

FACULTY FOLIO

BLUE SKY



Department of Emergency Medicine

SCHOOL OF MEDICINE

UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**



Richard Zane, MD

An introduction
and invitation

The Department of Emergency Medicine works to change the world through excellence in clinical care, research, education, and innovation. Our mission attracts people inspired by possibilities—*blue sky* thinkers.

Here, you will meet professors who challenge conventional wisdom and lead by example, inspiring others in a quest for transformation. Each has 2 stories to explore: “inspired” shares personal purpose, and “impact” explains their legacy.

Meet a magnificent group of seven faculty. Reach out to learn more, and please consider supporting their work.

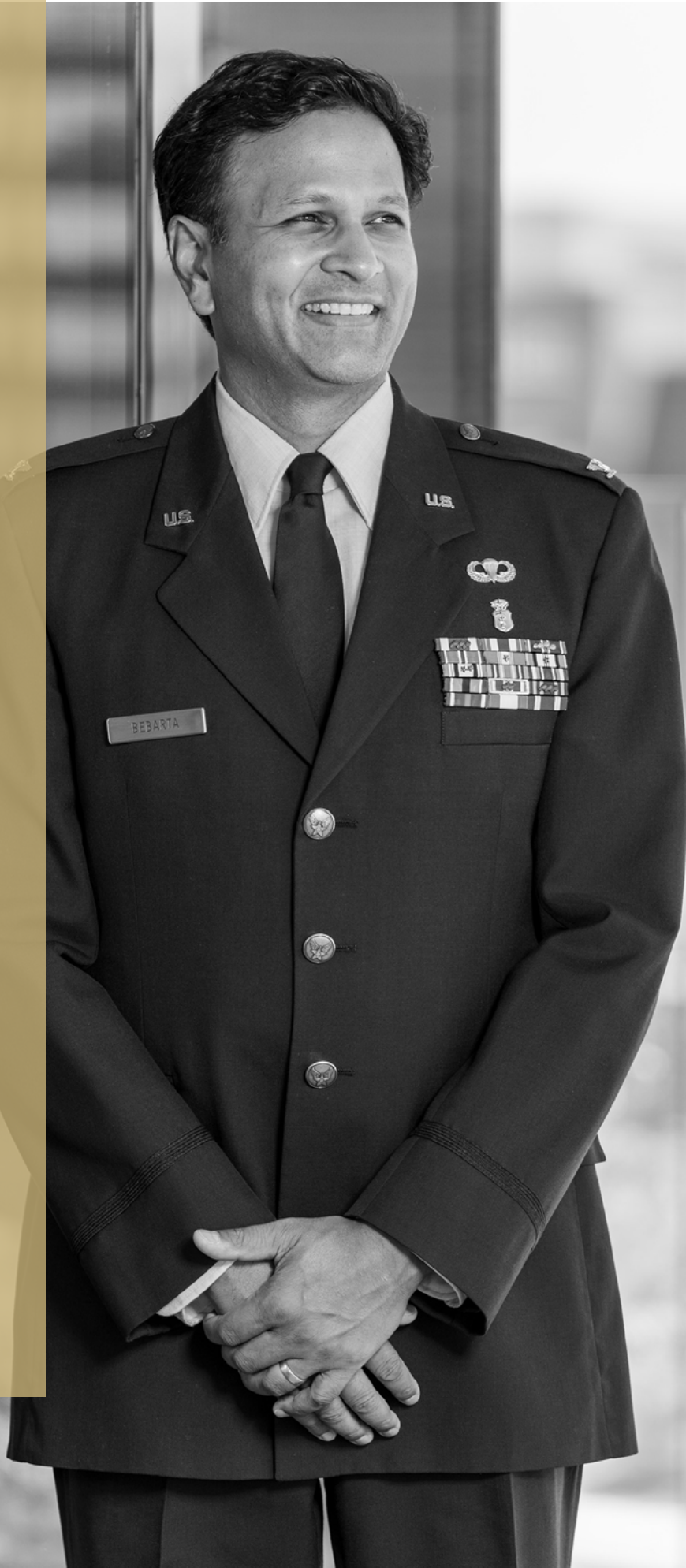
Onward,

A handwritten signature in black ink, appearing to read 'RDZ' with a stylized flourish at the end.

Richard D. Zane, MD, FAAEM

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INSPIRED





Healing Connection

Patient care and innovation span from the civilian to the military realm

When Vikhyat “Vik” Bebarta, MD, was in his early teens, his father Prafulla struggled with a mysterious ailment that eroded his thinking and evaded a definitive diagnosis. Bebarta, his mother and brother would frequently make the hour-long journey from Denmark, South Carolina, to the Medical College of Georgia in Augusta to visit him.

Amid a litany of tests that would ultimately prove inconclusive, Bebarta remembers a young attending physician, Paul Fischer, MD, entering the room and saying a few simple words that would calm the anxious family: “We’ll take care of you.”

“I learned from Fischer what a doctor can do,” Bebarta recalls. “It’s not about how many tests or x-rays you order or how many consults you give.”

“IT’S ABOUT HOW YOU MAKE A FAMILY FEEL. HE HELPED ME UNDERSTAND HOW IMPORTANT IT IS TO TALK TO THE FAMILY AND PATIENTS. HE SAW THE IMPACT MY DAD’S ILLNESS HAD ON OUR FAMILY FROM THE RURAL SOUTH WITH NO COMMUNITY TO LEAN ON.”

Bebarta’s parents immigrated to the U.S. from India. His father held a PhD in demography and his mother held two PhDs, spending her career as a professor and higher education administrator.

"My parents encouraged me to go into education," he says. "I grew up in an environment of inquiry, publications, grants and teaching."

Still, the self-described "skinny brown kid with a long funny name and a southern accent" needed to find places to fit in Denmark, a sleepy hamlet of about 4,000 people.

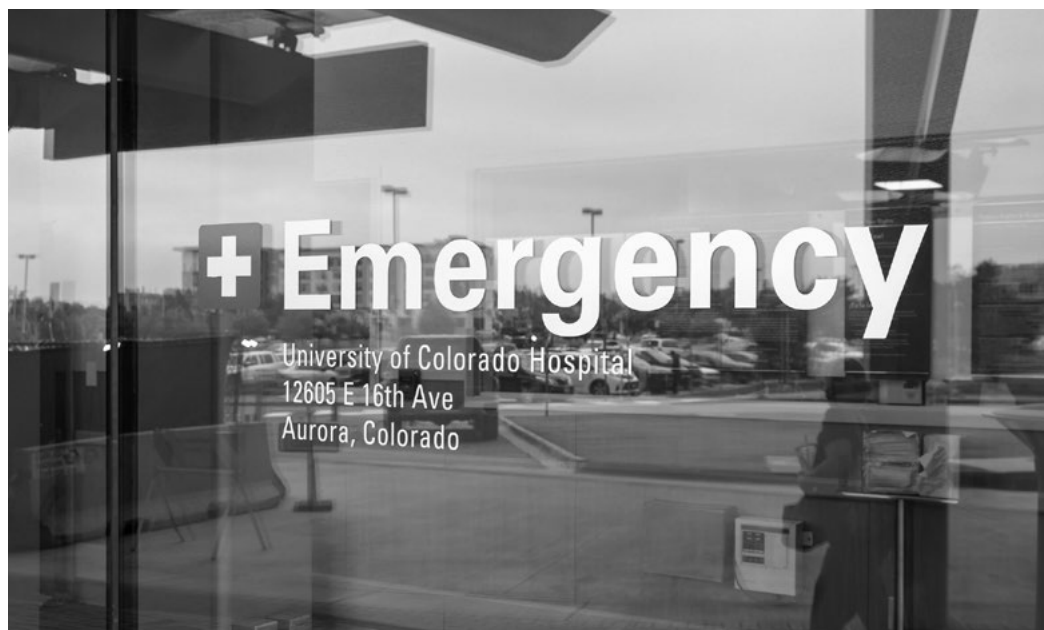
He grew up participating in Cub and Boy Scouts, led by a mustachioed, motorcycle-riding machinist and Army veteran named Gus Eubanks. A history buff and outdoorsman with an artistic flair, Eubanks was an "inspiration and someone to look up to in that small town," Bebarta remembers, who hiked and camped with Eubanks and his three sons over the years. They became a second family.

A DIFFERENT PATH

When the new South Carolina Governor's School for Science & Mathematics opened a few hours away from Bebarta's hometown, a teacher encouraged him to apply but he initially hesitated.

"I got a pickup truck. I'm playing football. I'm going to prom. I don't want to go with the nerds," he recalls thinking at the time until his mother intervened. "She told me, 'Put yourself on a different path.' So, I decided to go. It turned out to be the biggest opportunity of a lifetime."

Bebarta was one of 64 students in the school's inaugural class of 1988. He took challenging classes taught by instructors recruited from nearby colleges. Crediting Eubanks as an influence, Bebarta chose to enroll in the Air Force Academy in Colorado Springs after graduating high school in 1990. From there, he went on to earn a medical degree from George Washington University School of Medicine. Attracted to the fast pace of emergency medicine



and trauma care, Bebarta later served as chief resident at Denver Health Medical Center, the Colorado capital city's only Level I trauma center at the time.

"I LIKED THE DIRECT IMPACT, THAT FROM THE MOMENT I TOOK CARE OF A PATIENT THAT I WOULD BE CHANGING THEIR LIFE," BEBARTA EXPLAINS.

Bebarta's interest in emergency medicine included a passion for toxicology. He felt expertise in chemical exposures and threats would be important for future of the Air Force. A 2001 meeting with the chief of Air Force Emergency Medicine resulted in Bebarta completing a two-year toxicology fellowship at the Rocky Mountain Poison Control and Drug Center, led by Richard Dart, MD, Professor of Emergency Medicine and Medical Toxicology and Pharmacology at the CU School of Medicine. Dart had built a center that specialized

in science and research and served as a valuable consultant to the medical community.

"I saw what a big enterprise looked like on the scientific side," Bebarta says. "It was eye-opening to me."

Dart's work revealed to Bebarta how to solve problems by bringing together academic, industry and federal research in common cause. That concept helped him to later build and direct several Air Force research programs.

MISSION FOCUS

The different building blocks of Bebarta's medical education prepared him for the chaos of treating soldiers injured on the battlefield. He served 14 years of active duty, including four overseas tours in Iraq, Afghanistan, Jordan, and Syria.

In 2005, Bebarta began serving as Chief of Emergency Medicine at Joint Base Balad's Air Force Theater Hospital, then the largest U.S. hospital in Iraq. Soldiers, many of them just 18 or 19 years old, were flown by helicopter to Trauma Bay II from battles in places like Fallujah

and Ramadi maimed by shrapnel, burned by improvised explosive devices, and peppered with bullets.

“Trauma Bay II was the genesis of innovation in casualty care and the bedrock for applications in clinical practice,” Bebarta says.

The ongoing challenge was to act with urgency to save lives and decrease suffering. Through it all, Bebarta says he hewed to the example set by Fischer.

“They would come in with lost limbs and I would later be talking to their mother back in Arkansas or Texas about their child. In their direst moments, you’re there to save them,” Bebarta says. “You’re also there to take care of them, to talk to and console their families. People talk about med school being built around learning science, studying, and building knowledge. To me, it was always more about making human contact.”

Bebarta’s efforts to save lives with improved techniques in resuscitation, prehospital care, treatment for traumatic injuries and other work has earned him numerous honors, including the 2022 Air Force Hero of Military Medicine Award for the Advancement of Military Medicine. Additionally, he is a Colonel in the U.S. Air Force Reserve and is Senior Leader for the Office of the Chief Scientist, 59th Medical Wing, Joint Base San Antonio, Texas.

