



DISCOVERY BEGINS HERE

Elements 2017

BUILDING THE
FUTURE OF SCIENCE



COLLEGE OF
NATURAL SCIENCES
COLORADO STATE UNIVERSITY



Photo by Bill Cotton

ON THE COVER: Building the Future of Science

This year, we opened our new Biology Building and Chemistry Research Building. Generations of students and research will be transformed and supported by these buildings – thanks to their thoughtful design and insightful attributes. They will help ensure that discovery begins here (*read more on page 8*).

Welcome to Elements

Welcome to the latest issue of *Elements*, the annual magazine from the College of Natural Sciences at Colorado State University. This magazine brings you news and discoveries from our college. Read on to learn more about the exciting stories generated by our alumni, faculty, undergraduates, graduate students, researchers, and friends. And thank you for being part of our story.

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YOUR SOURCE FOR COLLEGE NEWS

To stay up to date on the latest College of Natural Sciences news, visit: natsci.source.colostate.edu.

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in Chemistry

We welcome your support! To help create new stories of discovery visit www.natsci.colostate.edu/giving or contact Simone Clasen at simone.clasen@colostate.edu or (970) 491-0997. Thank you!



FROM THE DEAN

From the Dean



As I look back at this year, I marvel at how far we have come. Just two years ago, we were breaking ground on our two new buildings, the Biology Building and the Chemistry Research Building. This August, the extraordinary facilities opened on-time and on-budget for the start of the semester, welcoming

thousands of students and dozens of researchers to new labs, classrooms, and collaboration spaces (*read more on page 8*). Every time I set foot inside the buildings, I can feel the excitement of discovery.

What makes these buildings even more incredible is how they came to be. The Biology Building was funded primarily through student fees, a decision made by the student-run University Facilities Fee Advisory Board. This speaks deeply to the impor-

tance our students place on cutting-edge learning and research – and the pressing need that the department has had for a new space. The Chemistry Research Building is here thanks almost entirely to the state of Colorado, which saw the incredible value our discoveries and innovations bring to the region.

In addition to physical projects, we have also wrapped up a major institutional undertaking, completing our new strategic plan for the college. This document emphasizes our commitment to an inclusive community, student success, research excellence, faculty excellence, and global impact (*read more at: <http://col.st/PfOMJ>*). It will take us through the year 2021, helping ensure that “discovery begins here.”

I have greatly enjoyed sharing these recent milestones with many of you in person, and I hope to have the opportunity to meet with many others in the coming months. Our alumni continue to inspire me with their accomplishments and dedication. I hope you will enjoy reading about two of our incredible alumni and their work in this issue (*pages 6 and 7*).





VISION 2021: DISCOVERY BEGINS HERE

The College of Natural Sciences will be a nationally recognized leader in scholarship, education, and discovery in the sciences. Through cutting-edge foundational and vital interdisciplinary research, the college will educate and inspire the next generation of scholars, researchers, and professional leaders to thrive and contribute to an ever-changing global society. – *College of Natural Sciences 2021 Strategic Plan*



Like other significant achievements, ours would not have been possible alone. It is only through partnerships and support from you, our alumni, family, and friends, that we have achieved these goals – and will soar to meet new ones.

Jan Neger

JAN NERGER, Ph.D.
Dean of the College

Faculty Updates – 2017

NEW HIRES

CHEMISTRY

Jeffrey Bandar
Garret Miyake
Robert Paton
Joseph Zadrozny

COMPUTER SCIENCE

Vinayak Prabhu

PHYSICS

Hua Chen
Mike Mooney

TENURES AND PROMOTIONS

BIOCHEMISTRY AND MOLECULAR BIOLOGY

Eric Ross

BIOLOGY

Dhruba Naug
Graham Peers

CHEMISTRY

Delphine Farmer
Amber Krummel
Amy Prieto
Matthew Shores

COMPUTER SCIENCE

Asa Ben-Hur
Sangmi Pallickara

MATHEMATICS

James Wilson

PSYCHOLOGY

Bryan Dik
Gwen Fisher
Mike Steger

NEW EMERITI

BIOCHEMISTRY AND MOLECULAR BIOLOGY

Barbara Bernstein
A-Young Woody

PHYSICS

Siu Au Lee
Stephen Lundeen

IN MEMORIAM

CHEMISTRY

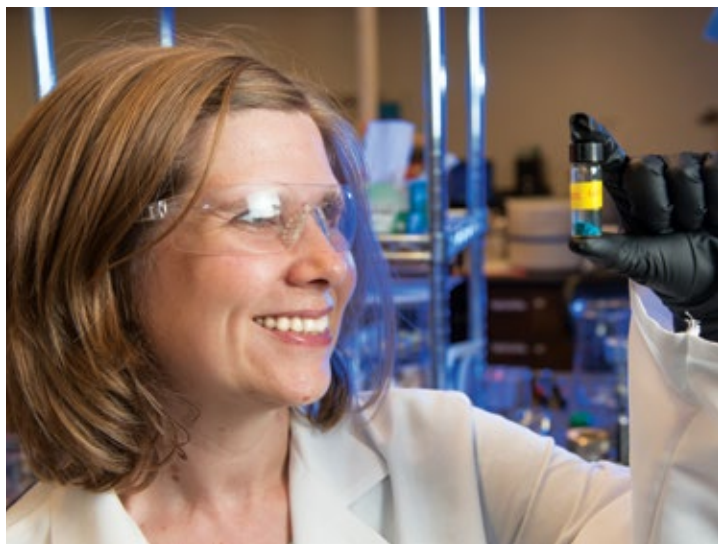
Rodney Skogerboe
Clarence Warren

COMPUTER SCIENCE

Adele Howe

PHYSICS

Philip Kearney



NEW ASSOCIATE DEAN FOR RESEARCH

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The college is pleased to announce the appointment of Associate Professor Melissa Reynolds as the new associate dean for research. In the Department of Chemistry, Reynolds works on the development and study of advanced biocompatible materials, and her research has received awards from the National Institutes of Health, Department of Defense, National Science Foundation, as well as the university and college. Former Associate Dean for Research Professor Jim Sites returned to the physics department full time this summer.

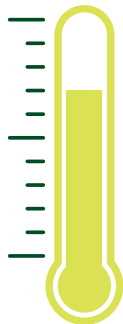


DISTINGUISHED ALUMNUS 2017

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The college recognizes Jack Cochran, MD (biological science, '68) as its 2017 Distinguished Alumnus. Cochran followed his CSU degree with medical school and a career in private practice before joining Kaiser Permanente. First in Colorado, and then nationally, Cochran helped initiate the digital health records and patient-centric care that Kaiser has become known for. He retired in 2015 as executive director of the Permanente Federation, which oversees the care for 10 million people nationwide.

\$60M



The College of Natural Sciences has a goal of raising \$60 million by 2020 for the University's \$1 billion State Your Purpose campaign.

.....

CURRENT STATUS \$42 MILLION – AND COUNTING.



College Professor Laureates 2017

DAN COOLEY & MELISSA REYNOLDS

THE COLLEGE OF NATURAL SCIENCES selected Associate Professor of Statistics Dan Cooley and Associate Professor of Chemistry Melissa Reynolds as the 2017 Professor Laureates. Cooley studies extreme value modeling, which assists in complex assessments of weather and climate,

subjects he will speak about in his laureate lecture this winter (*read more on page 23*). Reynolds works on the application of chemistry to improve medical devices and drug delivery, which she described in her spring laureate lecture.

ALUMNUS SPOTLIGHT **BOB RADEMACHER**

CSU Alumnus Uses Math and Computer Science to Lead Technological Innovations in Finance

BOB RADEMACHER (physical science, '85) has made a career of staying ahead of the technological curve in the financial sector – an industry heavily reliant on mountains of nuanced, fast-moving data. He is now chief technology officer for CSS, LLC, a privately owned investment firm in Chicago, and has developed technology at Swiss Bank Corporation and UBS, among others.

But when he arrived on campus in 1980 from his hometown of Northfield, Ill., his plan was not to go into finance, but to become a forest ranger.

One semester, however, he signed up for a physics class. He soon dropped it, though, “because I really didn’t get it,” he explains. But the next semester, he reenrolled in the class, which was taught this time by Professor William Derbyshire. “I took it again, and my world changed,” he says. “It was due to him, being able to communicate it to me.” Other courses in the College of Natural Sciences led him to a physical science major, which focused on chemistry, mathematics, and physics. “I enjoyed everything CSU had to offer,” he says. During his undergraduate career, he collected enough courses in computer science, economics, and geology to also graduate with minors in each of those three subjects.

