COVID-19

LOCKDOWN’S VIOLENT RESPONSE
VACCINES: HOW WE BUILD TRUST
TEACHING THROUGH THE SCREEN
REDLINING AND WHO GETS SICK
The Magicians at Work

After Jim Steinmeyer’s book Hiding the Elephant: How Magicians Invented the Impossible and Learned to Disappear

Over the years they hunted, the wayward apprentice watchmakers, the disappointing sons who transformed their surnames, hunted over acres of hinges, cogs, calluses, hidden whiskey, mustaches a breath from feral, poured an ocean of fortune into fabrications of brass and iron, spent entire seasons strumming massive harps of wire into perfect calibrations of invisibility, prayed to the gods of adjustable mirrors, cursed the gods of temperamental gaslights, broke the legs of imitators and thieves, chewed holes in each other’s pockets, harnessed nightmares of giant silver hoops making endless passes over the bodies of the dead, hoisted high a cenotaph for hundreds of sacrificed rabbits, breathed miles of delicate thread into the lost labyrinths of their lungs, all to make a woman float to make a woman float and none of them ever thought of simply asking her.

—Nicky Beer, PhD
Department of English
The University of Colorado Denver prides itself on our creative/scholarly activities in diverse areas. Our faculty members hunt dark matter miles underground, publish poetry in The New Yorker, and fight for education as a fundamental right in the halls of the Colorado Capitol Building.

This magazine is our attempt to periodically highlight in one place the inspiring work of our faculty. In this inaugural issue, we approach the ways in which COVID-19 has upended normality, both near and far. Our researchers write about the pitfalls of virtual learning, the conundrum of vaccinating the anti-vaxxer, and the reasons behind the at-times violent response to lockdown and mask mandates. Jeremy Németh and Sarah Rowan profile Denver’s Valverde neighborhood and reveal how decades of redlining made certain neighborhoods bellwethers for COVID-19 survival.

This issue, and those to come, is the brainchild of Rachel Sturtz in the Office of Research Services. The magazine will evolve as she produces and edits future issues. Our original plan was to have both online and print editions. For now, it will just be available online. Get the word out about it. In future issues, we will dive deeper into CU Denver scholarly work, with in-depth profiles, investigative stories, and original reporting.

In the Winter 2021 issue, we’ll explore justice and equity research and creative works at CU Denver. Got a story we should cover? Reach out—we’d love to hear from you.

Bob Damrauer
Associate Vice Chancellor for Research

In the Wake of a Devastating Wildfire, burnt land has a respite before the next blaze. Until now, no one has known the length of that break. Researchers from CU Denver and Portland State looked into the increasing rates and intensity of fires in the U.S. West, up tenfold over the past 40 years. They wanted to know: Once the shrubs, trees, and other woody fuels have burned up, how long would it take before the next one?

About 10 to 15 years, says Brian Buma, PhD, assistant professor in the Department of Integrative Biology. That post-burn “protection,” meaning a lower probability of reburning, is not a long time, with the reburn effect shorter in California and longer in the Rockies.

The results serve as a warning to fire managers of the limits of natural buffers against reburning and the importance of letting fires burn in the first place. Prescribed burns and thinning practices can limit woody fuel and prevent widespread destruction, like Colorado saw in 2002, when the Hayman Fire impacted more than 138,000 acres of the Colorado Front Range. This fire, Buma reminds us, happened 18 years ago.
Fetal Health Negatively Impacted by Airplane Noise

If the skies seem noisy these days, it’s because they are. A new Federal Aviation Administration (FAA) policy called NextGen unintentionally increased noise levels when it implemented a new satellite monitoring system in a number of airports around the U.S. The system allows an increased number of planes to fly in the air simultaneously to save fuel and reduce flight time. It also unintentionally increased noise levels when it implemented a new satellite monitoring system in a number of airports around the U.S. The system allows an increased number of planes to fly in the air simultaneously to save fuel and reduce flight time. It also increased aviation noise—a headache for nearby residents, but worse still for expectant mothers.

By examining unique birth records over a 12-year period and analyzing information on mothers’ home addresses and National Transportation noise data near Newark Liberty International in New Jersey, CU Denver researchers found an inextricable link between noise exposure and the low birth weight of infants.

Prolonged exposure in the “noise pollution corridor”—the new, highly trafficked flight paths to runways that can expose neighborhoods to noise levels over the 55dB threshold—leads to a 17% greater chance of mothers having a low birth weight baby.

Laura Argys, PhD, professor of economics, and her colleagues Susan Averett and Muzhe Yang said the findings are significant and have major policy implications. “Low birth weight can have important health and developmental impacts through childhood that last into adulthood,” says Argys. —Sarah Erickson

THE JINJU FORMATION OF SOUTH KOREA IS an extraordinarily rich site for Cretaceous-era, fossilized dinosaur tracks. In 2019, a construction crew stumbled across a new set of tracks that were detailed enough to show the imprint of toes, toe pads, and skin of the feet that had once walked across the muddy shoreline. The narrow trackways were made by the hind feet of a crocodylomorph, an ancient cousin of the crocodile. Unlike our modern crocs, who walk on four legs, the fossilized tracks belonged to a nine-foot-tall, bipedal croc that walked with one foot in front of another.

When CU Denver’s Martin Lockley, PhD, a specialist in fossilized tracks, saw them, he knew the tracks belonged to an undiscovered species. Working with Kyung Soo Kim, professor of paleontology at Chonju National University of Education in South Korea, Lockley and his colleagues published their findings in Scientific Reports.

CARTILAGE IS A COMPLIANT, elastic tissue that’s soft enough to cushion joints but strong enough to resist compression and withstand the substantial load bearing of our bodies: key for running, jumping, and our daily wear and tear. But creating synthetic replacements that truly match the properties and behaviors of biological tissues is tough. CU Denver scientists, led by mechanical engineer professor Chris Yakacki, PhD, are the first to 3D-print a complex, porous lattice structure using liquid crystal elastomers (LCEs), creating devices that can finally mimic the tricky tissue.

