edu** for more information.

MISSOURI S&T

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150 YEARS

LET'S CELEBRATE MISSOURI S&T'S STORY

From our founding in 1870 as a pioneering technical school to our 21st century standing as a national technological university, Missouri S&T's story spans a century and a half of remarkable change.

GET SET TO CELEBRATE 150 YEARS OF MINER PRIDE!

A year of special events kicks off with MinerFest 150 in October 2020 and concludes with the Alumni of Influence celebration in November 2021. In between, mark your calendar in green for our biggest best-ever festival — or "Bestival" — over St. Pat's Weekend in March 2021.

Watch for the publication launch in October 2020 of a commemorative book by Curators' Distinguished Teaching Professor emeritus Larry Gragg. His history of the university spans 150 years of Miner milestones, memories and mischief.

Visit **150.mst.edu** for more information.