DISCOVERY BEGINS HERE

Elements 2018

COLLEGE OF
NATURAL SCIENCES
COLORADO STATE UNIVERSITY

Celebrating 50 Years *of* Discovery

ON THE COVER: More than 50 Years of Discovery

Labs and research techniques might have changed over the years, but the commitment to discovery has not. Featured on the cover: Two glimpses into CSU chemistry labs.

Image credits: Bill Cotton (2017) and courtesy of the University Historic Photograph Collection, CSU, Archives and Special Collections (undated).

Welcome to Elements

Welcome to a special issue of *Elements* magazine, celebrating the 50th anniversary of the College of Natural Sciences at Colorado State University. Each year, *Elements* brings you the latest news and discoveries from our college. And this year, we are excited to also bring you a glimpse of the many discoveries from the college's past, as well as a look at what the next 50 years might hold. Thank you for being part of our history – and our future.

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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.

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!

COLLEGE OF NATURAL SCIENCES

From the Dean

I feel honored each day to serve as dean of such an incredible college that is educating the next generation of scientists and supporting globally impactful research. I am also grateful for the pleasure and the privilege of getting to connect with so many of you from our college throughout the year. Thank you for sharing your stories, your time, and your generosity.

This year is a particular honor to serve as dean as we celebrate the College of Natural Sciences' 50th anniversary. To mark the occasion, we have delved into the college's rich history – and the deep traditions of many of our disciplines that have been around far longer – to bring you an exciting look into our years of growth and discovery (read more on Page 8).

The college wouldn't be what it is today without generations of students who have come through, contributed to research, and taught us along the way. We have profiled several of these incredible alumni from the past 50 years (see Pages 16-23). To commemorate the first academic year of the college, 1968-1969, we also profiled two particularly inspiring alumni from those years (read more on Pages 6-7).

Although science is built on a strong foundation of the past, it is quintessentially a forward-looking discipline, one that is always striving to be better and to solve new problems. But it is not we who will be creating the future of science. It is the students we are training today. We spoke with a few of them to see what current and future global challenges they hope to use their education in the sciences to help solve in the next 50 years (read more on Page 25).

I will leave you with an insightful quote from one of our recent alumnae, Molly Corder (P.S.M., '18), who is putting her CSU train-

Botany Lab at CSU, 1929

Courtesy of University Historic Photograph Collection, CSU, Archives and Special Collections

ing to work implementing cutting-edge reproductive technologies to bolster populations of endangered and threatened species, including the northern white rhino. Corder says: “Don't ask yourself what you want to be when you grow up. Ask yourself which problems you want to solve in the world. When you figure out which problems you're called to solve, remember that solutions are possible. Get excited about what you love, and save the world!”

Here’s to the next 50 years of discovery – and beyond.

JAN NERGER, Ph.D.
Dean of the College

Faculty Updates – 2018

NEW HIRES

BIOLOGY
Marc Nishimura
Kristen Ruegg

COMPUTER SCIENCE
Francisco Ortega
Craig Partridge

PSYCHOLOGY
Michael Thomas

STATISTICS
Joshua Keller

TENURES AND PROMOTIONS

BIOCHEMISTRY AND MOLECULAR BIOLOGY
Jennifer DeLuca

BIOLOGY
Chris Funk
Shane Kanatous
Joe von Fischer

COMPUTER SCIENCE
Sudipto Ghosh
Shrideep Pallickara

MATHEMATICS
Jeffery Achter

PHYSICS
Mingzhong Wu

PSYCHOLOGY
Deana Davalos
Daniel Graham
Kimberly Henry
Matthew Rhodes
Jessica Witt

STATISTICS
Dan Cooley

NEW EMERITI

CHEMISTRY
Elliot Bernstein

COMPUTER SCIENCE
James Bieman
James Peterson

MATHEMATICS
Paul Kennedy
Kelly McArthur

PHYSICS
Steve Robinson

PSYCHOLOGY
Larry Bloom

IN MEMORIAM

BIOCHEMISTRY AND MOLECULAR BIOLOGY
Parviz Azari

MATHEMATICS
Howard Frisinger

PHYSICS
Harold Kaufman
Dale Winder

PSYCHOLOGY
Dean Miller

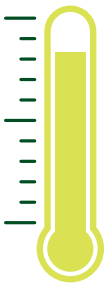
FIRST DATA SCIENCE MAJOR IN THE REGION

This fall, CSU became the first university in the Rocky Mountain region – between the Midwest and West Coast – to offer an undergraduate major in data science. Students in the new degree program, which is housed in the College of Natural Sciences, will take a foundation of computer science, mathematics, and statistics courses. They will also work together to complete group capstone projects before they graduate, solving real-world problems – with data.

DISTINGUISHED ALUMNI 2018

This year, the college is pleased to announce two distinguished alumni: Brent and Marianne Keeler. Dr. Brent Keeler (B.S., physical science, '74) worked as a physician at the Aurora Women's Clinic, where Marianne Keeler (B.S., biological science, '73) worked as a bookkeeper. Together, they have served hundreds of women and families.

$60M

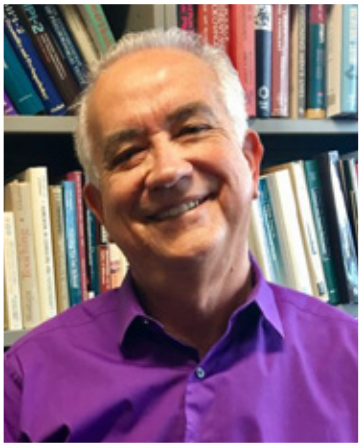


The College of Natural Sciences has a goal of raising $60 million by 2020 for the University's $1 billion State Your Purpose campaign.

CURRENT STATUS **$49 MILLION – AND COUNTING.**

COLLEGE PROFESSOR LAUREATES 2018

The college named psychology Professor Ernest Chavez and biology Professor Deborah Garrity as its 2018 professor laureates. Chavez studies emotional outcomes and ethnic and minority issues, and he delivered his laureate lecture in the spring. Garrity researches embryonic heart development and will give her lecture in the fall.



DIANA WALL INDUCTED INTO THE NATIONAL ACADEMY OF SCIENCES

Diana Wall, University Distinguished Professor and director of the School of Global Environmental Sustainability, was elected to the National Academy of Sciences this year. A member of the biology department, Wall studies soil ecology in Antarctica, which she has visited every research season since 1989. She is the namesake of the continent's Wall Valley. She is the 11th CSU faculty member – and first CSU female faculty member – to be named to the Academy.

MICHAEL SMITH SCHOLARS ENTER SECOND YEAR

This fall, the Michael Smith Scholars in Chemistry began their second year studying fully supported at CSU. Michael Smith, a former CSU chemistry student and energy entrepreneur, created 10 four-year scholarships for dedicated undergraduate students earning American Chemical Society-certified degrees.

Linda Randall at her restaurant with her husband, fellow biochemist Gerald Hazelbauer

ALUMNA SPOTLIGHT **LINDA RANDALL, CLASS OF 1968**

Uncovering Mechanisms of Life and the Thrill of the Experimental Hunt

LINDA RANDALL (zoology, '68) has spent her career studying how life works. "I was always interested in living things," she says. "It was, and still is, amazing to me that something is alive."