Yakacki, who works out of CU Denver’s Smart Materials and Biomechanics (SMAB) Lab, worked with his team to develop a honey-like LC resin that, when hit with ultraviolet light, cures and forms new bonds in a succession of thin photopolymer layers. The final cured resin creates a soft, strong, and compliant elastomer. When printed in lattice structures—levels of a honeycomb pattern—it began to mimic cartilage.

The structures have several applications, like shock-absorbing football helmet foam (for which the NFL has given Yakacki a grant) or even small biomedi cal implants for toes, but Yakacki is most excited about its possibilities in the spine because 3D printing’s precision can match the complicated anatomy perfectly.

 EVENTS

GENDER BIAS + CONCUSSIONS

Boys’ lacrosse is a full contact sport that allows body and stick checking, and its players must wear hard shell helmets with full face masks. Girls’ lacrosse, which prohibits body checking and has rules in place to prevent stick checking to the head, allows optional flexible headgear with or without integrated eye protection. The difference in protective equipment is echoed in head injuries.

A study by faculty at CU Denver and the Colorado School of Public Health found that girls are 2.6 times more likely to sustain a concussion, and that 45% of their concussions could have been prevented with the boys’ helmets. In girls’ lacrosse, stick or ball contact was the most common mechanism of concussion, accounting for 73% of all concussions, while athlete-athlete contact accounted for only 20%.

“Bottom line, girls playing lacrosse are sustaining concussions that could have been prevented if gender bias did not prohibit them from wearing the very helmet required for boys,” says lead author Dawn Comstock, PhD, professor of epidemiology at the Colorado School of Public Health. —S.E.
The first round of funds, a total of $150,000, was awarded to nine winners in October, including Farnoush Banaei-Kashani, PhD, for his project, “Developing Descriptive and Predictive Causal Models to Study the Impacts of Highway Construction on Ambient Air Quality in the Front Range”; Serena Kim, PhD, for “Integrated Solar Energy for Sustainable, Resilient, and Equitable Communities”; and Bryan Wee for “In Support of Child-Friendly Cities: Identifying and Applying Geospatial Technologies to Represent Children’s Sense of Place.” —Alex DeWind

**Police Shootings Linked to Inaccurate Dispatch Information**

**Dispatch Calls Provide Key Information to Officers**

Officer decision-making and consequently their actions, said Paul Taylor, PhD, assistant professor in the School of Public Affairs.

“If the information they receive is incorrect, by even the slightest amount, it can drastically increase the likelihood for an error,” says Taylor.

In his study, 300 officers listened to a simulated dispatch call for a potential trespass in progress with a description of the subject involved. They heard one of three scenarios: the initial dispatch information, the initial call with an update that the subject “appeared to be holding a gun,” and a third that said the subject “appeared to be talking on a cell phone.”

Officers shot the subject more than twice as often when the dispatch call stated that the subject “appeared to be holding a gun.” Taylor attributed this to confirmation bias. He said, in the face of uncertainty and time compression, people tend to cling to their initial interpretation or understanding of an event. They actively seek information that confirms that understanding while ignoring disconfirming information at a subconscious level.

Taylor, a former police officer, said that understanding the underlying weaknesses in everyday police practice can help in the search for evidence-based practices to improve safety for officers and the public they serve. —S.E.

**MOTORCYCLE RALLY LEADS TO COVID-19 SURGE**

**IN THE EARLY MONTHS OF THE PANDEMIC,** Black Lives Matter protests and Trump rallies failed to produce a surge in COVID-19 cases, according to Andrew Friedson, PhD, associate professor of economics, who tracked the outcomes of each. Instead, the largest superspreader event turned out to be South Dakota’s Sturgis Motorcycle Rally, which may have been responsible for 250,000 cases.

Over 400,000 motorcycle enthusiasts gathered in Sturgis, South Dakota, in mid-August for the annual rally. Attendees barely wore masks or socially distanced, and that led to an estimated 250,000 COVID-19 cases from August 2 to September 2, nearly 20% of the national cases during that time period.

Friedson and his colleagues estimated that the rally generated $12.2 billion in public health costs.
IN THE MIDST OF A PANDEMIC, POST-APOCALYPIC MOVIES offer a sense of schadenfreude that things could always be worse. See: David Liban’s new film, A Feral World, which depicts a Colorado rife with nanobot attacks and scavenging orphans. With the film festival season canceled due to the pandemic, the film made its debut on iTunes and Amazon on September 22.

The film follows a boy trudging through a post-apocalyptic Colorado, when he comes across a woman searching for her abducted daughter. The pair bond and their journey leads to a despot who collects children for nefarious ends. Similar to Richard Linklater’s film Boyhood, Liban shot the film over a number of years (four, in his case), aging the film’s characters as the story’s timeline progresses.

Liban, associate professor and chair of the Film and TV department in CAM, said he’s always been a fan of post-apocalyptic films and books like Road Warrior, Book of Eli, The Road, and Seed. But it was while watching his son Caleb act that he was inspired to create the short Feral, with his son in the lead role. After the short made its rounds on the film festival circuit, Liban expanded it into a feature.

Pulling from CAM talent, Liban filled his roster with faculty, including associate professor Jessica McGaugh, lecturer Timothy McCracken, associate professor Craig Volk, former associate professor Leslie Gaston-Bird, as well as a crew made up of students and alumni.

“I wouldn’t have been able to make this movie without the students,” says Liban, who funded the film himself, with additional help from online fundraisers and grants from ORS. “It was truly a labor of love.”

The actors made their way through locations like a burned-out sugar beet factory in Lyon, the Tivoli building, and Bear Creek State Park. Filming in Colorado is a filmmaker’s dream: Unlike in L.A., Liban said people couldn’t be friendlier. He’s hoping for that same hospitality next summer.

IN JULY, COLORADO STATE PATROL troopers began clearing out nearly 200 residents from homeless encampments that surround the Colorado Capitol. The enforcement of city ordinances like camping bans, park curfews, and obstructions of public passageways is lawful. But a study from CU Denver found that the increase in “tough love” and “quality of life” policing in cities around the U.S. undermines the sleeping patterns, physical safety, and mental health of people experiencing homelessness.

