STATE

MAY 2020

A SPECIAL ISSUE FROM COLORADO STATE UNIVERSITY AND THE CSU SYSTEM

[Letter From *the* / EDITOR]

CONNECTING DURING A PANDEMIC

We are reaching you with three special issues this spring and summer – combining *STATE*, the magazine of the CSU System, and *Colorado State Magazine*, the publication for alumni and supporters of our flagship university. These issues are smaller, more frequent, and are mailed to a combined readership. This allows us to conserve resources while staying in touch during a critical time.

It is stunning to consider: A microbe is behind this. A germ – something we cannot see – sparked the COVID-19 pandemic and is wreaking havoc on human health and economies.

Here are a few more things we cannot see, things essential to getting through: ideas, knowledge, determination, and humanity.

Colorado State University and the CSU System are reaching out to you in this historic moment because you are in our closest circle – alumni, coworkers, parents, partners, policymakers, supporters, friends. People who, like us, care deeply about higher education and its critical role in preparing leaders, developing a skilled workforce, driving a vibrant economy, and improving quality of life in Colorado and around the world. This work has proved vital many times over; now it is essential to recovery.

Just two months ago, as the pandemic grew urgent in the United States, the mechanics of higher education took the fore. Our physical campuses emptied; our work moved online. Our faculty and students convened using tools of the Internet. Our staff worked remotely to support academic missions in teaching, research, and engagement. Our leaders also collaborated virtually to quell the spread of disease. This is innovation in action, involving tens of thousands of students, faculty, and staff.

Yet, these mechanics are a means to our real work: ensuring an energetic flow of ideas, knowledge, determination, and humanity for the benefit of society. Discovery is the heart of our work, and it is heartening to see untiring commitment to it across our campuses, even as they have functioned largely in a virtual sphere.

Normally, our team would be producing the June issue of *STATE*, the magazine of the CSU System, followed by the September issue of *Colorado State Magazine*, the publication for CSU alumni and friends. But this is not a normal time, not by a long shot. So our plans changed; we're reaching you with three special issues that save resources and help us stay connected at a pivotal time.

With these issues, we hope to share a sense of how our System and campuses are responding to the COVID-19 pandemic to uphold our higher-education tenets and goals. After all, *you* have shaped and embodied this work – carrying it into the communities of Colorado and beyond.

In this edition, you'll find stories about Colorado State University's internationally regarded expertise in infectious disease, which dates to the school's earliest years. Our System and campus leaders share their thoughts about recovery and the value of our academic programs, brought into sharp relief by the pandemic. You'll learn about one of the System's most prominent initiatives, the new Spur campus, which is forging ahead. You will also meet an alumna, Angie Paccione, head of the Colorado Department of Higher Education, who is working around the clock on behalf of colleges, universities – and students.

Thank you for your shared commitment to students, to discovery, and to the future. ■

STATE

A SPECIAL ISSUE FROM COLORADO STATE UNIVERSITY AND THE CSU SYSTEM

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PERSPECTIVES

ON THE COVER: "Innovating in a Pandemic," illustration by Dave Cutler

THIS PAGE: Students abruptly moved from on-campus classes to online course delivery as the pandemic arrived in force in mid-March. Leaders of the CSU System's physical campuses look forward to the return of students, faculty, and staff. Photo: Joe A. Mendoza / Colorado State University

[Perspective: *Tony Frank* / CHANCELLOR, CSU SYSTEM]

DEAR COVID-19:

I'm writing to get some thoughts off my chest as I sit here late at night, unable to sleep, thinking about a 25-year-old woman. She's tough as nails, but she has viral pneumonia and she's alone and she's scared. You've made a big impression on her – on all of us, for that matter. And I know you're not done yet.

You've made uncertainty and even fear a part of our everyday lives. You've disrupted weddings and birthdays, postponed graduations, ruined plans, and dashed more than a few dreams so far. You've forced hardworking people into unemployment lines and left small, family-run businesses struggling to hold on.

You've given those of us who work with infectious diseases a new understanding of the individual lives behind our graphs and curves. You've surprised us: your silent carriers, your diverse symptoms and clinical presentations – much about you has us struggling to catch up.

You've pushed our doctors and nurses to the brink. And you've taken loved ones from us. Sometimes, they have died in the hands of strangers, with even their funerals held in isolation.

You've exposed some of our societal fault lines – painful gaps between rich and poor, rural and urban, the young and the old, the technologically connected and those with limited access, the healthy and those whose health is compromised, even in unseen ways.

You've made your mark in our history books – you will be remembered.

But what's more important to me is what you can't do. You can't keep us from adapting. You can't stop our creativity and humor. You can't stop us from caring for one other. You can't stop us from expressing our diverse opinions as human beings. You can't keep us from expressing our beliefs in something larger than ourselves. You can't separate us from the love of our family, the compassion of our friends; even the gentleness in the touch of a total stranger for those who are in your final grasp is beyond your ability to prevent.

And you can't stop us from learning, from innovating, from working together in unexpected ways to fight you. Right now, we've got scientists who have shut down their own work to help private companies test their existing drugs and chemical compounds to see if any of them can stop your spread. We have volunteers lining up to give blood, hand out free meals at school sites, take in foster pets, and go shopping for strangers. We have front-line employees in grocery stores, hospitals, and campus residence halls who are putting themselves on the line to make sure their communities are safe and cared for. We are strongest together – and you have reminded us of that, in ways we should never have forgotten.

So go ahead: Unleash whatever havoc is within your power, but do so knowing that we are relentlessly resisting you, learning about you. And we will win. Throw your worst at us, and realize that it cannot hold a candle to the beauty of the better angels of the human spirit.

Goodbye.

– tony

Tony Frank, D.V.M., Ph.D., is chancellor of the Colorado State University System, which includes Colorado State University, CSU Global, CSU Pueblo, and the emerging Spur campus at the National Western Center in Denver. He became full-time chancellor in July 2019, after serving as 14th president of CSU, the System's flagship, for 11 years, with four years in the dual role of chancellor and president. CSU System campuses annually educate nearly 60,000 students, with almost 9,000 graduates per year.

The catastrophic influenza pandemic of 1918 halted campus activities, yet students returned to the State Agricultural College of Colorado; the class of 1919, shown here, represents resiliency after the worst outbreak of infectious disease of the past century. Photo: Colorado State University Archives, Libraries & Special Collections

[Perspective: *Joyce McConnell* / PRESIDENT, COLORADO STATE UNIVERSITY]

WE WERE BORN FOR THIS

LAND-GRANT UNIVERSITIES ARE MORE IMPORTANT THAN EVER

During Colorado State University's sesquicentennial year, we have looked back proudly at our history as our state's land-grant university. Now, a global pandemic has the whole world looking forward with anxiety and uncertainty, wondering how we will overcome a range of extraordinary challenges.

I can tell you how, precisely *because* I've spent this year learning about CSU's leadership as a land-grant institution and because I spent 24 years at another land-grant institution before becoming president of CSU.

We will overcome the challenges ahead of us thanks to land-grant universities, which are uniquely prepared to solve the world's most complex problems, from climate change to a global public health crisis.

Let me give you an example. After CSU was founded in 1870, our professors taught "scientific agriculture" and irrigation to address a local need: how to successfully grow crops in what was then called the Great American Desert. What made that endeavor special back then is the same thing that makes land-grant universities so special today. The university **taught** students innovative practices backed by **research** that also was put to use through direct **engagement** with farmers. And of course, CSU's innovative farming methods moved quickly beyond Colorado to establish us as a global leader in agriculture.

Those three things – education, research, and engagement – are the pillars of the land-grant mission. We used them 150 years ago to transform agriculture across an entire region. We use them now to save lives across the world.

In this magazine, you will read stories of some of the extraordinary work we are doing in response to this pandemic. Only by looking at the entire issue, though, will you see what I see: CSU's intertwined commitment to teaching, research, and engagement, and the phenomenal breadth of that commitment, which makes the land-grant university exactly what our world needs right now.

AMAZING WORK IS BEING DONE ACROSS THE UNIVERSITY; HERE ARE SOME HIGHLIGHTS:

- As early in the pandemic as February, CSU researchers had access in their labs to specimens of the virus that causes COVID-19. That's because CSU has decades of experience addressing community health needs through infectious disease research and response, in our College of Veterinary Medicine and Biomedical Sciences, in the One Health Institute, and in our Infectious Disease Research Center.
- We currently have research teams pursuing two potential vaccines, one using an engineered form of *Lactobacillus acidophilus* (the probiotic found in yogurt) and another using ultraviolet light and vitamin B2.
- Researchers in the Department of Microbiology, Immunology, and Pathology are testing hundreds of existing drugs, compounds, and chemicals to see if they might fight the virus that causes COVID-19.
- At the request of Colorado Gov. Jared Polis, we are coordinating testing among research institutions across the state on shipments of newly manufactured personal protective equipment for the state's health care workers. As we conduct this testing, we're also able to provide recommendations for large-scale production and distribution of PPE.
- The Smart Textiles and Nanotechnology Research Group in the College of Health and Human Sciences is testing fabrics for medical gowns, assessing factors such as durability, comfort, safety, and health.
- Engineers and disease researchers with CSU's Rapid Prototyping and Applied Engineering Lab are moving quickly to develop a disinfectant effective against COVID-19.
- The CSU Veterinary Diagnostic Laboratories have secured certification for laboratory testing performed on humans and are conducting testing for the coronavirus on site.
- We are conducting antibody testing research, with the long-term goal of improving testing for the virus.

Joe A. Mendoza / Colorado State University

William A. Cotton / Colorado State University

Joe A. Mendoza / Colorado State University

We are also thinking holistically and contributing to protect and improve quality of life in the face of COVID-19. Two CSU economists helped shape parts of the initial $2 trillion federal stimulus bill, making sure small agribusinesses weren't left out. Meanwhile, our social science researchers are investigating the mental health impacts of this pandemic, the impact of sheltering in place on physical activity for older adults, and the long-term economic and sociological impacts that will be felt worldwide.