“Military service channeled my career, my future, and my investment in being part of work with similar, like-minded people who want to do the same thing. It allowed me to see a side of myself that I’d never seen before – as a leader and decision maker in war. It also launched my research career and desire to find real answers to problems that no one else has. It was so empowering,” he says.



PROBLEM SOLVER

His commitment to patient care and innovation bridges the civilian and military worlds. Some may consider the civilian and military realms separate, but much of the hard-earned advances in emergency and trauma care earned in the crucible of battle have translated to civilian lives saved, Bebarta points out.

He joined the University of Colorado School of Medicine as a tenured Professor and Vice Chair of Strategy and Growth for the Department of Emergency Medicine. With the encouragement of Department of Emergency Medicine Chair Richard Zane, MD, Bebarta founded and directs the CU Center for Combat and Battlefield (COMBAT) Research. COMBAT brings the talent and expertise of the academic world to help the military solve clinical problems.

“WE’RE ALIGNING THE BRIGHTEST FROM THE UNIVERSITY OF COLORADO WITH THE BEST FROM THE MILITARY AS A TEAM TO SOLVE THE DEPARTMENT OF DEFENSE’S TOUGHEST CLINICAL CHALLENGES,” BEBARTA SAYS. “WE LOOK FOR SOLUTIONS THAT CAN BE IMPLEMENTED IN A RUCKSACK, ON A TRUCK, OR PUT ON A SHELF IN A COUPLE OF YEARS.” ■



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IMPACT

Progress from Pain

Medical innovation from the battleground is helping patients at home

The Iraq War took a terrible toll in human life. The suffering, which knows no nationality, was incalculable. Yet that war, as with all others, produced a painful irony: the tragedy led to lifesaving advances in medical care.


The search for progress continues through the efforts of Vikhyat “Vik” Bebarta, MD, Vice Chair of Strategy and Growth for the University of Colorado Department of Emergency Medicine and director of the CU Center for Combat and Battlefield (COMBAT) Research. A dedicated scientific researcher, Bebarta has been awarded some \$60 million for more than three dozen federal grants, including 25 where he was principal investigator, and has published more than 220 scientific manuscripts.

The problems COMBAT is tackling have quite a wingspan. They

include reducing military firearm suicides and opioid misuse, decreasing oxygen use by special operations medics for casualty victims, helping develop a wearable device to detect COVID-19 before symptom onset, employing simulation to prepare combat medics for stressful events, and developing new therapies to treat traumatic brain injuries.

A companion initiative to COMBAT is the NIH-funded Translational Innovation and Antidote Development (TRIAD) Research Colorado, which Bebarta also founded and directs. More than a dozen institutions collaborate to bring life-saving innovation from researchers to clinical trials that ultimately translate into hands-on patient care, whether that be from battlefield medics, military and civilian hospital workers, or anyone committed to improving patient care.





COMBAT and TRIAD are currently working to design easy-to-administer antidotes for chemical exposures. These have occurred on the battlefield, during civilian terrorist attacks, after industrial accidents and train derailments, among other disaster scenarios. Most antidotes must be administered by someone with special training, making timely, large-scale responses difficult.

Currently, the antidote for cyanide requires an intravenous injection, but COMBAT Research and TRIAD is developing an intramuscular injection that operates like an EpiPen.

TIME IS TISSUE

To illustrate the need, Bebarta recalls the 2013 Boston Marathon bombing. The two detonated pressure-cooker bombs sprayed shrapnel through the densely packed crowds, killing three and injuring hundreds of others. In the attack, bystanders, taxi drivers, store owners, and police cared for the wounded until hospital transport arrived.

"It wasn't nurses rolling up sleeves and putting IVs in," Bebarta recalls, as would have been required if poisonous chemicals had wafted through the streets, searing lungs by the thousands.

The ongoing threat of domestic terrorism remains, he warns.

"Chemicals are too easy to get," Bebarta says. At the same time, he adds, the specter of chemical weapons being used against soldiers and civilians in wartime hovers over conflicts, such as Ukraine. Both examples highlight the need for effective countermeasures.

"WE NEED TO DESIGN FOR THE MILITARY AND FOR CIVILIAN AGENCIES, IN AN INNOVATIVE AND COLLABORATIVE WAY, AND WITH INDUSTRY, FOR COUNTERMEASURES THAT ARE SAFE AND THAT ANYBODY CAN PICK UP AND USE," BEBARTA SAYS.

COMBAT Research and TRIAD's intramuscular injection antidote would empower military personnel, civilians, first responders, and even bystanders, to respond quickly to both deliberate chemical attacks and accidental toxic releases. The FDA is currently reviewing the antidote solution, delivered in 2-milliliter doses, for use in both the military and civilian settings. Bebarta hopes for approval in the next two years.

"For a chemical exposure, time is tissue," he says. "The same is true of trauma."

Bebarta sums up the work of the COMBAT and TRIAD in terms of translating basic science to practical application. As that applies to the chemical antidote and countermeasures, that means taking "molecules to market," from the "bench to the bedside to the bystander" and from the "bench to the battlefield."

His team is working with the Department of Homeland Security and locally to train responders and understand what they need to use antidotes in the pre-hospital, trauma, and clinical settings.

"When we understand what responders need, we take that back to the bench," Bebarta says.

A host of other questions must be answered, he adds. Of course, antidotes must be safe and easy to use. But it's also necessary to consider how they will be used and to establish clinical guidelines for their application.

"WE'RE TRYING TO COVER MORE THAN ONE CHEMICAL AS WELL AS INJURIES WITH CHEMICAL EXPOSURES, TRAUMA, AND HEMORRHAGE OCCURRING TOGETHER," BEBARTA SAYS. "WE ARE LEADING A TEAM TO STUDY THIS, FIGURE OUT THE MECHANISMS AND GET SOLUTIONS OUT THE DOOR."

STORIES OF SACRIFICE

Meeting these and other goals is far more than an academic exercise for Bebarta, who completed four tours of duty overseas, including two in Iraq, in 2005 and 2006.

In a 2012 article in the journal *Annals of Emergency Medicine*, Bebarta wrote, "The war isn't about the medical care we give...it's about the soldiers whose stories we'll never read and the sailors who arrive home draped in a flag. Their sacrifices have tremendously advanced our knowledge of trauma and emergency medicine."

Bebarta assumed the role of medical innovator in heat-seared battle theaters nearly 20 years ago. On civilian ground, his mission to



find new ways to save the lives of the service men and women who protect us remains unchanged.

"Our research, development, and innovation bring academia, industry, and the military together to deliver innovative solutions now that Marines could have used back then in Iraq," he says.

Support from external grants and gifts make change possible on a grand scale, saving lives today and tomorrow, for people in war zones and at home. He can't change history, but through his COMBAT initiatives, Bebarta has an opportunity to change the future. ■

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INSPIRED





Lessons from War

How a global emergency care program was built from early experiences in Angola

Even as a child, Emilie Calvello-Hynes, MD, the eldest daughter of two Presbyterian ministers in Weymouth, Mass., a blue-collar suburb of Boston, stood out as a leader.

"She was very dedicated to what she did, and not afraid to try new things. Competitive in a very good way," recalls her father, Richard Brondyke.

Money was tight growing up in a home centered around the rhythms of the church, but Calvello-Hynes's parents always encouraged her to dream big.

She recalls a woman in their congregation who had graduated from Bryn Mawr College in Pennsylvania. Calvello-Hynes's parents told her, "If that's something you want, you should apply."

A LEAP OF FAITH

Calvello-Hynes went on to enroll at Bryn Mawr, where she was interested in the sciences, especially chemistry. She remembers wrapping up her junior year when her father asked if she had considered a career in medicine.

"I told him the only way I'm ever going to do medicine was if it was global health work," recalling her half-righteous, half-defiant response. "He answered, 'funny you should say that. We have one of our missionaries here right now and he works in Angola.'"

He connected her with Steve Duncan, MD, a trauma surgeon and medical missionary supported by the Brondykes' church. Duncan was back in the states for a short time to gather medical supplies after part of

his hospital was destroyed by civil war violence. Little did she know one short conversation would drastically change her life.

"Steve said to me, 'If you want to come, you have to tell me now,'" Calvello-Hynes recalls. "I just went for it. I'm not sure how or why. I certainly didn't have the funds. As my parents would say, it was very much 'a leap of faith.'"

"I wanted to see what was happening there in the context of the civil war and landmine injuries, and the way U.S. policy was changing what it was like for patients on the ground. There was certainly a compelling feeling of, 'I don't understand this. I need to understand more.'"

Decision made and with a scholarship from Bryn Mawr funding her flight, she soon arrived in Windhoek, Namibia, where she would await transport to bordering Angola. Her first trip outside the United States, the 19-year-old found herself sitting alone for hours at a Windhoek bus stop wondering if her ride would ever come. Finally on the road and heading to her destination, she remembers seeing United Nations peacekeeping forces making their way out.

"The road up to the Namibian border was littered with burnt-out tanks and destroyed buildings... I could not help but wonder what I had gotten myself into," she later wrote in an article about her experience.

That summer, she would witness first-hand the suffering of people trapped in the ravages of civil war, deprived of basic resources. While in Angola, Calvello-Hynes assisted in any way she could, working in a local orphanage, preparing food, and playing with the children. In the hospital, she shadowed Duncan as



he worked in the operating room, where she did everything from changing bandages to sterilizing surgical gloves so they could be reused. Exposed to myriad cases — from infectious disease to traumatic injuries caused by landmines — it was a visceral introduction to public and global health challenges.

When it was time to return to the states, she struggled with the abrupt transition. Halfway home, jet-lagged and with the experience fresh in her memories, she recalls breaking down in London's Heathrow Airport, sobbing for hours.

"I could not make sense of the disparities I had seen in that country and moving so quickly into a location with such relative affluence," Calvello-Hynes says.

FINDING HER LIFE'S WORK

"I WAS QUITE NAÏVE. I DIDN'T HAVE A LANGUAGE OR FILTER OR FRAME TO PROCESS WHAT I SAW. WHAT THAT DID FOR ME WAS EMBED THE EXPERIENCE IN A WAY THAT CHANGED MY TRAJECTORY IN LIFE. I DIDN'T DECIDE, 'I WANT TO BE A DOCTOR.' I JUST CAME HOME AND NEVER COULD SHAKE WHAT THAT EXPERIENCE HAD BEEN."

Back on U.S. soil, she moved forward with a degree in chemistry, graduated college and worked for three years as a pharmaceutical researcher at DuPont Pharmaceuticals.

Yet she continued to seek out experiences echoing her time in Angola; most of her vacations were spent in the field serving on other international medical missions. Eventually, she realized the inevitable: she wanted to devote her life to global health work. She applied to Johns Hopkins University School of Medicine and was accepted. She started taking extra classes and volunteering at local emergency departments to prepare herself, all while working full-time at DuPont.

“Emergency medicine would give me a very broad skill set — we treat everyone, from neonates to octogenarians,” Calvello-Hynes says of her decision to pursue the specialty.

While earning her medical degree, she simultaneously earned a Master of Public Health from Johns Hopkins, further readying herself for a career in global health.

“She is one of those people where others within our class have looked forward to seeing what she’s going to accomplish, because we knew she was going to do great things,” says Andy Muck, MD, a classmate from Johns Hopkins.

After Calvello-Hynes finished her emergency medicine residency at Johns Hopkins, a massive humanitarian crisis arose: the 2010 Haiti earthquake. Calvello-Hynes was among the first of her Johns Hopkins colleagues to join the response and would go on to serve as director of emergency services for the International Medical Corps. It was in Haiti where she met Greg Hynes, a flight nurse and fellow volunteer, whom she would later marry.



Over the next several years, Calvello-Hynes would travel the globe, with posts in Liberia, South Africa and the United Arab Emirates before returning to the United States. She was drawn to Denver, because it checked all her boxes: academic medical center, international airport, mountains and nature.