The study, done in collaboration with advocacy organization Denver Homeless Out Loud, surveyed 484 people experiencing homelessness across Denver. Researchers found that 74% had been asked to “move along” by police, and that 44% had been ticketed or arrested for a “quality of life” violation.

Without the well-lit areas of public parks or the security and resources of a group—reasons why people experiencing homelessness stay together—those who moved to avoid police contact were more than twice as likely to be physically assaulted and 39% more likely to be robbed than homeless persons who didn’t move. And when police enforced camping or shelter bans, there was a 45% increase in the risk of weather-related health issues like frostbite, heatstroke, and dehydration.

The situation will only get worse alongside the pandemic and the increasing number of evictions, said Marisa Westbrook, doctoral student in health and behavioral sciences, who worked alongside associate professor Tony Robinson, PhD, on the study.

WHERE’S WALDO?

SPACE WEATHER, WHICH CAN LEAD TO beautiful auroras in the night sky or destructive effects on power grids and satellites, is especially important for scientists and engineers to understand and predict. Last fall, Mark Goldkowski, PhD, professor of electrical engineering, along with colleagues at Georgia Institute of Technology and Stanford University, unveiled the world’s largest database of extremely low frequency (ELF)/very low frequency (VLF) data. The open-access database is named WALDO, or Worldwide Archive of Low-Frequency Data and Observations.

The preserved recordings capture a snapshot of the Earth’s quickly changing atmosphere and space environment, which is why the effort to maintain existing data is crucial for future research. Researchers around the world will be able to access nearly 1,000 terabytes (TB) of data from the living repository to further scientific efforts in fields like ionospheric remote sensing, earthquake forecasting, subterranean prospecting, and space weather effects.
I
n the weeks following the stay-at-home orders, some people began to react with violence to their situation. This displacement of blame is called scapegoating. In May, lecturer Michael Kim joined professor Sarah Tyson, PhD, on the CU Denver Philosophy Podcast to talk about it. The following conversation has been edited for clarity and length. You can listen to the full episode here.

Q&A

THE BLAME GAME

Explaining lockdown’s violent response through the lens of French philosopher René Girard

BY SARAH TYSON & MICHAEL KIM

Sarah Tyson: You mentioned that René Girard, and specifically his thinking about scapegoating, has been useful to you for thinking about the pandemic. Tell us why.

Michael Kim: My thoughts initially turned to Girard when I started paying attention to the various kinds of eruptions of violence, both potential and actual that we’ve been seeing in the past couple of weeks. For example, the lockdown protests, in which people open-carried firearms and assaulted store employees enforcing mask policies. Girard has a foundational concept called mimetic desire. Desire for Girard is paradoxically both social and conflictual. He believes that when we have desires, they don’t just come from within us—from some inner core or id—but rather we mimic or mirror desires from other people.

As children, we mimic our parents, both in terms of behavior and what we find important to want or desire. The consequence of this is that our desire is never our own, but a result of somebody else’s. This can lead to what Girard calls rivalry or conflict: The other person’s desire is seen as a threat to my own acquisition of my desires. This is one of the fundamental sources of violence in society. Girard believes there’s something inherent about rivalry within the very fact of social living. We try to put the longest possible interval between episodes of violence by trying to differentiate, separate and stagger the various ways in which we might compete for the optics of our desires.

One of the primary mechanisms of that separation and deferral of conflict is through scapegoating. The scapegoat becomes the third party to which we can export our hostilities. We locate it as the cause of tension or disharmony within our society.

Then the ritual sacrifice of the scapegoat becomes the way in which we are able to purge those conflictual and violent tendencies. Wars are the obvious example. Jews were persecuted during the Black Death because you can’t blame a disease. You need to find somebody to blame and to channel that frustration of what you’re not no longer able to do within the security and comfort of a well regulated society.

That can help us think about what’s happening now, during this pandemic, when our lives have been entirely disrupted. Millions of people have lost their jobs. And even those of us fortunate enough to still have jobs and income have had our lives disrupted in other kinds of ways. And so there’s not only a disruption in our lives, but a change in the way in which we’re able to negotiate social life. And if we’re not employed, or we’re not sure about what the future will hold, then our capacity to live is threatened.

And there’s something about not having anyone or anything to blame, right? I think about a scene in an early episode of Family Guy where Peter was supposedly lost at sea and drowned. At the memorial service they hold on the shore, the mayor takes out a knife and starts stabbing the water to punish the sea for drowning Peter. [Editor’s note: “You won’t be hurting anyone anymore,” he yells.]

It illustrates this need we have to find someone or something to blame. We want revenge when our lives are harmed or when something is taken away from us. And when we can’t do that, when the cause of that loss is something like a virus, then you see this almost desperate and urgent need to find something or someone who can be held accountable.

So we’re seeing conspiracy theories about how this is a false flag, like the virus was lab-created either by the U.S. government to justify this authoritarian lockdown or by the Chinese. We want to blame scientists or some nefarious cabal, because otherwise, there’s no one to blame.

That’s when we see these irrational eruptions of violence, in the Family Dollar incident, a security guard told a female customer to put on a face mask. She went home, told her husband, and then the husband came back later totrail the security guard and, eventually, shoot him.

We’re seeing this violence as actual shooting or fighting, or posturing, like the storming of the Michigan State Capitol by people with weapons.

ST: You’re giving me insight into this experience I keep having when I go for walks: negotiating the sidewalk or intersection with somebody else. This is not a simple matter of just walking past one another.

If you want to give six feet, it requires somebody stepping off the sidewalk. I’m willing to be the person who does it, but I always feel angry when somebody doesn’t acknowledge that I’ve done it. I feel a little annoyed.