And let's not forget CSU's engagement work. We're sharing what we discover with our communities and with researchers and partners across the country. We've made plans to open residence halls to first responders who need to self-isolate after exposure or for recovery. And at the request of the Colorado commissioner of agriculture, CSU Engagement and Extension convened the CSU Task Force on Colorado Food Supply, which provides up-to-date, data-driven analysis of food supply chain issues created by the pandemic.

We are also, of course, still teaching thousands of students, a few of whom remain in residence halls, most of whom are off-campus and/or with their families. Indeed, the incredible faculty and staff who work with our students are doing more than teaching. Not only have professors completely re-created their syllabi and lessons for the virtual classroom, many of them are reaching out to students individually, making themselves available at literally all hours of the day, and connecting students to CSU resources they suddenly need, from financial aid counseling to mental health support. Our academic advisers and student success team members have also personally called, emailed, and texted hundreds of students.

This is the land-grant mission in action in a crisis. It's an extraordinary thing to be a part of, and for me, as the president of CSU at this historic moment, it has never been clearer that what is truly the foundation of the land-grant university is not the pillars of teaching, research, and engagement.

It's a commitment to people. And it drives everything we do. It always has.

Today, as when this institution was founded, CSU offers access to higher education. We do essential, purpose-driven research. We affirm that the knowledge we generate must be put to work addressing challenges, solving problems, and improving the quality of people's lives. And we put people first.

We know that the challenges will continue to get bigger. That's all right; we will be bolder. And we will continue to demonstrate the unique and lasting power of the land-grant university to our world, which needs us now more than ever. ■

Joyce McConnell, J.D., is the first woman and 15th president to lead Colorado State University, flagship of the CSU System and the state's land-grant university. Founded in 1870, CSU is celebrating its 150th anniversary. Before joining CSU in Summer 2019, McConnell was provost at West Virginia University; she was earlier dean of the WVU College of Law.

BY COLEMAN CORNELIUS

INSIDE *the* BAT CAVE

HOW DO BATS STAY HEALTHY WHILE HOSTING VIRUSES THAT CAUSE VICIOUS DISEASE IN PEOPLE? THE ANSWERS COULD LEAD TO CURES.

Fifteen years ago, at a scientific meeting on Colorado State University's Mountain Campus, a colleague asked immunologist Tony Schountz a question that was starting to percolate in the minds of infectious disease experts: "What do you know about bats?"

"Well, most are made of ash, but some are made of maple," Schountz replied. He had played baseball in college; and, until then, his immunology studies had centered on hantaviruses, a family of infectious agents spread by deer mice and other rodents. In 2005, Schountz really did know more about wooden baseball bats than he knew about the world's only flying mammals.

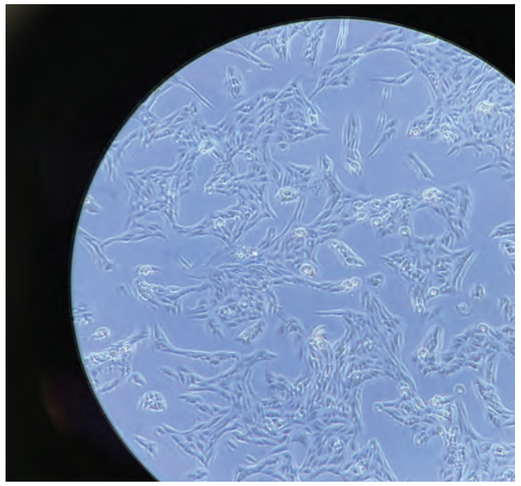
But the question proved prophetic. It came on the heels of a global outbreak of severe acute respiratory syndrome sparked in 2002 by a new coronavirus. The virus had not been earlier identified, much less as a cause of human disease. It was dubbed SARS-CoV.

Bats have an exceptional set of attributes that likely allow them to function as reservoir hosts of emerging pathogens, including the novel coronavirus.

As researchers later surmised, the SARS virus pulled off a rare feat enabled by the mixing and mingling of nature, animals, and man. The coronavirus apparently hopped from horseshoe bats in southern China, skipped to a wild catlike creature called the masked palm civet, jumped to people – with an assist from viral exchange at a live animal market outside Hong Kong – and then flared into an outbreak of respiratory disease passed from person to person. SARS spread through more than two dozen countries. It resulted in upward of 8,000 known infections and nearly 800 deaths. Sound familiar? That's because SARS predated two other novel coronavirus contagions following an eerily similar route, in all likelihood starting with bats: an epidemic of Middle East respiratory syndrome in 2012 and the current COVID-19 pandemic. The virus that spawned today's health and economic crisis is SARS-CoV-2.

More than 60 percent of communicable diseases in people have spilled over from animals, a category known as zoonotic disease. And 75 percent of new or emerging infectious diseases are zoonotic, the World Health Organization reports. That includes COVID-19.

These facts are well-known among those who study contagious disease. Even so, the SARS outbreak was a wakeup call for the scientific community, which earlier had regarded bats mainly for their ability to spread rabies. Knowledge about SARS grew more compelling alongside mounting evidence that fruit bats were the natural source, or reservoir hosts, of Ebolavirus. It was discovered



Above: Cells isolated from bats are seen through the eyepiece of a microscope in Tony Schountz's lab. The cells are used to examine how bat-borne viruses replicate and suppress defenses. Photo: Courtesy of Dominic Frederico. Right: Schountz is an expert in bat immunology and works in the CSU Arthropod-borne and Infectious Diseases Laboratory. With investigations related to COVID-19, his lab has continued to operate during the pandemic. Photo: John Eisele / Colorado State University

in 1976 and identified as the spark for a storm of Ebola virus disease in Africa. After these outbreaks, researchers increasingly asked if bat colonies could serve as enormous vats for infectious pathogens that might cross species barriers to threaten human health – much as birds, rodents, nonhuman primates, and other creatures have hosted and transmitted disease across time. Consider plague, caused by the bacterium *Yersinia pestis* and spread by bloodsucking fleas from rats to people; the Black Death pestilence of the Middle Ages is known as the most lethal outbreak of infectious disease in recorded human history.

"Bats are amazing animals. They are very important to natural ecosystems, and we've learned they are reservoirs of innumerable viruses, some of which have emerged to become really significant pathogens in humans. It's almost frightening the number of viruses bats can be infected with that cause no illness to them," said Barry Beaty, a University Distinguished Professor Emeritus who is internationally known for research into severe human diseases spread by mosquitoes. Beaty co-founded CSU's Arthropod-borne and Infectious Diseases Laboratory, known as AIDL, where Schountz conducts research.

In recent years, Schountz has become Colorado State's resident bat man. He is a foremost expert on the bat immune system and its uncanny ability to halt viral disease. The issue is central to understanding the new coronavirus pandemic – and to development of potential vaccines and treatments – because genomic analysis has identified horseshoe bats in China as the probable source of SARS-CoV-2.

Schountz is contributing to three federally funded studies tied to SARS-CoV-2, collaborating with partners at Colorado State University, the University of Pennsylvania, and Montana State University. He is conducting a vaccine study; investigating unique ways viruses influence host immunity; and examining bat immune response to environmental stressors that might prompt viruses to jump species.

To these projects, Schountz adds molecular analysis of disease avoidance in bats. He seeks insights that might help thwart infectious diseases in people. Put simply: Could the human immune system be medically encouraged to mimic that in bats? "We're looking for clues about the workings of a successful immune response that does not cause damaging inflammation and disease," said Schountz, an associate professor in CSU's Department of Microbiology, Immunology, and Pathology. "We want to leverage that for vaccine candidates and new therapies."

As scientists more and more have discovered, bats harbor many viruses. The microorganisms flow into and circulate among their hosts, like springtime snowmelt rushing into a reservoir. And viruses often breach the dam. They flush, or shed, into the natural environment and even move into other species, usually without causing harm.