With his strong foundation in mathematics from his major and his experience in computer science and economics from his minors, he was hired as an intern at the Chicago trading firm O’Connor & Associates. The group was known as one of the pioneers of options theory (options allow investors to purchase the opportunity to buy a commodity or asset for a particular price in a certain time frame – unlike futures, which obligate the buyer to make the purchase – and were, at the time, difficult for most groups to price correctly). The firm had been founded

by mathematicians and used its intellectual and technological capital to stay at the forefront of innovation in the field. “It was the very beginnings of applying mathematical algorithms to portfolio management theory,” Rademacher says. “So, I kind of got in at the ground floor of the application of computer science to trading.”

As he worked his way up through the ranks of programmer, project leader, and systems manager, the company grew. Eventually, the firm merged with the Swiss Bank Corporation and then with UBS, where Rademacher was an executive director. In 2001, he left UBS and joined CSS, LLC, a small group composed of colleagues with whom he had worked at O’Connor & Associates, Swiss Bank, and UBS. “I’ve been working with some of the same top-notch people for over 30 years,” he adds.

Through the decades, technology and the financial industry have undergone tremendous changes. But Rademacher credits his experience at CSU with helping him stay ahead – even though his computer science experience in college meant “visiting the old CDC computer in the basement, standing in line, handing in your punch cards, and coming back a day and a half later to see that you made a typo,” he says with a laugh. Rather, the value is that “CSU really taught me how to learn, how to pick up new technologies and learn new things,” he says.

“Certainly, the computer industry has not stayed the same, and you have to grow along with it or you’re gone,” he says. “And the training at CSU gave me a good foundation to help me keep moving forward. I just loved it.” •



Kathy Juneau (right) with Dean Nerger

DONOR SPOTLIGHT KATHY JUNEAU

Legacy of Independence: CSU Alumna Earned Ph.D. as a Single Mother of Two

IN THE LATE 1980S, the Chemistry Building was usually quiet on Sunday mornings. But one person you could reliably find there was Kathy Juneau, a Ph.D. candidate in the lab of Professor Louis Hegedus. “I would come in every Sunday morning, 7 a.m. to noon – because the kids were usually in bed, so I would get a lot done.” Not the “kids” she studied alongside (although she suspected they might be sleeping in after a night out) but her own children, then in middle and high school.

Now, Juneau is a retired senior staff scientist from Celanese chemical company where she helped create large quantities of Ibuprofen for BASF. But 30 years ago, she was a non-traditional Colorado State University graduate student and a single parent of two.

She had been working at Colorado State University’s Foot-hills campus, applying her double master’s in chemistry and mathematics from the University of Minnesota, Minneapolis, when her first child, Thor, was born. Although she spent time during the day raising her kids (Kara would come three years later), she never stopped learning. She took evening classes at CSU in astronomy, zoology, science fiction writing – and even a roller skating class. But “I had always thought I would go back to chemistry to get a Ph.D.,” she says. “I wanted to be more independent – financially and in my education – after my divorce.”

So when Thor was 12 and Kara was nine, she started auditing chemistry classes to catch back up – and because, since her master’s in the 1960s, she says, “they had discovered some new things!”

In 1986, she was formally accepted into the doctoral program in the department. Excelling in a rigorous Ph.D. program and in single parent duties was not always easy. But she acknowledges her advisor Hegedus and Professor Frank Stermitz for being there to encourage and support her – and for understanding when she needed to zip out of the lab for a parent teacher conference or head home for a couple hours to have dinner with her kids (for which, she says, the conversation was usually more interesting than the food) before coming back to campus for an evening class. “Professor Hegedus and Professor Stermitz realized that raising kids was a difficult job,” she says.

She also credits her success to her children themselves (and to whom she dedicated her doctoral dissertation). “They just buckled down and did the job they needed to do, which was to go to school and focus on their academics,” she says. “Of course, they saw me studying all the time, so I guess when you do it instead of say it, there’s more of a force!”

It was her experience through those five Ph.D. years that inspired her to start the new Kathleen, Thor, and Kara Juneau Fellowship in Chemistry “to allow others to be independent in their science careers and in their finances,” she says. In particular, she hopes the fellowship will benefit women who are going back to school.

“It really surprised me that I had enough money to finance a fellowship for other people,” she says. Thanks to her dedication, more students will now be able to take advantage of this opportunity at CSU. •



Building the Future of Science

TWO NEW BUILDINGS CREATE NEW HOMES FOR DISCOVERY AT CSU

THIS SEMESTER, the College of Natural Sciences opened two new large science buildings to better support learning and discovery at Colorado State University.

The new Biology Building is now home to the entire Department of Biology, including its faculty, staff, post-doctoral researchers, graduate students, undergraduate majors – and the more-than 18,000 CSU students who take classes in the department every year.

The new Chemistry Research Building provides much-needed, updated research space for the department. Eleven faculty labs have moved to the building, providing new space for those groups – and more room for research and teaching in the main Chemistry Building.

“Our college produces world-class research and helps to educate nearly every undergraduate student on campus,” says Jan Nerger, dean of the college. “These two new buildings will provide worthy and inspirational homes for students and faculty to do their very best work – and to help shape the future of these ever-evolving disciplines.”





CLEAR AND PRESENT NEED

Those who have stepped inside the mid-last century Anatomy-Zoology Building might recall an exciting class, fascinating lab, or engaging office hours with a professor. But the structure and design did not lend itself well to student collaboration, informal

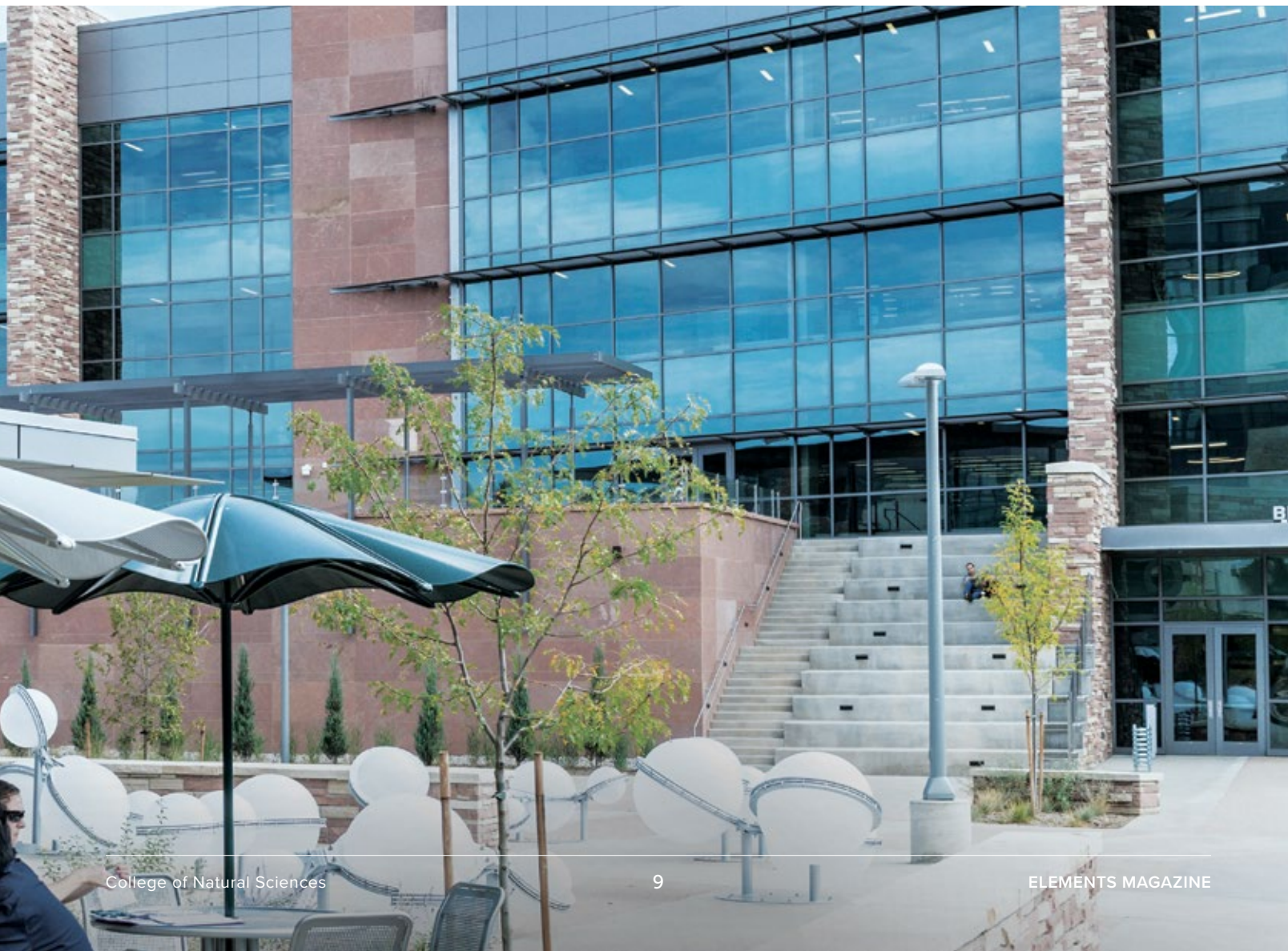
interactions with faculty, or undergraduate downtime – hallmarks of a successful 21st-century university building.