Randall is now a professor emerita of biochemistry and the Wurdack Chair Emerita of Biological Chemistry at the University of Missouri, Columbia. She is also a member of the National Academy of Sciences and the American Academy of Arts and Sciences. But decades ago, she was just another girl in Las Cruces, N.M., watching ants. "I spent hours noting their behavior and movements," she says. "Later, I dreamed of studying larger animals with more complex behaviors." But her academic journey took her to the study of life on a more micro scale.

As an undergraduate at CSU, she took as many biology and zoology courses as she could. Once she got to graduate school, studying molecular biology at the University of Wisconsin-Madison, this course work allowed her to spend the majority of her time in the laboratory. It was in the lab where she found her passion: experimentation. "As I was learning about science, I had thought that the thrill would be in having great insights," she says. But "once I started doing research, I realized that my greatest pleasure – and occasional insights – came in the course of the intense concentration required to perform complex experiments successfully."

Thanks to these successful experiments, Randall has helped to uncover how proteins are exported across cellular membranes. Moving new proteins across membrane barriers is essential for all living organisms, whether the bacterium she studies, ants, or humans. In particular, Randall discovered how specialized compounds work as "chaperones," shuttling proteins.

Randall joined the faculty of Washington State University in 1981 after working at the Pasteur Institute in Paris and at Uppsala University in Sweden. While at Washington State, she met Albert Yates, who would later become CSU's 12th president. "He was one of my great supporters," Randall says. "This included playing a character for a dance and pantomime I created for my Distinguished Faculty Address."

Before leaving Washington for the University of Missouri in 2000, and amid her scientific successes, Randall realized a dream of hers outside the lab: "The same week I was elected to the National Academy of Sciences, I opened Combray, a fine-dining restaurant in Pullman." In typical fashion, she had dived into the field: "I prepared for owning a restaurant by auditing most of the courses at a culinary institute," she says. "I was a scientist by day and a restaurateur by night. The years the restaurant was open were the most exciting of my life."

Although she is no longer waiting tables or assisting chefs after her days in the lab, she has plenty of old-fashioned scientific excitement in her life. "To me, it is a thrill every time an experiment gives a 'good result' – one that provides an insight, no matter how modest, about how living things work," she says. "These thrills are not frequent – most experiments have technical problems or generate confusing results. But for those of us in basic research, the thrills of a good result are worth the frustration of all the rest."

And she is still enjoying the valleys and peaks of the experimental hunt. Her research at Missouri is funded through 2020 by the National Institutes of Health. "I continue to get great satisfaction out of doing experiments," she says. "There are discoveries I still hope to make." ●

Duane Harris at the grand opening of the Biology and Chemistry Research buildings

DONOR SPOTLIGHT **DUANE HARRIS, CLASS OF 1969**

Alumnus Launches Career in Marine Sciences, Commitment to Education at CSU

FORT COLLINS might not seem, at first blush, to be the obvious launching place for a long career in marine science. But Duane Harris (B.S., biological science, '69) took his passion for the natural world and his CSU bachelor's degree to the coast of Georgia, landing a job with the state's Department of Natural Resources eventually becoming director of the entire Coastal Resources Division.

His love for aquatic environments came from the year his family was stationed in Guam, where he says, "if I wasn't in school, I was in the water." After returning to Colorado, Harris dived into science and mathematics courses in high school in Aurora. Despite that strong preparation, he still wasn't sure he could cut it in the sciences in college. So he started his first year as a business major. But he tested the waters – and soon discovered that he belonged in biology. There, he had two particularly influential professors in the areas of mammalogy and fisheries. "It really stimulated me to go further in science," Harris says.

After graduation, Harris was hired to be one of just four marine biologists for the state of Georgia. And they had their work cut out for them. "The first three years I was here, we were on the boat every day doing surveys of all of the marine resources along the entire coast of Georgia," he said. He felt more than well prepared – despite the unfamiliar terrain. "The education I got at CSU was very strong," he says. "I had a really good background on how to do science and on how to do scientific research." So he didn't mind spending his first few months on the job getting to know the Latin names of so many unfamiliar species.

Harris spent his entire career with Georgia's Department of Natural Resources, leading the Coastal Resources Division from 1983 until his retirement in 2002. Day to day, his work often extended beyond his official purview. "Fish don't seem to know state or federal boundaries very well," he says with a laugh. So he worked closely on cooperative regional management with the Atlantic States Marine Fisheries Commission and the South Atlantic Fishery Management Council, serving as chairman of both groups.

Throughout his career, his foundation from CSU and the college served him well. "I felt really good about the education I received," he says. He continues to support the college and University to make that education possible for the next generation by giving to the College of Natural Sciences Undergraduate Scholarship fund and the College of Natural Sciences Strategic Initiative fund. He and his wife, Carol, even provided an additional incentive gift for the college in this year's Love Your State Day of Giving challenge. "We have really committed ourselves to CSU and the College of Natural Sciences," he says. "CSU is our first love and where we feel appreciated for doing what we can do."

Although Harris still makes his home on St. Simons Island, Ga., he has started traveling back to visit CSU regularly. "I think what CSU is doing, with the new buildings, the great professors, and the fabulous students the college has; it's really so impressive," he says. "I appreciate everything CSU did for me – and continues to do. I see it every time I go back." ●

FEATURE

A HISTORY OF DISCOVERY

COLORADO STATE UNIVERSITY'S COLLEGE OF NATURAL SCIENCES: EST. 1968

IN 1968, science was at the forefront of the national consciousness. The U.S. was in the midst of the Space Race, *2001: A Space Odyssey* captivated popular audiences, and a semiconductor company called Intel was founded. Science was also on the minds of Colorado State University administrators as they launched a new college on campus: the College of Natural Sciences.

The disciplines represented in the College of Natural Sciences – biochemistry and molecular biology, biology, chemistry, computer science, mathematics, physics, psychology, and statistics – had strong foundations on campus going back long before the college was founded, with some reaching back even to the University's very first courses in the 1870s.

1870

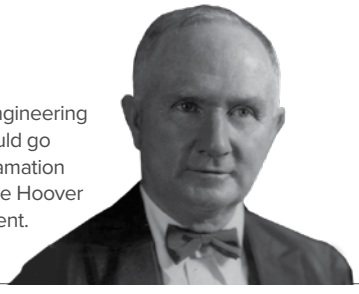
The Colorado Agricultural College is founded. Some of the first classes taught include botany, entomology, mathematics, and natural philosophy (physics). The University's first president, Elijah Evan Edwards, arrived in 1879 as a professor of physics and natural history.

1882

James Cassidy, an instructor in botany and horticulture, begins the collection that would become the CSU Herbarium, which is now the oldest in Colorado and holds more than 100,000 specimens.

1886

The Department of Physics and Engineering is created. Elwood Mead, who would go on to lead the U.S. Bureau of Reclamation and oversee the construction of the Hoover Dam, teaches in the new department.



1889

The Department of Mathematics is created.

1890

The Department of Zoology and Entomology is created.

1909

Physicist Charles Lory is named president of the University after leading the Department of Physics and Applied Electricity.