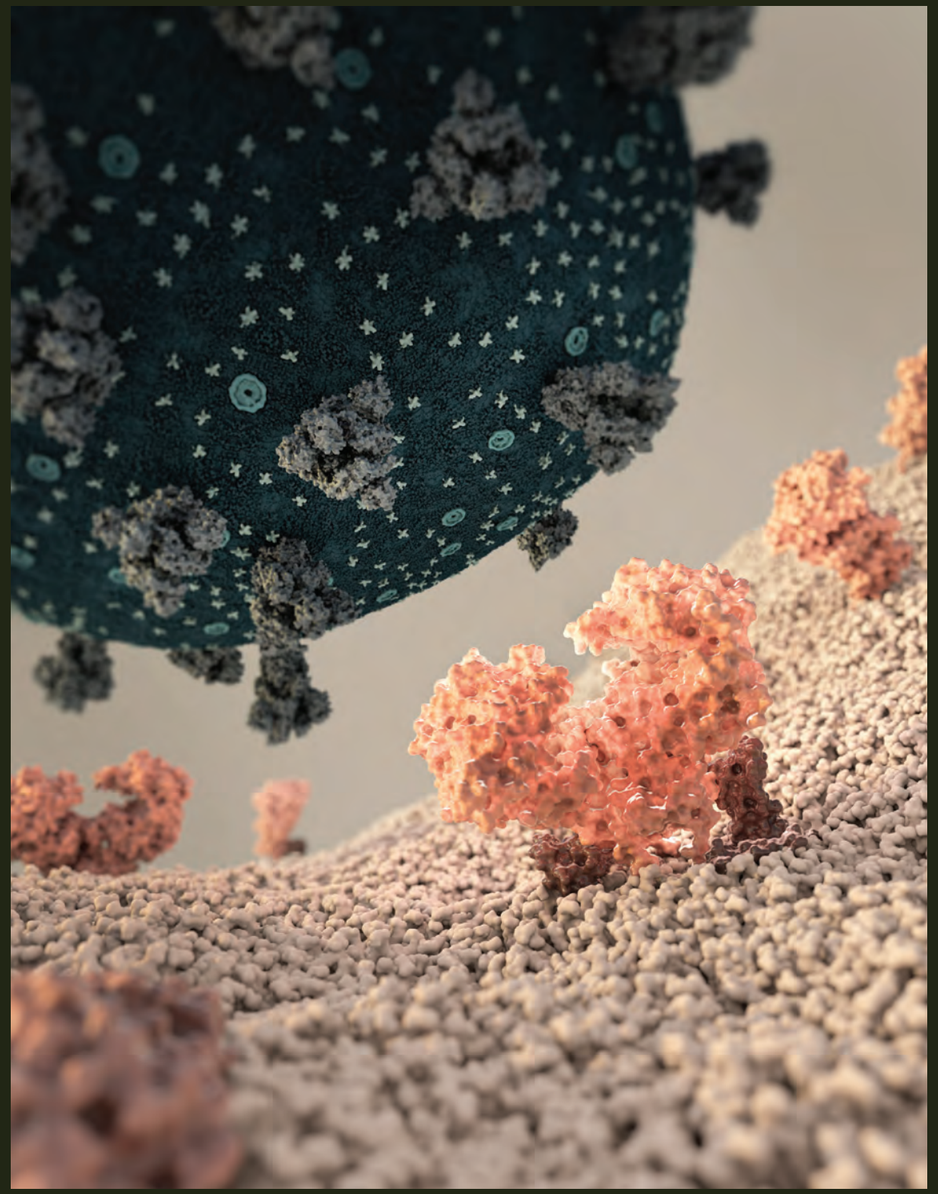
But on rare occasions, pathogens spill over from bats to people and provoke bouts of virulent human disease, sometimes with other animals as intermediaries. Examples include rabies, Ebola, Marburg, and Nipah viruses, as well as the coronaviruses that sparked outbreaks of SARS, MERS, and, now, the dangerous respiratory disease COVID-19.

The movie *Contagion*, released in 2011 and noted for scientific realism, illustrated a transmission chain based on the real Nipah virus: bat, pig, index patient, epidemic. Nipah virus, naturally hosted by certain fruit bats, can cause acute respiratory infection and fatal encephalitis in people, making it a stark public health concern, according to the World Health Organization. As suggested in the film, a viral spillover might occur through contaminated blood, saliva, urine, feces, or tissue from a host species.

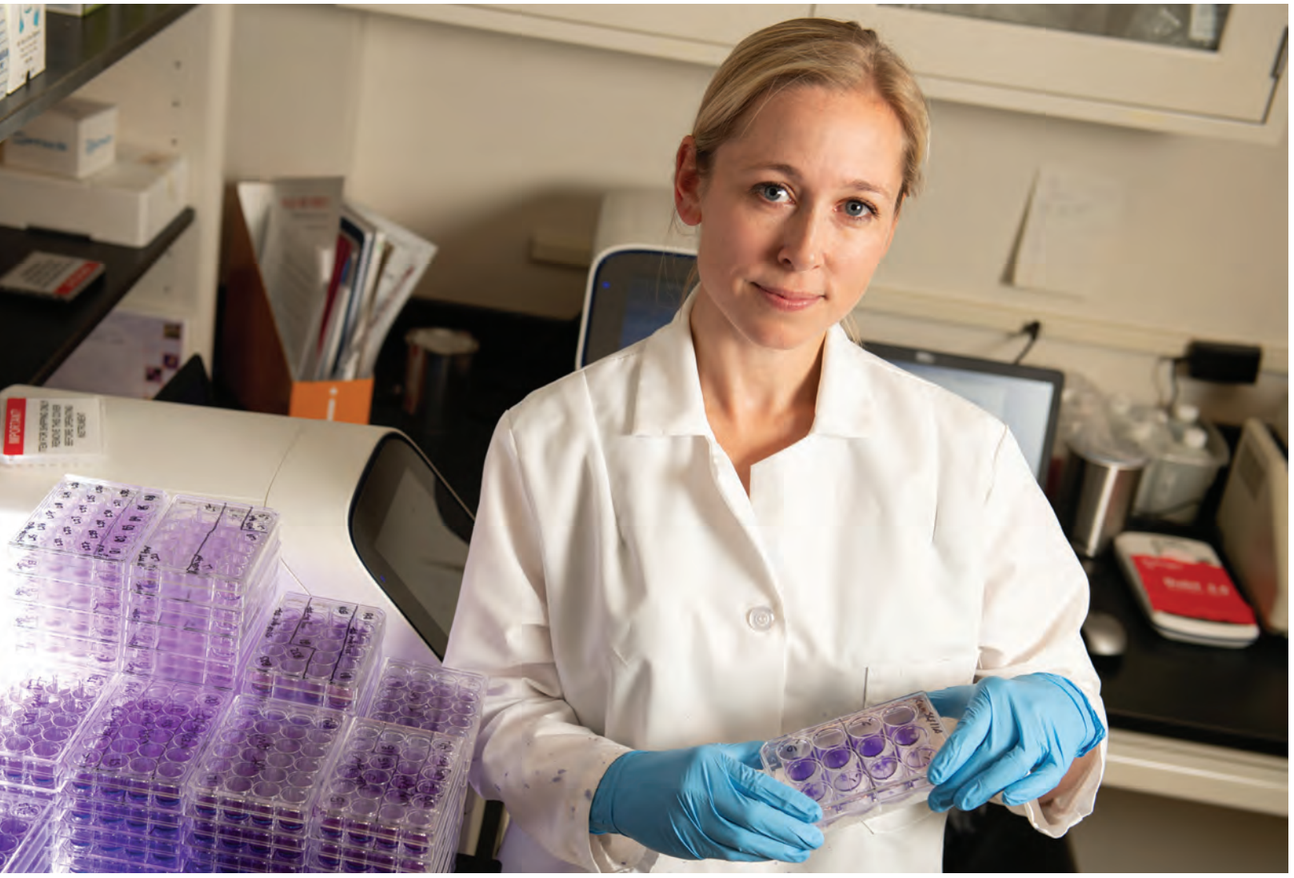
> "All of these viruses have bats as part of their biological cycles, but the bats have no signs of disease. We're interested in how bats are able to host pathogens that are really significant in humans, but they don't sicken bats at all."
>
> – Tony Schountz, associate professor,
> Department of Microbiology, Immunology, and Pathology

Andrew Dobson, who studies the ecology of infectious disease at Princeton University, described one viral path in a perspective titled "What Links Bats to Emerging Infectious Diseases?" published in 2005 in the influential journal *Science*. Bats, Dobson explained, nosh on fruits and insects and spit out uneaten bits and pieces. Those bits and pieces – speckled with virus particles in residual bat saliva – are easily encountered or ingested by other wild animals, livestock, or directly by people. "Knowing more about bats, and particularly more about bat ecology and immunology, is crucial if we are to develop new treatments and ways to control the viral diseases that are an increasing threat to humans," Dobson wrote, presaging research to come.

COVID-19 presents a new round of questions about pathogen dynamics and emergence. Through sampling and genomic sequencing, scientists traced SARS-CoV-2 to a live-animal and seafood market in Wuhan, China. But they have not yet confirmed the site and circumstances of a spillover event. Some scientists



This illustration, which appeared on the March 27, 2020, cover of the influential journal *Science*, represents SARS-CoV-2, the novel coronavirus, as it approaches to invade a human cell; after the viral spike protein binds to a receptor, cellular changes lead to infection and the respiratory disease COVID-19. These structures and their interactions provide a basis for development of vaccine candidates and therapeutics. Illustration: Courtesy of V. Altounian / *Science*



Rebekah Kading, an investigator in the CSU Arthropod-borne and Infectious Diseases Laboratory, is set to begin biosurveillance of bats in Uganda, hoping to learn about viruses harbored by the bats and how those microorganisms move into human populations. Photo: John Eisele / Colorado State University

ask whether an intermediate host, such as the illegally trafficked pangolin, or scaly anteater, might have served as a bridge to move the novel coronavirus from bats to people. Research recently published in journals, including *Nature Medicine,* has examined this possibility without clear answers. Yet the novel coronavirus closely resembles virus sampled from *Rhinolophus affinis*, a horseshoe bat species found in southern China. This means the bat is the likely reservoir host for the virus behind COVID-19, just as bats were behind several earlier malignancies.

But here's the thing about bats: They don't get sick.

"All of these viruses have bats as part of their biological cycles, but the bats have no signs of disease," Schountz said, of deadly microorganisms harbored by bats. "We're interested in how bats are able to host pathogens that are really significant in humans, but they don't sicken bats at all."

Schountz is among dozens of CSU researchers responding to the COVID-19 pandemic with new or quickly repurposed projects aimed at developing diagnostics, vaccines, and treatments to battle coronavirus disease. They join scientists around the globe in a race to combat the scourge.

Rebekah Kading, one of Schountz's colleagues in AIDL, is poised to start a five-year bat biosurveillance project, funded by the U.S. Department of Defense, in caves around Mount Elgon National Park in Uganda, a volcanic region on the border of Kenya. Kading and her team, partnering with local researchers, want to understand what viruses circulate among bat species in the region and how, in turn, those viruses move into the human population. They will collect blood and fecal samples from bats, examine the samples for viruses, and compare data to findings from human serum samples. They will even outfit bats with GPS devices – called "batpacks" – to track movement of the creatures and their microbes. Ultimately, the collaborative team hopes to identify health risks to people who live in the region and visit bat caves in and around the national park. "We're expecting to find coronaviruses, which is a timely issue," Kading said. "We'll know a lot more about what pathogens are in the bats and how they're circulating. It's tying together the ecology of bats and infectious disease."

