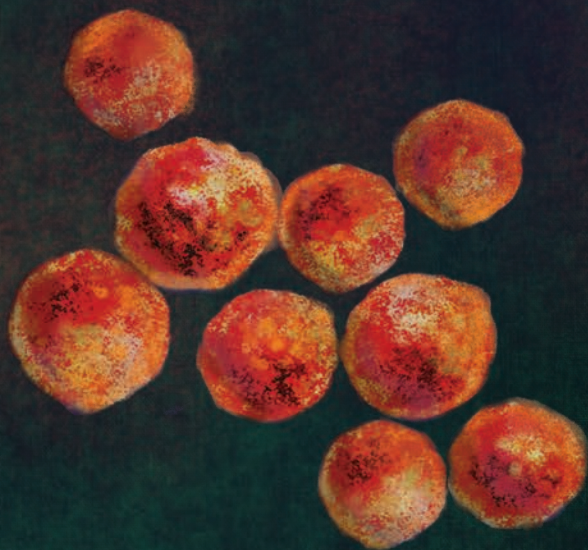


Vitals

M A G A Z I N E

DARTMOUTH HEALTH | GEISEL SCHOOL OF MEDICINE



Battling the Antibiotic **Apocalypse**

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An aerial photograph of the Dartmouth College campus in Hanover, New Hampshire. The image shows a mix of historic brick buildings, green lawns, and a large central quad. In the background, there are rolling hills covered in dense forest, with a few buildings visible on a distant ridge. The sky is overcast.

Welcome to

Vitals

MAGAZINE

Blood pressure, temperature, heart rate, breath. These initial measurements—your vital signs—give your doctor a baseline understanding of your health. The opening lines to the story of you.

This concept is central to *Vitals Magazine*, the new flagship publication from Medical & Healthcare Advancement at Dartmouth. From cancer and infectious disease to mental health and access, humanity faces profound health challenges—and the paths toward solutions are being forged right here. With the launch of this magazine, we have a new venue from which to share how Dartmouth researchers, clinicians, and innovators are working to answer medicine's most pressing questions.

For this inaugural issue, we turn a spotlight on the future of health.

Today's health professionals find themselves in a rapidly evolving landscape. How are they adapting in response? And how do today's breakthroughs find their way to the clinic? Here, we explore the ways in which Dartmouth's unique ecosystem empowers scientific discovery to effect positive change on patients in our region and beyond.

As you turn the pages of this and future issues, or visit *Vitals Magazine's* website, you'll meet the people, programs, and communities behind the Geisel School of Medicine at Dartmouth and Dartmouth Health's longstanding, outsized impact on the world of health and medicine. We sincerely hope you enjoy reading *Vitals Magazine* as much as we have enjoyed creating it.

Thank you for joining us in this exciting new chapter.

Vitals Magazine Team

On the Bright Side

Why does the brain divide its work between two hemispheres, with each side specializing in tasks like language, handedness, and recognition of faces? To find out, a team led by Marnie Halpern, PhD, a neuroscientist and chair and professor of molecular and systems biology at the Geisel School of Medicine at Dartmouth, has turned to a tiny fish. In this confocal image (below), neurons light up on both sides of a juvenile zebrafish's hindbrain, but only on the left side of its forebrain, revealed using CRISPR-engineered transgenic techniques. Asymmetry of brain cells—like that visualized here—influences behavior and, in humans, has been implicated in disorders such as autism, epilepsy, and schizophrenia. By tracing how this early “one-sided glow” is connected to other brain regions, Halpern’s lab aims to shed light on how such left-right differences shape cognition and behavior—and what happens when that natural bias goes awry.

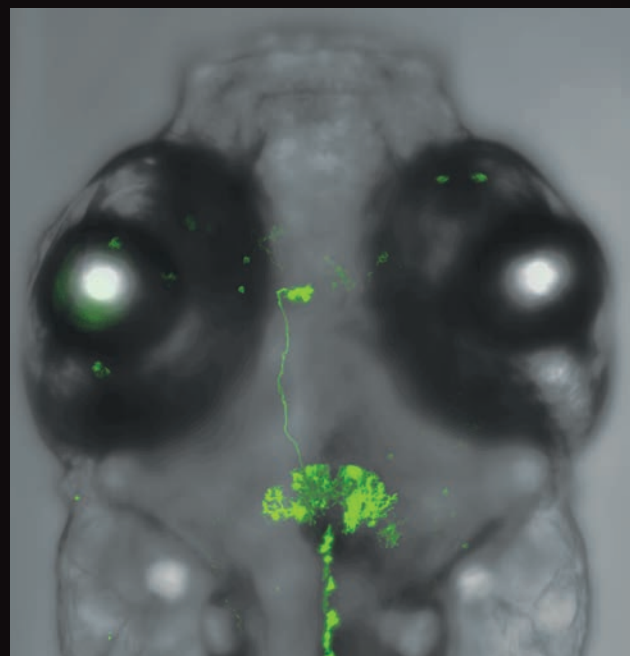


Image courtesy of Krishan Ariyasiri, PhD

Neuroscience researchers Krishan Ariyasiri, PhD (right), and Marnie Halpern, PhD (left), study scans of zebrafish brains.