The Department of Botany and Forestry is created.

1925

The first course in statistics at CSU is taught by Andrew Clark, who would later serve as chair of the mathematics department as well as dean. He is also the namesake of the Andrew G. Clark Building.

1930

Ruth Ashton Nelson earns her M.S. in botany. Her thesis, *Plants of Rocky Mountain National Park* (first widely published in 1933) would become the original definitive guide to flora in the park.

1933

The Division of Science and Arts is created, led by G. H. Whiteford, head of the Department of Chemistry.

1935

The University is renamed Colorado State College of Agriculture and Mechanic Arts.

1955

Elmer Remmenga arrives at CSU as an experiment station statistician. He will later join the statistics faculty and help to establish scientific computing at CSU, obtaining grants for IBM mainframes that would become the first high-performance computers on campus.

1958

The name Colorado State University is adopted.

Faculty member Genevieve Garst teaches the first computer science class at CSU.

1961

Franklin Graybill establishes the Statistical Laboratory, which will later be renamed the Franklin A. Graybill Statistical Laboratory, also affectionately known as the "Stat Lab."

The Department of Mathematics becomes the Department of Mathematics and Statistics.

The Department of Psychology is created after separating from the education department.

1963

Faculty members Franklin Graybill and Alexander Mood publish the influential textbook: *Introduction to the Theory of Statistics.*

1965

The CSU observatory is opened on East Drive. Stuart Lincoln MacDonald taught astronomy in the mathematics department in the early 20th century and, in 1905, obtained the 4-inch telescope that would serve as the main telescope on campus for the next 60 years. Mathematics faculty member Leslie Madison succeeded MacDonald and helped bring the observatory – and its 16-inch telescope – to fruition. The facility would be renamed the Madison-MacDonald Observatory in 1986 and is still used today.

CSU physicist Saul Basri describes the operational foundation of Einstein's general theory of relativity.

1966

The Department of Biochemistry is formed, offering masters and doctoral degrees. The department begins offering undergraduate degrees in 1984 and is renamed the Department of Biochemistry and Molecular Biology in 1993.

1968

The College of Science and Arts splits to become the College of Natural Sciences and the College of Humanities and Social Sciences. Chemistry Professor William Cook serves as the first dean of the college until 1983.

1969

Mary Cleave receives her B.S. in biological science. Cleave would go on to work for NASA and crew two space shuttle flights, taking her 3.9 million miles. Her research included monitoring global vegetation.

The Meyers Reaction, an efficient way to make carbon bonds, is reported by chemistry faculty member Albert Meyers. Meyers would go on to be elected to the National Academy of Sciences in 1994.

1971

The Department of Statistics is formed.

A computer science section is created within the Department of Mathematics, and the department's name is changed to the Department of Mathematics and Computer Science.

John Gill receives his Ph.D. in mathematics, completing his dissertation on Möbius transformations under the supervision of Professor Arne Magnus. In addition to his career as a mathematician, Gill is credited with founding the climbing sport of bouldering.

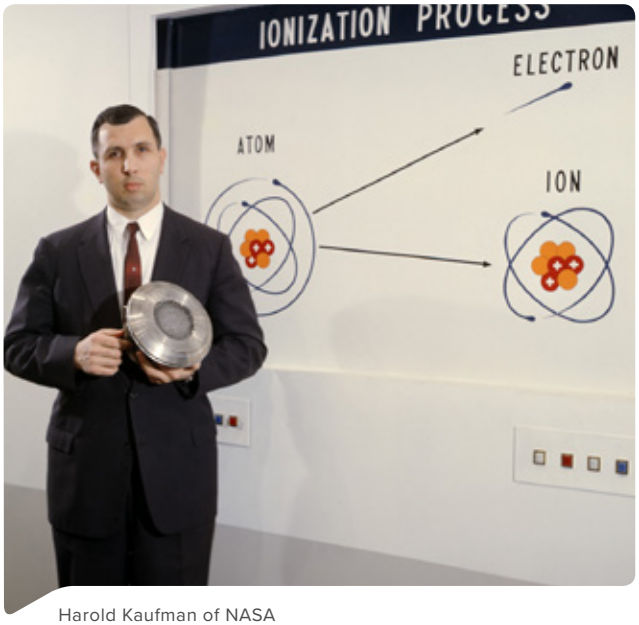
FEATURE

1972

CSU psychology faculty member Richard Suinn becomes the first U.S. Olympic Team sports psychologist. Suinn also served as chair of the department, mayor of Fort Collins, and, in 1999, president of the American Psychological Association.

1974

The Department of Computer Science is formed, offering a B.S. in the discipline. Graduate degrees would be offered starting in 1980.



Harold Kaufman of NASA

HAROLD KAUFMAN, who developed ion thrusters used on spacecraft, joins CSU as a faculty member in the physics department after earning his Ph.D. from CSU and working for NASA for 23 years. He would go on to serve as chair of the department and, in 2016, be inducted into NASA's Glenn Research Center Hall of Fame. He is the namesake of the Kaufman thruster.

1977

Howard Evans, a faculty member of zoology and entomology and expert in evolutionary biology, is elected into the National Academy of Sciences.

1978

The Stille Reaction, which is widely used in organic synthesis, is reported by CSU chemist John Stille.

Physicist Bill Fairbank measures the motion of a single atom using the photon burst method at CSU.

1979

Theoretical chemist and National Academy of Sciences member Marshall Fixman joins the faculty at CSU. Fixman's research focuses on polymer theory and critical phenomena.

1981

Ralph Christoffersen, a chemist with a background in mathematics, becomes CSU's 10th president.

1985

Jonathan Rubinstein receives his master's in computer science from CSU. Rubinstein would later work as a senior vice president of hardware engineering at Apple, where he helped to develop the iMac and the iPod.

1987

The departments of Botany and Zoology merge to form the Department of Biology.

1988

Mathematics faculty Aubrey Poore begins work on multiple target tracking, which will later spawn Numerica Corp., a successful aerospace engineering company.

CORPORATION numerica

1990

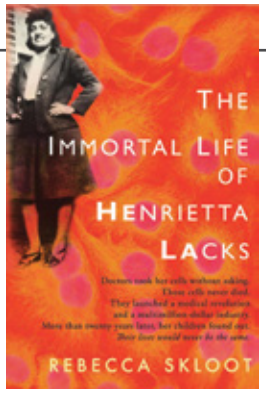
Albert Yates, a theoretical chemical physicist, is named president of CSU. He is the namesake of the Albert C. Yates Hall chemistry and biosciences building as well as the Albert C. Yates Chair in Mathematics.

1996

Adele Howe, of the computer science department, develops Savvy Search, one of the first meta search engines, or metacrawlers, deployed on the Internet.

1997

Rebecca Skloot receives her B.S. in biological science. She will go on to publish the bestselling book *The Immortal Life of Henrietta Lacks* in 2010, which wins numerous awards, including the National Academy of Sciences' Best Book Communication Award. It is later turned into a film starring Oprah Winfrey.



2000

Physicist Siu Au Lee is the first to cool atoms beyond the first column of the periodic table – and the first to cool atoms requiring ultraviolet lasers. The work would lead to CSU collaboration in a National Science Foundation laser cooling consortium with Harvard University, Massachusetts Institute of Technology, the National Institute of Standards and Technology, and Bell Labs.