Calvello-Hynes recalls picking up the phone and cold-calling Richard Zane, MD, Chair of the Department of Emergency Medicine at the University of Colorado School of Medicine.

“I WOULD LIKE TO COME TO YOUR INSTITUTION. AND I WOULD LIKE TO BUILD YOUR GLOBAL EMERGENCY CARE PROGRAM. WHAT DO YOU THINK ABOUT THAT’?” SHE PROPOSED. ZANE’S ANSWER? A RESOUNDING YES. ■



BLUE SKY FACULTY FOLIO

IMPACT

Sustainable Strength

Global Emergency Care Initiative founder helps empower underserved nations to care for themselves

In some parts of Africa, the journey to receive emergency care can take days. Emilie Calvello-Hynes, MD, will never forget the times she waited in vain at a remote healthcare facility to receive a patient who did not survive the trip.

"They often needlessly die, suffering and alone. We know the solutions to these problems," she says. "Now it is time to figure out how to implement the interventions necessary so that all patients everywhere can have access to timely, quality emergency care."


Through a shared vision with Richard Zane, MD, the George B. Boedecker Professor and Chair of the Department of Emergency Medicine at the University of Colorado School of Medicine, and backed by seed funding from the department, Calvello-Hynes

founded the Global Emergency Care Initiative (GECI) in 2018.

Lead by Calvello-Hynes and other emergency care experts on the faculty, the GECI is focused on preparing countries with limited resources to care for themselves. In these nations, access to pre-hospital care (including clinics and transportation) is at best limited. Patients get to treatment when and how they can, often traveling by taxi or on foot. Even if patients arrived faster, their future is still dire if they can't receive specialized emergency care.

It's just one of the deficiencies plaguing under-resourced health care systems. Calvello-Hynes spent much of her early career providing medical care amid chaos. Disaster response in non-governmental organizations (NGOs) is not set up as proactive, so instead each humanitarian





crisis is addressed as it occurs. In the 2010 Haiti earthquake, she witnessed NGOs reacting as quickly as possible, pulling together all the external resources they could gather and bringing them to disaster sites. She later studied the efficacy of typical NGO disaster response teams, publishing her findings.

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CALVELLO-HYNES
OBSERVED.**

Calvello-Hynes pivoted her career after this realization, shifting her focus from humanitarian crises to systems development work. Capacity-building would speed up emergency response time, improve resource allocation, and lead to sustained improvement in quality of care.

The academic and practical arms of global emergency care have long been separated, with the best theoretical practices not suited for effectiveness in the real-world settings. Calvello-Hynes' group

at the GECI seeks to bridge this divide, seeking pragmatic solutions designed for low-resource areas.

FORMULA FOR SUSTAINABLE CHANGE

The team's approach is to develop and implement tailored educational tools that are field-tested for value and sustainability. Working in partnership with host countries throughout the globe, the team is informed by extensive, on-site research to ensure systems are built to meet a populations' unique needs.

When the University of Colorado Center for Global Health approached the GECI about a collaboration to build an emergency care system in Zambia, the team quickly got to work. Beleaguered by poor road infrastructure and lack of modern safety mechanisms, Zambia was experiencing a disproportionately large number of multi-vehicle accidents yet there were no emergency care specialists in the entire country.

“They frequently had mass casualty incidents with 40, 50, 60 people being injured at a single time,” Calvello-Hynes says.

The Ministry of Health sought the GECI's help increasing frontline worker capacity. A conventional approach to Zambia's problem would have sought to re-create a western emergency care system. But Calvello-Hynes and her team knew that this would not work.

“What used to be brought to these locations were things like advanced trauma life support or advanced cardiac life support. The basic premise of those courses is that you have enormous health facility infrastructure, you have monitors, you have electricity, you have

critical care, you have a surgeon standing by,” Calvello-Hynes says.

“This assumes you have all these things which don’t exist. Exporting those type of courses into those type of locations does not work.”

Instead, the GECl took a different track. Previous research by GECl faculty demonstrated the efficacy of the World Health Organization’s Basic Emergency Care course in resource-limited settings. When implemented in Uganda, mortality was reduced by a staggering 50 percent. They began by training Zambian healthcare workers in the course, eventually training them to teach the course themselves. Through a “train the trainer” mentorship, GECl faculty facilitated the transition to a completely local model perpetuated by and for Zambians.

“When a mass-casualty incident comes in, they feel empowered and able to deal with it, both in terms of triage and the actual medical care for those patients,” Calvello-Hynes says.

The GECl’s partnership with Zambia has been a shining success for the program. Frontline emergency care providers are better trained and more confident. Local patients receive better care, and local emergency care trainers and leaders ensure that these improvements are sustained.

The GECl and Ministry of Health are now rolling out the CARE Emergency Toolkit—a training course designed to help workers respond to humanitarian crises—in 10 Zambian hospitals. They will then study the effect it has on clinical care provision.

Leading the effort is Mwiche Chiluba, MD, the only emergency specialist in the country, who was mentored by Calvello-Hynes

and other GECl faculty. Chiluba initially collaborated with the GECl to launch some of the first Basic Emergency Care training courses, later charting additional courses for future development.

“She’s championing setting up a specialist training program in country. She has rolled out triage to several emergency care units across the country,” said Calvello-Hynes. “If that were me, I’d be completely overwhelmed, but she managed it with incredible grace, and we were able to partner effectively with her.”

By stepping into a leadership position, Chiluba is guiding the transformation of emergency care in Zambia.

“IT HAS BEEN WONDERFUL MENTORING DR. CHILUBA AND HELPING AUGMENT HER CAREER TO WHERE SHE IS REALLY THE CHAMPION FOR HER COUNTRY. THAT’S WHAT WE AT GECl REALLY CARE ABOUT,” CALVELLO-HYNES SAID. “WE DO NOT WANT TO BE THE ONES OUT FRONT. THE FASTER YOU CAN WORK YOURSELF OUT OF A JOB, THE BETTER. THAT’S WHAT SUSTAINABLE CHANGE IS.”



GLOBAL HEALTH STARTS AT HOME

Within the School of Medicine, the GECl prepares medical students, residents, and fellows to practice global health. Faculty members teach global health curriculum in the Colorado School of Public Health and work with the University of Denver’s School of International Studies to hold large-scale humanitarian crisis simulations for medical residents. This extensive network of support and preparation represents one of the ways in which global health has developed.

Another example of how the field has matured is a widening perspective of what global health work means from the local lens of refugee populations, including the recent influx of Afghani newcomers to the metro Denver area.



"My most recent hire is going to take this issue on as a targeted project. We're not just flying overseas and doing something. Rather, many of those people are coming here. How do we serve their needs, how do we advocate for them and better understand what their needs are?" Calvello-Hynes asks.

The GECI has expanded substantially in the handful of years since it was established. Now a large program within the Emergency Medicine department, it employs seven faculty members, and has its own fellowship program and residency track. Yet funding streams are limited, and the GECI is primarily backed by individual faculty members' research grants, supplemented by private donations.

GECI faculty leverage their networks to stretch their funding further. Rather than buying vehicles, they borrow. Rather than renting locations for training and lodging, they rely on the hospitality of local partners.

"EVEN WHEN WE GET SMALL AMOUNTS OF MONEY, WE'RE ABLE TO USE THOSE FUNDS IN A WAY THAT DRAMATICALLY AMPLIFIES THEIR EFFECT," CALVELLO-HYNES SAYS.

This efficient use of funds represents a deliberate break from the past, when efforts to improve global health often spent money inefficiently.

"In pre-hospital care, we want solutions that are reasonable and rational in resource-limited settings. That doesn't mean buying half-a-million-dollar ambulances and just plopping them down in a country, which believe me, has been done," Calvello-Hynes says.

This approach to global health is pragmatic and experience-informed, with an explicit focus on achieving lasting change. An important part of sustainability is ensuring that the GECI can continue to develop and evolve. ■

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INSPIRED





Mentee to Mentor

Early influences helped one physician create a learning environment for others

Christopher Hoyte, MD, spent his formative years in Plano, Texas learning valuable life lessons from his parents. His father Edward, a now-retired probation officer, often brought a young Chris along with him for overnight shifts at the county's detention facility. That up-close view of the lives of incarcerated individuals made a distinct impression.

"I learned a lot about discipline in those days," Hoyte recalls, who preferred to spend his time on sports field, going on to play soccer at an elite level in high school. "I said, 'I want no part of this.'"

Hoyte also occasionally tagged along to work with his mother, Dorothy, who managed the radiology office at University of Texas Southwestern Medical Center. There, a few physicians took an interest in him. By shadowing providers as they did patient rounds, Hoyte received an early education about the body and the power of teaching.

"I remember those people even now, and I probably will for the rest of my life," Hoyte says. "One of the highlights of my life was returning years later to UT Southwestern to meet up again with my early mentor, neurosurgeon Bruce Micky, MD."

STUMBLING BLOCK

When Hoyte was just 10 years old, his father fell seriously ill due to heart valve damage caused by an early bout of rheumatic fever. Post-operative complications of valve replacement surgery led to a difficult, years-long recovery for the elder Hoyte.

"I had a hard time processing what was going on because my dad was always a tough guy and my role model," Hoyte says, recalling his grades were even affected during that time.

Supported by his mother and guided by the physicians at UT Southwestern, he was eventually able to get back on track, buckling down at school.

"My mom really came through for me. There were times I was angry and distracted, and my focus waned on school and sports," Hoyte says. "She really held it together and didn't let me feel sorry for myself."

He said the difficult experience taught him to appreciate the gifts of everyday life. "I learned not to take anything for granted," he says, "and to be grateful for what you have."

His skill on the soccer field earned him an invitation to the elite Olympic Development Program. Several universities recruited him to play the sport, but he "locked in" on his academic pursuits, heading to Princeton University in New Jersey to study molecular biology. By that time, he says he was "95 percent" settled on medical school.

Sticking to the plan, he attended medical school at Rutgers University in New Jersey. Hoyte originally thought he'd pursue neurosurgery like his mentor and traveled down that path for a few years — until a rotation in emergency medicine changed everything.



BRINGING THE A-GAME

In the high-intensity emergency room at University Hospital, the young Hoyte hopped room to room, learning to juggle a variety of cases, and fueling his passion for the field. Often encountering terrified family members seeking out hopeful information about their loved ones, he drew on memories of his father's medical struggle to comfort them.

"I've been on the other end of that, and I know what it feels like," Hoyte says.

"THERE IS NOTHING LIKE THE FEELING OF STEPPING UP AND DELIVERING WHAT YOU NEED TO DO FOR FAMILIES. I LOVED THE CHALLENGE OF WALKING INTO THE ROOM AND HAVING TO BE MY BEST EVERY SINGLE TIME."

Hoyte completed his emergency medicine residency in at the venerable Cook County Hospital in Chicago. The public health

hospital's high-volume Level I trauma center was a fertile urban training ground, and Hoyte saw people suffering from all manner of disease and injuries. It reinforced his belief emergency physicians are front-line stalwarts of the healthcare system.

"I saw Chris take care of patients at the bedside, where he would talk directly to people with care and concern. He carried himself with integrity," says Steven Aks, MD, who was the hospital's director of Emergency Medicine and Toxicology and one of Hoyte's mentors.

As chief resident at Cook County, Hoyte committed to the same set of values and passed them on to other providers, he adds.

"He was a positive-energy individual who was always there to bring other people up," Aks says. "He was always teaching, always supporting others."

Hoyte discovered medical toxicology was an intriguing subspecialty during his time at Cook County. He was drawn in to learning the physiology and pharmacology driving the myriad poisoning agents that included chemicals, medications, biologic agents, and environmental exposures, as well as determining how to treat them.