It’s interesting to think about that part of what’s going on there, right? There’s a desire to be able to just walk, and we’re in a situation where we can’t. It requires these action. If I extend my hand to you for a handshake, Girard knows that there’s a problem, no matter what your response. If you refuse the handshake, then your refusal becomes an affront to me. You’ve initiated a moment of conflict and power struggle.

MK: Girard talks about the everyday, mundane experience of a handshake, a social act that by refusing my hand, and that act can immediately turn us into rivals. If you give someone space on the sidewalk, and they don’t reciprocate in the right way, then the expectation is that a good kind of reciprocation has broken down and then that reciprocity turns conflictual.

On the other hand, if you do return my handshake, what looks like accord nevertheless has the potential for conflict. My response to your accepting of my handshake or giving me six feet is tied up in how I perceive what your response is, or should be, to it. And if you end reciprocally, your response to my response has these strange, potentially conflictual dynamics.

ST: It exacerbates this whole situation, right? We’re not really sure how to act. There’s all the pressure we feel to wear these masks in public, and then the resistance to that if you are someone who believes in these conspiracies, for example. We need to be more aware of ourselves, our own desires, and why we are reacting the way we are.

MK: Girard reminds us that the mimetic nature of desire tends to hide itself. We forget that the way we are acting is not just ourselves, but the ways in which we are not only responding to others, but also picturing others and others’ desires.
CoV-2, the virus causing the pandemic, becomes available. Despite broad enthusiasm for a vaccine, we will have to face some hard questions about what to do with those who do not want to be vaccinated.

FOR MORE THAN a decade, I have been studying vaccine refusal and the ways individual rights and community responsibilities are bound together and are sometimes in conflict. Now, as we face new questions about the COVID-19 pandemic, and federal and state responses, these issues are of critical importance.

Outside of the military, the U.S. does not have any existing laws to mandate vaccination, and the laws that do exist are enforced at the state or local level. All states require childhood vaccines as a condition for accessing schools or childcare settings, though states allow exemptions for medical reasons and sometimes non-medical ones. Although a range of vaccines are typically encouraged, not mandated. The exception is for healthcare workers and students who face greater risk of becoming infected and spreading infection, particularly to those who might be most vulnerable to the worst outcomes of infection.

Childhood vaccines are recorded in state-run vaccine registries. These databases merge records from multiple health providers and allow families to more easily access their children’s vaccine records when needed. Registries also help states and local governments identify where pockets with low immunity exist and to act quickly to contain outbreaks. Although these systems are secure and allow individuals to opt out, they nonetheless raise concerns about what parents I spoke with referred to as “womb-to-tomb tracking.”

EVEN IN PLACES where parents are legally entitled to opt out of vaccines, states have the power during a disease outbreak to quarantine or otherwise limit the freedoms of the unvaccinated. This right was affirmed in 1905 when the U.S. Supreme Court heard a challenge to a law that required residents to be vaccinated against smallpox or pay a fine. The court ruled in that case, Jacobson v. MA, that governments are entitled to limit individual freedoms for the good of the community, arguing that, “Society based on the rule that each one is a law unto himself would soon be confronted with disorder and anarchy. Real liberty for all could not exist under the operation of a principle which recognizes the right of each individual person to use his own...regardless of the injury that may be done to others.”

State powers are not absolute. Public agents must demonstrate necessity and cannot exercise power in an arbitrary, unreasonable manner or go beyond what was reasonably required for the safety of the public.” There must be a clear relationship between the intervention and the legitimate public health goal it seeks to accomplish. Since this 1905 decision, we have seen challenges to these state powers, which inform our current and future responses to COVID-19. In 2019, with measles outbreaks around the country, many cities worked to immunize those who were unvaccinated and enacted quarantines for those who refused. Rockland County in New York, for example, restricted the movement of people who lived in areas with high rates of infection, barring them from school until a threshold level of immunity was reached, and blocking unvaccinated children from gatherings of more than 10 people. New York City went further and identified four Brooklyn ZIP codes with high rates of unimmunized children and measles infections and ordered anyone over six months of age who lived, worked, or attended school there to be immunized or face a fine.

WHEN IT COMES to children, there is strong consensus on vaccines. Some advocates insist that access to vaccines is a core human right consistent with the United Nations Convention on the Rights of the Child, which promises children “special protection” and opportunities to “develop physically, morally, spiritually, and socially in a healthy and normal manner.” (Those who oppose vaccines make the same assertion.) With adults, these issues are more complicated, since adults’ rights to refuse healthcare, even when
The Jacobson decision was cited in 1925 to defend state-ordered sterilization as a means of preventing the state from interfering with the welfare of society. Marbury v. Madison, a decision that protected property rights and should be protected from government intrusion.

In Colorado, one resolution additionally addressed on Colorado Republican Party activism. COVID-19 pandemic. Balancing individual rights and community interests is complex and requires thoughtful policy makers and clear communication. The public also has a role to play in ensuring that state power is not used against those who are already vulnerable. This might indeed result in more protests but also spark essential conversations on how states can account for their efforts to protect everyone in the community.

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BY RACHEL STURTZ

The Xiaojun Ren Group Earns Its First R01

Visualizing the biochemical reaction of a single epigenetic molecule leads to a paradigm shift.