“I would study there occasionally,” says Holly Perretta, a fourth-year biological science major, who works in the lab of Professor Melinda Smith. “But there really wasn’t any private or quite study space. It wasn’t necessarily the most welcoming environment.”

Department Chair and Professor Mike Antolin agrees: “Undergraduates had no good reason to be in our building after classes.” For years, the building has been more of a workhorse than a destination.

Similarly, the Chemistry Building has been stalwart in meeting the growing needs of a highly productive department. But that structure was also built in the mid-20th century. It was intended for about 150 fume hoods. As of this summer, the department was operating with 225 hoods. Due to the high capacity, the building was using substantially more electricity and water than it should.

The labs themselves were isolated – and some, such as that of Professor Eugene Chen’s research group, were even divided among entirely different wings of the building. This left graduate students like Robin Cywar missing chances to learn from faculty





and fellow students. “I think I could have learned a lot more by now if I had been working more closely with others,” she says. Chemistry Professor Matthew Shores notes that, “some of the best student learning opportunities come from peer-to-peer conversations at the work bench.”

The two new buildings do more than remedy the shortcomings of the older structures. They bring a bright new future to these two key disciplines on campus – and in the state.

STUDENT-FUNDED, STUDENT-FOCUSED

The need for a new home for the biology department was obvious to CSU students. So much so that the undergraduate-led University Facility Fee Advisory Board approved \$57 million of their funds to go toward the creation of a new building. As a result, the \$70 million, 155,000-square-foot, LEED Gold-Certified Biology Building is highly student-focused. It is designed specifically to be a welcoming home base – a place for people to learn and to linger. “We built it as a destination,” says Mike Antolin, the department’s chair. “We expect to be able to attract even better students – undergraduates and graduates – and faculty.”

A key feature of the new building is the many common spaces and study areas. Each floor has open, comfortable seating with movable furniture for group or solo work or relaxation. These spots are scattered throughout the building, where students have more chance encounters with faculty and graduate students. On the first floor, numerous study rooms – with dry-erase tables and walls – invite concentrated work and collaboration. There is also outdoor study space, including a large second-floor

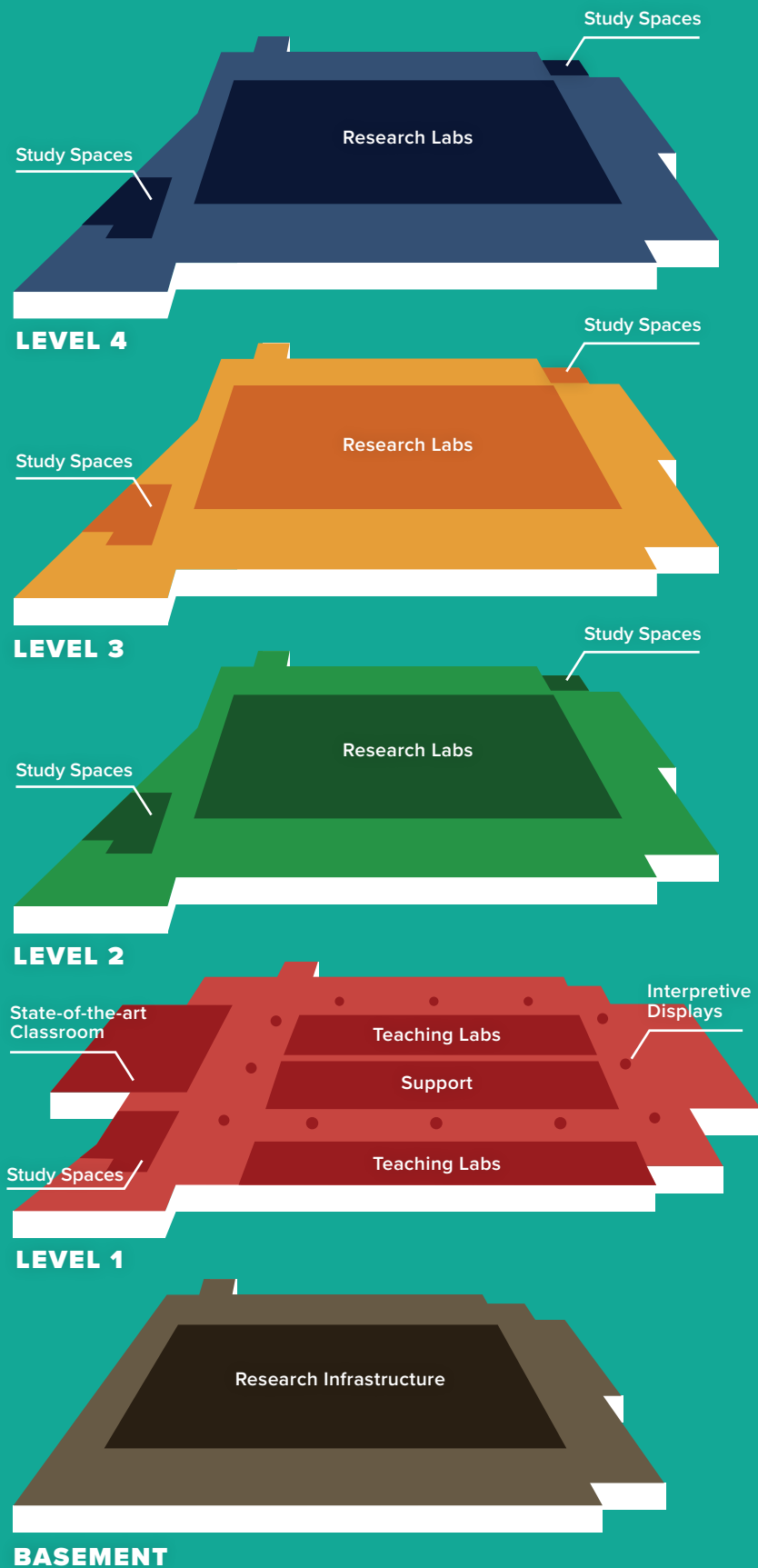
terrace equipped with tables, seats, and even power outlets. The building is already well used and loved by students: “I feel like the building’s a good place to hang out and be around other science majors,” says undergraduate Holly Perretta. “The resources in that building – the new lab space, the new classrooms, the new study spaces all of it – are going to help me do well in my classes,” Perretta says, “because I have a space to learn.”

The building was also designed to be inspiring. “Once you step inside, you just get excited about science,” Perretta says. Much of the wow-factor comes from the stunning living wall, large aquariums, and the interpretive displays that line the building’s first-floor. These displays showcase the breadth of the discipline, from the sub-cellular to the ecological, allowing students to interpret concepts and ideas differently as they progress through their studies. The 17 thematic installations – ranging from molecules to the biosphere – were designed by the exhibition company Studio Tectonic, whose founder worked as an exhibit designer for the Smithsonian Institution and has won numerous national awards.

“We wanted it to be a uniquely biology building – to help students feel a connection to the world they’re studying,” says Associate Professor Rachel Mueller. “We designed the space of the building to feel creative, to allow students to ask their own questions and develop their own sense of wonder.”

The classrooms, too, reflect the latest in learning and design. Tables are on wheels so they can be moved around into different configurations and encourage more interactive teaching and

BIOLOGY BUILDING



STUDY SPACES

The building is peppered with comfortable, inviting areas for students to study in groups, pairs, or alone. Modular common space furniture and collaboration rooms allow students to adapt the space to their needs.



STATE-OF-THE-ART CLASSROOMS

Classrooms in this building feature movable furniture, whiteboard tabletops, and multiple screens for interactive teaching and learning. One even has a 3D projector.



EXPANDED TEACHING LABS

Six new teaching labs allow more undergraduate students to get high-quality, hands-on research experience.



INTERPRETIVE DISPLAYS

Biology-themed displays dot the first floor, providing students and visitors an immersive, educational experience, no matter what their level of study.



FEATURE

learning. Even the table tops are well thought-out: not only are they dry-erase board-topped, but they can also be flipped up vertically so that students can share their work with the rest of the class. Large monitors on the walls allow students to easily plug in for digital show-and-tell. There is also a 3D projector so students can dive into the concepts they are learning.