The challenges of treating regular people harmed by too much of a good thing, such as a pregnant patient who overdosed on an iron supplement, captivated him.

"That hooked me," he recalls.

In 2009, Hoyte took his passion for medical toxicology west to Denver for a two-year fellowship at Rocky Mountain Poison & Drug Safety (RMPDS). He became the center's fellowship director in 2015.

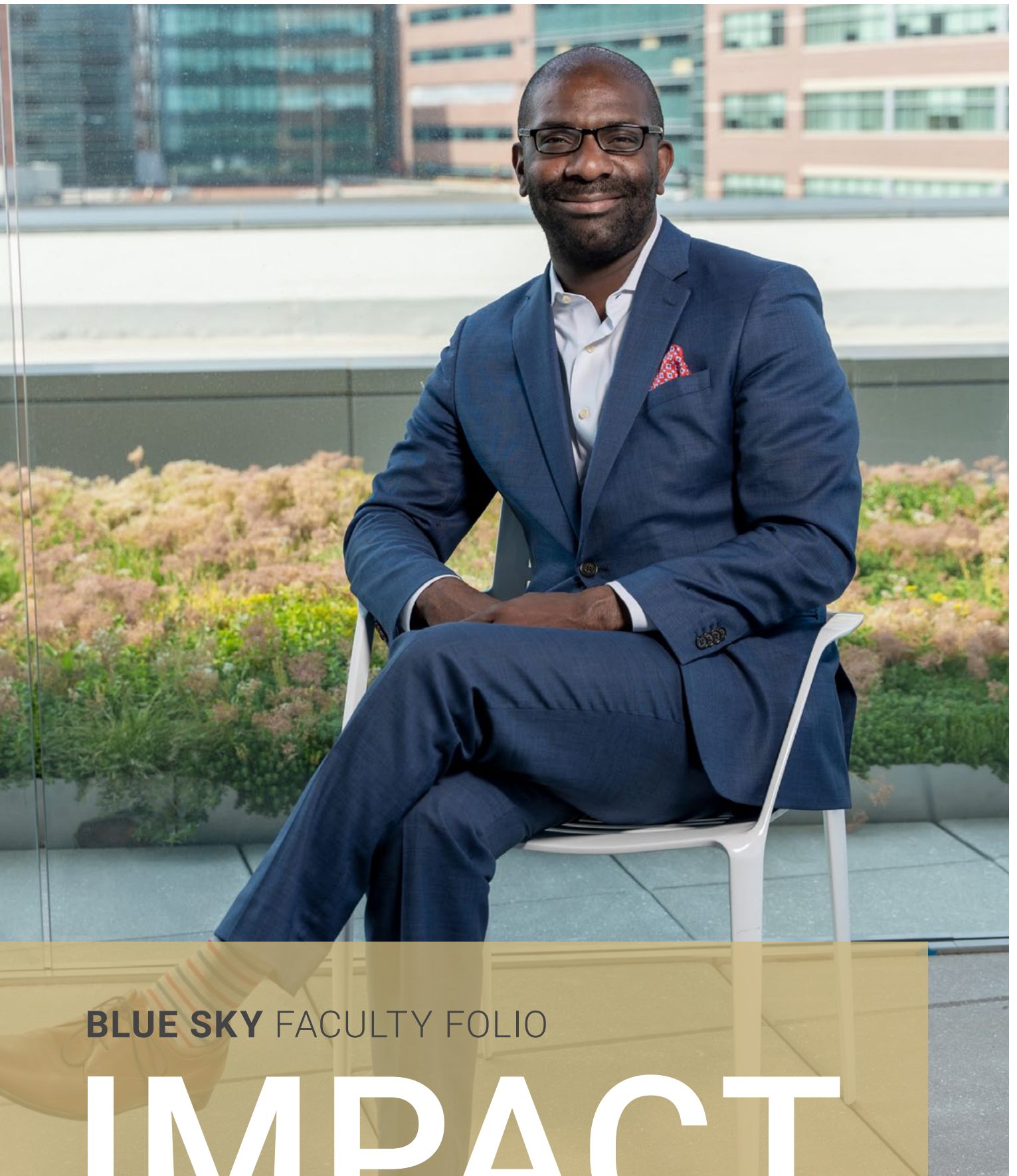
"MY MAJOR GOAL IS TO HELP OTHERS BE AT THEIR BEST TO REACH THEIR GOALS. I BELIEVE THAT I AM RESPONSIBLE FOR CREATING THE ENVIRONMENT FOR THE LEARNERS IN MY CHARGE," HE SAYS. "TRAINING OTHERS TO BECOME MEDICAL TOXICOLOGISTS AND EMERGENCY MEDICINE PHYSICIANS IS SHAPING THE FUTURE OF HEALTHCARE."

Four years later, he became RMPDS medical director, where he strives to help the organization deliver the highest quality of care to those they serve. He also serves as the organization's fellowship director.

He began working toward a Master of Business Administration at the University of Colorado Denver, earning his degree in 2021. He was encouraged along the way by Richard Zane, MD, Chair of Emergency Medicine at University of Colorado School of Medicine, where Hoyte now serves as Professor of Emergency Medicine.

Today, Hoyte is taking the valuable lessons gleaned from his mentors to help others succeed through teaching and research roles within emergency medicine, toxicology, and sports medicine. ■





BLUE SKY FACULTY FOLIO

IMPACT

Searching for the Inch

Applying athletic performance and recovery methods to patient care

Christopher Hoyte, MD, has loved sports all his life and played soccer at an elite level in high school.

Ultimately choosing academics over sports as a career path, he is now a Professor of Emergency Medicine at the University of Colorado School of Medicine, medical director of the Rocky Mountain Poison and Drug Center (RMPDC), and a prolific toxicology researcher. Yet, his fascination with the daily athletic dramas that play out on fields and in arenas around the world remained.


Early in his academic career, he began probing the paths athletes follow as they strive to excel. More than a decade later, his research turned to athletes' recovery methods and the razor-thin margins that separate athletic victory and defeat. Were there applications for patients struggling with serious illness or injury, he pondered?

"I love sports and athletics and the fact athletes always want to perform and get back on the field," Hoyte says.

"THE STRATEGIES THEY TAKE TO DO THAT IS WHAT STARTED MY INTEREST IN SPORTS MEDICINE. FOR TOP ATHLETES, THE DIFFERENCE BETWEEN THOSE WHO WIN AND THOSE WHO LOSE IS SOMETIMES VERY SMALL — THEY WIN BY INCHES."

Where and how, Hoyte wondered, do athletes find that inch? And what is the evidence their methods – medications, diet, psychology, physical therapy, individualized training – provide a quantifiable





benefit outweighing potential risks? As a medical toxicologist, Hoyte understands the temptation for athletes to turn to stimulants, dietary supplements, and powerful analgesics like opioids, as they grasp for the slimmest advantage over competitors. Ambitions and careers often rest on the ability to perform. Yet, he's seen the serious toll these substances have taken on some athletes.

"There are not enough studies to inform people about which substances work to improve performance and which don't," he says. "For the ones that don't, all you have is risk."

Hoyte's research interest in the intersection of sports medicine and medical toxicology began during a fellowship at RMPDS, where he co-authored a paper on the use of energy drinks, dietary supplements, and prescription medications among athletes. Although most athletes surveyed reported using energy drinks to enhance their performance, more than half used prescription medications, including opioids.

In the decade that followed the study's publication, use of opioids among athletes and the public generated intense scrutiny and efforts to abate a public health crisis. Positive steps followed, but new drugs and supplements constantly emerge, often hyped with thin evidence of their effectiveness.

"We need more research targeted to athletes about the risks and benefits," Hoyte says.

COMPETING TO SURVIVE

Hoyte is also investigating whether strategies used by athletes to gain a competitive edge can be applied in patient care. Athletes may use medications to control pain and continue performing, but for

seriously ill patients, pain control can be a matter of life and death.

Muscle weakness and wasting is a major problem for patients in intensive care units. Pain control can help patients get up and move around to improve their muscle strength and lung function – as well as their survival.

Athletes have also developed methods to optimize their bodies' ability to produce energy, use glucose, and maintain stores of nitrogen, which is essential for building muscle mass.

"Athletes must recover quickly," he says, noting a Tour-de-France cyclist toiling in the thin Alps air can't take a week off to recuperate from severe fatigue and energy depletion. "We can take their recovery methods, study and tweak them, then apply them to people who are very sick or life-threatening."

A nitrogen-rich diet or substances like oxandrolone, an androgen and anabolic steroid used by some athletes to improve strength and build muscle mass, may help prevent muscle wasting in patients with severe burns, Hoyte describes. Some studies found oxandrolone can help pediatric and adult burn patients rebuild muscle mass lost as the body tries to heal from the trauma of the injury.

"The metabolic rate in these patients is sky-high," Hoyte says. "The amount of energy they expend trying to recover from the injury is huge."

He acknowledges use of performance-enhancing substances in patient care may be a gray area, as substances like oxandrolone and human growth hormone (HGH) are banned by the World Anti-Doping Agency. While HGH has some health risks, studies found it is protective against muscle loss in burn patients, improves abdominal surgical

recovery in young patients, and minimizes muscle weakness in patients after anterior cruciate ligament reconstruction.

In Hoyte's view, the standards for using HGH or other drugs for the appropriate patient at the right dose should be entirely different than the standards that are applied to athletes. High-level athletic competitors, Hoyte says, spend vast amounts of time, energy, study, and personal resources "fighting for the inch" of separation in a high stakes battle for money, reputation, and publicity. The playing field is very different for patients confined to beds in ICUs or burn units, where success equals survival.

**"IT'S NOT A COMPETITION
BETWEEN PATIENTS.
IT'S LIFE AND DEATH,"
HOYTE SAYS.**

CATALOG OF CARE

Hoyte envisions developing a "catalog" of treatments for recovery that athletes use and what conditions they might target in patients.

"We could take medical conditions in the world where someone's life is on the line or at risk and say, 'What chemical or metabolic pathway is failing?'" Hoyte says. "Then we could match those with [specific] recovery agents and study them in the patients."

The approach unites Hoyte's early love of sports, his fascination with athletes' drive for excellence and his commitment to doing everything possible to help patients survive and thrive.

"I want to translate the power of recovery science used in sport among athletes and bring it to the bedside for patients," he says. "I believe that this work will allow patients to survive some conditions that they could not in the past and to benefit directly from the greatness of athletic pursuit. We will be able to look patients in the eye and say, 'There is no stone unturned. We're going to help you find your inch.'" ■



BLUE SKY FACULTY FOLIO

INSPIRED





Pursuit for Perspective

A quest to save lives and prevent injury through greater understanding of others

Growing up in Denver, the snowcapped peaks of the Front Range were a constant reminder for Marian “Emmy” Betz, MD, MPH, of the vast expanse awaiting on the other side. Betz attended Manual High School in northeast Denver with classmates who came from diverse backgrounds and viewed the world through a different lens than her own.

Both of her parents are PhD scientists with ties to the University Colorado School of Medicine. Her father, Bill, is Professor Emeritus in the Department of Physiology and Biophysics and her mother, Joan, conducted post-doctoral research in microbiology before leading a distinguished teaching career in higher education.

“I GREW UP IN A FAMILY WITH A LOT OF SCIENCE,” BETZ SAYS. “MY PARENTS HAD A STRONG BELIEF IN THE POWER OF SCIENCE TO HELP MAKE THE WORLD BETTER. IT’S IMPORTANT TO ME TO DO WHAT I CAN TO MAKE THE WORLD A LITTLE BETTER EACH DAY.”

Her quest to contribute to the global greater good sent her far from Colorado, where she visited many other states, countries,

and cultures. Spending a year abroad during high school and another after medical school, every encounter was a valuable opportunity to Betz to learn.