L ast August, Xiaojun Ren was nearly celebratory. Two days before, he’d heard that his application for an R01 National Institutes of Health (NIH) Research Project Grant was competitive—“13th percentile,” he told me—which meant there was a good likelihood he’d get it, especially as a new researcher. He also asked that we not talk about it in the article because, well, it hadn’t happened yet. He’s superstitious. And despite his ear-to-ear grin, Ren mentioned the word “stressful” more than a few times. Six years is a long time to work toward a vaccine available, half of all Americans and 67% of those over age 60 say they plan to get the vaccine when it becomes available. When the polio vaccine was first licensed, there was more demand than supply, and arguments ensued over whether it should first be given to those who could pay for it or to those at greatest risk, and who should decide. The response to one of the last outbreaks of smallpox—New York in 1947—suffered from inadequate supply. Recent vaccine shortages have forced decisions on how best to ration them. People generally want vaccines and see them as beneficial, but governments must strategize in finding ways to contain infection as cities, businesses, and travel systems reopen. Arguments about a containment strategy less invasive than a vaccine, like whether to require a mask in stores or on flights, suggest this may be difficult to solve. Questions about how to handle vaccine refusal will become increasingly significant, particularly if evidence of immunity becomes required for participation in civil society. What limitations, we must ask, should be reasonably placed on adults who don’t want the vaccine and don’t have immunity from infection? State law may drive policies on this, but corporations and private entities may also be able to make vaccination a condition of employment or service. During other outbreaks, employees in particular industries have often been required to show evidence of vaccination or immunity to continue working. For example, hospitals typically require workers who refuse the flu vaccine to wear masks and stickers on their badges to denote their unimmunized status, or some will simply terminate their employment. Based on precedent that was set in the historic case of smallpox, states would likely be able to require COVID-19 immunizations or exclude those individuals without immunity from work. States could also force unimmunized workers to take heavy precautions to prevent them from infecting others, so long as scientific consensus exists. Yet the state’s ability to “keep in view the welfare, comfort, and safety of the many, and not permit the interests of the few as the Jacobson decision suggests, will not be easy. Prior to COVID-19, we faced a social landscape marred by disputes over what constitutes fact, knowledge, authority, and the appropriate role of the state. COVID-19 did not create these disputes, but magnified them. The success of any public health intervention will rest on the public’s perceptions of the reasonableness of the proposed interventions. That may not be forthcoming. IN THE PAST few months, many organizations have condemned potential future efforts to require vaccines, to track immunization records, or to make employment decisions based on vaccine status. In Colorado, one resolution additionally called on the Colorado Republican Party to affirm “the rights of citizens to live free of tracking and discrimination (medical tyranny).” Texans passed a resolution insisting that “healthcare decisions, including routine preventative care such as immunizations, should be between a patient and healthcare professional and should be protected from government intrusion.” Other states, including Wyoming and New Jersey, have organized efforts to limit vaccine usage or mandates. These resolutions, actions, and recent protests suggest that states’ ability to place community above individual preference will likely be challenging and challenged. Vaccines are an important tool in promoting public health and have saved lives. Nonetheless, questioning state power remains important. In addition to controlling disease, the Jacobson decision was cited in 1925 to defend state-ordered sterilization to purportedly protect the “health of the patient” by preventing the state from being “swamped with incompetence.” Just this spring, the fifth U.S. Circuit Court of Appeals used the case to validate Texas’s order to stop physicians from performing abortions during the COVID-19 pandemic. Balancing individual rights and community interests is complex and requires thoughtful policy makers and clear communication. The public also has a role to play in ensuring that state power is not used against those who are already vulnerable. This might indeed result in more protests but also spark essential conversations on how states can account for their efforts to protect everyone in the community.

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A few months later, Ren’s speculation proved correct. The R01 funding came through.

LAST NOVEMBER, Ren and a team of undergraduate and graduate students published a paper in bioRxiv (pronounced “bio-archive”), an online distribution service for pre-publication critique. The study was built on a decade-old discovery in the gene regulation field. An online service for pre-publication critique, bioRxiv, is a major advancement in sharing research. The study was built on a decade-old discovery in the gene regulation field as others have scrambled to catch up.

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The discoveries explain within liquid droplets.

The separation of oil and water, stimulates biochemical reactions and may underpin the selective expression of genes. Ren set out to understand the physicochemical principles behind droplet formation.

In the study, the team was able to separate and observe individual genes in a liquid droplet within the nucleus of a cell. From a very early point in the separation, the team found these liquid droplets assemble and dissemble in response to different environmental stimuli, like blowing colorful bubbles. They watched how genetic materials are incorporated into or released from the droplets in real time, and in doing so, pinpointed a driving force within the protein that encompassed specific genes within liquid droplets.

The discoveries explain why the same gene in different cell types of the human body functions distinctly—turning the outside world took notice.

Within four days, journals began reaching out about the discovery. Within 20 days, the groundbreaking study was expedited and published in the Journal of Biological Chemistry. "By the end of the year, the liquid-liquid phase separation in gene regulation was noted among the top 10 of Science's 2018 Breakthroughs of the Year."

"WE ARE ONE OF THE FIRST of a few labs to develop a single molecule technique to understand the order of the biochemical reactions within the cell," says Ren. Only a few labs are within spitting distance of this kind of research: MIT, Harvard, National Institutes of Health, and University of California, Berkeley, among them.

In 2016, Ren and a team of undergraduate and graduate students developed a sophisticated technique called live-cell, single-molecule imaging, which allows the observation of single molecules in real time in a living cell. This pioneering technique was published in eLife. Two years after they developed the single-molecule technique, the team used it to view the genetic processes that lead to the formation of tumors, which led to a paper published in Nature Communications. By watching individual molecules, the team identified a single protein, Chromobox 7, capable of turning off genes that lead to tumors called diffuse intrinsic pontine gliomas (DIPGs)—a rare and devastating form of pediatric cancer.

Before then, most scientists and researchers guessed what was happening within a cell that causes diseases like DIPG. They could narrow down and observe the molecular culprits in test tubes, but no one understood the physics principle that organized them. No one was searching for the driving force that led that physics perspective: What are the fundamentals of the assembly's driving force? What is the energy source?

REN FOCUSED ON chromatin, the material that makes up the structure of chromosomes.

Chromatin acts like an unwieldy vine composed of DNA, RNA, and histones, which look like beads on a string and create the structure of chromosomes. The DNA in one cell is approximately six feet long, and chromatin wraps it so tightly that it crams those six feet into a space one-hundredth of a millimeter in diameter; it's the twine that keeps the twisted ladder of the DNA helix from unraveling.

But chromatin is malleable and exists in two forms: euchromatin (active) and heterochromatin (silent). Polycomb Group complexes—proteins that control a huge swath of genes that regulate several cellular functions and all developmental pathways—control its structure. They can remodel chromatin and switch genes on and off, like the ones that lead to tumors. That's why understanding the molecular details is so important.