1993

Mathematics faculty members Eugene Allgower and Kurt Georg publish *Numerical Continuation Methods,* a seminal book in applied mathematics.

1994

Jerry Deffenbacher, a psychology faculty member, publishes his influential scale of driving anger, or "road rage."

2001

The college creates a new Bachelor of Science in natural sciences with an emphasis on science educator training; the former physical sciences major becomes a concentration in this degree.

2002

The biochemistry department launches the first combined B.S./M.S. program at CSU.

2004

Psychologist Ross Loomis pioneers environmental psychology work at CSU with research on visual and noise pollution in natural areas.

2005

Biochemistry and molecular biology Professor Karolin Luger is the first faculty member at CSU to be named a Howard Hughes Medical Institute Investigator.

2006

Psychology faculty member Lorann Stallones discovers the link between the use of pesticides and depression in farmers.

2009

Biochemistry and molecular biology's Jennifer DeLuca is the first at CSU to be named a Pew Biomedical Scholar as a current faculty member by the Pew Charitable Trusts. Her research focuses on protein structures involved in chromosome segregation during mitosis.

2013

Faculty member P. Shing Ho is among nine biochemists worldwide to coauthor the official definition of the halogen bond for the International Union of Pure and Applied Chemistry, which was among the top 1 percent of citations for chemical sciences papers published that year.

Chemistry faculty member Amy Prieto develops a 3-D battery. The technology is on display at the Smithsonian Institution and is now used by the spinoff, Prieto Battery, which has received backing from Intel, Stanley Ventures, and others.

Prieto Battery

2014

The college launches an undergraduate major in neuroscience in collaboration with the College of Veterinary Medicine and Biomedical Sciences.

Atmospheric chemist and National Academy of Sciences member A.R. Ravishankara joins the chemistry faculty at CSU. He would later receive a scientific leadership award from the U.N. for his work on the Montreal Protocol and be named a University Distinguished Professor.

UNITED NATIONS

2016

Physics faculty Norm Buchanan, Bruce Berger, Walter Toki, and Robert Wilson are among the elite scientists to share the Fundamental Physics Breakthrough Prize for their work on neutrino oscillations.

2017

The college opens two new state-of-the-art science buildings on campus: the Biology Building and the Chemistry Research Building.

Biochemistry and molecular biology faculty member Tim Stasevich uses a custom-built imaging system to observe for the very first time single-molecule RNA translation dynamics in living cells.

2018

Diana Wall, a professor of biology, University Distinguished professor, and director of the CSU School of Global Environmental Sustainability, is elected to the National Academy of Sciences. She is CSU's first female faculty member to join the Academy.

The college launches the first undergraduate major in data science in the region.

FEATURE

THE NEXT 50 YEARS OF DISCOVERY

FIFTY YEARS AGO, we could not have foreseen the impact and power of big data or the depths of insights we would obtain about the human brain. What might seem like obvious trajectories today – nucleotide base pairs discovered in the lab transforming into personal genomic testing or information theory laying the foundations for online security – were unknowns in 1968.

So where will today's sciences take us in the next 50 years? Our college's departments weigh in on where their disciplines might lead by 2068.

BIOCHEMISTRY AND MOLECULAR BIOLOGY

"It is possible that we will have created from scratch a living organism capable of replicating and responsive to external stimuli. The neuronal network of an individual human brain will be completely mapped and reproduced electronically, raising questions such as: What is artificial intelligence, and what does death really mean? Individually tailored and personalized cures will be available, including gene editing. Moreover, gene editing will have gone beyond curing genetic diseases, extending to elective genetic cosmetic surgery."

CHEMISTRY

"One constant in chemistry is that its practitioners have one foot in discovery and the other in practicality, seeking to address the challenges facing humanity. In the short term, I think we will find new solutions to energy and environmental problems, and I think we will make serious strides in fighting cancer. Longer term, I hope that we will learn to solve current problems – and invent new materials for problems that don't exist yet – with a better appreciation for long-term consequences."

BIOLOGY

"The ability to manipulate genomes will continue to improve, especially with techniques for moving traits among organisms. Some of this will be on the level of single cells, with implications for cancer therapies. Biofuels will be common. Understanding the microbial world will be common. Climate change will have moved the distributions of plants and animals, with challenges for conservation and for agriculture. Computation, especially visualization, will be a basic part of all students' training and experience. And we will use bigger data than what we use now. But in the end, biologists love living things, so that part of biology will remain the same."

COMPUTER SCIENCE

"Computers will continue to get ever-more embedded into our lives, both for work and play. I think the overall trend of the next 50 years will be continuing to shape the computers to better fit humans – rather than forcing humans to fit computers. Twenty years ago, we had to type information into our computers. Now we speak to them, and we're on our way to gesturing and eye-tracking."

MATHEMATICS

"Researchers in the mathematics department will develop theoretical understanding of asymptotic and nonlinear modeling of data, providing the underpinnings of practitioners of data science across nearly all disciplines. New hybrid medical imaging techniques will be invented. Mathematicians will create ingenious new mathematics. And our researchers will be at the center of a data-driven approach to understanding how students learn mathematics at the collegiate level, causing dramatic reduction in differences in success rates between genders."

PHYSICS

"We will have a better handle on the differences between matter and antimatter in many different ways that address important unknowns about how the universe is constructed. Our control over small gases of atoms will likely progress to close to the limit of what is possible, and this will result in new computing techniques via quantum computation and new ways of measuring time, accelerations, electric and magnetic fields, and gravity. We will continue to see the development of new materials and will likely be able to predict and design useful materials to a much greater extent. But the most exciting possibilities for the next 50 years will be surprises."

PSYCHOLOGY

"In the next 50 years, psychology will enable: breakthroughs in our cognitive neuroscience understanding of human memory in health and disease; a data science revolution in human resources; development of direct brain-machine interfaces through permanent implants in the cerebral cortex; and the development of new behavioral therapies to treat addictions."

STATISTICS

"There will be increasing focus on developing new statistical models along with new statistical tools for complex systems. Statistical computations will continue to be a major driver in the development of high-performance computing capabilities. There will be much tighter integration of statistical models for data with mathematical models for processes principles; the treatment of scientific models as 'black boxes' will become less common. The uncertainty qualification and reproducibility of results and predictions will become increasingly important."

The next 50 years of science will be big – and big-time interdisciplinary – with scientists approaching the same important problems together, from different areas of expertise and experience. Making all of these discoveries will be the students being educated today.

"The future of science and education in the sciences is a dynamic and challenging one, therefore it must also be an inclusive one," says Jan Nerger, dean of the college. "We will need all of the creative thinking and diversity of approaches we can get to tackle the global challenges we will face over the next half-century." From artificial intelligence to climate change to global pandemics, she notes, the sciences will be essential in creating a sustainable future for later generations.

"The best way to create a scientific culture that can really tackle these issues is to ensure we have education in the sciences that is open and accessible to all," Nerger says. The college has laid strong foundations for this future. "We are incredibly proud of what we have done to support world-changing research and broad educational and outreach opportunities over the past 50 years. Our work, however, has just begun," she notes. "We must keep striving to do even more for the next 50 years – and beyond."