After high school, Betz headed to Yale University for her undergraduate work. She took a year off after earning her degree, broadening her horizons through teaching at an American school in Abu Dhabi, United Arab Emirates. She returned to the United States to attend medical school at Johns Hopkins University in Baltimore.

"Travel instilled in me a love for understanding how other people do things and appreciating the chance to see the world from a different point of view," Betz says. "That's a big part of what I do today."

During her first year of medical school, Betz worked at National Institutes of Health where she first learned a Master of Public Health degree existed. She had always been drawn to her mother's microbiology textbooks and hearing stories about infectious disease experts working as medical detectives, tracking down the pathogens and microbes that drive devastating maladies like malaria.

"There was a little bit of 'saving the world' in those stories. I had a strong desire to do good for the world and public health fulfilled that for me," Betz, who applied to Johns Hopkins MPH program while she was in medical school.

After earning both degrees, she completed a clinical rotation at Johns Hopkins emergency department, an area she did not initially anticipate working in.

"But I liked it every time I was in the ER," Betz recalls. "I liked the people working there and the work itself."

She went on to complete an emergency medicine residency



at Beth Israel Deaconess Medical Center in Boston, where she was chief resident. It was there she realized the emergency room was a better fit for her than the medical detective in single-minded pursuit of a rogue microbe. Of many impactful experiences during that time, one stands out to this day.

During the third year of Betz's residency, she helped care for an adolescent boy who was brain dead and receiving supportive care while his family deliberated donating his organs. Bullied in school, he had taken his own life.

"His teenage brain didn't consider the consequences," Betz says, who couldn't shake the thought of the unnecessary and avoidable death that lay ahead from the boy's impulsive act.

Suicide has personally impacted Betz and she's witnessed the ripple effect of their actions. As she built her public health career in injury prevention, those experiences motivated her to find ways to prevent fatal self-injuries, particularly those caused by firearms, the most used weapon in suicides.

"IT'S ONE OF THE THINGS THAT HAS KEPT ME IN THE FIELD," BETZ SAYS. "IF I CAN DO SOMETHING TO HELP OTHER FAMILIES SUFFERING FROM LOSS, THAT FEELS IMPORTANT TO ME."

Near the end of her residency, Betz made an important professional connection with Matthew Miller, MD, a leading gun violence researcher at Harvard T.H. Chan School of Public Health. Bonding over their interest in injury prevention, they co-authored many articles on firearm ownership, storage, and suicide. But at that time, Betz says, she wasn't yet ready for it to be her focus.

She returned to Colorado to work on research and strategies to prevent injury to older drivers, amassing a considerable body of work in the field, before reentering the firearm space.

A key motivator was her frustration that suicide was left out of debates focusing on protecting against mass shootings and community violence – neither of which she said should be overlooked.

In a 2015 TEDxMileHigh talk, Betz noted 9 in 10 people who attempt suicide with a gun will die, but only 1 in 10 who survive a suicide attempt will go on to take their life.

SHE ADVOCATED FOR PHYSICIAN COUNSELING AND CULTURAL COMPETENCY — A PHYSICIAN'S WORK TO REDUCE FIREARMS INJURIES AND DEATHS MUST BE BALANCED WITH THE RIGHTS AND VALUES OF THOSE WHO OWN THEM.

Not content with simply speaking or writing about the subject, Betz entered “an awkward first conversation” with Michael Victoroff, MD, a Denver-area physician, firearms instructor, and competitive shooter. He contacted her to begin a dialogue after reading her editorial.

“I had a lot to learn about the culture and community of gun owners,” she admits.

She took the NRA basic pistol course with Victoroff as her teacher, alongside a few other physicians. Victoroff taught them about the guns and how to handle them, then led them to a firing range to shoot a few rounds. For Betz, the experience wasn't entirely comfortable because she'd never been around guns during her life.

“It was important for me to realize why people fire guns — as a hobby, to relieve stress, or as a sport — to be in that world and talk to people. It's like traveling and learning about other cultures,” she says.

With every such potentially lifesaving conversation spurred, and the many miles traveled physically and intellectually, Betz continues her commitment to improve the world that her parents instilled.

“Medicine is one way to do that,” she says. “Not the only way, but it is one way.” ■





BLUE SKY FACULTY FOLIO

IMPACT

Balancing Act

Reducing firearm injury and death while respecting gun ownership rights

Marian “Emmy” Betz, MD, MPH, Professor of Emergency Medicine at the University of Colorado School of Medicine, is a clinician and researcher who advocates for suicide prevention through harm reduction work centered on firearms.

An issue of particular concern in Colorado, the number of suicides rose 20 percent in the state from 2013 to 2020, increasing each year except for a slight dip between 2019 and 2020. During the same period, suicides by firearms rose 32 percent. Half of those deaths were from 2020, the same year, Colorado has the seventh-highest suicide rate in the nation.

For Betz, the statistics point to an irrefutable conclusion: “Decreasing access to firearms is important to decreasing suicide risk,” she said.

While suicide prevention is a special interest, Betz is strongly committed to reducing all manner of firearm injuries and deaths.

She collaborates with academic colleagues, state agencies, firearm owners and retailers, and others who have the same goal, serving as founding member of the Colorado Firearm Safety Coalition. As the director of the Firearm Injury Prevention Initiative at the CU Anschutz Medical Campus, Betz facilitates partnerships, education, and research to prevent firearm-related injuries. She is also the primary investigator for the Patient-Centered Injury Prevention initiative, which investigates the most effective ways to communicate with individuals and reduce their risk of harm.





STAKEHOLDER SUPPORT

Betz recently led a National Institutes of Health-funded study that explored the views of stakeholders – firearm range owners and retailers, law enforcement agencies, and state and national organizations – about using voluntary out-of-home storage of firearms as a suicide-prevention strategy.

While the qualitative interviews of representatives from each of the three groups revealed significant concerns, such as liability, about how to store firearms outside the home, they were supportive of contributing to suicide-prevention efforts.

“Out-of-home firearm storage is a recommended option for individuals with suicide risk, but little has been known about its feasibility,” Betz says. “This grant has allowed our multi-disciplinary team to examine the views and experiences of these stakeholders related to out-of-home storage. The project, still ongoing, has led to high-level discussions with policy makers and regulators – including the Bureau of Alcohol, Tobacco, Firearms and Explosives – about strategies to facilitate voluntary, temporary out-of-home storage.”

For Betz, it’s just one of many strategies designed to buy time for individuals considering suicide. “The time between deciding to take one’s life and truly taking action may be minutes to hours,” she says. “But if they have access to guns, they are likely to die.”

She emphasizes the solution is not taking away people’s firearms but help them understand the risks and encourage them to make their own decisions about mitigation.

To that end, Betz led a 2019 study, published in the journal *Injury Prevention*, that tested a new online decision support tool called *Lock to Live*, which is free and available in English and Spanish, offers support and resources that include options for storing firearms. It also discusses medications and other factors that increase suicide risk.

CRITICAL CONVERSATIONS

Betz’s work in preventing suicide by firearms extends to helping fellow providers communicate with their patients about the sensitive subject. Getting that kind of conversation started can be difficult when tasked with delivering effective clinical care in a busy emergency room or clinic, Betz says.

In 2015, Betz began urging her physician colleagues to ask patients who appeared to be struggling with mental health or behavioral issues if they had suicidal thoughts and if so, did they have access to firearms.

“IF I’M GOING TO TALK TO A SUICIDAL PATIENT ABOUT LOCKING UP HIS GUNS, WHAT SHOULD I SAY TO MAKE THAT EFFECTIVE?” SHE ASKS.

Betz turned to Michael Victoroff, MD, a Denver-area physician and firearm instructor, for a better understanding. He ultimately became her co-founder of the Colorado Firearm Safety Coalition, where their work focuses on safe gun storage, suicide prevention and training. They also created a hands-on session on gun safety for CU Department of Emergency Medicine faculty.

"It's important to recognize the role we can play as providers in reducing the risk of firearm injury and death," Betz says.

With the Patient-Centered Injury Prevention Initiative, Betz works to find science-based approaches to help individuals find personally acceptable routes to reducing risk to themselves and others. A major component of the work is the technique of motivational interviewing, which prods people to identify their own reasons for making a behavioral change. To do that, it is vital that providers listen to patients and respond substantively, even during discussions they may find uncomfortable.

"Healthcare providers often have not been trained or had practice in how to address sensitive topics without judgment or to know what to say next," Betz says.

The social stigma of suicide may also affect some healthcare providers, some of whom may also have strong personal or political views on firearm ownership. She says partisanship is okay outside of medical settings but has no role in the trauma bay or exam room. When a provider meets a struggling patient, the goal must always be to help the individual "find hope and get through a rough patch."

"Regardless of their background, we want people to be healthy and prevent injury. I am grateful to help play that role." ■



BLUE SKY FACULTY FOLIO

INSPIRED





Family Tradition

Continuing a legacy of service in medicine and society

For Adit Ginde, MD, MPH, strong influences of medicine, science, and social impact are visible from the closest branches of his family tree, starting with his parents. His father, Arun, was a neurosurgeon and his mother, Rekha, was a pathologist.

"I was definitely interested in medicine from an early age," says Ginde, Professor and Vice Chair of Research for Emergency Medicine at the University of Colorado School of Medicine. "I tried to keep an open mind, but I always knew that this was a path that I was likely to go on."

Ginde was raised in a Washington, DC, suburb where his parents eventually settled after immigrating from India years earlier.

"My parents came to this country with a good education but with nothing in their pockets and no local family support," Ginde says. "They built a good life from that, instilling the value of education and hard work in their children."

His paternal grandfather, Ramchandra Ginde, established the city's first dedicated department of neurosurgery at King Edward (VII) Memorial Hospital (KEM) in Mumbai, India. While completing a medical school rotation at KEM, others regularly inquired if he was related to the pioneering neurosurgeon whose accomplishments were documented in textbooks.

On his mothers' side, Ginde's grandfather, Harilal Mahimtura,

was a lawyer and social justice advocate in Colonial India. Mahimtura was among the group accompanying Mahatma Gandhi on the Salt March (also known as the Dandi March) civil uprising in 1930 protesting the British monarchy's salt monopoly.

"MY FAMILY SAYS THEY SEE A LOT OF BOTH GRANDFATHERS IN ME – THE WORK ETHIC AND DRIVE AND THE COMMITMENT TO SOCIAL IMPACT, PUBLIC HEALTH AND CARING FOR OTHERS," GINDE SAYS. "BOTH ASPECTS RESONATE WITH ME."

Ginde's combined interest in emergency care and public service emerged soon into his training. While studying biology at Rice University in Houston, he joined an effort to launch an on-campus emergency medicine service. Although the school was situated across from Texas Medical Center, it was difficult to get timely ambulance service. In the first class that completed emergency medical technician (EMT) training at Rice, he provided on campus, pre-hospital care until graduating. During this time, he also volunteered with local 911 emergency medical services, providing care to many Hispanic patients, which gave him first-hand insight into the healthcare plight of the underserved.

"It exposed me to medicine in general and to emergency medicine as a specialty," he says. "It showed me very clearly that I love doing this type of work."



As an undergraduate, Ginde spent a summer working at the United States Naval Research Lab in Washington, D.C. There, he conducted bench research on blood substitutes that could act as synthetic oxygen-carrying red blood cells and provide protection for both members of the military and civilians from hemorrhaging or chemical poisoning during war, mass casualty events, and other emergencies.

"That was my first real introduction to research and the experience stayed with me," Ginde recalls.

He returned to community service work while pursuing a medical degree at Washington University School of Medicine in St. Louis, founding a student-run initiative that provided CPR training to students, staff, and neighboring community members. It was also in St. Louis where Ginde met his future wife,

Kara Penn, who owns a consulting business focused on social justice.