The only problem? There was no easily accessible technique to study.

Three years before his team discovered that the Chromobox 7 protein shuts off the growth of DIPGs, Ren and his team created what they called single-molecule chromat immunoprecipitation imaging (Sm-ChIPi). The group used an ultra-sensitive single-molecule technique that can observe Polycomb Group proteins binding to chromatin in action.

When Ren's lab became the first to visualize a biochemical reaction of a single epigenetic molecule in a living cell in real time, it was a paradigm shift in epigenetics, the study of external modifications to DNA. With the technique, they could dissect molecules to understand their behavior. They could reprogram the epigenome and turn off the drivers of disease.

In their first study using Sm-ChIPi, the team found that two protein complexes called PRC1 and PRC2 assembled differently on chromatin. Ren showed the scientific community that understanding the cell assembly process—and answering the why behind it—was possible. His group published their findings in the November 2015 issue of the Journal of Biological Chemistry. It won one of the journal's Best of the Year designations and became one of its most read studies of 2015.

REN CREDITS HIS initial interest in chemistry to his middle school chemistry teacher in the small village of Tianxing, in China. His interest in biology came in high school, but he chose to study polymer chemistry at the University of Michigan, where he went on to earn his masters in organic chemistry and his doctorate in macromolecular chemistry and physics under the supervision of Professor Jiacong Shen, member of the Chinese Academy of Sciences, and Professor Guimin Luo.

When he began his post-doctoral fellow at the University of Cambridge, he teamed up with Sir Shankar Balasubramanian and Sir David Klenerman, two knighted chemists who had created a new generation of single molecule methodology called Solexa, which led to an explosion of accurate, low-cost sequencing of human genomes. Ren's advisors focused on telomerase, the end part of chromatin. Ren showed the scientific community that understanding the cell assembly process—and answering the why behind it—was possible. His group published their findings in the November 2015 issue of the Journal of Biological Chemistry. It won one of the journal's Best of the Year designations and became one of its most read studies of 2015.

Ren followed suit, developing an interest in chromatin and the single molecule.

During his time at Cambridge, Ren waffled between physics and biochemistry—which subject had bigger problems to solve?

"My advisors are pioneers in physics technology, but they focused on genetics," says Ren. He was interested in the cell itself. I thought I could develop a way for us to observe these molecules in living cells, in vivo. But to do it, I needed to leave.

He left Cambridge for the University of Michigan, in Ann Arbor, to join Tom Kebreab as his advisor in epigenetics. There, Ren says, he focused on the molecular processes in living cells. He found his calling: Polycomb Group protein complexes and epigenetics.

"One day, I hoped to combine all of the epigenetics, cell biology, bio-physics, chemistry in my own lab—that's why I came to CU Denver," says Ren. "I needed a place that would allow me to create a lab different from any other."

THE XIAOJUAN REN GROUP began in September 2012. He works alongside undergraduates and graduates as they probe the mysteries of stem cells, chromatin biochemistry, and single-molecule biophysics. Since its formation, the group has pushed the limits of single-molecule fluorescence microscopy methods to study epigenetic regulators in native states and in living cells using single-molecule imaging.

And now, with the R01 funding, the team can dive deeper into the liquid-liquid phase separation, hoping to understand the efficient and specific control of gene activity, which is essential for all life. They also hope to define how liquid droplets of Polycomb proteins organize the genome—a key to understanding how healthy and disease states are to understand.
very year, budget crises, administrative bloat, and student attrition plague institutions of higher education. And yet, we stay, gluttonous for the punishment.

This year, the proverbial shit hit the fan when COVID-19 forced everyone indoors and online. The ensuing rush was a veritable fox hunt for the technological solutions that would provide continuity as we lost our campuses and our communities. Leave the classroom, but get back to class as early as technologically possible. The “view hallo” was shouted at the first sight of Zoom, Slack, and Flipgrid. I have been in digital learning in one form or another since 1999, but I have never been asked to speak on the subject more than I have been these past months.

My expertise, once seen as fringe or suspect, or chancy, has now become the practice upon which education must wager its future.

And yet my expertise in digital pedagogy—specifically, critical digital pedagogy—resides more in the relationships between teachers and students than it does in the delivery of instruction. I’m often thought of as the “tech” guy, but what I actually do is very intentionally human.

When I’m asked what technologies I’d recommend to build community online, ensure students don’t cheat, or enable meaningful discussion, I’ve found myself answering, “Teach through the screen, not to the screen.” Find out where your students are, and make your classroom there, in a multiplicity of places.

WHEN I FIRST started teaching online a dozen years ago, my students were scattered across the United States and the Middle East. They were single mothers in rural communities, truck drivers who were rarely in one place for very long, first-generation college students without access to a library, and enlisted men and women serving abroad.

There was no classroom for them. I had to make one: with words, with conversational context, with pictures, with questions.

Taking an online class was a risk for many of them. They couldn’t be sure they’d finish the term, or that the state funding would come through in time to buy their books. Many of them didn’t understand how college could be different from high school, much less how learning online was radically dissimilar from classroom learning.

They came to their screens with little sense of what was there. It wasn’t—couldn’t be—the technology that created a space for learning.

THIS CRISIS facing education didn’t need COVID-19. We have been living on the edge for a long time; and to be honest, I’m not sure which way is down. On the one side, there are administrators and administrations that suppose online programs are one solution to the retention of student populations, an answer of higher enrollment for the question of institutional sustainability. These folks are much less concerned with the pedagogy of digital teaching and learning than with the statistics that reflect success—which means salability of their programs, which are supported by very instrumental approaches to education, approaches that Paulo Freire referred to as “the banking model” of education. Information, or content, is handed to students, and they are then expected to echo back that information in the form of assessments. Rather than knowledge production, these instrumental approaches are focused on knowledge consumption.