Consulting Career Launched Amid Rattlesnakes

ROCCO FABIANO | B.S., ZOOLOGY, '78; M.S, BIOCHEMISTRY, '80

Sometimes scientific advancement requires extreme measures. Like creating a lab that houses hundreds of rattlesnakes. "Periodically, I would hear screaming and would realize that my girlfriend – now my wife – had come to visit me and turned left one office too early," recalls **Rocco Fabiano** (B.S., zoology, '78; M.S., biochemistry, '80), now president and CEO of Ygrene Energy Fund.

Fabiano ended up working next door to so many snakes after having discovered an interest in organic and physical chemistry while a zoology major at CSU. Biochemistry Professor Anthony Tu recruited Fabiano for a master's degree and to work on a grant Tu had received to develop antivenoms for rattlesnakes.

After Fabiano completed his rattling graduate work at CSU, he earned his M.B.A. from Cornell University, hoping to go into consulting for the biotech industry. But he was actually too far ahead of the curve and found that, "they were not yet hiring consultants," he recalls. His subsequent career in financial consulting, however, has still drawn deeply on what he learned in the department. "I found that applying the analytic discipline I learned in biochemistry to business problems gave me a tremendous advantage," he says.

In addition to its benefits, "I really enjoyed studying biochemistry because it spans such a wide range of areas of interest to all of us," Fabiano says. "Understanding biochemistry on a global scale is central to investigating the evolution of our planet and in trying to improve our world's ecosystems. On a more personal scale, understanding biochemistry is essential to studying our moods, our relationships, and our overall health," he says. "Biochemistry touches every aspect of our life and our world."

PAVING A PATH AS A FIRST-GENERATION STAR STUDENT

Luke Sylvester arrived at CSU from Southern California planning to become a veterinarian. Now the second-year biochemistry student has his eye on medical school. "CSU has definitely helped evolve my career path in a way I wasn't expecting," he says. Sylvester still finds time to work as a veterinary technician, which is impressive because in addition to being a biochemistry major, he is also president of the Biochemistry Student Association, a biomedical engineering minor, the senator for ASCSU's Pride Office, an Inclusive Community assistant, and a member of Theta Chi fraternity. He also works as a research assistant in a lab on campus, studying peptides in brain neuropathways – research that won him college honors at the annual Celebrate Undergraduate Research and Creativity showcase.

Of all of Sylvester's varied activities, however, he says, "the most exciting part is just being able to get a higher education. I'm the first in my family to go to college. Being given the chance to go and get that education in a field that I love, I hope that helps pave the path for my younger brother as well."

UNCOVERING THE MYSTERIES OF DNA

Science continues to unravel the inner workings of our DNA. Some of those secrets have been unveiled in part by Professor P. Shing Ho. His work has delved into, as he puts it, "the structures and structural gymnastics of nucleic acids and their function." In particular, his research is working on ways to use halogen bonds to control molecular structures for bioengineering and drug design. His work on halogen bonds has gained him international renown in the field as well as the 2018 Scholarship Impact Award, which recognizes work that has had a major impact in the world.

Scientific Foundations for Leadership

MARCIA BANKIRER | B.S., BIOLOGICAL SCIENCE, '74, M.ED., '75

Marcia Bankirer (B.S., biological science, '74; M.Ed., '75) was drawn to CSU, like so many, "by the idea of veterinary medicine," she says. Once she began studying here, however, she says, "my interest in biological science and my initial classes and faculty broadened my interest beyond animals."

Bankirer's subsequent career has certainly taken her far beyond animals. She is currently dean of Pacific Oaks College in California. She has also served in leadership roles at Argosy University, Central Michigan University, the Denver School of Nursing – and CSU, where she was associate provost for continuing education. "Although I 'left' science to go into education," she says, "my science background has given me research, scientific, and systems-thinking skills that assisted me through my doctorate and in all of the higher education administrative roles I have been in."

Additionally, she still has a deep appreciation for the experiences the biology department, CSU, and Fort Collins provided for her. "That was where most of my pivotal life moments occurred," she says. "CSU developed my curiosity and inquiry."

FROM THE UNITED ARAB EMIRATES TO CSU

Naomi Mathew traveled a long way for her first class as a biological science major at CSU – all the way from the United Arab Emirates. "My biggest fear about coming to the States was that I would be all by myself," she says. "But that was so wrong – I started making friends the first day." Mathew is now in her third year and finds the course work challenging but interesting – and the faculty accessible. "I want to be a veterinarian one day," she says.

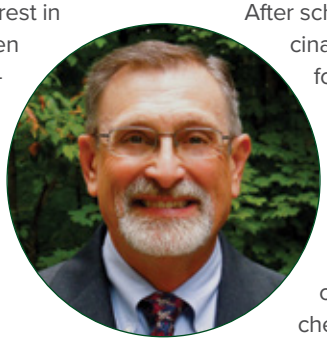
PLAGUE MAY LURK IN AMOEBAE

The plague bacterium that caused the deadly Black Death in the 1300s, *Yersinia pestis* might find safe haven in single-celled amoebae hiding in the soil. This discovery suggests a reason why outbreaks seem to come and go unexpectedly. The work, which was published in *Emerging Infectious Diseases*, was led by David Markman, a graduate student in the Department of Biology working with Professor and Chair Michael Antolin.

While plague does not currently cause widespread outbreaks, it does persist in wildlife and still infects humans in some places, including sub-Saharan Africa and Madagascar. In Colorado, it spreads among prairie dogs and other burrowing rodents. Unlike many infectious diseases, plague seems to reappear in the same strain, suggesting that the bacteria are lying in wait. Amoebae are unusual suspects to harbor bacteria, which they usually destroy. But, says Markman, "the bacteria were surviving and actually quite happy inside the amoebae." For his work, Markman also received the Young Investigator Award from the American Society of Tropical Medicine and Hygiene.

R&D – and Inspired Discovery

GLENN BOUTILIER | B.S., CHEMISTRY, '74

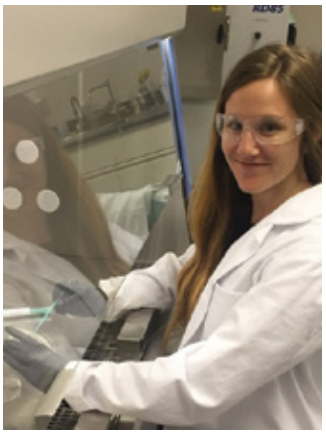


Glenn Boutilier's (B.S., chemistry, '74) early interest in chemistry was catalyzed by faculty at CSU – even before he enrolled. "Professor George Splittgerber took an interest in a prospective student during a campus visit, and I knew I wanted to choose CSU," Boutilier recalls. Splittgerber became Boutilier's adviser – but was far from his only mentor here. "Professor Rodney Skogerboe gave me a view of working on large real-world environmental problems with lots of different parts. Some of the chemistry graduate students 'adopted' me, and I learned firsthand what was required to be successful in graduate school before I even started," he says.

After school, Boutilier continued to work in the subject that fascinated him. "My CSU education gave me the foundation for a 35-year career as a research and development scientist and chemical problem solver at Procter & Gamble," Boutilier says. "The processes to manufacture those products were skills I began developing at CSU."