After medical school, Ginde says he relished providing acute and episodic care during his emergency medicine residency at Beth Israel Deaconess Medical Center in Boston. He simultaneously earned a Master of Public Health at Harvard where he saw patients with substance use disorders and psychiatric illnesses with no access to primary care.

"I valued making a difference for people in a moment of great need," he says.

Ginde secured his first research grant during a clinical research fellowship through Beth Israel and Harvard Medical School. He led a study evaluating the feasibility and effectiveness of screening high-risk patients for undiagnosed diabetes in the emergency department setting – often their only contact with the healthcare system.

A TURNING POINT

His path eventually led him to the CU Department of Emergency Medicine, where he's contributed to an impressive body of research since joining the faculty in 2007.

His extensive investigations into the health effects of vitamin D insufficiency attracted national attention. The work culminated in a trial aimed at protecting a vulnerable population: older residents of long-term-care facilities. It demonstrated monthly high doses of vitamin D were effective in preventing acute respiratory infections in these individuals. He led another clinical trial on high-dose vitamin D for treating critically ill patients that was published in the *New England Journal of Medicine*.

"I am fortunate to have gained so much experience in efficient and innovative clinical trials design and implementation," he says.

To date, he has published some 240 peer-reviewed research articles that focus primarily on critical injury and illness, but also address questions of health equity and access.

In 2020, Ginde found himself drawing from his past two decades of mounting expertise and the legacies of both his grandfathers. Faced with the world's largest public health emergency in a century, he would play a leading role globally in studies of treatments for COVID-19.

"I HAD PREPARED MY WHOLE CAREER FOR THIS MOMENT, AND THIS WAS THE MOMENT THAT DUTY CALLED," GINDE SAYS.

"You are doing things for public health purposes, and there was no greater challenge or honor that I could imagine for my career." ■





BLUE SKY FACULTY FOLIO

IMPACT

Transcendent Effort

How a physician-scientist became a leader in COVID-19 treatment research

Long before the COVID-19 pandemic emerged, Adit Ginde, MD, MPH, Professor of Emergency Medicine and Vice Chair for Research at the University of Colorado School of Medicine, was well into a productive clinical and research career. He had published numerous peer-reviewed articles, secured extensive federal funding, and led acute and critical care trials focusing on respiratory infections including pneumonia, sepsis, respiratory failure, and acute respiratory distress syndrome (ARDS).

This impressive research portfolio propelled Ginde to take on a significant role responding to the largest global public health crisis in generations. When the federal government launched Operation Warp Speed, he helped design and conduct multiple vaccine trials as part of the \$18 billion initiative


to accelerate international COVID-19 vaccine research and development through public-private partnership.

Joining the international sprint to quell the virus' impact, Ginde was also involved in early therapeutic trials, including Passive Immunity for our Nation (PassITON) which studied convalescent plasma as treatment, and ORCHID, which determined that hydroxychloroquine was not effective for COVID-19 inpatients.

AN ACTIV ROLE

National Institutes of Health formed the Accelerating Covid-19 Therapeutic Interventions and Vaccines (ACTIV) platforms in mid-April 2020 to lead a coordinated response strategy. ACTIV brought together sibling agencies including Operation Warp Speed and other leading experts from





emergency medicine, critical care, and infectious diseases to study six categories of therapies for COVID-19 patients.

Ginde joined the ACTIV-3 leadership team, which designed the platform for trials of antiviral drugs to treat COVID-19 inpatients, including monoclonal antibodies – laboratory-produced infection fighters, delivered by infusions.

“THIS WORK HAS FELT LIKE A CULMINATION OF WHAT I HAD PREPARED FOR MY ENTIRE CAREER,” HE SAYS. “YOU WORK TO TRY TO MAKE AN IMPACT ON PATIENT CARE AND OUTCOMES AND TO LEARN HOW TO BETTER TREAT PATIENTS. THIS WAS PUTTING THAT GOAL ON OVERDRIVE BECAUSE THERE WAS SUCH A PUBLIC HEALTH NEED AND SO MUCH AT STAKE.”

In 18 grueling months, ACTIV-3 completed six clinical trials of antiviral treatments. Ginde experienced a satisfying post-trial payoff as co-lead author of a study that compared the effectiveness of one of the monoclonal antibody treatments to a placebo in hospitalized COVID-19 patients. The study concluded that while

the treatment did not shorten hospital stays, it did reduce deaths by 30 percent.

Continuing his work, Ginde led the University of Colorado’s arm of ACTIV-4, which investigated the effectiveness of drugs designed to prevent secondary damage to heart, lung and blood vessel tissue caused by COVID-19. He’s also part of the ACTIV-6 trial, which is studying existing drugs, such as ivermectin, to see if they can prevent severe disease in COVID-19 outpatients.

Beyond ACTIV, Ginde took on a novel challenge as the national principal investigator of the six-site TREAT NOW trial, funded by the Department of Defense to investigate the effectiveness of repurposing two anti-HIV drugs as combination therapy for COVID-19 outpatients.

The work was challenging because it had to be completed without “any physical interaction with the participant,” Ginde says.

Demonstrating that “no-touch trials” are feasible and effective with careful design, integrated information systems and “fail safes” to protect patient privacy and safety, TREAT NOW offers just one example of how clinicians and researchers can apply the lessons learned from the first few years responding to the COVID-19 pandemic and beyond, Ginde believes.

“We are in a stage now that we are able to be a little bit reflective, while seeing that there is a mountain of work still ahead of us,” he says.

AN EXTRAORDINARY OPPORTUNITY

The pandemic underscored the need for governments, public health experts, and healthcare systems to remain flexible in their response to an ever-changing virus, Ginde says.

For example, while monoclonal antibodies produced mixed results with COVID-19 inpatients, they proved very effective in treating outpatients with moderate to severe symptoms.

But this good news was met with multiple barriers to patient access. Authorized by the FDA in November 2020, supplies of monoclonal antibodies were limited, many providers didn't know about them, and patients who wanted them often lacked timely access to an ordering provider. And while the medications were free from the federal government, there was no guarantee that the infusions could be administered without cost.

Ginde and other COVID-19 response leaders "strongly recommended centralized resources to order and access treatment to overcome these barriers," championing state-run facilities to administer the treatments free of charge. Later that month, a standing order from the State of Colorado's chief medical officer allowed eligible patients to receive the treatments for free at sites run by the Colorado Department of Public Health and the Environment.

This decision helped Colorado manage healthcare resources and save lives during the peaks of the Delta and Omicron variants and eased access to care among individuals who have been disproportionately affected by the pandemic, Ginde noted.

Despite these wins, Ginde warns, "The virus is always ahead. We just try to minimize the amount we are behind. Treatment- and vaccine-resistant variants cause us to re-evaluate current strategies and develop new countermeasures as the virus mutates and adapts."

Each medical advance creates a new set of challenges and



assumptions about all treatments – including how equitably they can be administered – are susceptible to change with each new variant.

"One of the main issues is that the evidence for COVID-19 therapeutics evolves so rapidly, from initial knowledge of efficacy to the changes that occur as variants have evolved," Ginde says. "For providers, it's been challenging to keep up with all the new and ever-changing treatments, as well as where and how to access them.

Aiming to do just that, he created the real-world evidence platform, mAb Colorado. This led him to start directly informing decisions by the Food and Drug Administration, White House COVID-19 Response Team, and U.S. Government inter-agency therapeutic advisory groups.

Now recognized as a national and global leader in the ongoing fight against COVID-19, Ginde has added nearly 100 publications to his C.V. since the pandemic began, with more in progress.

"WHAT HAPPENED IN A LITTLE MORE THAN TWO YEARS IS EXTRAORDINARY IN TERMS OF HOW QUICKLY SCIENCE CAN MOVE TO ANSWER QUESTIONS AND PROVIDE ACTIONABLE DATA THAT HAS SAVED MANY MILLIONS OF LIVES THROUGH VACCINES AND THERAPEUTICS," HE SAYS. "IT IS TRULY AN HONOR TO CONTRIBUTE TO THIS TRANSCENDENT EFFORT. HOW LIKELY IS IT IN A LIFETIME TO HAVE SUCH AN OPPORTUNITY?" ■

BLUE SKY FACULTY FOLIO

INSPIRED





Dreaming Big

Lifelong love of learning fuels high achievement in military, nursing fields

Even at a young age, Kathleen Flarity, DNP, PhD, Associate Professor in the Department of Emergency Medicine at the University of Colorado School of Medicine and Deputy Director of the CU Anschutz Center for Combat Medicine and Battlefield Research (COMBAT), displayed an exceptional work ethic and an appreciation for service. Born into a military family, she spent much of her early life in Adana, Turkey, where her father was stationed at Incirlik Air Force Base.

“MY FATHER REALLY INSTILLED IN ME THE BENEFIT OF HARD WORK, SETTING GOALS AND WORKING TOWARDS THEM WITH INTEGRITY, HONESTY AND HONOR WHILE BEING UNAFRAID OF FAILURE,” FLARITY SAYS.

After spending eight years in Adana, Flarity was 10 when her family moved to Cedar Falls, Iowa. She grew up working after school to earn money by babysitting, detasseling corn and bussing tables at restaurants. Prior to graduating high school, Flarity’s plan had been to go to nursing school. She applied and was accepted but couldn’t afford the tuition, so she set aside her nursing dreams and sought a new path.

“I didn’t know anything about grants, about scholarships. I didn’t even know about the service academies. But what I did know was that my brother had joined the Army the previous year. He was a military police officer and was enjoying it,” she says.

This sparked the idea to enlist a combat medic, but there was one snag. Still only 17, Flarity needed parental permission, and her father wasn’t convinced that his daughter should join the military. It was 1980 — the first year that women were allowed to serve in previously all-

male platoons. Her father eventually acquiesced, and Flarity enlisted. At basic training, she was soon chosen as squad leader.

"The leader of basic training sent my father a letter announcing that I had been named the outstanding trainee of the cycle. For my father to see me as a woman in this position, that's when he absolutely embraced me being in the military," Flarity says.

PUSHING GOALS

When she was a sergeant and stationed in South Korea, Dr. Kenneth Lee, a physician and Army Major, called her into a meeting.

"He said, 'Kathleen, let's talk about your goals.' I can't remember what I said, but it wasn't enough. He said, 'You need to dream bigger than that. What would be a reach goal for you?'"

SHE ADDS, "AT THE TIME, I WANTED TO EARN A BACHELOR OF SCIENCE IN NURSING, AND TO ME, THAT WAS UNATTAINABLE. NO ONE IN MY FAMILY HAD GONE TO COLLEGE. I THOUGHT I WASN'T SMART ENOUGH, I WASN'T CAPABLE OF IT, BUT SAYING THAT GOAL OUT LOUD REALLY SOLIDIFIED FOR ME I WAS GOING TO ACCOMPLISH MY GOAL."

When Flarity returned to the states, she enrolled in the Allen School of Nursing in Waterloo, Iowa, where she planned to attend years earlier. In 1987, she earned a



diploma in nursing while continuing to serve in the U.S. Army Reserve as a medic. A year later, Flarity completed a Bachelor of Science in Nursing, fulfilling the goal she set in South Korea. But she was only getting started.

Over the next 20 years, Flarity embarked on a remarkably productive dual career, rapidly ascending the ranks of the Air Force while earning multiple advanced degrees in nursing and education. This includes a Master's in Nursing (specializing in emergency and critical care), a Doctorate in Education, and a Doctorate in Nursing Practice.

While achieving once unimaginable academic success, Flarity was also advancing through the military ranks. Shortly after earning her diploma in nursing, she received a commission in the U.S. Army Reserve as a second lieutenant. Three years later, in 1991, she was

promoted to first lieutenant, then deployed to Saudi Arabia in support of operations Desert Shield and Desert Storm.