In many research projects, Schountz and his collaborators rely on a CSU breeding colony of about 100 Jamaican fruit bats. The bats are just 3 inches long, with distinctive leaf-like protrusions from their snouts. They live on a diet of fresh cantaloupe, watermelon, and bananas; females produce offspring every five months. The uncommon research colony provides a dependable supply of nasal, fecal, and tissue samples, imperative for sound scientific studies; the colony augments Schountz's field studies in Trinidad and Grenada.

Virtually all of Schountz's research examines the interaction of viruses and their reservoir hosts – a relationship he likens to a détente. The relaxation of wartime tension between invading virus and host immune system yields an equilibrium: The virus persistently replicates and sheds, as it is genetically programmed to do, while suppressing the host's inflammatory response and the severe illness and death that could follow. The deal lets a virus keep on trucking, while the bat host flaps on its moonlit way, with little or no sign of disease.

The relationship is so unusual that Schountz and other scientists think viruses and bats have co-evolved over millions of years, through the continuous thrust of infection and parry of evasive immunity. Yet, viruses that churn in bats without producing illness have, at times, proven highly infectious when surfacing in the human population. In an article published in *Frontiers in Immunology* in 2014, Schountz and his co-authors hypothesized that evolutionary dynamics make some viruses more dangerous when they cross to animals with different defense mechanisms, including people.

Of course, bats are not completely impervious. They are susceptible to some diseases that dramatically impact their health and ecology, as Schountz noted in a commentary published in the journal *Viruses.* For instance, white nose syndrome, caused by a fungus, has killed millions of bats in North America, including some threatened and endangered species.

Yet their role as reservoir hosts of emerging viruses has put bats in the scientific spotlight.

"Tony is one of the great experts on viruses that persistently infect bats," said Carol Blair, an esteemed professor emerita of virology who joined Colorado State in 1975. As the first female head of CSU's Department of Microbiology, she urged teaching and research in infectious disease and, with Beaty, led formation of the Arthropod-borne and Infectious Diseases Laboratory; she still collaborates with its faculty. "It's very important work," Blair continued, referring to research into bat immunity. "I credit Tony for being one of the early ones to recognize that importance."

His focus on bats began when Schountz was at the annual fall meeting of the Rocky Mountain Virology Association in 2005. He and a few colleagues gathered for beer and pretzels after a day of presentations. Their discussion turned to bats and viruses.

Three years before that, SARS had swept through Asia, Europe, North America, and South America, leading to critical cases of pneumonia, before aggressive public health measures helped halt the outbreak. The scientific community needed to know more about bats and their ability to host novel viruses that might jump to people and cause alarming outbreaks of infectious disease.

> "Good Lord, it was euphoria in the '60s and '70s, when everyone thought vaccines of the time were going to solve all these problems. In the end, that was wishful thinking. Our group always knew other zoonotic diseases were going to be important and emerging. Unfortunately, this is a growth industry."
>
> – Barry Beaty, University Distinguished Professor Emeritus and co-founder of the Arthropod-borne and Infectious Diseases Laboratory

That's when Charles Calisher, a CSU professor emeritus and a giant in virology, turned to Schountz and asked what he knew about bats. As the group chatted, a collaborator in the molecular biology program at the University of Colorado School of Medicine, Kathryn Holmes, suggested Calisher compile a list of viruses known to circulate in bats. It would be a good way to better gauge the potential for outbreaks of zoonotic diseases, she said.

"Why should I write a list? Why don't you write a list?" Calisher objected.

But he was well-suited for the task, with decades of leadership in the field of arbovirology, the study of viruses transmitted by biting insects and other vectors, first at the Centers for Disease Control and Prevention and then in AIDL. So he relented. Calisher

checked with far-flung researchers to assemble a list; the inventory ran to 66 viruses. That's scant within thousands of described virus species, but revealing as a sign of bats as viral reservoirs. The effort grew into a review paper, with Calisher as lead author. He assigned sections to a population biologist, veterinarian, and two virologists; Schountz took the section on immunology.

"There's nothing known," Schountz said at one point.

"Then write questions," Calisher said. "How come these viruses don't wipe out entire colonies? These bats are snuggled up, breeding, urinating, and drooling on one another. There's something weird about bats in terms of immunity."

The paper, "Bats: Important Reservoir Hosts of Emerging Viruses," lists viruses that consistently infect bats without inducing sickness. It also summarizes characteristics that make bats "exquisitely suitable hosts for viruses and other disease agents." It's a remarkable collection of attributes: the ability to fly, nocturnal activity, hibernation, roosting behavior marked by daytime torpor, evolutionary history, lifespan, valuable ecological functions, and breeding and feeding habits. In addition, the authors noted, bats make up more than 20 percent of all mammalian species and are found almost everywhere on the planet.

> "Knowing more about bats, and particularly more about bat ecology and immunology, is crucial if we are to develop new treatments and ways to control the viral diseases that are an increasing threat to humans."
>
> – From the journal *Science*

The editor of *Clinical Microbiology Reviews*, a journal of the American Society for Microbiology, snapped up the paper because it assembled important information earlier scattered or underappreciated.

"We'll take it," he told Calisher. "Bats are going to be a big deal."

The review appeared in July 2006 and had an immediate impact, helping spur a wave of new research into bats and emergent infectious diseases. It has amassed 1,165 citations and counting, an impressive barometer of scientific influence. (The vast majority of published research papers are cited fewer than 10 times; those cited more than 1,000 times are rarities, the journal *Nature* has shown.)

"It activated this whole area of research into bats and their viruses," Schountz said. For him, the paper has been a blueprint for years of subsequent investigations funded by the National Institutes of Health and the Department of Defense, among other top granting agencies.

Indeed, knowledge generated during the past 15 years about bats and infectious disease has been essential to understanding and responding to the COVID-19 pandemic.

Contributing such knowledge was exactly the plan when Beaty, Blair, and fellow faculty members formed AIDL in 1987. The group, based on the CSU Foothills Campus, was well-aligned with the international research agenda in its hunt for knowledge and innovations to control zoonotic diseases that often hit developing nations hardest, yet, as COVID-19 demonstrates, have zero concern for political boundaries.

"Good Lord, it was euphoria in the '60s and '70s, when everyone thought vaccines of the time were going to solve all these problems. In the end, that was wishful thinking," Beaty recalled. "Our group always knew other zoonotic diseases were going to be important and emerging. Unfortunately, this is a growth industry." Beaty helped lead a project for the Institute of Medicine, one of the authoritative National Academies, that resulted in a seminal research report published in 2003 and titled *Microbial Threats to Health: Emergence, Detection, and Response.*

From the start, AIDL specialized in serious pathogens spread by arthropods, including mosquitoes, fleas, and ticks. Think chikungunya, dengue fever, malaria, tularemia, yellow fever, and diseases caused by West Nile and Zika viruses, among others. The group also has discovered details about hantavirus ecology in rodents. Investigators have partnered with CSU veterinary colleagues – a key resource in studying zoonoses – and with those at local branches of the Centers for Disease Control and Prevention and National Wildlife Research Center, also on the Foothills Campus. Through such collaborations, AIDL helped establish the field of vector biology to shed light on interactions between pathogens and their conductors; the roles of rodents and bats are part of the broader puzzle.

AIDL faculty also have led national research training programs and have attracted grants from the largest federal funding agencies. These include $21 million from the National Institutes of Health to help build the Rocky Mountain Regional Biocontainment Laboratory, which provides expansive biosecure research space and houses a national Center of Excellence for Biodefense and Emerging Infectious Diseases, linked to similar centers around the country; the building's final phase opened in 2008.

AIDL remains an indispensable part of the university's teaching and research in infectious disease and is a cornerstone of the nexus on Foothills Campus. It fits under the umbrella of CSU's Infectious Disease Research and Response Network, designated as a university Program of Research and Scholarly Excellence. Other groups in the network include the Mycobacteria Research Laboratories, which study tuberculosis and leprosy; the Prion Research Center, which examines pathogens that cause chronic wasting disease, mad cow disease, and others with striking similarities to human neurodegenerative diseases; and the Veterinary Diagnostic Laboratories, which provide front-line surveillance and testing of zoonotic disease. Rounding out these teams is the Infectious Disease Research Center, which often leads projects in partnership with government agencies and private industry. The center runs a state-of-the-art facility, called BioMARC, that develops and manufactures vaccines, diagnostic tools, testing reagents, and therapeutic drugs and devices.