Even after a long career in analytical and polymer chemistry, he says he still marvels at the basics of chemistry. "I still love to look at the periodic table and see how chemical properties and the arrangement of protons, neutrons, and electrons come together."

BANISHING BACTERIAL BIOFILMS



By 2050, infections from antibiotic-resistant bacteria will outpace cancer and cardiovascular disease to be the most common cause of death in the U.S. CSU chemists are working to combat these brutal bugs without the use of more antibiotics.

One way these tough bugs invade is by forming dense biofilms. "Biofilms are nasty once they form and are incredibly difficult to get rid of," says graduate student Bella Neufeld. So she, Melissa Reynolds, who is an associate professor and the associate dean for research, and their colleagues are developing new materials that inhibit the formation of these films in the first place. Such a surface could not only prevent infections but could also reduce our reliance on antibiotics – which fuels the creation of new superbugs.

Their material is a copper-based metal-organic framework. When tested against the particularly virulent bacterial strains of *Pseudomonas aeruginosa*, their material led to an 85 percent reduction in the bacteria – "a remarkable impediment of biofilm formation to achieve, given the strength of this bacteria strain," Neufeld and her colleagues concluded in their study.

MAKING WAVES IN CLIMATE RESEARCH WITH A NOAA SCHOLARSHIP

Climate change is already having a major impact on marine environments. And undergraduate Jarod Snook is eager to contribute to the research to better understand these changes. Snook, a third-year chemistry major, is the recipient of a two-year scholarship from the National Oceanic and Atmospheric Administration, which includes funding support for his academic work at CSU as well as a summer internship at a NOAA facility of his choosing next summer. He plans to apply what he has learned so far in chemistry to research human impacts on marine environments – as well as to advocate for environmentally friendly government policy.

The Art and Science of Computer Science

VASUDEV BHANDARKAR | M.S., COMPUTER SCIENCE, '82

Vasudev Bhandarkar (M.S., computer science, '82) sees within the field of computer science both a logic and an art. He has taken that blended sensibility to create a career in the field that has contributed to large corporations and successful startups. But in 1980, he was just looking for a computer science program with good access to hiking trails. And he found one – one at the foot of the Rocky Mountains, no less.

Bhandarkar arrived at CSU, sight unseen, in the middle of winter from Mumbai, India. "It was the first time I'd seen snow in my life," he recalls. He had undergraduate and master's degrees in physics, as well as a certificate in computer science from university in India and was ready to tackle the CS field. "I may not have been a hardcore computer science major, but the department's ecosystem was very supportive, and I learned a lot," he says. After graduating, Bhandarkar worked for Bell Labs in Westminster, Colo., before moving to an even snowier climate in New Hampshire to work for Digital Equipment Corp. After that – and a couple years at Apple – Bhandarkar struck out on his own in 1994, founding and running companies that have been valued in the billions.

"I've been very fortunate as an immigrant kid to be able to start my own companies and create thriving new businesses in America," he says. "And I've been able to leverage that bounty to create new things – it's like a work of art; I like to bring that creativity to work."

Bhandarkar's current company, ScoreData, uses business data to help clients make predictions about consumer behavior. "So now I'm in the data science field," he says. "I kind of envy the students who will come to the new CSU data science program and learn in this new phase of the industry."

FIXING THE INTERNET

In the early days of the Internet, if you found a problem, it was often your challenge to fix it. So when Craig Partridge, then an employee at BBN Technologies (now part of Raytheon) and a graduate student at Harvard University, discovered a major bug in how e-mail was routed, he was told to go fix it. His fix ended up being good enough that we still use it today. Several years later, he also realized that Internet routers had internal speed limits, which might be able to be broken. So he led a team that found new internal architecture for routers, a solution that is also still in place. For this pioneering work, he was inducted into the Internet Hall of Fame in 2017.

After 35 years with Raytheon BBN Technologies, most recently as chief scientist for networking research, Partridge joined CSU this summer as a professor and chair of the department.

MICRO SOLUTIONS FOR MACRO PROBLEMS

In an era of smart watches, virtual assistants, and self-driving cars, technological inefficiencies would seem to be long gone. But looking closely at today's devices, computer science Assistant Professor Louis-Noël Pouchet sees plenty of them. Specifically, he sees compilers, designed for an era of single-processors, that can't keep up – sapping productivity, time, and energy.

"This is a problem that everyone has, yet nearly no one realizes," Pouchet says. He is developing a new and sustainable approach to optimizing compilation that uses automatic program generation and deep learning techniques. His work has the potential to increase the battery life of handheld devices as well as to improve high-performance computing applications, such as those used to mine genome data or diagnose diseases. Pouchet recently received a five-year CAREER Award from the National Science Foundation to support his research – as well as his efforts to bolster teaching about compiler optimization, which will help make large-scale improvements in this area more, well, efficient.

DOPPLER TO DEFENSE:

A Far-Reaching Mathematics Career Trajectory

KIM KERRY | B.S., MATHEMATICS, '72

Kim Kerry (B.S., mathematics, '72) discovered the power and draw of mathematics in school while his family was living abroad in India. By high school, he was presenting projects on the Doppler effect. "By that time, I was hooked," he says. He found that mathematics also served as the underpinning for the new field of computer science. When he was sudying at CSU in the 1960s and '70s, "software development was in its infancy, and there was a heavy reliance on mathematics," he says. That intersection helped shape his long-term career trajectory.

Kerry retired in 2016 as a vice president at Raytheon Command, Control, Communications, Computers Systems & Intelligence, which specializes in air, land, radar, traffic management, and public safety systems. Concurrently, he was CEO for Thales Raytheon Systems Co. LLC, which delivered large-scale systems and 3-D air defense radars. Previously, he served as director of Middle East Operations for Hughes Aircraft Co. and provided leadership and technical direction for defense systems used in Egypt, Saudi Arabia, and South Korea.

"The mathematics and related computer skills that I gained at CSU have remained at the core of my ability to understand complex problems," he says. "From my first job as a computer analyst after graduating from CSU, through the ranks of defense electronics companies, I have fallen back on my education," he says. "Little did I foresee that I would end my career leading a large organization that produced various types of radars and air traffic and command and control systems worldwide. The skills I learned early in my life, including my four years studying mathematics at CSU, made this possible."

BETTER APPLIED SCIENCE – THROUGH MATHEMATICS

Professor Wolfgang Bangerth works at the intersection of mathematics, computer science, and engineering, and his research and resulting software packages are used the world over.

ELEMENTS: *How does mathematics underpin your work?*

BANGERTH: I work with mathematicians to develop the mathematics that underlie computer simulations of processes – think, how air flows around a wing or how an object deforms when you apply an external force. And I work with applied scientists – geoscientists, physicists, fire modelers, biomedical engineers, and others – to apply these mathematical techniques in actual applications.

ELEMENTS: *How does your computer software come into play?*

BANGERTH: The motivation for all of this is that today, most processes in engineering and the sciences are modeled on the computer before they are implemented. In many cases, it is cheaper to do this than to build prototypes. In other cases, is it simply not feasible – for example, if you wanted to understand how Earth's interior moves or how galaxies form.