She also had accumulated combat service, deploying as the Commander of the 455th Expeditionary Aeromedical Evacuation Squadron in Bagram, Afghanistan, in 2011. There, she directed all air medical evacuation teams at the height of the conflict.

During her military career, Flarity had risen from a basic training squad leader to the Mobilization Assistant to the Air Mobility Command Surgeon, a position with oversight of a budget of \$781 million and assets exceeding \$1.6 billion. She served a total of 15 years in the Army and 26 years in the Air Force, where in 2017, she achieved the rank of Brigadier General.

As in her academic career, Flarity's rise in the military has much to do with her work ethic.

"I'M BLESSED THAT I HAVE INTRINSIC MOTIVATION. THOUGH THE ONLY EXPECTATION WAS THAT I WOULD GRADUATE HIGH SCHOOL, MY PARENTS ALWAYS INSTILLED IN ME THE IDEA THAT I CAN DO WHATEVER I SET MY MIND TO," SHE SAYS.

"I love learning; I'm a life-long learner. Some of my education was happenstance, like getting a Doctor of Nursing Practice because the Air Force was leaning towards requiring all its nurse practitioners to have their DNP. As a leader, I didn't think I could ask that of people and not do it myself."

COLORADO AND COMBAT

In 2008, Flarity was assigned to Peterson Air Force Base in Colorado Springs, serving as the inaugural Commander of the 34th Aeromedical Evacuation Squadron. While stationed there, she also took on a civilian job, working as a nurse scientist for UCHealth Memorial Hospital in Colorado Springs. Her hospital work eventually led her to the University of Colorado's Anschutz Medical Campus in Aurora, home of the Center for Combat Medicine and Battlefield Research (COMBAT) within the Department of Emergency Medicine.

"Knowing my military history and my research background, Vik Bebart, who founded COMBAT, came to me, and said, 'I really need a deputy director,'" Flarity says.

She jumped at the opportunity, and they quickly got to work.

"We've only been around three years, but the amount of work that we've already done is exceptional," she says. "One of the things that's helped us do so well is the speed of trust from being well-known in the research and military communities. People know that if we're involved, it has integrity." ■





BLUE SKY FACULTY FOLIO

IMPACT

Sustaining Compassion

Research to help healthcare providers build resiliency

Kathleen Flarity, DNP, PhD, Associate Professor of Emergency Medicine at the University of Colorado School of Medicine and Deputy Director of the CU Anschutz Center for Combat Medicine and Battlefield (COMBAT) Research, is a leader in compassion fatigue research.

Like post-traumatic stress syndrome but for healthcare providers, compassion fatigue has been rampant throughout the COVID-19 pandemic and is well known to caregivers working within military units.


UNDER PRESSURE

"Pressure on healthcare professionals is ever increasing, and these challenges are facing the entire nation. Work as a healthcare professional is hard;

it requires self-regulation and resiliency both personally and professionally to mitigate the negative effects of caregiving."

"THE EFFECTS OF WORK-RELATED STRESS AND BURNOUT ARE REAL, SIGNIFICANT, AND CAN BE DEVASTATING. IT HAS BECOME EMERGENT AND INCUMBENT UPON LEADERS TO ADDRESS THE ISSUES STEMMING FROM WORK-RELATED STRESS CONDITIONS," FLARITY SAYS.





Flarity first became interested in compassion fatigue when she and her close friend were deployed to Iraq as part of an Aeromedical Evacuation Squadron. A flight nurse during Operation Iraqi Freedom in 2003, he struggled during and after the deployment, ultimately leaving both the Air Force and the nursing profession.

“He came back a changed man. He was profoundly affected, both personally and professionally,” Flarity recalls.

IN 2011, FLARITY PERSONALLY EXPERIENCED COMPASSION FATIGUE WHEN SERVING IN AFGHANISTAN AS THE COMMANDER OF THE 455TH EXPEDITIONARY AEROMEDICAL EVACUATION SQUADRON.

In addition to the standard stress of war, she experienced burdens unique to her position as a leader. Her symptoms included sleep disturbances, obsessive rumination about her teams and patients, and a state of hypervigilance, all of which took a profound toll.

“I worried not only about the patients I personally cared for, but about all our patients. And then my military family, which is the people on my teams, because in a day, they saw what most of humanity doesn’t see in a lifetime,” Flarity says. “We’re taught to just push it down, push it down, and we’re not taught techniques or mechanisms to deal with it in the moment or fix it. So, it builds and builds and, as I tell people, it’s going to surface, whether it’s six months, two years, or five years from now, and it will surface in negative ways if not addressed.”

MOVED TO ACT

Galvanized by her and her friend’s experiences, Flarity began to research compassion fatigue. This led her to world-renowned traumatologist Eric Gentry, MD, who was implementing a recovery program for clinicians suffering from compassion fatigue. Flarity had tried some of his techniques herself and found them to be helpful.

“I called him up and said, ‘I’m worried about my people, and I want to know what you can do about it.’ At the time I didn’t say I had any symptoms. I wasn’t yet able to share my own vulnerabilities,” Flarity says.

Gentry invited Flarity to do some one-on-one training and gave her permission to use his findings and techniques in her own research. For her first study, Flarity recruited a group of emergency nurses at UCHealth Memorial Hospital in Colorado Springs. The nurses attended a four-hour seminar with Flarity’s interventions that included group work, individual exercises, demonstrations, and guided imaging.

Flarity collected participant data before and after the seminar. She measured what she calls the three constructs of compassion fatigue: burnout, secondary traumatic stress (experiencing traumatic stress from helping others with their traumatic experiences), and compassion satisfaction (finding meaning in caring for others). The results were highly encouraging.

“Compassion satisfaction went up and burnout went down, which was my hypothesis; I was hoping to see those two,” Flarity says. “But secondary traumatic stress also went down, which I didn’t expect, because I changed nothing in their work environment. Providers were still seeing the challenging patients, the critically ill and injured patients, but it was their response that changed.”

Flarity proceeded to expand the scope of her work, completing a year-long study of nurse residents. Study participants gathered once a month and attended a four-hour seminar in the first study at the six-month mark. Participants experienced improvements burnout, secondary traumatic stress, and compassion satisfaction symptoms. Participants were surveyed six months after the seminar.

"I asked them about the interventions. 'What did you do, and how often?' The ones that had implemented the techniques daily had continued to have the protective, mitigating factors," Flarity says.

Not only did her interventions work, but for committed individuals, Flarity's interventions offered enduring, healthy coping mechanisms. The pandemic offered Flarity the perfect opportunity to help front line caregivers.

"We have participants write down three of the negative effects of their work as a caregiver on a card. Read it silently, then pass it to the next person to do the same. It's called the silent witness. The results are a word cloud of all these ideas like sleep, fatigue, exhaustion. It is powerful."

Flarity's data shows that when participants practice the techniques she teaches, they can benefit greatly. One of her techniques is a breathing exercise designed to shift caregivers from a fight or flight state to feeling calm and capable. She instructs them to breathe deeply, inhaling the word "peace," then exhaling the word "calm."

AWARENESS IN ACTION

Awareness around compassion fatigue has come a long way over the course of Flarity's career, and she's proud of the work campus leaders have done to support their caregivers.



"I think there's a lot of visibility right now on burnout and compassion fatigue. We've done a lot of things to support our caregivers, such as well-being committees, interventions, recharge rooms, peer-counseling, and we're rolling out a system called 'First Call,' which is a 24/7 call line where you can talk about anything to a mental health professional," Flarity says.

Flarity shares a vision for leadership in healthcare that can embrace and initiate methods to create a more efficient, empathetic, and effective system for future generations of caregivers, administrators, and patients.

"SUPPORT FOR COMPASSION FATIGUE RESEARCH IS MORE CRITICAL NOW THAN EVER, ESPECIALLY AMONG NURSES, TO PROMOTE HEALING AND RETENTION FOR HEALTHCARE PROFESSIONALS," SHE EMPHASIZES. ■

BLUE SKY FACULTY FOLIO

INSPIRED





Wild Medicine

New frontiers for
emergency care

Head north a couple of hours from the bustle of New York City and the world transforms from canyons of concrete to the heavily wooded hills, studded with lakes and ponds, of the southern Adirondacks. The area was the home of John “Jay” Lemery, MD, Professor of Emergency Medicine at the University of Colorado School of Medicine and Section Chief of Wilderness and Environmental Medicine. He grew up in small-town Glens Falls, New York, about 10 miles from Lake George, a crystalline gem.

The natural beauty of the mountains, lakes and wildlife exerted a powerful influence on

the course of Lemery’s career. After high school, Lemery attended University of Virginia in Charlottesville. As an Echols Scholar in the College of Arts and Sciences, he was encouraged to design his own course of study. Lemery dove into arts and humanities, political economy, and foreign affairs studies. The broad approach ultimately prepared him to think about healthcare as integral to the social fabric rather than an isolated thread.

“The program is very valuable because it gives you permission to explore disparate disciplines,” he says.

“THAT HAS BEEN A HALLMARK OF MY CAREER – BEING ABLE TO PULL TOGETHER SEEMINGLY UNRELATED THINGS AND MESH THEM INTO NEW FRONTIERS.”

GOING BEYOND TRADITIONS

After earning his undergraduate degree, Lemery enrolled in the Geisel School of Medicine at Dartmouth College. Near the end of his studies, a resident colleague convinced him to join a wilderness medicine elective.

The class traveled to Arizona for an 18-day trip through the Grand Canyon on the Colorado River. The team studied scenarios in a wilderness medicine curriculum during the excursion that Lemery described as “mind-blowingly stimulating.”

He put the memories “in the bank” shortly before he began an emergency medicine residency at New York University and Bellevue Hospital, where he was chief resident. Throughout the program, Lemery organized wilderness medicine weekends with his colleagues and designed a curriculum for trips to familiar territory at Lake George.

“Over time, I realized wilderness medicine was a viable niche, with possibilities for resident education, clinical excellence, and research,” he says.

Lemery saw a “real market” for those hungry to understand the most effective ways to care for people living, stranded, or



confined in isolated environments. The approach would be different than “backpack medicine,” romanticized as an intrepid provider venturing into the wild, provisioned only with “scissors, duct tape, a Swiss army knife.”

The more useful idea, he felt, was to develop a subspecialty with specific methods of care formulated through rigorous practice. That meant determining, for example, the high-potency medications and point-of-care diagnostic equipment, such as ultrasound, which would have the most effective “real-world applications” in far-flung locales, Lemery says.

The end goal: codify evidence-based guidelines through peer review. In 2007, Lemery developed Clinical Practice Guidelines (CPGs), based on unbiased, reviewed input from experts. The first 10 were published in the journal *Wilderness and Environmental Medicine*.

“The mindset of the CPGs is steeped in looking objectively at austere and remote care that is not addressed in traditional medical training,” Lemery notes.

GRAND OPPORTUNITY

His wilderness medicine work led Lemery to a realization that humans face a growing health crisis: climate change. He looked at burning forests, deluged coastal cities, hurricane-battered homes, and the death and human suffering caused by intensifying natural disasters.

At the time of the CPG work, Lemery was an instructor in emergency medicine at Weill Cornell Medical College. While he thought about how to help people prepare for and survive in harsh environments, he also saw the planet itself becoming a less hospitable place – even as some politicians, businesspeople and ordinary citizens questioned the reality of climate change and the motives of those who presented evidence supporting it.

Lemery concluded that the time has come for the medical and scientific community to recognize and confront the medical repercussions of climate change. “We have a core mission

to inform the public of the health risks of climate change clearly, unambiguously and without prejudice,” he says. “If we succeed in that, we have a fighting chance of changing policy.”