The teaching laboratory space has also been vastly expanded, with six new teaching labs open for use. “Lab courses are integral to teaching the sciences,” Antolin says. With so many students studying in the department, this will allow them to expand essential hands-on research opportunities. “The sciences are the last great apprenticeships – the only way to become a scientist is working with scientists, he says.”

The building is, of course, not just for instruction. It is also a new home for frontline research. About 100 faculty and staff report for work to the building each day. The new design brings technologically advanced and efficient research facilities to the department. Open labs on each floor allow researchers in similar fields to collaborate and share resources. “We literally tore down the walls,” says Associate Professor and Associate Chair Joe von Fischer. “As individual faculty research programs grow and shrink, it’s easy to reallocate space to meet that need.” Top-of-the-line equipment facilities make up the core of each floor, giving labs around it easy, shared access to instrumentation, teaching collections, and storage.

Students and others will also get to see the research in action, thanks to what the department calls “science on display.” Hallways and labs are separated by glass, allowing anyone to see the science happening inside the labs.

Overall, the new building has “a flexible design that allows us to be nimble in adapting to future needs,” Antolin says. It is also efficient. Designed to maximize student funds, the fume hoods,

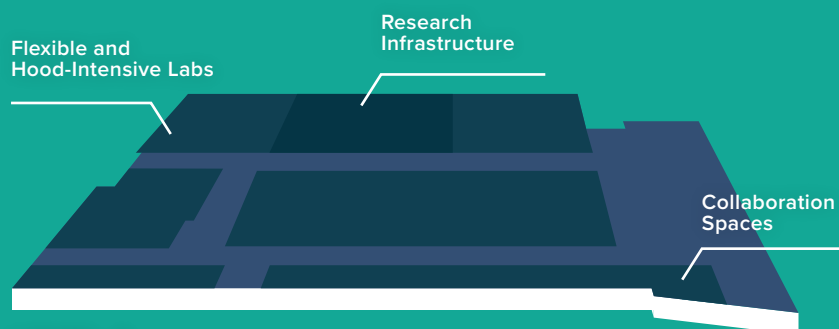


water, and drainage are centralized to save costs. And because the building is LEED Gold-Certified, it will also cost less to operate for the long term.

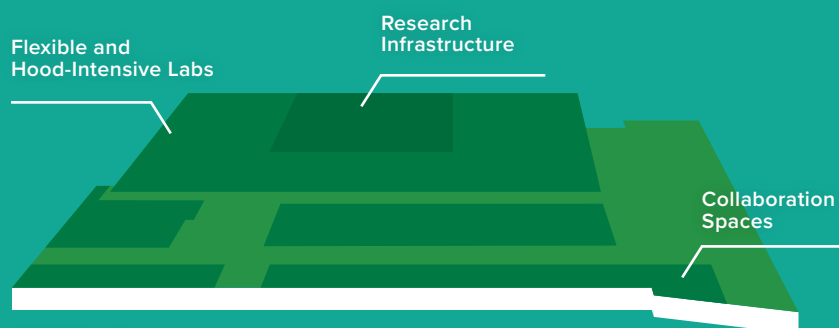
INNOVATION-DRIVEN, RESEARCH-MINDED

In spite of the Department of Chemistry’s close and dated quarters, the faculty has continued to bring in outstanding awards, including millions of dollars in grants from the Department of Energy, National Science Foundation, National Institutes of Health, Department of Defense, and private-sector entities, such as the Alfred P. Sloan Foundation and the Arnold and Mabel Beckman Foundation. Faculty members have also started promising companies, such as Prieto Battery, and partnered with industry corporations such as BP, to make real impacts in people’s lives.

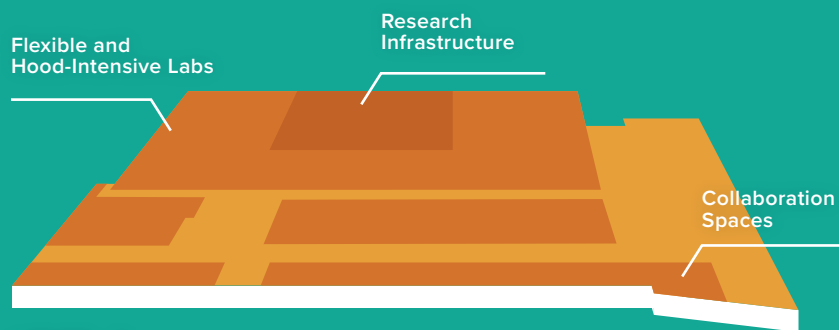
CHEMISTRY RESEARCH BUILDING



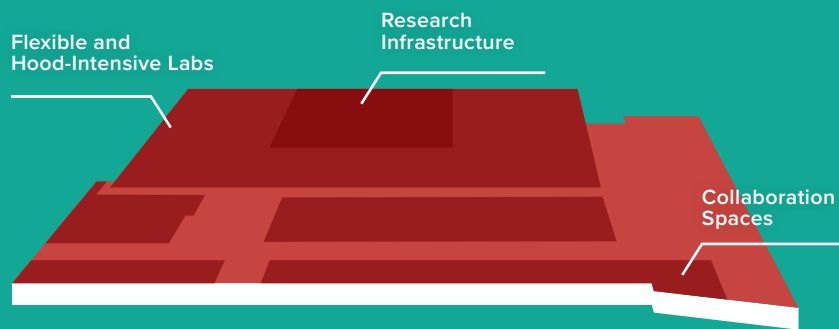
LEVEL 4



LEVEL 3



LEVEL 2



LEVEL 1



HOOD-INTENSIVE LABS

The central labs in this building bring much-needed additional hood space and state-of-the-art stations to the department and its researchers.



OPEN, FLEXIBLE LABS

By building each floor around a central research theme and knocking down walls between researchers, faculty – and students – will be able to share ideas and equipment.



COLLABORATION SPACES

Dedicated areas allow for informal collaboration of faculty and students in the department, which houses more than 180 graduate students and more than 140 undergraduate majors. Floor-to-ceiling magnetic dry-erase boards make for easy and open areas in which to share ideas.



RESEARCH-READY INFRASTRUCTURE

A cutting-edge science building requires amped up infrastructure, which this building has baked in. And thoughtful planning allowed for it to still meet LEED Gold-Certification.

The new Chemistry Research Building offers an exciting new chapter for the department. “The new building will enable new and better research in a safe, modern, energy-efficient setting,” says Chuck Henry, chair of the department. “It will allow recruiting of the best and brightest at the student, postdoc, and faculty levels.”

Eleven faculty – including four new faculty members – have their labs in the new building. All told, about 100 faculty, staff, researchers, and graduate students work in the new, \$55.4 million, 60,000 square-foot, LEED Gold-Certified building.