Vitals Magazine

STORIES ON HEALTH AND MEDICINE

Fall 2025

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For more *Vitals Magazine* storytelling, go to vitalsmagazine.dartmouth.edu.



Building a Healthy Future Together



As we welcome a new chapter in leadership, we are filled with gratitude for the uniquely collaborative and porous academic medical ecosystem that spans our institutions.

Across Dartmouth Health and the Geisel School of Medicine at Dartmouth, you can find faculty, researchers, clinicians, and learners revolutionizing healthcare and medicine together. In doing so, they are transcending departments, disciplines, and institutions to develop the most comprehensive and potent solutions to the biggest challenges to health.



This is the power of our partnership. Because we work so fluidly across departmental and institutional boundaries, we're accelerating progress: Whether it's developing cutting-edge AI tools to support patient care and diagnostics; advancing real-time genomic analysis to transform how we detect cancer; or confronting antimicrobial resistance with

"It is a tremendous privilege to be entrusted to foster the uniquely collaborative excellence that defines our academic medical ecosystem. Working together, we are building the future of health, right here and right now."

— Joanne M. Conroy, MD, and Steven D. Leach, MD

a coordinated, cross-campus response, our community is not only imagining the future of health, they're also building it, right here and right now.

We are both energized by the momentum already underway and excited to build upon our established work across our academic medical institutions. Already, we are expanding bridges across the entire Dartmouth ecosystem to unite interdisciplinary problem-solvers to devise innovative treatments for some of the most deadly and complex diseases. Together, we are poised to amplify our shared mission: to educate, to discover, and to deliver the best possible care to every person and every community we serve.

The future of health is not a distant aspiration. It's happening here. And we couldn't be more proud to be in it with you.

Joanne M. Conroy, MD
CEO and President,
Dartmouth Health

Steven D. Leach, MD
Dean (Interim),
Geisel School of Medicine

Steven D. Leach
Geisel Interim Dean



Steven D. Leach, MD, began his term as interim dean of the Geisel School of Medicine at Dartmouth on September 15.

A nationally recognized leader in cancer research and academic medicine, Leach served as director of Dartmouth Cancer Center from 2017 until he began his role as dean. In that position, he expanded clinical services, advanced research initiatives, and deepened community engagement. As dean, he brings a deep commitment to excellence and collaboration across Dartmouth and Dartmouth Health.

A member of the National Academy of Medicine, Leach has a long track record of leading seminal breakthroughs in pancreatic cancer surgery, biology, genomics, and therapies. His discoveries underpin our understanding of the mechanisms driving the development of pancreatic cancer and have led to the development of cutting-edge treatments.

Prior to joining Dartmouth Cancer Center, Leach held the David M. Rubenstein Chair and was the inaugural director of the Rubenstein Center for Pancreatic Cancer Research at Memorial Sloan Kettering Cancer Center in New York City. Leach earned his AB in biology at Princeton University and his medical degree from Emory University. He completed his residency in general surgery and a postdoctoral research fellowship at Yale University, followed by a surgical oncology fellowship at MD Anderson Cancer Center.



Cardiologist Kerrilynn Hennessey, MD, with a patient.

Catching a **Silent Killer**

An underdiagnosed genetic condition puts 34 million people unknowingly at risk of deadly heart attacks by age 30. An innovative diagnosis protocol could change that.

By Mara Johnson-Groh

Suffering a heart attack in your 30s may seem like bad luck. But for some families, like Terry Sturke's, it's commonplace. On Sturke's father's side, many family members have died in their 30s. In cases like these, the cause is not misfortune or unhealthy habits, it is genetics.

Familial hypercholesterolemia (FH) is an inherited disorder that affects some 34 million people worldwide. It's caused by a mutation in a gene that controls how cholesterol is cleared from the body. FH can be managed with cholesterol-reducing medications, but if left untreated, FH

causes bad cholesterol levels to skyrocket, starting from birth, increasing the risk for heart disease up to 20 times. While FH can manifest in anyone with the mutated gene, it is significantly more common in New England, as individuals of French-Canadian ancestry are more likely to have inherited FH.