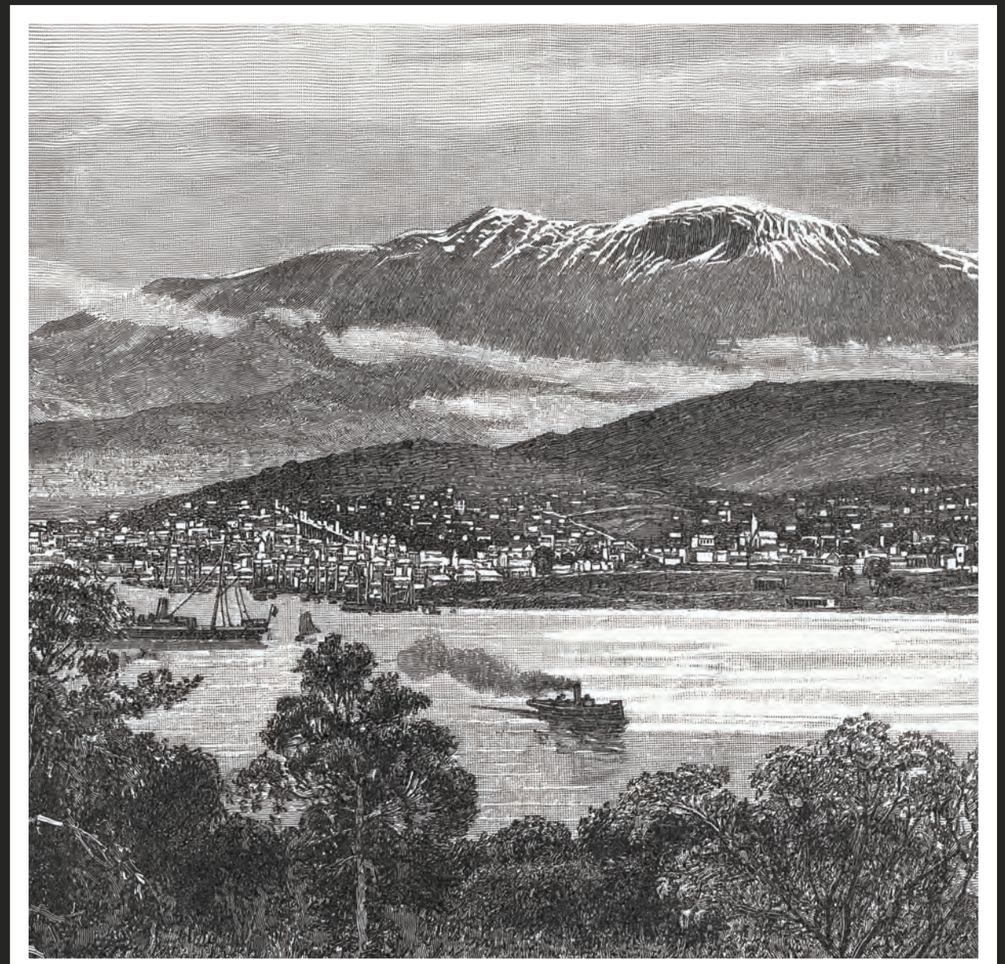
This ecosystem gives CSU an edge in tackling infectious disease, said Ray Goodrich, a biotechnology investigator and executive director of the Infectious Disease Research Center. In fact, he noted, specialists across campus are pursuing COVID-19 solutions. These efforts include vaccine studies, coronavirus surveillance projects, analysis of antiviral drugs, and testing of personal protective equipment for health care workers. "We have the people, the knowledge, and the facilities required for infectious disease research," Goodrich said. He is evaluating a vaccine candidate that would use ultraviolet light and vitamin B2 to stop coronavirus replication while maintaining viral components that prompt human immune response. "The assets at CSU have allowed us to mobilize very quickly and bring some incredible talent to bear on the biggest event of our time affecting human health," Goodrich said.

There is plenty of work ahead for Schountz and others in the Arthropod-borne and Infectious Diseases Laboratory. A new research facility will soon boost this work: The Center for Vector-Borne Diseases is under construction on the CSU Foothills Campus, with an anticipated opening late this year. The $23 million building encompasses about 40,000 square feet of new offices, biosecure laboratory space, and insectaries. It will bring together about 90 faculty members, research associates, students, and staff; they represent fields including virology, bacteriology, immunology, and computational biology. These are among the interconnected disciplines needed for new insights into the emergence and spread of disease – and possible paths for prevention and cures.

"I'm extremely excited about it," said Blair, the retired professor who helped form AIDL. "If any good comes out of this devastating pandemic, I hope it's the realization that we need to continue investing in funding for infectious disease research. This is an unusual pandemic, but it won't be the last." ■

> "The assets at CSU have allowed us to mobilize very quickly and bring some incredible talent to bear on the biggest event of our time affecting human health."
>
> – Ray Goodrich, executive director, CSU Infectious Disease Research Center

CSU research assistants Elena Lian and Gabriela Ramirez, working in biosecure laboratory space, test compounds and products for their efficacy in fighting COVID-19 as part of the university's scientific response to the pandemic. Photo: William A. Cotton / Colorado State University



Mount Wellington rises above Hobart, on the island state of Tasmania.

[Perspective: *Sue VandeWoude* / DIRECTOR, ONE HEALTH]

EVACUATION ORDER

SHE WAS IMMERSED IN ONE HEALTH RESEARCH. OUR ONE HEALTH CRISIS INTERVENED.

I had been in Hobart, Tasmania, off Australia's southern coast, for nearly two months on my first, and almost certainly my last, sabbatical. I had seen wombats, echidna, kookaburra, regularly heard the calls of forest ravens and cockatoos, and had visited a handful of local brewing establishments. And, yes, I had also been at work. This included taking baby steps in learning statistical computing and graphics (R programming) and a set of mathematical modeling principles (structural equation modeling). Along the way I had become a fan of Sewall Wright, a population geneticist who had famously studied guinea pigs, and I had created a two-color correlation graph with actual data that I had proudly shared with my adult children.

The goal of my sabbatical was to use these tools to understand a novel process by which a cat's immune system could resist infection with feline immunodeficiency virus, or FIV. I hoped my findings would not only lead to new treatment options for cats with this disease, but, by analogy, guide novel ways to modify infections caused by the human disease correlate, HIV. This One Health project – linking animal disease to its human analogue – could push my laboratory studies in a new direction.

But on March 12, I received an unexpected notification from the U.S. Department of State advising "all current U.S. Fulbright participants to make arrangements to depart their country of assignment as soon as possible." Despite the growing pandemic pandemonium I had watched unfolding in news reports, it had not dawned on me that I might need to truncate my visit to the University of Tasmania, Australia, more than a month early. At that point, the small island state had very few confirmed cases of COVID-19 compared to countries coping with mounting catastrophe.

I had been poised to travel the next week to the University of Queensland and University of Sydney to visit veterinary colleagues working in the field of viral spillover and infectious disease. I was looking forward to meeting with Edward Holmes, a virologist at the scientific center of the growing pandemic, who for years has predicted events that could lead to a global disease outbreak. I was intending to ask Dr. Holmes about the practice and applications of One Health, the study of systemic problems that incorporate environmental, human, and animal considerations, using transdisciplinary approaches. The thoughts of this world expert on one of the most high-profile One Health topics – transmission of microbes from animals to humans when the environmental context favors rare events – would be of great assistance when I returned to Fort Collins at the end of my sabbatical to assume the role of director of the CSU One Health Institute. Yet, my visit was canceled by the most severe One Health crisis of our lifetime.

After receiving the State Department's notice, I wrestled with the decision of whether to ride out the pandemic in a secluded spot about 3,600 miles north of Antarctica or endure a 30-plus hour trip through at least four airports during the exponential phase

While on a One Health research sabbatical, Sue VandeWoude learned about Tasmanian ecology and history. Scenes included, clockwise from top left: Churchill Avenue Overpass, University of Tasmania; Mersey River, near the town of Mole Creek, on ancestral lands of the Aboriginal people; Forester kangaroos on Maria Island; the mouth of River Derwent near Taroona; a mother wombat and joey on Maria Island; sea eagles at Arthur River; and Point Puer, site of a former British boys prison at Port Arthur. Photos: Courtesy of the author

of SARS-CoV-2 spread. While considering my options, I biked and hiked along the River Derwent. Signs of the pandemic were virtually absent, other than hand sanitizer and social distancing behavior at the café. Flora and fauna were reassuringly untouched by the spasm gripping the human world, and this added surreal features to the circumstances. Communications with family, interspersed with final trips to Hill Street Grocery and other favorite haunts, helped me realize I needed to wrap up my trip. This decision was punctuated by announcements that Australia's two primary airlines would be suspending all international flights. So with great inner sadness, I boarded a plane the next week in Hobart, and 30 hours later found myself back in Fort Collins.

The procedures in place at international terminals to intensify screening for COVID-19 consisted of collapsing each planeload of passengers into a small hallway to be asked individually if we had recently visited China. Given the number of passengers congregating through the small passageway – many of whom were wearing masks, some stifling coughs and sneezes – I spent my first two weeks in Fort Collins in self-isolation before transitioning home.

How does it feel to be here? Nothing is the same, and everything is the same. It is spring, the house is dusty, birds are deep in preening activities. Vistas of Pacific bays and stands of eucalyptus are replaced with prairie and foothills and old cottonwoods. I can't stop thinking about how extraordinarily lucky I am.

I have become immersed in COVID-19 research activities and preparations to advance the CSU One Health Institute as a powerhouse. I am convinced CSU can be an absolute leader in this area; we have a remarkable coalition of passionate faculty who thrive on rolling up their sleeves, being practical, and working together.

Yesterday, for the first time in weeks, I looked at a spreadsheet and prepared to import it into R studio. I thought about standard equation modeling. I listened to the boreal chorus frogs and spotted a great horned owl. I reviewed the latest scientific findings about COVID-19 on *bioRxiv* and counted my blessings for living in a safe and secure environment. I realized it is time for One Health. ■

Sue VandeWoude, D.V.M., is a newly named University Distinguished Professor, the highest academic honor CSU awards to faculty for outstanding scholarship and achievement. She is a member of the National Academy of Sciences and a professor of comparative medicine whose research examines the ecology of infectious disease in wild and domestic cats, often using insights from feline disease to better understand equivalent diseases in people. VandeWoude recently transitioned from associate dean for research in the College of Veterinary Medicine and Biomedical Sciences to director of the CSU One Health Institute.

GERM THEORY

A VETERINARIAN AND BOVINE TUBERCULOSIS

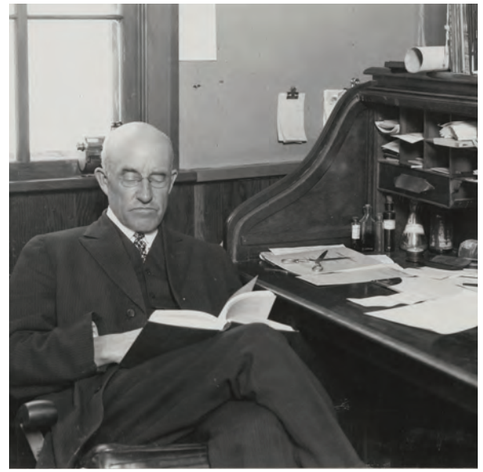
It was 1901, and Dr. George Glover was irked. The young veterinarian had tested the college dairy herd for *Mycobacterium bovis*, the pathogen that causes bovine tuberculosis, and had discovered prevalent disease.