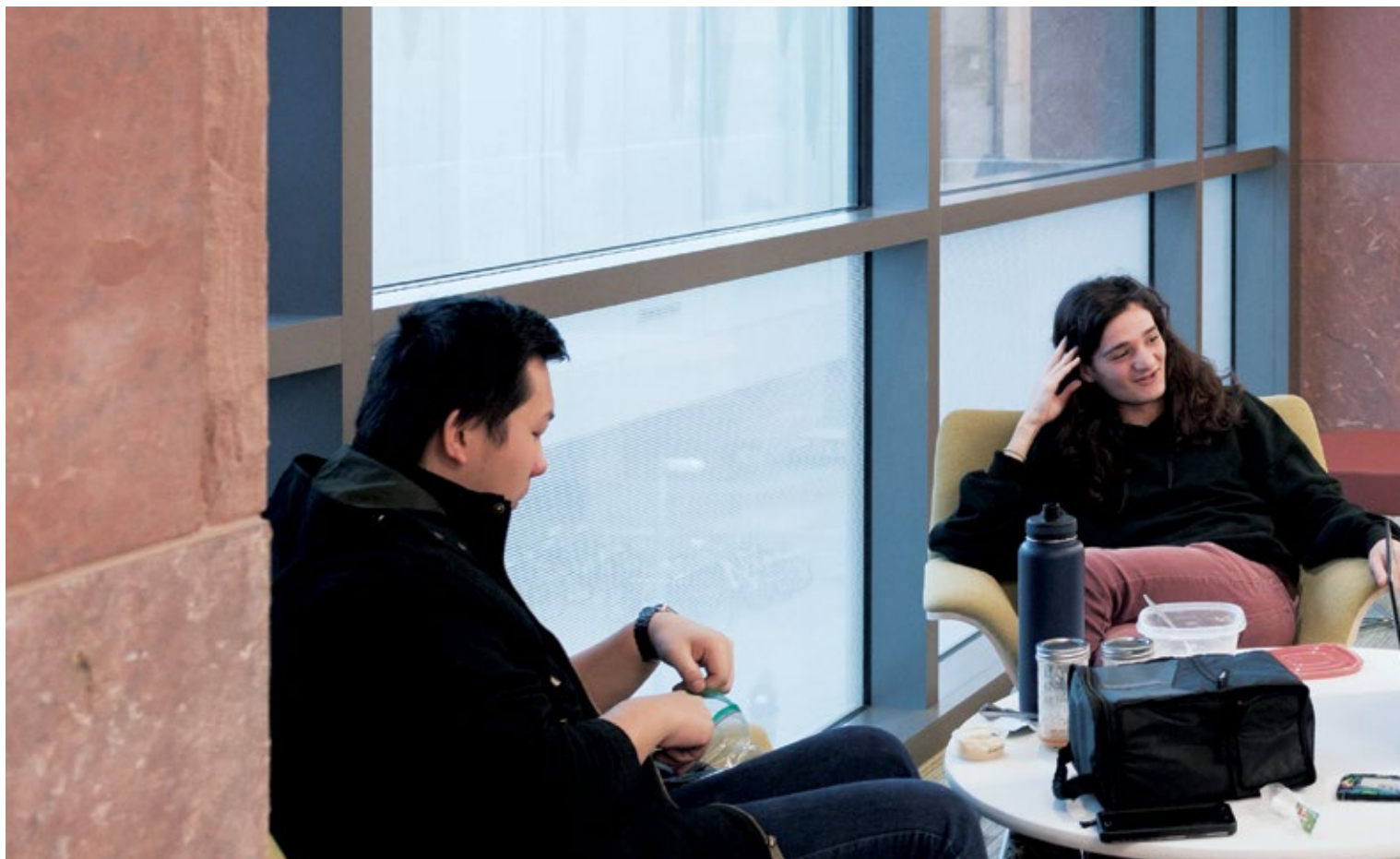
The building uses open labs to organize researchers around disciplines. “It allows researchers and students to openly collaborate and share ideas,” Henry says. The first floor houses materials chemistry. The second floor is home to inorganic and polymer chemistry. The third-floor lab is dedicated to synthetic organic chemistry, and chemical biology lives on the fourth-floor.

“The open lab concept reflects how chemistry is done nowadays,” says faculty member Matthew Shores, whose team now occupies space in the second-floor lab, along with Eugene Chen’s group. “Having multiple research groups in one large lab space promotes a good mix of expertise and resources – and can help us stretch research funds. And being so close to some of the best synthetic chemists in the country can’t hurt in terms of motivation and expertise.”

Students working in the labs are also benefitting from the new design. “It really deepens the pool of resources for everyone,” says graduate student Robin Cywar. “As a relatively new graduate student, it helps just to see the way successful researchers go about their work. And being able to ask questions and have conversations about research with all group members greatly impacts my learning and lab technique.” Additionally, she says, “my environment has a huge impact on my mindset, with factors such as natural light, social interaction, and a clean, organized workspace all playing a role in being a productive, positive graduate student.” (As Shores observes, “It turns out that sky blue-colored walls in my old labs could only go so far to simulate the outdoors.”) Each of the floors of labs have expansive windows with views of campus.

In addition to the visible features, the building also includes a powerful – and power-saving – infrastructure to enable pace-setting research inside for decades to come. Ventilation and plumbing make up a fundamental part of the building design, and fitting the high-powered research infrastructure into a LEED Gold-Certified structure is no small feat. The result is “a forward-thinking space that will serve as a model for research facilities in the chemical sciences,” Shores says.

Many faculty and staff remain in the main Chemistry Building, where the department is planning renovations to update and improve the space. This additional room will allow “other groups to expand to accommodate more students and research,” Henry



says. The new iteration of the older building will also focus on research clusters. Additionally, “the Central Instrument Facility is expanding to fill the entire basement,” he says.

“Our goal is to grow the program to adapt to the evolving nature of chemistry and its interface with other sciences – while retaining the emphasis on basic science,” Henry says.

SCIENCE MALL STRENGTH

In addition to much-needed, updated learning and research space, these two new buildings bring a vision of the future of science and learning to the college and university. They mark the gateway to the campus’ growing Science Mall, which also includes the Anatomy-Zoology, Environmental Health, Microbiology, and Pathology buildings, along with the Painter Center and Yates Hall. A new Health Education Outreach Center is also under construction in the area.

The two new structures were built in tandem, allowing for substantial cost-savings and a more unified environmental and aesthetic plan. The Haselden Construction team, led by CSU alumni and employing numerous CSU graduates, and architecture and design firm Hord Coplan Macht won the bids for both buildings. This meant that crews could work and plan together. As a result, the departments were able to add additional finishings and features while staying on time and on budget.

The integrated landscaping around the buildings features native plants as well as a storm water capture system. “The whole Science Mall creates a much more inviting space,” biology’s Antolin says. And it is already realizing its broader mission of “helping to build a science-savvy public,” he says.

The buildings dovetail with the college’s new 2021 strategic plan goals of student success, research excellence, faculty excellence, global impact, and inclusive community. “We are helping to shape the future of science here at CSU, and we are proud and grateful to be able to have these exceptional facilities,” says Dean Jan Nerger.

After three months of use, the buildings have just begun to create their legacies in the two fields – and in the lives of students. “The enduring strength of the two buildings lies in their thoughtful design,” she says. “It is a design that encourages collaboration and horizontal integration among colleagues and vertical integration among students and faculty. These dynamic structures are truly a reflection of our college,” Nerger says. “I cannot wait to see the discoveries that are made inside those walls – and that travel beyond, to make an impact on the world.” ●





Army Medic to CSU to Mayo Clinic

EIGHT YEARS AGO, Steven Rooker never imagined that joining the U.S. Army would lead him to study medicine. Back in 2011, he was assigned to the 82nd Airborne Division as a platoon medic and deployed to southern Afghanistan for a seven-month tour. The terrain there was flat and covered with poppy fields, making it a high alert area for explosive devices.

This was where Rooker's life changed forever. A member of his platoon stepped on an IED, losing both his legs in an instant. Immediately, Rooker ran into open fire to try to stop the bleeding from the femoral arteries. Rooker used his medic training to stabilize him until he was picked up by a helicopter.



The soldier survived. "It was transforming," Rooker says.

Rooker received the Army Commendation Medal for his valorous achievement as a combat medic. In 2013, Rooker decided to apply to Colorado State University to study biochemistry. During his time here, Rooker researched in the Mycobacteria Research Lab and volunteered as an EMT. "Rarely have I seen a student so enjoy the process of learning and discovery in all his classes," says Aaron Sholders, undergraduate program coordinator in the department. "He really is remarkable." This spring, Rooker graduated cum laude with a B.S. in biochemistry and received a generous scholarship to attend the Mayo Clinic School of Medicine in Rochester, Minn., where he is now on his way to becoming a doctor.



WHAT MAKES CELLS TURN CANCEROUS?

What makes a normal cell in our bodies "forget" its identity and become cancerous? This is the question that led Biochemistry and Molecular Biology Assistant Professor Erin Osborne Nishimura to study gene expression during development using nematode embryos.

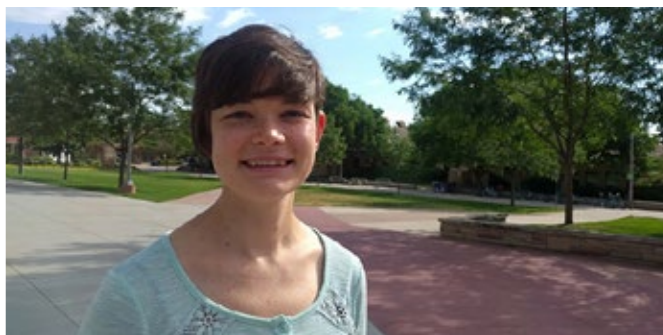
Her work has won her a prestigious Webb-Waring Biomedical Research Award from the Boettcher Foundation. The three-year grant "will allow our lab to bridge our basic biology pursuits into translational avenues with more direct impact on human health," she says.

CRYSTAL VANDER ZANDEN: 23 AND A Ph.D.

Most college students finish their undergraduate degree around the age of 22. But Crystal Vander Zanden isn't most students. The 23-year-old Arizona native finished her Ph.D. in biochemistry this summer, making her the youngest ever doctoral graduate from the Department of Biochemistry and Molecular Biology.

At age eight, she asked her mother if she could enroll in a biology course. After passing an entrance exam, Vander Zanden took her first college-level course at Glendale Community College at the age of 9. At age 13, she graduated from Glendale High School.