But on the other thin side of this edge is a concern about online learning: that it is inadequate, that it’s a poor substitute for classroom learning. Among students, online courses are commonly considered easier and more convenient. And this is because most of the practices of online education assume a universalization of the learning process, one generally founded on behaviorism. In truth, most online practices, courses, and programs are a poor substitute for classroom learning, in part because they attempt to be as much of the classroom as possible. But the only thing that really transfers from the physical to the digital is lecture, rubrics for participation, and, unfortunatley, our fear that students will cheat.

We have not coded for the human in education, and so, unless we know how to seek it out past digital platforms, algorithms, and surveillance tools, the human is largely left out of online learning.

The problem, as I see it, is that no one has started from the beginning. The entire online education industry has jumped the gun. Rather than any single thing bursting or can answer that question. We need to acknowledge and rely on the human experience.

IN THE MIDST of this crisis, when we are faced not only with an abrupt switch to digital teaching, and the practices and complications that come with it, but also with the inequities of technology, there are many who want to transform uncertainty into opportunity. Corporations dealing in educational technology want us to believe they have the solutions that will not only make this transition to online easier, but will guarantee the success of our students. And advocates for online learning—instructional designers and technologists in some cases, people like me in other cases, and also the stay administartor—see this as a shining moment when everything we know that works in terms of online education will come to light. “Teach to the screen,” they say. “It’s guaranteed to work.”

BUT a crisis is not an opportunity, unless it helps bring communities together. We can plug our students into the virtual learning environment, we can mandate that they turn their cameras on in Zoom, we can use remote proctoring services to ensure they’re not cheating on their exams... but does that constitute teaching? Does that help us develop a sustainable, equitable digital pedagogy?

What happens when learning goes online? This is not a question that technology can answer. It’s one that we—teachers, librarians, learning designers, students—need to answer. Good online education comes not from the purchase of another platform, but out of dialogue, out of the will to empower everyone involved in teaching and learning to create a form of digital learning that isn’t just instrumental or performative but authentic, meaningful, and just.

“I have been in digital learning in one form or another since 1999, but I have never been asked to speak on the subject more than I have been these past months.”

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WHAT HAPPENS WHEN LEARNING GOES ONLINE? THIS IS NOT A QUESTION THAT TECHNOLOGY CAN ANSWER. IT’S ONE THAT WE—TEACHERS, LIBRARIANS, LEARNING DESIGNERS, STUDENTS—NEED TO ANSWER.
Redlining decades ago set communities up for greater danger. Pollution from busy roads, widespread public transit use, and lack of community-based health care are putting certain communities at greater risk from COVID-19.

IS YOUR NEIGHBORHOOD RAISING YOUR CORONAVIRUS RISK?

BY JEREMY NÉMETH AND SARAH ROWAN

IMAGE VIA MAPPING INEQUALITY
icente Arenas moved to the edge of Denver’s Valverde neighborhood, attracted by low housing prices and proximity to his downtown job just three miles away.

The one-square-mile neighborhood mixes small, ranch-style homes with auto body shops, metal fabricators, and industrial supply warehouses, and is hemmed in on its four sides by state highways and interstates. Much of Valverde is devoid of streetlights and wide sidewalks, a fact that Arenas laments. But he immediately felt a strong kinship with the local Hispanic population, which comprises 81% of residents.

“There is a real sense of familia in this area,” Arenas says, “where every house has multiple generations. From the grandparents down to the little kids, families are piling into trucks together, and you’ll see five guys crowded around trying to fix an engine. And then there’s the smell of fresh tortillas every night.”

The neighborhood is most vibrant in the evenings, he explains, when residents return home after long workdays in the construction and food service industries.

But what makes Valverde so attractive to Arenas might also have increased the area’s risk amid the coronavirus pandemic. Valverde’s location brings air pollution, which can raise the risk of serious respiratory problems. Bustling homes makes social distancing nearly impossible, and commuting together increases exposure to potentially infected individuals.

“ZIP code is a great indicator of risk for disease transmission.”
IT CAME AS LITTLE surprise to us, an urban planning professor and an infectious disease doctor, that Valverde had the highest COVID-19 hospitalization rate in the city.

Public health officials and urban planners have long known that one’s ZIP code is an especially reliable indicator of educational attainment, lifetime earnings, and even life expectancy. Near Washington, D.C., for example, residents of Chevy Chase can expect to live nearly 33 years longer than those from Barry Farm, a neighborhood just 10 miles away.

ZIP code is also a great indicator of risk for disease transmission. Across the U.S., in cities as diverse as Austin, New York City, and San Francisco, lower-income communities of color are experiencing disproportionately high rates of COVID-19 infection, hospitalization, and death.

One set of explanations for these geographical disparities focuses on the individual circumstances of neighborhood residents. Indeed, for the 60% of low-wage U.S. workers lucky enough to have kept their jobs through the crisis, those in “essential service” positions like construction, food preparation, and retail cannot simply Zoom with colleagues from home. They often rely on family members, who may themselves be in high-risk age groups, for childcare and depend on crowded public transit for their commutes before returning home to crowded apartments or houses. And those with limited English fluency often struggle to obtain reliable health information. Lack of health insurance often leads people to delay seeking medical care, sometimes resulting in severe health consequences.

In Denver, neighborhood maps also reveal other influences. For example, maps of COVID-19 hospitalizations overlap with maps showing lack of health insurance and access to preventive medical care.

Yet few people have focused on how neighborhood characteristics, or environmental factors, might play a role in virus transmission. Is it possible that neighborhoods themselves are making people sick?

It’s likely. The CDC says that people with asthma are at higher risk for severe illness if they contract COVID-19, and rates of asthma are notoriously elevated near highways like those surrounding Valverde. Diabetes, hypertension, and obesity rates are also strong risk factors for virus contraction; these conditions are linked to physical activity and diet, which are themselves directly influenced by access to quality walking and biking infrastructure, parks, and healthy food outlets, all features that tend to be lacking in disadvantaged neighborhoods.

WHY DOES THIS geographical clustering of disadvantage and privilege occur in cities around the U.S.?