Glover, founder of Colorado State University's world-class veterinary program, was sure that culling infected cattle from the campus herd – and from dairy herds everywhere – would prevent terrible human illness. At the time, tuberculosis nearly matched pneumonia as the leading cause of death in the United States; transmission of TB from cattle to people was a serious threat. To control contagion, the National Tuberculosis Eradication Program instituted widespread herd culling in 1917.

But convincing people before then? Just try.

"We urge upon all the warning that the difference between human and bovine tuberculosis has not yet been settled finally, and that the precautionary measures for preventing the spread of the disease by butter and milk cannot be safely abandoned," Glover wrote in an Agricultural Experiment Station bulletin published in September 1901. He did not shy from fist shaking: "The conclusions arrived at by reliable authorities are here compiled, hoping to accomplish something toward arousing the masses from their lethargy."

A farm kid from Longmont, Colorado, Glover arrived at the State Agricultural College of Colorado in his family's lumber wagon in 1880, a year after the college opened. He was one of three students in the first graduating class in 1884 and co-founded the college Alumni Association. Glover attended veterinary school at Iowa Agricultural College, practiced for a time in Denver, and returned to Fort Collins to start the standout veterinary school here.



Dr. George Glover was one of the first students to graduate from CSU in 1884. He founded the university's renowned veterinary school – and launched its longtime focus on infectious disease by working to banish bovine tuberculosis from state dairy herds. Photo: Colorado State University Archives, Libraries & Special Collections

He started more than that: Glover initiated infectious disease research, a premier enterprise at the college that became Colorado State University. With his work on bovine tuberculosis, Glover was a vocal early proponent of a field later called One Health, whose practitioners pursue solutions to challenges involving people, animals, and the natural environment. Zoonotic diseases, which cross species, vividly illustrate the ties. Exhibit 1: COVID-19.

Glover knew veterinarians were perfectly positioned to improve public health. Who better to pinpoint the path of infectious disease from animals to people – and to seek cures for both?

The veterinarian also was forerunner of a CSU program of world renown: the Mycobacteria Research Laboratories. Founded in the 1980s, it is the largest academic research group in the United States dedicated to understanding and seeking cures for mycobacterial diseases, including tuberculosis and leprosy. These intractable infectious diseases remain devastating among people around the world.

BY COLEMAN CORNELIUS

Unpasteurized milk products were once a significant source of TB in people. Dr. George Glover led a battle against the problem by linking zoonotic disease to progressive public health programs. (As the above center photograph shows, CSU's vet students once were all men; now women dominate the field.) Photos: Colorado State University Archives, Libraries & Special Collections

> **“We urge upon all the warning that the difference between human and bovine tuberculosis has not yet been settled finally, and that the precautionary measures for preventing the spread of the disease by butter and milk cannot be safely abandoned. The conclusions arrived at by reliable authorities are here compiled, hoping to accomplish something toward arousing the masses from their lethargy.”**
>
> – Dr. George Glover, *Relation of Bovine to Human Tuberculosis*, published by the Agricultural Experiment Station, September 1901

The affiliation might be surprising, but it’s all of a piece. Starting in the late 1800s, Colorado was “the world’s sanatorium,” where countless consumptive patients sought relief from respiratory illness in clean, dry air and sunshine. The afflicted convalesced in tent cities and TB wards. Some of those facilities became hospitals, including National Jewish Health of Denver, a world leader in respiratory health.

At the college in Fort Collins, Glover was well aware of the scourge. It wasn’t so long after German physician and microbiologist Robert Koch discovered the tuberculosis bacterium and linked it to human disease; he later won the Nobel Prize for his discoveries. Science was still connecting other dots: that human and bovine forms of TB are related and spread among species, including wildlife; that tainted dairy products are a source of TB in people; that pasteurization kills infectious microorganisms in milk; and that prevention is the first line of defense for public health.

In 1901, Glover decided to prove the threat of bovine tuberculosis with a demonstration for the State Board of Agriculture, the college governing board. Members earlier had shown “scant tolerance” for Glover’s warnings. From the school’s dairy herd, the veterinarian picked a seemingly healthy cow, euthanized the animal, and performed a necropsy for the influential onlookers. The animal’s lungs and glands “were rotten with disease,” Glover recounted in 1944, during an interview with Ruth Wattles, an English professor who wrote a history of the university’s early years, titled *The Mile High College*.

As the book relates, Glover found a nodule of infection in the cow’s udder, removed it, and with a flourish, cut through it. “Out ran pus and milk on the ground,” Glover told Wattles.

“Dr. Glover stepped back dramatically and pointed. ‘That’s what you’ve been selling to people for milk,’” he declared, according to the historical account.

“An old-time cattleman and member of the board looked, spat, and cursed like a Missouri muleskinner. ‘I order this mess be cleaned up,’” he said, according to Glover’s retelling in *The Mile High College*.

With that, Glover had the go-ahead to cull tubercular dairy cows from the college herd and, in so doing, establish and promote scientifically valid practices for controlling bovine tuberculosis on farms and ranches across Colorado. The strategy gained traction. The nationwide campaign that began several years later – combined with commercial milk pasteurization and federal meat inspections – virtually eradicated bovine tuberculosis in the United States. It is heralded as a public health triumph.

Meantime, the human variant of TB, caused by *Mycobacterium tuberculosis,* has dramatically declined as a cause of illness and death in the United States.

Even so, an estimated 13 million people in the country are infected with a latent form of the disease without showing symptoms, representing a sleeping giant of potential illness, according to the Centers for Disease Control and Prevention. Worldwide, TB remains a leading cause of death, infecting a staggering one-third of the global population and killing up to 2 million people annually, the World Health Organization reports.

CSU is seeking cures through its Mycobacteria Research Laboratories, an internationally respected research group investigating tuberculosis and other mycobacterial diseases.

The university’s modern era of TB research began in 1980, with the arrival of a rising biochemist named Patrick Brennan, a specialist in leprosy who had been a senior researcher at National Jewish Health of Denver. Brennan, a University Distinguished Professor Emeritus, served as chairman of the WHO Program for Tropical Disease Research, among other eminent roles.

In 1986, a key partner arrived: Ian Orme, a leading tuberculosis immunologist and one-of-a-kind educator and researcher. Together, Brennan and Orme – well-known as an Irishman and an Englishman – formally established the Mycobacteria Research Laboratories. They built the team into an international brain trust, with a stream of significant TB discoveries, from fundamental findings to vaccine and drug development. Orme, also a University Distinguished Professor, died in 2018.

The research group continues robust investigations through the work of 19 key faculty members and dozens of research staff and students.

“We have research that goes from basic science to preclinical work, testing drugs and vaccines,” said Dean Crick, a professor and director of the Mycobacteria Research Laboratories. “The breadth of the expertise is remarkable.” ■

SPUR MO*VES* AHEAD

NEW CAMPUS SPOTLIGHTS FOOD, WATER, AND HEALTH

The CSU Water Building will be one of three core facilities on the forthcoming Spur campus at the National Western Center. Rendering: CAA ICON

BY TIANA NELSON

Hundreds of people from across Metro Denver and Colorado were set to gather April 30 to celebrate groundbreaking for Spur, the innovative new campus of the Colorado State University System at the National Western Center. Then COVID-19 changed everyone's plans.

The celebration is delayed, yet the CSU System's largest building initiative is moving ahead. Construction started in April, and Spur is set to open in 2022.

It will be like no other campus in Colorado: three buildings focused on lifelong learning about food, water, and health – critical and interconnected topics in the West and around the globe. Spur, in the works for more than six years, will be within the ambitious urban redevelopment of the historic National Western Stock Show complex. The campus will be a vital part of the National Western Center, and its leaders already have launched robust outreach programs in the surrounding communities of North Denver and beyond.

The pandemic is a stark reminder of the pressing need for collaborative research, education, and public outreach on topics that will be front and center at Spur, said Tony Frank, chancellor of the CSU System.

"This crisis puts many things in perspective and heightens the importance of the Spur campus," Frank said. "Spur is all about fostering joint research, providing free public access to education about issues that impact every facet of our lives, and encouraging deeper awareness and understanding of how food, water, and health connect people and communities worldwide. If anything, this dire situation has reinforced our conviction that these issues are more important and more interconnected than ever before."

The CSU System is part of a core coalition whose involvement in the National Western Center will bring new, year-round educational and entertainment programming to the storied grounds of the National Western Stock Show, near the interchange of Interstates 70 and 25 in northeast Denver. The alliance also is enabling dramatically upgraded Stock Show facilities and is maintaining the state's best-known symbol of agricultural and Western heritage on the site where it all began in 1906.

Why is that important? The National Western Stock Show annually attracts more than 700,000 people during its 16 days, its leaders report. It tallies a yearly economic impact of some $120 million. And, each year, it raises $500,000 for the National Western Scholarship Trust, which distributes more than 100 scholarships to students – including many CSU students – studying agricultural sciences, rural medicine, and veterinary medicine. In fact, with their missions in education, CSU and the Stock Show have been close partners since their early days.

Other founding partners united to establish the National Western Center are the city and county of Denver, the Denver Museum of Nature & Science, and History Colorado.

"Spur will bring people together and enhance their understanding of issues that impact us all. There's a reason the three buildings are organized around themes rather than disciplines – we want young people, in particular, to see you can work on solving problems related to food security or water quality or health, regardless of your background," said Jocelyn Hittle, senior director of sustainability and Denver programs for the CSU System.