She now has a National Institutes of Health-funded postdoctoral fellowship at the University of New Mexico, where she is conducting research on biophysical characterization of Alzheimer's disease-related protein aggregation, while also teaching courses at a local community college.



Google Street View Cars Map Methane Leaks

A set of Google Street View mapping cars, specifically equipped with advanced methane analyzers, are allowing Colorado State University researchers to “see” invisible methane leaks from natural gas lines beneath our streets.

The groundbreaking project is led by Joe von Fischer, associate professor in biology and associate chair of the department, in partnership with the non-profit Environmental Defense Fund and Google Earth Outreach. von Fischer’s CSU collaborators include Dan Cooley, from the Department of Statistics, among others from across campus.

Data from the project are helping utilities, regulators,

and advocacy groups reduce wasteful and environmentally damaging leaks faster and more cost effectively. Besides being the main ingredient in natural gas, methane is also a potent greenhouse gas, with more than 80 times the warming power of carbon dioxide over a 20-year timeframe.

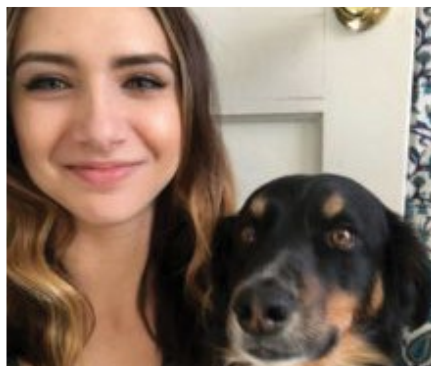


“This is a huge challenge that almost nobody had been thinking about before,” von Fischer says. “Now we’re finding out just how widespread these leaks are.” And once they’re located, the leaks can be fixed, which is a boon to the environment – and to bottom lines: New Jersey utility Public Service Electric and Gas Company has approved almost \$1 billion worth of upgrades directed in part by the CSU researchers’ data.

INSPIRED BY FIELDWORK

Christina Parise came to Colorado State University with the goal of becoming a veterinarian, even working through school and summers as a veterinary technician. But two weeks in Baja California Sur, Mexico, at CSU’s Todos Santos Center, changed her direction.

“I was in the first class that went over Winter Break in 2015,” Parise says. “The campus wasn’t built yet, so we camped on an island and studied marine life. We counted sea turtle eggs and helped some of the last ones to hatch make it to the water.” She graduated with a degree in zoology in spring 2017.



TOP HONORS FOR DISTINGUISHED PROFESSOR

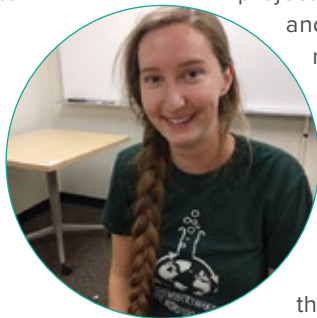
Colorado State University Distinguished Professor Diana Wall has received the Ecological Society of America’s highest honor, the 2017 Eminent Ecologist Award. Wall is a world-renowned soil ecologist who has traveled to Antarctica for the past 27 years to study soil nematodes. Of particular interest to her work is the McMurdo Dry Valleys, one of the coldest, driest, and windiest ecosystems on the planet, where she and her collaborators are investigating ecosystem responses to climate change. In honor of her many scientific contributions, Wall Valley, Antarctica, was named for her in 2004. Wall, who is also director of CSU’s School of Global Environmental Sustainability, holds numerous other accolades, including being named the 2016 British Ecological Society’s highest distinction of Honorary Member, a member of the American Academy of Arts and Sciences, and a fellow of the American Association for the Advancement of Science, among numerous others. “I am excited to join such an esteemed group of ecologists as we work toward a future in which ecology takes center stage,” she says.



Deaf Student Trail-Blazed Her Way to Chemistry Degree

EVIE BANGS WAS 5 YEARS OLD when she started to lose her hearing. At age 8, her hearing plummeted, and she could no longer understand her teachers. Now she's a CSU alumna. She got there not by dwelling on what she lost, but on focusing on what she gained, which includes a degree in chemistry from the College of Natural Sciences.

Bangs might be CSU's first deaf chemistry major – at least in anyone's memory. It took Bangs an extra year to finish her degree, in part because of the uniquely time-consuming way she needed to absorb challenging course material, with the help of sign language interpreters. For every class, as well as for group



projects, Bangs was accompanied by two interpreters and one class transcriber. The two interpreters were necessary due to the complexity of the material; sometimes, while one was working with Bangs to quickly make up signs for words like "stoichiometry" or "adiabatic process," the other continued to listen to the instructor so that Bangs missed as little as possible.

"Everywhere I go, here at CSU, people have filled in the gaps for me," Bangs says. "They made it so that I could be successful." Bangs graduated with an American Chemical Society-certified degree in spring 2017, which requires additional training and lab work. She aspires to attend graduate school and become a professional chemist.

PROFESSOR ENTERS 6TH DECADE OF PUBLICATION



In 1956, Dwight D. Eisenhower was elected president, and a young chemist named Frank Stermitz published his first scientific paper. Since then, Stermitz has authored and co-authored more than 255 peer-reviewed scientific publications, with his latest appearing earlier this year. Throughout the past six decades, Stermitz, now a professor emeritus in the Department of Chemistry, has become a world expert in the systematic investigation of diverse plant flora in the western hemisphere and continues to make headway in his research at the college. His work has contributed to a vast assortment of natural product studies, in particular the isolation and structure of new compounds from medicinal, toxic, and ecologically interesting plants.

CHEMIST JAMIE NEILSON NAMED SLOAN RESEARCH FELLOW AND COTTRELL SCHOLAR

Colorado State University Assistant Professor Jamie Neilson is using chemistry to create new, innovative materials to change the way we harvest and use energy. He is also leading the charge to integrate his work into a new sustainability-focused educational program on campus. For his myriad achievements on both of these fronts, Neilson was named a 2017 Sloan Research Fellow, a prestigious award for early-career scientists and scholars working on fundamental research, as well as a 2017 Cottrell Scholar, a distinction that recognizes excellent teacher-scholars for their innovation and academic leadership. "One of our main goals," Neilson says, "is to highlight the critical role that the natural sciences play in sustainability."





Making Software Developer-Friendly

Before going to graduate school, Laura Moreno worked as a software company development engineer, where her team managed a large industrial legacy system that several financial intuitions depended on. The system ran on close to a million lines of code, but, she says, “with little to no formal documentation, most of the knowledge about the system went away with people who left the company or moved on to other projects.” Additionally, she says, “the tools used to maintain the product were either obsolete or out-of-date. This was clearly a suboptimal situation for maintaining a critical banking system.” This problem drew her to doctoral research around the best ways to maintain software systems.

Now an assistant professor in the computer science department at CSU, Moreno focuses her work on how to “provide developers

with timely and adequate information, tools, and practices,” she says. And these are not one-size-fits-all solutions. She is working “to automatically identify the information developers need based on their specific context by considering the task at hand, their experience, the system, etc.” she says.



“Since we live our lives through software, if one of those systems fails, chances are we will waste time and/or money – and sometimes lose our patience,” Moreno notes. “In the case of critical systems, the risk is even higher and the consequences of a failure range from loss of sensitive data and personal injuries to environmental damage and loss of lives. That’s why research on methodologies, practices, and tools for developing, maintaining, and evolving software is crucial.”

CS GRADUATE CREATED COMMUNITY AT COLORADO STATE UNIVERSITY

In just three semesters at Colorado State University, Victor Fuentes did his best to pack in a four-year college experience. He was a computer science major with a minor in mathematics; a mentor to local Latino youth; and co-founder of a campus group that advocates for undocumented immigrants. He also lived in a residence hall for the first time his senior year, serving as a peer academic leader for the College of Natural Sciences Learning Community.

What’s behind all of the activity for this introverted, unassuming, Rubik’s Cube-solving student? The child of undocumented immigrants who takes nothing for granted.

Fuentes graduated in spring 2017 and now has a job as a software engineer.



INSPIRING INCLUSION

To recruit and retain the very best students and to help foster an inclusive community, a group of faculty in the department created the Computer Science Inclusion and Excellence Scholarship fund. It awards support to outstanding incoming students, and this year, it is backing three talented, female first-year students. Through additional donations, several women in the undergraduate major were also able to attend this year’s Grace Hopper Celebration in Orlando, Fla. The department is aiming to reach a permanent endowment to ensure that these efforts are ongoing.

To learn more, visit: advancing.colostate.edu/CNS/GIVE, and search for “inclusion”



Mathematics Tangles with String Theory

In recent decades, the cutting-edge world of string theory has breathed new life into an old field of mathematics. Algebraic geometry, which studies the shapes that come from polynomials, remained a largely theoretical field for centuries. Until string theory came along.