ELEMENTS: *How do you help to bridge these disparate fields?*

BANGERTH: There is a need for engineers who understand how to do these kinds of computer simulations. There is a need for mathematicians who understand the tools that underlie these simulations and who can develop better methods. And there is a need for computer scientists who know how to translate mathematical techniques into software that can be used for such simulations. I am a bit of all three.

ENGAGING UNDERGRADUATES IN RESEARCH

This past summer, 16 CSU undergraduates had the opportunity to participate in firsthand mathematics research. The students, led by Professor Rachael Pries and Associate Professor Patrick Shipman, delved into dynamic projects, including: "points on curves and error-correcting codes," "hyperbolic geometry: dynamics and Julia sets," and "vaporchromatic and microweather patterns." This program was funded through a National Science Foundation grant, the college, and the department.

FROM MUNITIONS TO THE MAGIC KINGDOM

Alumna Finds Physics Everywhere

LYN YUCUIS | B.S., PHYSICS, ’81

For alumna **Lyn Yucuis** (B.S., physics, ’81), her physics major took her on a career ride she never could have anticipated. An inspiring high school teacher set her on track to study physics in college. And once she arrived at CSU, she says, “I really liked all the physics courses because they showed how physics is everywhere.”

Since graduating, she has indeed found the discipline everywhere. She first put her CSU physics education to use in the U.S. Air Force as an aircraft and munitions maintenance officer. From there, her career took off with The Walt Disney Company. In addition to her work in security operations management there, she helped start an education program for student groups. She designed “Physics in the Magic Kingdom” to be interactive in “explaining the physics involved in the different attractions at Walt Disney World,” she says – from the monorails to Space Mountain. “We were trying to get kids interested in physics and not be intimidated by it. I think we were successful, as the program is still going strong at Disney after 20 years!”

Yucuis retired from Disney in 2014. But she is still putting her physics background to work, and it is working to her advantage. “I now spend my time golfing with my husband and friends – lots of physics involved in golf!”

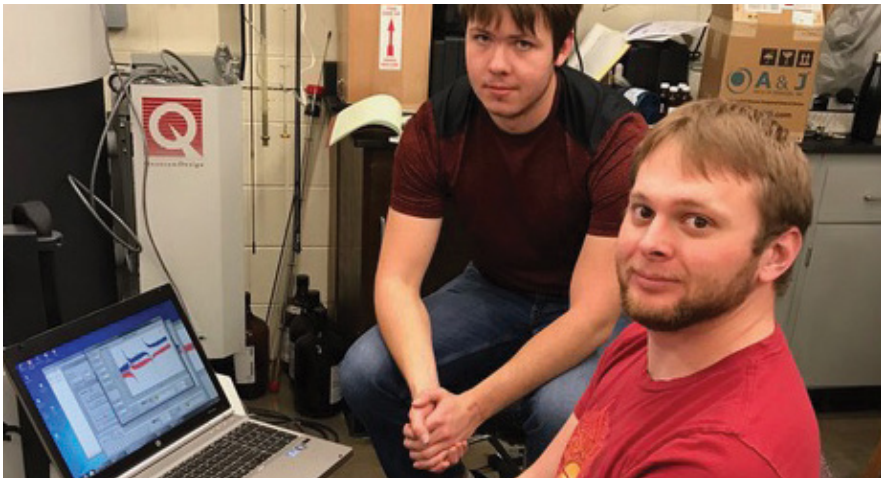
UNFRUSTRATED PHYSICS

Kate Ross works in the world of quantum frustrated magnets. But her work itself has been anything but frustrated. The assistant professor was recently awarded an Early Career Research Program Award from the U.S. Department of Energy. Just prior to that, she received the Oxford Instruments Lee Osheroff Richardson Science Prize for North and South America, the American Physical Society George E. Valley, Jr. Prize, and was named a Canadian Institute for Advanced Research Azrieli Global Scholar. Her internationally recognized research employs neutron scattering techniques to better understand exotic magnetic ground states.

UNDERGRADS TACKLE QUANTUM MECHANICS

While most undergraduate students only dip their toes into the vast waters of their majors, fourth-year student Andrew Sexton and recent graduate Aaron Glock (B.S., physics, ’17) have taken the full plunge. They have become valuable lab assistants exploring the effects of quantum mechanics on magnetic systems. They have also developed and tested a new resonant ultrasound spectroscopy insert probe designed to measure the vibrational frequencies of materials in extreme environments, such as temperatures as low as two Kelvin and magnetic fields up to nine Tesla.

Although the work is far beyond what they learned in class, they approach it with an open mind. “I’m probably only understanding a fraction of what’s going on,” Glock said. “But everyone can do it. You just have to stop telling yourself that it’s hard.”



Making a Career About People

VICKY FARROW | B.S., PSYCHOLOGY, ’72; M.S., CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS, ’75

Vicky Farrow (B.S., psychology, ’72; M.S., child development and family relationships, ’75), arrived at CSU from her hometown of Golden, Colo., with an interest in people. She toyed with the idea of becoming a social worker or studying sociology, and she eventually landed in the psychology department. “I found that I loved the content of psychology courses, so I knew I chose the right major,” she says. Starting her second year, “I had one of the most incredible opportunities – I got to be a paraprofessional in the Counseling Center. I was able to put into practice things I was learning in class – and that had a lifelong effect on my career.”

She spent most of her career in organizational development and leadership for major corporations, including AT&T and Sun Microsystems. “My real specialty is around change management and executive development, she says. My focus has always been on the broader system, and that came from my experience at the Counseling Center. They were doing organizational development before it was even a thing.”

Now, Farrow and her husband own Amista Vineyards in California. Even in this new chapter, she says, her experience as a psychology major at CSU “affects everything I do – even in the wine business. Because it’s not only about the subject matter – it’s about the people.”

A STATISTICALLY SIGNIFICANT PATH

Honors student Kirstyn LeCavalier has found her passion in clinical and counseling psychology, which aligns with her “desire to make a difference in the world,” she explains. And she has already begun doing just that through her research into addiction psychology – research she started her first year at CSU. “I find this field incredibly interesting,” she says. “Working with Assistant Professor Mark Prince and the students in his lab has changed my life and career. I have been given endless opportunities and support.”

LeCavalier, who is this year’s president of Psi Chi, is also leveraging a minor in statistics to bolster her work in psychology. “Once I began doing research, I fell in love with the combination of statistics and psychology,” she says. “I think it is absolutely incredible that we can take a dataset that is only a table of information and produce results that translate into qualitative data that is significant for people’s lives.”

IS DÉJÀ VU RELATED TO PREMONITIONS?

For some people who experience déjà vu, the strange feeling has an eerie twist: they feel like they also know what is going to happen next. Professor Anne Cleary has built on her previous déjà vu research to test whether this phenomenon might be due to a recalled memory of a similar situation. Showing study participants different scenes with similar layouts, the researchers asked participants experiencing déjà vu whether they felt like they knew what would come next – and if so what. During déjà vu, many people indeed felt like they knew what would happen next. But it turns out that their predictions were only as likely as random guesses to be correct. And so that feeling of déjà vu-triggered premonition turns out to be only that – just a feeling.