Much of our present-day disparities in health, wealth, and social mobility can be traced back to the 1930s, when Valverde and similar neighborhoods were redlined by the Home Owners’ Loan Corporation. In this racist practice, banks would draw red lines on a map around neighbor-
hoods with populations of color, restricting lending in these places and starving them of investment for generations to come.

The legacies of redlining are well documented. Due to decades of disinvestment, once-redlined neighborhoods have higher poverty rates, lower performing schools, more segregation, lower social mobility, greater exposure to extreme heat, fewer parks, higher gentrification rates, and more indicators of urban decline than those that weren't redlined. Property is also the primary way that families build and inherit wealth in America, the median white family now holds about 10 times the wealth of the median black family and several times that of the median Hispanic family.

In Denver, decades of legally sanctioned disinvestment and segregation made redlined neighborhoods fertile ground for the siting of pollution-producing industrial facilities and two interstate highways, one of which runs directly through Valverde—a familiar story in cities around the U.S.

These inequities have contributed to vast differences in levels of social vulnerability—the constellation of individual and environmental circumstances that weaken a community’s ability to prepare for and respond to crises like this pandemic. Mapping scores on the CDC’s Social Vulnerability Index in Denver reveal how these clear patterns of disadvantage correlate with COVID-19 hospitalization rates.

GIVEN THESE REALITIES, how can cities best contain this virus and plan for the next pandemic?

A decentralized, health equity–oriented approach to fighting the epidemic that brings testing and support services into our most historically vulnerable neighborhoods can increase access to preventive health care and improve health across entire communities.

In the short term, critical efforts can include widespread free testing events in vulnerable neighborhoods, along with distribution of free hand sanitizer, cleaning supplies, and masks, which also helps ensure that at-risk residents do not have to travel on crowded public transportation to shop for these items. This is also an opportunity to link uninsured residents to health care coverage and primary care providers.

Denver Mayor Michael Hancock recently said the city is committed to “taking the test to the people, particularly where our most vulnerable residents live.” And in April, San Francisco rolled out temporary field care clinics in at-risk neighborhoods.

Health care workers in these dispersed clinics are trained to provide culturally and linguistically appropriate medical information about what to do if one feels sick, what testing and treatment options exist, and how to prevent further spread of COVID-19.

IN THE LONGER TERM, urban planners have demonstrated how a commitment to building healthy urban environments—those that prioritize walking and cycling, promote recreation, produce more affordable housing, allow residents to access healthy food locally, and provide public transportation options—can have long-lasting impacts for all residents.

In addition, locating neighborhood health centers in at-risk neighborhoods has been proven to improve health and build a sense of community trust that can be instrumental in times of crisis.

America is at a crossroads, and cities can embrace this opportunity to address health disparities. Health care officials and urban planning professionals are beginning to work together to help lift communities from the legacy of discriminatory policies. By employing interventions that acknowledge the power of place, the country can mitigate harm from the current epidemic and help create communities that are better prepared for future challenges.

State your project goal in the first few sentences

I’ve seen proposals where the PI does a fantastic job setting up a dire situation and explaining why their research is important, but then they forget to explain the research itself in the Specific Aims or Project Overview. This can be a fatal flaw. Reviewers often read many proposals at once and need a quick sense of what they’re about. State your proposed research project in the first few sentences and then cue your reviewers in on the solution. Don’t make them hunt for it.

Bold and highlight wisely

Bolding, underlining, and italicizing can be a nice way of highlighting the goal, hypothesis, or aims in your proposal, but it doesn’t take a lot to overdo it. Instead of creating a bolded/highlighted soup that confuses the reviewer, be selective about what stands out. Highlight the important sentences and then cue your reviewers in on the solution. Don’t make them hunt for it.

Don’t bury the lede

AT A RECENT E-SEMINAR, we offered several tips on grant writing for a lay audience. One of these was “don’t bury the lede.” Now, before you think that I don’t know how to spell “lede,” I’ll tell you that “lede” is the journalistic spelling. Apparently, they wanted to have their own special way of saying “lead” as “lede,” so there you have it.

Although burying the lede is an age-old journalistic warning, it is also an age-old mistake made in grant writing. To bury the lede in grant writing is to lose the main point of your proposal and reviewers who can’t find what your project is about. This often happens when you’re describing a project in a proposal and don’t take the time to step back and ask, Why does my work matter? Why does it matter to the funding agency and reviewers? Below, we’ve listed strategies to ensure nothing gets buried in your next grant proposal:

Show how bad the problem is (or how big the opportunity is)

Oftentimes, project investigators (PIs) forget to communicate the depth of the issue they’re tackling. When you’re focused on a big problem day in and day out, it’s easy to forget that not everybody grasps its scope. It’s our job to spell it out. Offer numbers to quantify how many lives are affected or how much money is wasted. Bring reviewers along your line of reasoning and be explicit about the “why” of your research.

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BOLDING, UNDERLINING, AND ITALICIZING CAN BE A NICE WAY OF HIGHLIGHTING THE GOAL, HYPOTHESIS, OR AIDS IN YOUR PROPOSAL, BUT IT DOESN’T TAKE A LOT TO OVERDO IT. INSTEAD OF CREATING A BOLDED/HIGHLIGHTED SOUP THAT CONFUSES THE REVIEWER, BE SELECTIVE ABOUT WHAT STANDS OUT. HIGHLIGHT THE IMPORTANT TEXT, NOT THE TEXT SAYING IT’S IMPORTANT. I’VE REVIEWED PROPOSALS WHERE THE RESEARCHER WROTE SOMETHING LIKE, “THIS OBJECTIVE IS VERY IMPORTANT.” IT’S NEVER A GREAT PRACTICE TO SAY SOMETHING IS “VERY IMPORTANT” IN YOUR PROPOSAL. TELL US WHY IT’S IMPORTANT AND THEN BOLD THAT.

Researchers often want to share a lot of important information all at once. Take your time to identify what your reviewer needs to know first and foremost, focus on that, and don’t distract them from it.

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Rowan is an assistant professor of medicine-infectious disease at the University of Colorado Denver.

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