Algebraic geometry, it turns out, is “fundamental to the particle interactions that these physicists were looking at,” says Mark Shoemaker, an assistant professor in the Department of Mathematics. The intersection, uncovered in the 1990s, was “completely surprising from a mathematical point of view,” says Shoemaker, who became interested in

the field in graduate school. Here at CSU, he explains, “I’m using this connection with physics to develop new results in mathematics.”

Shoemaker was recently awarded a three-year National Science Foundation grant to pursue his work in the field, fund graduate students, organize conferences, and bring speakers to campus. “This field is very exciting because it’s changing very quickly,” he says. And that’s the beauty of working in pure mathematics: “You can never know exactly when or how it’s going to be applied.”

KEEPING CALCULUS INSTRUCTION CURRENT: A Q&A WITH ASSISTANT PROFESSOR MARY PILGRIM



Mathematics Assistant Professor Mary Pilgrim studies education and learning in the math field. Her research has been published and highlighted around the world, most recently in an article in *The Conversation*. We asked her about what is changing in the way we teach math.

ELEMENTS: How could we update the way calculus is taught?

PILGRIM: Research shows that active learning is far more beneficial to students. However, even in the face of this research, calculus instructors still believe that lecture is the best way to teach.

ELEMENTS: How could reimagined mathematics content better serve students?

PILGRIM: Anything on the active learning spectrum would better serve students than them watching problems being correctly worked out. Students need to experience mistakes, understand why the mistakes exist, and then develop new ideas in order to more deeply understand content.

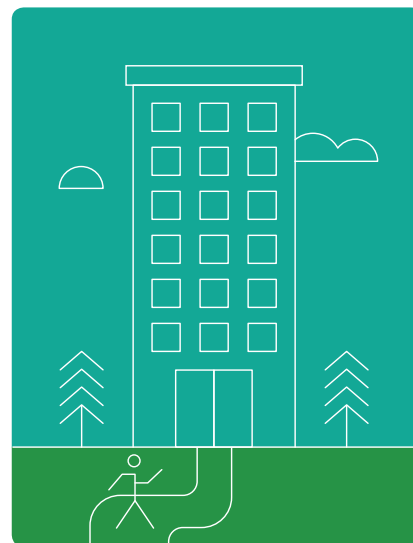
ELEMENTS: What would an updated mathematics class look like?

PILGRIM: There should be dialogue, engagement, debate, exploration, and experimentation – at least to some degree.

ELEMENTS: How is CSU and the mathematics department putting this research into practice?

PILGRIM: We are working closely on enhancing graduate teaching assistant training through the Calculus Center. We hope that the training will provide them with knowledge and support to try to implement active pedagogical strategies.

CALCULATING IMPACT: SUCCESS OF THE CALCULUS CENTER'S FIRST YEAR



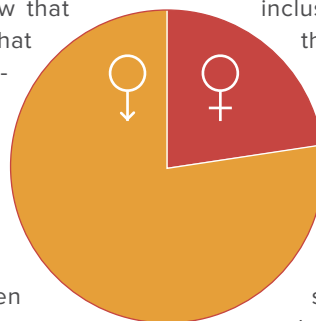
**MORE THAN 11,000 VISITS BY
MORE THAN 1,750 STUDENTS**

Calculus I (Math 160) students who visited the Calculus Center at least once were 40 percent more likely to receive an A, B, or C in the class than students who never stopped by.



Role Models in Physics

The CSU physics department has an active Society of Physics Students, dedicated undergraduate study space, and a small-department feel. But a few students saw that there was another niche to be filled: a group that would specifically support and encourage women, who currently make up about 23 percent of the department's majors. "We have a very small department, and we want [women] to feel welcome and encouraged – we want them to know there are role models who can help," says Aurora Popescu, a fourth-year undergraduate and current president of the Women in Physics group.



The group started in 2012 with about 10 members, and their meetings now bring in a couple dozen. The group is inclusive, welcoming anyone who supports women in the sciences. They put on weekly study sessions, do volunteer outreach, travel to conferences, and bring in professional scientists to talk to the group. For Popescu, who also works full-time in Associate Professor Norman Buchanan's lab, the group has provided valuable camaraderie – and a glimpse into opportunities that await in the sciences: "I want to go straight into industry," she says. "I love to hear what people do after they graduate."

OUT OF 94 UNDERGRADUATES IN PHYSICS, 22 ARE WOMEN



NEUTRINOS ENJOY THE SPOTLIGHT

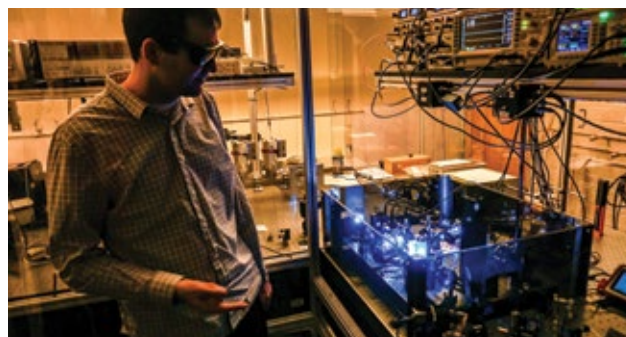
Buzzing through space, through our bodies, virtually everywhere, are billions upon billions of neutrinos. Behind only photons as the most abundant fundamental particle in the universe, neutrinos are enjoying a popular heyday. The subject of a recent Nobel Prize and the Breakthrough Prize in Fundamental Physics, neutrinos have hundreds of scientists all over the world, including several at Colorado State University, working to unlock all their mysteries.

Two separate, international scientific collaborations studying neutrinos, the T2K experiment in Japan, and the NOvA experiment at Fermilab, have reported new insights into how neutrinos behave. CSU researchers, including Professor Walter Toki, Professor Robert Wilson, and Associate Professor Norman Buchanan, have played a significant role in both projects. "Neutrinos are as interesting as electrons were 150 years ago," Toki says. "We believe neutrinos are at just a beginning stage of being understood."

QUEST FOR QUANTUM: CREATING ANTI-HYDROGEN WITH LASERS

In the basement of the Colorado State University physics wing, it is not unusual to encounter labs filled with lasers. But not many of them are focusing their beams on the goal of creating super-cooled hydrogen – and unlocking some of the biggest theoretical questions about antimatter and quantum mechanics.

Physics Assistant Professor Dylan Yost is behind this atomic quest in the college. And his work recently earned him a National Science Foundation CAREER Award, a highly regarded and well-funded honor that supports early-career faculty. Yost's award supports the development of a two-photon laser cooling technique. Many other, heavier elements are easier to laser cool, but, as Yost notes, "hydrogen is the simplest atom and so it is a good choice to test our most fundamental physical theories." Yost's research aims to put the rubber to the road – or lasers to the atoms – to see if these theories hold up in the real world.

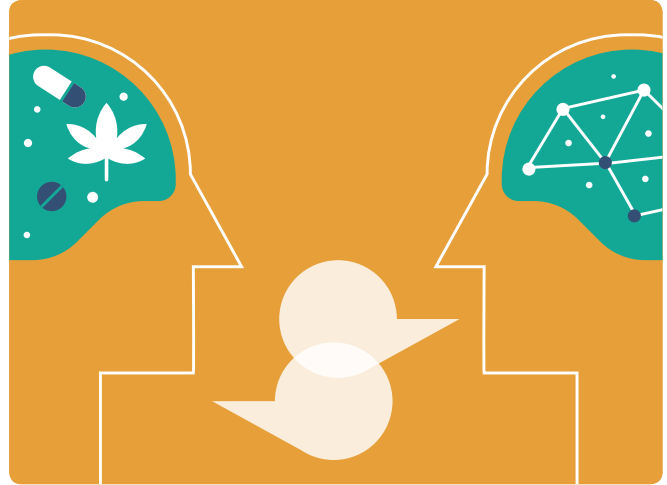




CSU Meets National Need for Addictions Counselors

NATIONWIDE, more than 20 million teens and adults have a substance use disorder. And that number might be climbing, with opiate use on the rise and with cannabis now legal for adults in seven states and the District of Columbia. In Colorado alone, more than half a million people regularly use cannabis, and about one in 10 will develop Cannabis Use Disorder. This leaves a lot of individuals who might need help. But qualified professionals are in short supply.