Creating a Foundation for the Next Generation

LESLIE BUTTORFF | B.S., STATISTICS, '79

As a high school student at Wheat Ridge High School in Colorado, **Leslie Buttorff** (B.S., statistics, '79) was interested in art – as well as in mathematics. "One day in my math class, someone came in from CSU and talked about statistics and all of the career opportunities using this degree, so I was sold," she says.

While at CSU, Buttorff says, "the statistics classes that focused on real-life problems were my favorite." As an undergraduate, she got involved with the Franklin A. Graybill Statistical Laboratory, where she did work for local businesses and the College of Veterinary Medicine. "These were very interesting assignments," she recalls. After CSU, she completed graduate school at Iowa State University.

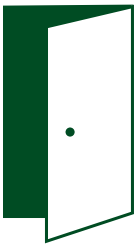
Her career has taken her into management consulting, where she has helped create forecasts for utility companies and assessed failure rates of equipment parts for nuclear power plants. She is currently CEO of Quintel-MC Inc., which focuses on enterprise resource planning. "In my career, I have always had uses for various statistical analyses, analysis of data, sampling, and financial forecasting," she says.

But she never imagined she might have such a successful career path thanks to statistics. In fact, she counted herself lucky to get to go to college in the first place. To pay for college, "my grandparents loaned me $1,000, and I worked all summer as a lifeguard and swimming coach – and I was also able to get a loan," she says. To help future students like herself, she has created the Leslie Cavarra Buttorff Scholarship in Statistics. "We have had five students in the program, and I hope it continues for some time," she says.

A CENTER FOR SUCCESS

The department launched the **Statistics Success Center** in Fall 2017. The Center offers walk-in help to students taking courses in statistics and is staffed by course instructors as well as graduate and undergraduate statistics students.

THE STATISTICS SUCCESS CENTER'S SUCCESS STATISTICS:



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STUDENT VISITS

FA 2017-SP 2018

UNCOVERING GAPS IN MENTAL HEALTH CARE FOR VETS

Accessibility and quality of services across the U.S. Department of Veterans Affairs health system have left a substantial unmet need for mental health services among veterans, according to a recent report from the National Academies of Sciences, Engineering, and Medicine, which was co-authored by CSU statistics Professor Jay Breidt.

Breidt is an expert in design and analysis of complex surveys and served on the national panel for the report. "When the analysis of the survey results came in, our role was oversight and interpretation of the results – and translating them for the clinicians and social scientists," he says. This is the fifth National Academies panel Breidt has served on.

COLLEGE COMMUNITY

SEEING YOURSELF IN SCIENCE

SCIENCE IS FACING A CHALLENGE. "We know that science employers and medical schools are looking for diversity and differences of thought and experience," says Alexandra Keller, coordinator of the College of Natural Sciences Learning Community, a residential community in the college. "But, by and large, as a society, we don't have that pool."

Part of the reason for that shortcoming is that, in the sciences, there are still "significant gaps in retention and success for low-income students, students of color, LGBTQ students, students with disabilities, and students who are the first in their families to go to college," Keller says. "So we wanted to create a space for students who may not feel a sense of belonging in science – or in college – to have a sense of community, to feel their identity is welcome and that they can bring their whole selves into their major and into the sciences," she says.

So the Science Outreach Scholars program was born. Working with a faculty member in the School of Education, Keller created an evidence-based program that incorporates a residential component, an academic seminar, and outreach. Now in its third year, the program has been incredibly successful, not only working toward improving retention among students, but also in creating a pipeline of mentors and leaders – and in changing lives.

"I had no idea this was something I needed in my life," says Kylie Contreras, a third-year biological science major from San Marcos, Texas, who was in the first class of Science Outreach Scholars and is now a peer academic leader for the program. "Being on the [program's dedicated] floor, being in the class – the extra support was fantastic. That's why I came back to work with the group."

Each year, of the 400 students entering the college's Learning Community, 40 are accepted into the Science Outreach Scholars. In their first semester, in addition to taking a dedicated seminar, students work with an outreach program in the college, such as the tutoring program Triunfo or the Little Shop of Physics, which brings hands-on activities to classrooms and communities.

Marcela Riddick, a third-year zoology and Honors student who came to CSU from Southern California, embraced the outreach experience. "My favorite part was seeing those kids and watching that click when they get engaged," she says. "You would see them start to question, and that was the best moment. Because for me, that's what science is: questioning what's around you."

Jumping right into outreach also catalyzes something for many of the new CSU undergrads. "Students who arrive and don't know if they belong or have what it takes to be here, all of a sudden, in that moment, they are the teachers, they are the cool college kids," Keller explains.

And this transformation goes two ways. As the CSU students discover their roles as scientific leaders, the children they're working with see them in that capacity – and start to be able to see themselves there too. Research has shown that very early on, children develop ideas about what paths are accessible to them – decisions that are often based on personal experience and identity. So seeing people in science who are familiar to them can spark a new idea about what is possible. "Sometimes kids can articulate, 'you look like me,' 'you sound like me,' but it is usually just the way they light up," Riddick says. "This program has been the most impactful experience that has ever happened to me," she says. "The way the group pushes me is why I stay – because I know there are a lot of other brains out there like mine that need that." •

STUDENT SCIENTISTS

SOLVING THE GLOBAL CHALLENGES OF

THE NEXT 50 YEARS

MEET FOUR OF OUR UNDERGRADUATES, WHO HAVE BIG PLANS ABOUT HOW THEY WILL PUT THEIR COLLEGE OF NATURAL SCIENCES EDUCATION TO WORK SOLVING SOME OF SOCIETY'S BIGGEST CHALLENGES.

JORDAN ADAMS

Psychology and computer science double major, class of '22

"Our lives are a constant stream of data. All of our personal data is being collected en masse and being used for various purposes. This private information is constantly falling into the wrong hands, which puts the financial stability and safety of countless Americans at stake. This is why I plan to use my psychology and computer science degrees to contribute to the world of cybersecurity. It is my dream to make the world around me better for the people who inhabit it."

LENA BRUNO

Physics major, class of '20

"I want to use my education to tackle the issue of sustainable energy. Any pathway that we use to transport electricity creates resistance, which causes a loss of energy. Physics has the potential to solve this problem using superconducting metals. This technology exists but it is not feasible for public use yet because superconduction only happens only at an extremely low temperature. I hope to develop an alloy that superconducts closer to room temperature and, ultimately, eliminate a major hurdle in the quest for clean energy."

ANGIE HERNANDEZ

Biological science major, class of '21

"My education from CSU will help me solve many issues in my home country of Honduras. Using my biological science degree to bring sustainable food and clean water sources to my country will be only the beginning. My degree from CSU will be the solid foundation to the change I will make in my country and hopefully around the world. Giving back to people is what I strive to achieve, and with the help from CSU, I know it is a possibility."

LUKE EWAN

Applied computing technology major, class of '19

"My education at CSU and in the College of Natural Sciences has helped me to understand the power of working as a team. There are always going to be different challenges we face. But it's clear that any challenge can be overcome if we put our minds to it. I dream of inspiring others to find a passion for learning so that they can empower their communities, their friends, and their families so that their education can continue, like mine has."

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