On any given day at Spur, you might find middle-school students collecting water samples along the adjacent South Platte River; the river itself will enjoy continued restoration as part of the National Western Center. Meantime, a partnership with the Dumb Friends League means CSU veterinary students will be trained and local pets will be cared for in a space that allows visiting children to watch and learn. Professionals attending conferences may gather on breaks to sip lattes on an outdoor patio, while researchers work in nearby labs, searching for solutions to global food shortages and other urgent challenges.

Every day, Spur will host families and tourists, K-12 student field trips, conferences and meetings, researchers in state-of-the-art labs, college students pursuing degrees in fields related to agriculture and sustainability, and local artists creating in on-site studios.

> "Spur is all about fostering joint research, providing free public access to education about issues that impact every facet of our lives, and encouraging deeper awareness and understanding of how food, water, and health connect people and communities worldwide. If anything, this dire situation has reinforced our conviction that these issues are more important and more interconnected than ever before."
>
> – Tony Frank, chancellor, Colorado State University System

Spur's mission to promote deeper public understanding of high-profile issues is more important than ever, said Tom Vilsack, past U.S. secretary of agriculture and former governor of Iowa. He is an adviser on the Spur project.

"The coronavirus pandemic underscores the importance of understanding connections between food and health. These topics are at the heart of animal health, human health, and a vibrant economy," Vilsack said. "Spur will grow our appreciation for all those involved in our agricultural and food industry and will help develop sustainable systems that can adapt to challenging disruptions."

Construction is just beginning. Yet, Spur programming is well underway and will expand as buildings open, noted Amy Parsons, executive vice chancellor of the CSU System. Advance programming includes the annual Water in the West Symposium; yearly health clinics for pets whose families live nearby; equine-assisted activities and therapies offered through a Denver satellite of CSU's Temple Grandin Equine Center; and a comprehensive, student-focused partnership with nearby Bruce Randolph School.

"Our team has been building relationships in the surrounding community and across the state, and we're already offering programming from our three System institutions – our flagship university in Fort Collins, CSU Pueblo, and CSU Global. These programs reflect what will become part of the daily fabric of Spur," Parsons said.

CAA ICON, an international project management firm based in Denver, is overseeing design and construction. The firm quickly responded to the COVID-19 pandemic to make sure workers are protected on the site, said Dan Loosbrock, vice president of CAA ICON. "The health and safety of the project team, workforce, and community are always the top priority," he added.

Christie Vilsack, a lifelong educator and educational adviser for Spur, said the pandemic is a vivid reminder that "education works best when it is fluid and responsive." She has traveled Colorado gathering ideas from community leaders, teachers, and CSU Extension officers to help shape Spur offerings.

With those recommendations, Vilsack envisions a Spur educational plan that, among other elements, highlights water issues illustrated by the South Platte River; connects students to job opportunities now and in the future; and helps engage K-12 students in districts with four-day school weeks.

"We want to provide a means for students and teachers to connect to each other to talk about issues around water, food, and health," Vilsack said. "COVID-19 has made it not just a big idea for the future, but a necessary goal for right now." ■

ANGIE'S LIST

AT THE TOP: STUDENT OPPORTUNITIES

Angie Paccione is always dynamic – so much so, that people often ask where she gets her energy. But these days, she is in overdrive as executive director of the Colorado Department of Higher Education.

The COVID-19 pandemic has pulled Paccione into the eye of a storm of disruptions for higher education, an essential engine for quality of life and economic health in Colorado. As a top advocate for Colorado postsecondary schools, Paccione spends her days calling campus leaders, examining forecasts for higher education funding, and analyzing policy needs to help institutions and their students.

"These are uncharted waters," said Paccione, who earned a Ph.D. in education and human resource studies at Colorado State University in 1998 and worked for a decade as a teacher educator in the CSU School of Education.

BY **COLEMAN CORNELIUS**

Angie Paccione, who earned a Ph.D. in education and human resource studies at CSU, is head of the Colorado Department of Higher Education. During the pandemic, she is problem-solving around the clock to support colleges, universities, and their students. Photo: Jesse Paul / *The Colorado Sun*

Gov. Jared Polis appointed Paccione chief of the Department of Higher Education, and she started in January 2019 as a member of his cabinet. Amid the coronavirus crisis, her job centers on two key responsibilities: understanding budgetary implications for higher education and potential barriers to attendance for students – and, then, representing their needs in the formation of state policies and laws. Her department works with more than 400 occupational schools, colleges, and universities; of these, about 30 are public institutions that rely on state funding for a portion of their budgets, including universities in the CSU System. Altogether, Colorado postsecondary schools annually serve some 400,000 students, with programs that confer everything from crane operator certifications to doctoral degrees in construction engineering and management.

Now and in calmer times, Paccione's beacon is the same: promoting opportunities for students.

"It's what I've always been about," she said. "Our work in higher education is about activating everyone's full potential, and the way to do that is to create opportunities for students – and also for students to say 'yes' to those opportunities. I've always been a person who has focused on, 'What is possible? How can we make it work?' That's the right focus for this time."

Paccione is a biracial woman who grew up immersed in African American culture in New York City, a background that gives her insights into educational access and equity, two of her focal areas. She was a star basketball player at Stanford University, with a double major in political science and psychology; she graduated with honors in 1983. After a run in professional basketball, Paccione moved to Colorado for a career that has included work as a high school teacher, coach, and administrator; a university professor; a Colorado state legislator; and a consultant in leadership and organizational development.

"Angie has it all – she really has a complete perspective," said Blanche Hughes, CSU vice president for student affairs, who worked with Paccione on campus in the 1990s. "She understands the whole realm of education and, on top of that, really understands how diversity and inclusion must be incorporated into everything we do."

Paccione's agency carries out policies on a range of academic and funding issues. This gives her a central role in promoting the needs of higher education – and students – to the Colorado Commission on Higher Education, state lawmakers, and the governor. She has contributed to a higher education master plan, called Colorado Rises: Advancing Education and Talent Development, designed to improve opportunities for students while advancing the workforce and invigorating the state economy.

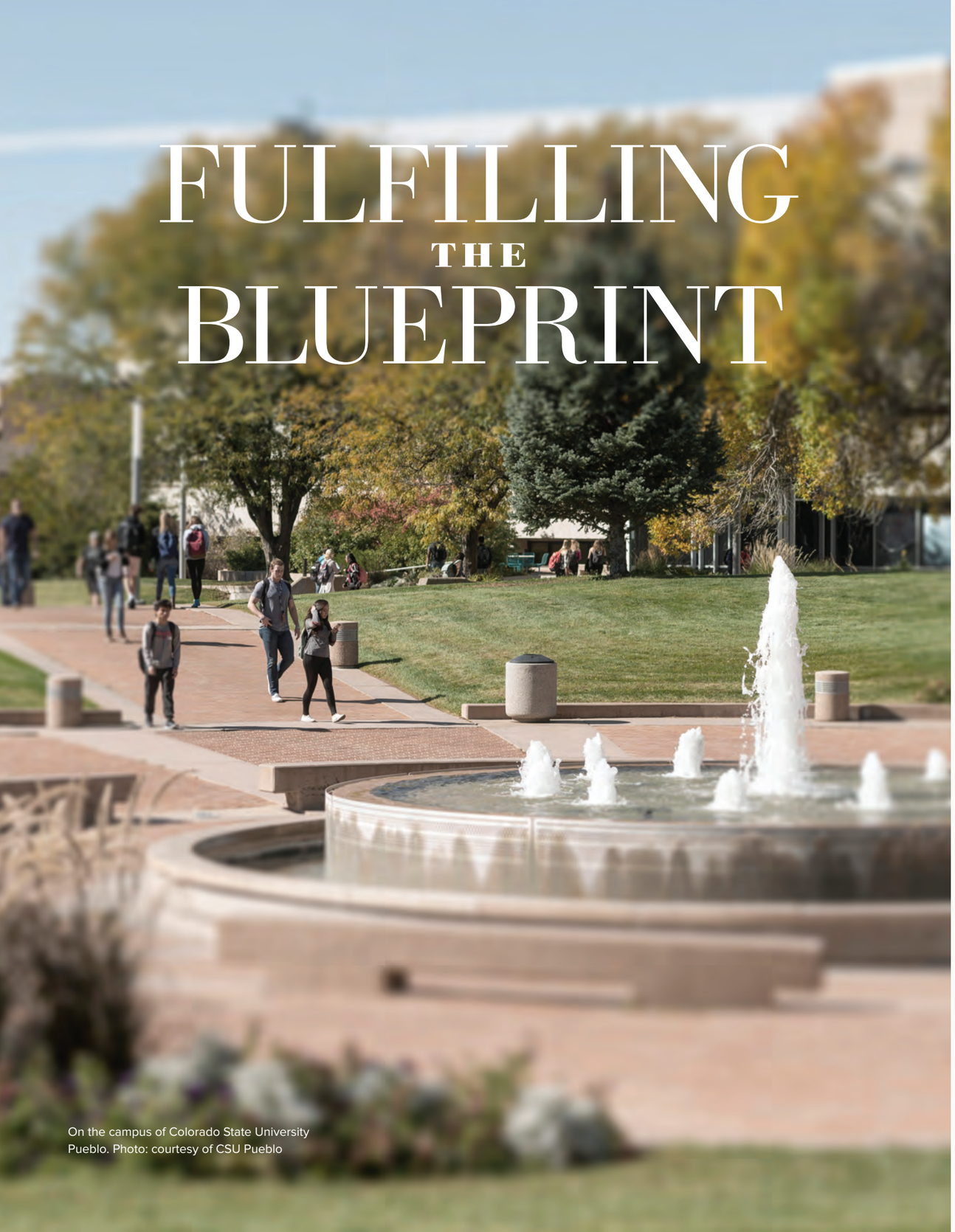
> "Dr. Paccione is a leader in this industry, and her commitment to Colorado students is unparalleled. Her expertise and dedication make her just the right person to lead Colorado's Department of Higher Education."
>
> – Gov. Jared Polis

During the pandemic, Paccione's role has markedly intensified, as postsecondary schools, students, and their families face untold financial challenges. For public colleges and universities, these challenges include anticipated hits to state funding and other revenue sources. The federal government has pledged more than $14 billion in coronavirus stimulus funds for higher education; much of the support is for emergency grants to college students in need. That leaves colleges and universities, which are significant employers in their communities, with many uncertainties and risks.