“I began to see the politicization of science around climate change,” Lemery says. “That was extremely dangerous.” He acknowledges that efforts to promote clean energy sources require policies that help workers in existing industries. There is compelling evidence of planetary warming, concentrations of atmospheric carbon dioxide, and other changes that are having effects on human health. Despite the contentious debates, Lemery sees a “grad opportunity” to elevate the importance of wilderness medicine among academic leaders and policy makers.”

“I BEGAN TO THINK THAT THIS IS WHERE THE FIELD NEEDS TO GO,” HE SAID. “IN WILDERNESS MEDICINE, WE HAVE A DUAL MANDATE OF TAKING CARE OF PATIENTS IN REMOTE AND AUSTERE PLACES, AND OF APPRECIATING THE BEAUTY AND FRAGILITY OF THOSE ECOSYSTEMS. CLIMATE CHANGE AND HEALTH POLICY ARE THE EXTENSION OF WILDERNESS MEDICINE.”

EXPANDING EXPERTISE

Lemery came to CU’s Department of Emergency Medicine in 2012. He created the Wilderness and Environmental Section in 2014, where he serves as Chief. Recognizing it was vital to add voices to the chorus of medical professionals calling for change, he founded the nation’s first non-governmental graduate medical education climate and health science policy fellowship in 2017, which draws in physicians from various medical fields. The fellowship helps physicians develop a “360 view” that places medicine in a larger context of policy and decision making.

“Focusing only on healthcare is not going to work,” Lemery says. “You need to be able to reference geopolitics. Clinicians by nature don’t like to wade in beyond their expertise, but this must be part of our bailiwick and our area of expertise. In our society, patients and their families are under threat. The data supports climate change health impacts are growing and are not going away in our lifetimes.”

His effort to build a cadre of climate-conscious clinicians also includes serving as co-director of CU’s Climate & Health Program. The program aims to understand the impacts of climate change on human health and advocate for smart policy addressing the crisis, all while advancing human dignity. In 2022, Lemery was awarded an Endowed Chair in Climate Medicine to advance this work, made possible by generous donors who facilitate enduring and transformative work.

Now, Lemery is working on questions of how to deliver care effectively on another hostile frontier, at the limits of the universe. ■





BLUE SKY FACULTY FOLIO

IMPACT

Destination Mars

The path from wilderness medicine to deep space

For more than two decades, John “Jay” Lemery, MD, has delivered healthcare in remote and austere places, where providers must make do with limited supplies. But the Professor of Emergency Medicine at the University of Colorado School of Medicine and Section Chief of Wilderness and Environmental Medicine has interests that span beyond earthy medical concerns.

As a young child, Lemery recalls urging his mother to repeatedly read him *National Geographic* stories about the planets.

“I WAS COMPLETELY ENAMORED WITH SPACE,” LEMERY SAYS.

As an eighth grader, he developed and submitted a project to be sent to NASA’s Space Station on how light sensitivity and gravity would affect earthworms migrating to space. “The idea was that you’re going to need earthworms to help grow food in healthy soil,” he recalls, but he ended up being too young to qualify for the competition.

Toward the end of an intense four-year emergency medicine residency at Bellevue Hospital in New York, he found out about a space medicine rotation at NASA and traveled to Houston to work with a group there. He wrote a paper addressing treatment of atrial fibrillation on Mars, and in 2007 co-authored a book chapter on space medicine for the journal *Wilderness Medicine*.





FINAL FRONTIER

Lemery recently joined NASA's Human Research Program as a contributing scientist on the initiative's Exploration Medical Capability Element (ExMC). The program is geared to optimizing human healthcare systems for deep space missions — travel to the moon and to Mars.

Work on keeping humans physically and mentally strong in space began with the first space station in 1969 and continued with the International Space Station (ISS), which launched in 1998 and hovers about 230 miles above the earth. Reaching the moon, at 240,000 miles away, and Mars, at an average 140 million miles afar, requires giant leaps, to put it mildly. The distances create a range of new questions for the human body and medical care.

"All the work about health and health risk has been predicated on the space station," Lemery says.

The ISS has a large pharmacy and an ultrasound machine, and protocols call for a sick or injured astronaut to be returned to Earth in 24 hours. Travel to the moon will take a week and a return trip will require a rocket launch from its surface. As for Mars, merely making communication transmissions involves a 15- to 30-minute delay.

These immutable physical challenges in the context of answering practical questions about how to deliver medical care to astronauts and settling on recommendations to colleagues make up Lemery's work. What we learned from the space station experience is only a starting point, he adds.

"FOR HUMANS TO HAVE A SUSTAINED PRESENCE IN DEEP SPACE, ALL THE MEDICAL RISK ASSUMPTIONS WE'VE MADE HAVE TO BE REWRITTEN AND REIMAGINED," LEMERY SAYS. "THE STAKES GO WAY UP. HOW DO WE OPTIMIZE CARE AND MINIMIZE RISK IN A SCIENTIFIC MANNER?"

SPACE MEDICINE

Lemery characterized the ExMC work as part of a "great leap forward" from thinking about healthcare delivery during low earth orbit missions like the ISS (600 miles or less) — with astronauts connected to Earth with a lengthy umbilical cord learning to conduct "Earth-independent medical operations" in deep space, during which crew members will have far less access to help. "This is the grand pivot," he said. "How do we begin to get our hands around this?" He compares the ExMC element to "a medical think tank" whose aim is to "effectively advocate for remote and austere care" in planning for space flight.

A fundamental question is how to overcome communication gaps imposed by the vast distances of space, such as in a scenario that a Mars mission crew member shows signs of stroke or heart attack. Technologies like artificial intelligence, augmented reality, virtual reality, and just-in-time training could help to fill the void in that situation and many others.

Augmented reality – superimposing computer-generated images over a person’s view of their environment – could enable astronauts to conduct a physical exam or look for signs of neurological weakness, while video links sent to a virtual reality headset could help to guide a crew member inserting an IV line. Astronauts will need a library of evidence-based resources to help them respond to routine medical concerns to life-threatening emergencies.

The ExMC team is developing its ideas in tandem with other elements of the Human Research Program, and Lemery is mentoring numerous colleagues to solve these problems.

“WE’RE PRACTICING OUR CRAFT,” HE SAYS. “WHAT ARE THE ISSUES? HOW DO WE OPTIMIZE HUMAN HEALTH AND PERFORMANCE? IT’S A CHALLENGE, AND THAT’S WHAT MAKES IT COMPELLING AS A SCIENTIST.”

Lemery is also interested in helping to train more physicians who can help advance missions in space. He is senior mentor to the team creating a first-of-its-kind, joint MD-MS degree program between CU School of Medicine and CU Boulder’s Department of Aerospace Engineering.

“There is a big need for well-educated, informed healthcare providers at NASA and in private space agencies,” Lemery says. “We also realized that one of the grand challenges for a physician working at NASA is liaising with engineers. Often, we speak a different



language. We have an opportunity to train clinicians who could be true leaders in their field with a Master’s degree in aerospace engineering.”

UNIFYING FORCE

The forests of the South Adirondack Mountains where Lemery grew up, the frozen terrain of Greenland, the tight environments of the International Space Station, the stark surfaces of the moon and Mars, and the vast emptiness between them may seem to have little in common with one another. But for Lemery, these remote and austere places offer unique opportunities to consider how to help humans survive.

“That’s the unifying thing for my career. I’m an educator and I think about how we thrive in non-traditional areas,” he says.

As to goals for the future, Lemery is both practical and aspirational. There is hard work ahead to face an environment under stress and how it will affect life for present and future generations.

“Space medicine a totally different species, but it inspires us again to think about what we can do as humans. I want to advance human potential,” he says. “If I can inspire our community and constituents to bring out the best in the human spirit, that, for me, will be a career well spent.” ■



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243

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99th
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Timeliness
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\$692M

In Research
Funding in 2022



34%

Increase
2021-2022

#1
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2,640

New
Benefactors

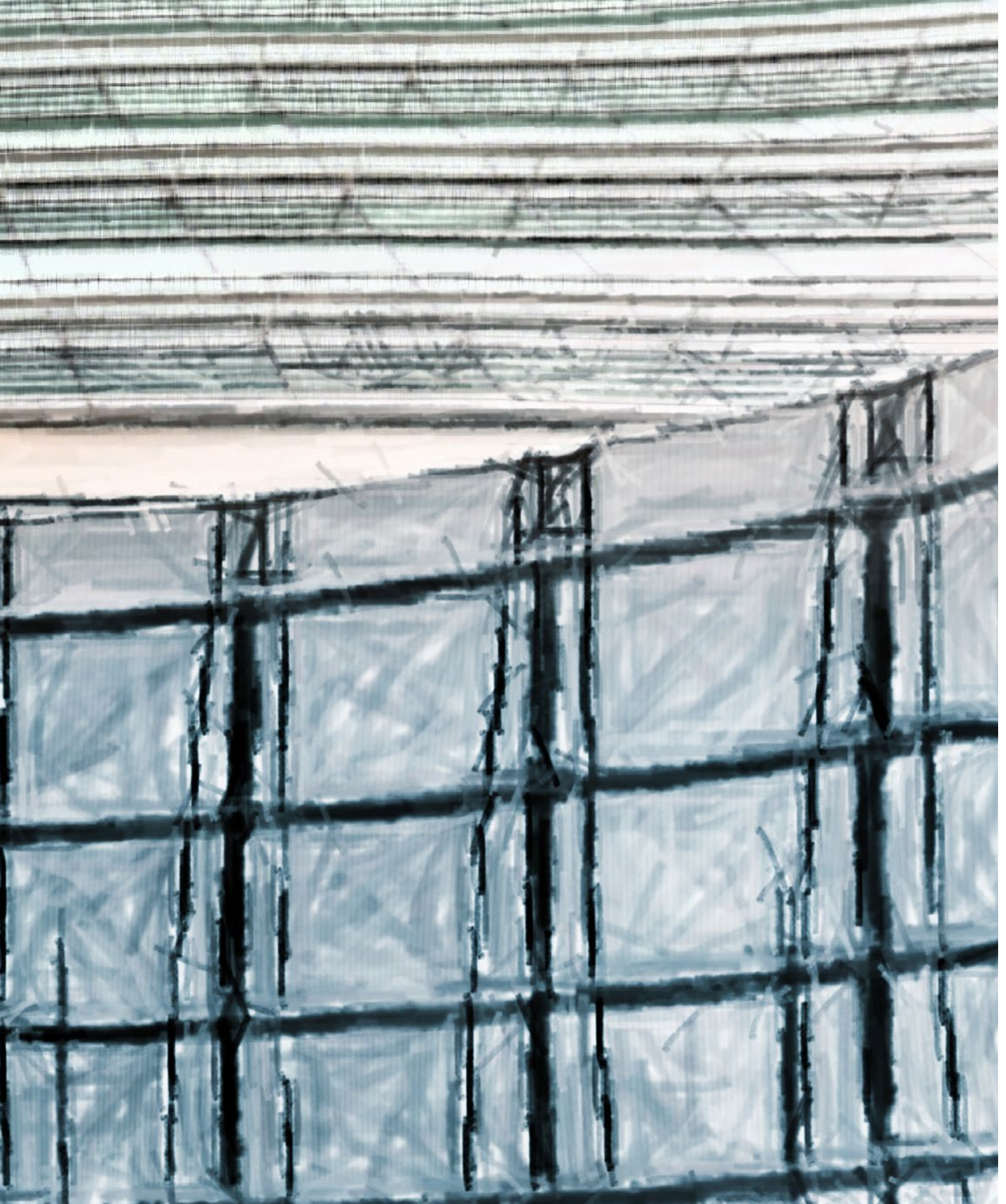


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