To help meet this growing need, with the help of an alumna's generous donation, CSU's Department of Psychology launched an undergraduate concentration in addictions counseling in 2014 and a Master's in Addiction Counseling this fall. The B.S. concentration qualifies students to test for the first level of certification. As Certified Addiction Counselors, they can participate in patient intakes and co-lead groups. The new master's program will enable students to attain the highest level of addiction counseling certification: Licensed Addiction Counselor. Graduates with this credential will be able to work anywhere in the country and in a variety of settings, from residential facilities, to outpatient treatment, to hospitals – and



even to open their own practice. “We are trying to increase the quality of care,” says Bradley Conner, associate professor and director of addiction counseling at CSU. And they are already on their way, with nine master's students enrolled in this fall's first cohort.

HOW TO IMPROVE YOUR LEARNING AND MEMORY, ACCORDING TO SCIENCE

Repetition, repetition, repetition. This memory mantra has been drilled into us for decades. But the latest science says we've been doing it all wrong.

In the Department of Psychology, faculty have been studying how our brains actually learn best. Associate Professor Ed DeLosh has some potentially surprising news: Forget all of that reviewing. “It might be the worst compared to a variety of other strategies,” he says.

“What people think works for learning and memory and what science tells us works for learning and memory don't match up,” DeLosh says. He also uses the new science of learning to better teach students and provide them with skills that will serve them well through college – and beyond. The department even offers an introductory course called Science of Learning.

WHAT WORKS?



1. Quiz yourself. Regular testing of information – even if you don't have it down yet – helps it stick better later.



2. Use “elaborative learning” – think deeply about what you're learning. Form meaningful connections between the new things you're learning and what you already know, other things you're learning, concrete examples, and everyday experiences.



3. Space out the information. Don't cram information into single sittings. Try to spread out learning. If you have two hours' worth of information you would like to absorb, try spreading the information out over multiple days, rather than using a single marathon session.

Alumna Barb Andre: Accountant to Biostatistician

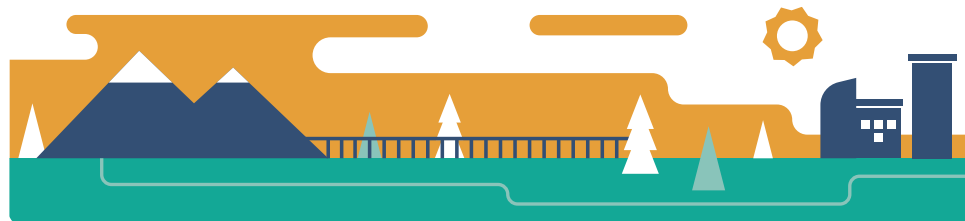
Barbara Graham Andre had been a stay-at-home mom with an undergraduate degree from CSU in wildlife biology ('84). When the recession hit and her husband lost his job, she jumped back into the workforce. She found a position as an accounting technician at CSU. But, she says, "It didn't take long for me to understand that I wanted to be connected to research – and that the best path there was through statistics." So, she spent a few years brushing up on mathematics before enrolling in the master's of science program in the Department of Statistics.

Andre, who finished her degree in 2013, credits her cohort and the supportive faculty for helping her get through the program. She



now works as a biostatistician in the Department of Microbiology, Immunology, and Pathology in the College of Veterinary Medicine and Biomedical Sciences at CSU.

"I have been involved in a number of studies on infectious diseases, as well as some studies on classroom methods," she says. "Every day brings a new challenge, and I am never bored." And what's even better, she says, is that she gets to "continue to tap the Department of Statistics for assistance. I am very happy to have the Graybill Statistical Laboratory resource available."



EXTREME RESEARCH

Twenty years ago, a 500-year flood swept through Fort Collins, inundating the campus and many of its buildings. Such rare but impactful events are just the sort of challenging phenomena Associate Professor, Associate Chair, and College of Natural Sciences Professor Laureate Dan Cooley studies. His work is in the extreme value field. Although the major flood is a classic example, this area touches many aspects of life: "Similar concerns arise with finance, insurance, and engineering," he explains. "People need estimates of how large a rare event could be so that infrastructure, like bridges and buildings, can withstand impactful events or so that companies have adequate reserves to withstand sudden economic downturns," he says.

He is currently working on a joint project with atmospheric scientists at the Lawrence Berkeley National Lab to better understand dependence of variables in extremes. For example, he says, "climate scientists use these tools to visualize dependence and to see time patterns, like the El Nino cycle," on larger trends.

Thanks to the interdisciplinary nature of the field, Cooley says he enjoys the opportunity to "work with and around so many very smart people."

HIGH-STAKES INTERNSHIP



IT'S NOT EVERY INTERNSHIP where you get to use your math skills to keep tabs on supercomputers. But for third-year CSU undergraduate student Jack Hill, this high-stakes mathematics wasn't an obstacle. Hill, who is pursuing a degree in statistics, had a technical internship this summer at Fidelity Investments in Boston, Mass., where part of his job was to monitor the massive data systems keeping the company's mutual fund information current.



PUBLIC ASTRONOMY NIGHTS

Tucked away on East Drive between the University Greenhouses and the Insectary is a portal to another galaxy. To many galaxies, in fact. There, an unassuming building from the 1960s houses the Madison-Macdonald Observatory, where the college is reinvigorating regular public viewing nights. Department of Physics' Astronomy and Astrophysics Instructor Emily Hardegree-Ullman and Little Shop of Physics Director of Outreach and Logistics Heather Michalak are heading up the nights, which are held the first and third Friday of each fall and spring, weather permitting. "The best part of my job has always been going out and observing," Hardegree-Ullman says. "It's fun to share that excitement with everyone else."

ECLIPSING EXPECTATIONS



This summer, parts of the country were plunged into a midday darkness as the moon passed directly between the earth and the sun, treating viewers to a rare total solar eclipse. The college and many of its units had been preparing for months for this celestial event with on-campus and regional outreach activities.

"An eclipse like this one is a time when people are focused on a natural event," says Brian Jones, director of the Little Shop of Physics, which spearheaded the efforts. On campus, Jones led a group student volunteers for the main event, which took place on the Intermural Fields, west of the Lory Student Center. Nearly 10,000 people gathered to watch the impressive 95-percent eclipse that traveled over Fort Collins at 11:47 a.m.

Farther north and east, in the "path of totality," CSU groups led additional events. At Carhenge, in Alliance, Neb., a team of Little Shop staff and interns offered activities and viewing opportunities for the thousands of people who traveled to that iconic location to experience the total eclipse. In Mitchell, Neb., Little Shop, along with Associate Dean Lisa Dysleski, physics and astronomy faculty member Emily Hardegree-Ullman, and the College of Natural Sciences Learning Community's Outreach Scholars, led activities for the local school system and town.

To enable people to see the eclipse directly, Little Shop of Physics distributed 50,000 pairs of free eclipse-viewing glasses to local schools and to the campus community. "We wanted everyone to be able to look for themselves," Jones says.

The eclipse fell on the first day of classes, kicking off the school year with flare. "It's a dramatic, memorable event," Jones says. "It's one that will stick with people – and, we hope, will ignite a desire for some people to learn a bit more!"

MEET THE MICHAEL SMITH SCHOLARS IN CHEMISTRY

Last year, Michael Smith, who studied chemistry at Colorado State University, donated \$400,000 to create 10 prestigious scholarships in the Department of Chemistry for students from the state of Colorado.

The 10 scholars arrived on campus this fall – meet these inspiring students.



RYANN DALY

Hometown: Durango, CO

"One of my main goals in my educational career, and in my life, is to evolve current medicine to a more holistic approach."



JACOB FISHER

Hometown: Arvada, CO

"I want to graduate from college and use my knowledge in chemistry to help preserve the natural resources of Colorado."



KATHLEEN FLOYD

Hometown: Fort Collins, CO

"I chose to major in chemistry because it can make a real difference in the world."



TYLER JOHNSON

Hometown: Lafayette, CO

"Neither of my parents went to college. After graduation, I plan on using my knowledge to begin making this world a better place."



YUMA MAYS

Hometown: Aurora, CO

"I was born in Japan but moved to Colorado at a very young age. Thank you so much for supporting and believing in me."



ELIANA OKESON

Hometown: Denver, CO

"In a teaching career, I will be able to pass along a love of learning and a wonder for the world surrounding us."



JOSE RIVERA

Hometown: Colorado

"I was born in a small town in Mexico. After graduation, I hope to impact my community. I want to study medicine and help people all over the world."



SARAH SANDERS

Hometown: Fort Collins, CO

"This scholarship allows me to work less, offering more time for me to focus on my studies."



MEGAN STEVENS

Hometown: Colorado Springs, CO

"Within my years here at CSU, I hope to be a part of a research team and find a topic that speaks to me."



MAGDELAINE WELLMAN

Hometown: Pueblo, CO

"It is very important to me that I make a difference in the world, or at least do my part to help. Chemistry is putting me on the right path to fulfill my dreams."



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