Lynn Bartels, a widely respected political columnist in Denver, reported on Paccione when she represented Fort Collins in the Colorado House of Representatives from 2003 to 2007. Paccione served two terms on the House Education Committee and rose to House majority caucus chair. Bartels covered that legislative work and, in a recent column in *Colorado Politics*, described Paccione's skills and commitment. "Here's to the students, faculty, and staff going through all this," Bartels wrote, referring to the pandemic. "And here's to Angie Paccione, for working around the clock to make sure Colorado comes out as well as it can."

Paccione said she maintains a sense of optimism arising from her experiences. Her personalized license plates proclaim "First1," reflecting her path. In 1976, as a high schooler, she tried out for the first U.S. Olympic women's basketball team; she didn't make the Olympic squad, but her showing kicked off years of play on national, college, and pro women's basketball teams, which took her around the world. Paccione also was a first-generation college student. She attended Stanford as the first African American woman to earn a full-ride athletics scholarship. Later, she became a teacher and administrator at Smoky Hill High School, in the Cherry Creek School District, and was the first woman to coach boys varsity high school basketball in Colorado's 5A class.

These firsts and others inspire and energize Paccione. "I'm as committed to students' success as I am to my own," she said. "That's what gives me energy. I don't want to let them down." ■



On the campus of Colorado State University Pueblo. Photo: courtesy of CSU Pueblo

FULFILLING THE BLUEPRINT

[Perspective: *Timothy Mottet* / PRESIDENT, CSU PUEBLO]

OUR 10-YEAR STRATEGIC PLAN IS SHOWN IN ACTION AT A CRITICAL TIME

For the past two years, our leadership team at Colorado State University Pueblo has been focused on innovation and the future – so when the pandemic hit, we were uniquely positioned to respond. Our long-term strategic plan prepared us to create a smart, nimble response to a world we didn't imagine when we unveiled the Vision 2028 blueprint in 2018.

From the beginning of the pandemic crisis, I articulated four priorities for any future decision (in this order): (1) Ensure our mission of teaching and learning; (2) Keep employees safe and full-time employees employed; (3) Create business continuity moving forward as we keep the campus running; (4) Provide financial sustainability.

Upholding these priorities has required we adapt quickly to meet the particular needs of our students. The university's IT team worked tirelessly to load 150 laptop Chromebook computers with the software our students needed. CSU Pueblo purchased 100 Internet regional "hot spots." Funding came through U.S. Department of Education Title III and V grants of $15.4 million, awards designated for Hispanic-Serving Institutions. Eighty more computers came from Colorado's Department of Higher Education.

Those computers and hot spots are a lifeline for many CSU Pueblo students. Erika Ayala Hodges is one. She and husband, Carter, are both Air Force veterans; they chose Pueblo as their new home when they left their posts in North Carolina. They drove a 25-foot RV to arrive at Pueblo's KOA Campground in January. They were just beginning to do the expected (enroll, find a place to rent, get a job) when the pandemic hit. They and their 1-year-old daughter, Isabella Rose, are now struggling through the temporary hold in their lives.

CSU Pueblo knows its students, and the keys to successful online learning were equipment and access. Erika is using a university laptop and hot spot. If we hadn't been able to respond to Erika's need, she would have lost her GI benefits and her chance at achieving her educational goals.

When we moved to close campus in March, we knew effective communication was critical to success. We have used multiple platforms to stay in touch with students and faculty as they transitioned online, and the campus website has been essential to keeping us informed. Our website Campus Safety: Coronavirus provides multiple resources, including weekly updates on professional development opportunities, dates and times for virtual "open office hours" to all employees, and information about fun online events and employee recognitions.

Electronic connection has become our lifeline to each other and to moving forward, even with current constraints. Faculty and students alike have had to be flexible in responding to remote learning.

Fortunately, some faculty are technology champions and gifted at creating a successful learning experience for students online. Associate Professor Alegria Ribadeneira is an outstanding example of teaching and service. When the university closed in-person classes, she knew her World Languages Program could not recognize its graduating seniors in the traditional way. They were left in a celebratory lurch. So she created an interactive flip e-book allowing students to tell their stories, say thanks, and post photos. Faculty recorded greetings, and Dr. Ribadeneira recorded a personal message for each graduate, ending with applause. Students can celebrate with friends and family now until December's on-campus ceremonies.

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>
> – Timothy Mottet, president, CSU Pueblo

In this challenging environment, we especially call upon the skills of experts such as instructional technologist Denise Henry. She helps faculty create effective communication and teaching online, whether they are synchronous (everyone meets at the same time) or asynchronous (self-guided learning). She's always focused on the student experience, which is enhanced through such techniques as adding reflection points, interactive tools, and formal assessment in a format that supports students needing ADA accommodation.

Everyone can learn to use technology regardless of their age and experience. CSU Pueblo makes sure all our faculty have the support they need to succeed as teachers in the online setting. They may not consider themselves digital natives, but they're working hard and trying.

And that's been one of the big lessons for our entire campus during this unprecedented challenge: It's good for everyone to keep learning – and planning and a spirit of innovation are the antidote to crisis. ■

Timothy Mottet, Ed.D., is president of Colorado State University Pueblo, a regional comprehensive university federally designated as a Hispanic-Serving Institution. As a recent Baldrige Executive Fellow, he undertook leadership development through a top-ranked program of the U.S. Department of Commerce.

[Perspective: *Becky Takeda-Tinker* / PRESIDENT, CSU GLOBAL]

LEADING ONLINE

OUR UNIVERSITY IS ADVANCING VIRTUAL EDUCATION TO BENEFIT STUDENTS AND EMPLOYERS

As we move beyond the immediate pandemic crisis, I am grateful for all our health care workers, first responders, and state of Colorado leaders who have dedicated themselves to our safety and well-being. Their hard work continues to be inspiring and invaluable to the future of Colorado.

I am also thankful for the work of our staff and faculty at Colorado State University Global, and our ability to continue to serve students toward their academic and workplace success, particularly at this time of soaring unemployment. While we, too, have had to adjust some of our operations, we have been able to maintain our regular class schedules without interruption, while continuing to support our students during a stressful time.

Although we have had to postpone our in-person spring commencement ceremony, I am excited that we will be able to celebrate the class of 2020 in our fully virtual ceremony May 30. CSU Global was one of the first institutions to provide such a ceremony, and I have no doubt this will be a fitting celebration of our students' extraordinary accomplishments.

As time passes and we start to look to the future (and out of our homes!), CSU Global's focus will be on getting people back to work in a post-pandemic world.

Our university model has always offered students and employers a highly versatile route to skills attainment and professional development. CSU Global began in 2008 – during the Great Recession – as the first independent, accredited, entirely online state university in the United States. Then, as now, we were able to offer tangible solutions to our students' employment challenges. Twelve years and more than 18,000 alumni later, CSU Global has more than 20,000 students enrolled from more than 60 countries, including students in nearly every county within Colorado.

Joe A. Mendoza / Colorado State University

Asynchronous online education is the hallmark of Colorado State University Global, and is a key to workforce development in a time that demands flexibility and innovation. Photo: Joe A. Mendoza / Colorado State University

For our students who were already juggling work, family, and community responsibilities, the COVID-19 crisis heightened their focus and time constraints – as well as their need for CSU Global's asynchronous online education. We've been proud of our model since its inception, and our commitment to a superior online and student-supportive learning environment is especially needed as institutions and businesses have been forced to transition to remote means for all that they do, including learning.

Our courses and programs are industry-aligned, and include employment-based tools, certification preparation, virtual internships, and workplace scenarios and simulations, to ensure that CSU Global learning is both academic and workplace relevant. Additionally, we are fortunate to have an expanding network of partners that help us deliver a high-quality, affordable education that truly meets the needs of industry and the workplace skills of tomorrow.

Our staff and faculty have collaborated with remarkable speed and agility to meet the recent challenges caused by the pandemic.

Since April, we have been able to provide free courses for educators who need information on best practices for K-12 and adult online teaching and online course creation. We've also added free courses for first responders who can benefit from information on stress management and social and emotional intelligence. And for those seeking a break from sheltering-in-place and endless Zoom meetings, we also added a free songwriting course led by Country Music Hall of Fame's Larry Gatlin – just think of the number of songs inspired by the goodness of humanity during the crisis!

We have modified policies that enable us to consider applications from high school graduates who were unable to take the SAT and ACT, and those who opted for Pass/No Pass grades during the turbulent spring semester. And for homeschoolers, we've opened up our gTPathway General Education courses, while we also partnered with Acadeum's Course Recovery Consortium to provide courses to students from other institutions who might not otherwise have been able to complete their year or degree due to COVID-19.

While the pandemic has tested our flexibility and service levels, moving forward we expect CSU Global's agile culture and adaptive online environment will continue to meet the demands of the dynamic future. We may not know what the global economy may throw our way, but certainly we will be ready to act and to serve. ■

Becky Takeda-Tinker, Ph.D., is the president and chief executive officer of Colorado State University Global. The Colorado Women's Chamber of Commerce recognized her among the 2020 Top 25 Most Powerful Women in Business for leadership, ability to mentor, and community service.

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The CSU community has been committed to improving lives and raising the human spirit for 150 years. We have faced many obstacles during that time, but perhaps none as extraordinary as COVID-19. Together, our efforts will continue and grow stronger as we support the world. Our infectious disease research is aiding in the fight against this pandemic, and we have adapted to operate in new and innovative ways. And as the world changes, our commitment to our students and their quality education remains the same.

Together. We continue.

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