"If it's diagnosed and treated particularly early in life, you see that patients have the same life expectancy as any other person, as long as we control their cholesterol," says Kerrilynn Hennessey, MD, cardiologist at Dartmouth Health's Dartmouth Hitchcock Medical Center (DHMC) and assistant professor at the Geisel School of Medicine at Dartmouth. "But if we

don't, then people can start having heart attacks in their 30s and 40s."

Yet 90% of people with FH are oblivious to their condition. To increase diagnoses and awareness, Hennessey, along with fellow cardiologist Mary McGowan, MD, launched the TREAT-FH pilot project at Dartmouth Health with support from The Susan and Richard Levy Health Care Delivery Incubator, a joint venture between The Dartmouth Institute for Health Policy & Clinical Practice and the Department of Community and Family Medicine at Dartmouth Health to support the development of innovative healthcare delivery solutions.

Hennessey and McGowan, along with a diverse group of collaborators, developed an innovative protocol that leveraged a machine learning model developed by the Family Heart Foundation to go through anonymized patient records looking for evidence of FH, a prohibitively time-consuming task for a human. When the algorithm identified an FH pattern, the team deanonymized the patient's record and scrutinized their full medical history. Ultimately, this protocol identified 61 previously undiagnosed people who were likely to have FH as well as 16 additional patients with other types of high-risk indicators. The team reached out to each patient to confirm the diagnosis and begin treatment.

"I had some patients say to me, 'I finally understand my family's curse where everyone was dying young of heart disease,'" says McGowan, who has since retired from Dartmouth Health.

The TREAT-FH program ran from 2021 to 2024 at Dartmouth Health, and has also been implemented at five other medical institutions. Hennessey and her team are now exploring sustainable ways to continue to improve FH awareness for Dartmouth Health's patient population. Since parents with FH have a 50% chance of passing FH on to their children, programs like TREAT-FH can also create cascades of diagnoses beyond the patients initially identified.

"When you identify a person with FH, you identify their whole family," Hennessey says, noting that on average, eight other family members are identified following the first diagnosis.

Early identification is essential for helping people manage their FH. Sturke, who is an advocate with the Family Heart Foundation and served as a patient advisor to the TREAT-FH team, was first diagnosed at a young age after her sister, a teenager at the time, was diagnosed following the development of cardiac chest pain. With innovative tools like TREAT-FH, more families like the Sturkes can be identified and treated. Over the years, Sturke's sister has taken medications, received therapy, and undergone bypass surgery to treat her FH.

"My sister, who never thought that she would see 40, recently turned 80," Sturke says. "And she's still going strong."

"When you identify a person with FH, you identify their whole family."

—Kerrilynn Hennessey, MD, cardiologist

To learn more about heart and vascular care at Dartmouth Health, contact Elizabeth Dollhopf-Brown at 603-646-5792 or Elizabeth.Brown@hitchcock.org.

Battling the Antibiotic Apocalypse

Dartmouth researchers and doctors are leading the fight against antibiotic-resistant infections.

By Jeremy Martin

It started quietly, an invisible invader moving through hospitals, clinics, and homes across the country. In 18 states, patients woke up to blurred vision, their eyes red and swollen. Some felt a stabbing pain, as if shards of glass were etched in their corneas. Others saw nothing at all. By May 2023, 14 people had gone blind, four had lost an eye, and four more were dead.

Months earlier, in February, the Centers for Disease Control and Prevention (CDC) had sounded the alarm: An extremely drug-resistant strain of bacteria—*Pseudomonas aeruginosa*—was sweeping the nation. Investigators traced the outbreak to an unlikely source: over-the-counter “artificial tears” used by millions to soothe dry eyes. Some bottles had been contaminated with the virulent bacteria, turning a simple remedy into a vector for one of modern medicine’s greatest threats: antimicrobial resistance.



“This strain of *Pseudomonas* is highly resistant to conventional antibiotics, which makes infections very difficult to treat,” says Michael Zegans, MD, section chief in ophthalmology at Dartmouth Hitchcock Medical Center (DHMC) and professor of surgery, microbiology, and immunology at the Geisel School of Medicine at Dartmouth. “That alone is scary—as is the fact that it led to patient deaths and the need to have some eyes surgically removed.”

While artificial tears leading to lost eyes is newsworthy, outbreaks of drug-resistant bacteria are a far cry from unusual. The World Health Organization (WHO) estimates 1.3 million deaths were directly attributable to antibiotic-resistant pathogens in 2019. In the U.S., antimicrobial resistance (AMR) leads to more than 2.8 million infections and kills 35,000 Americans each year, according to a CDC report. And things are on track to get worse. A meta-analysis published in September 2024 in the medical journal *The Lancet* projects that by 2050, AMR could claim more lives annually than cancer does today.

“The scariest thing as a clinical laboratory director is a bacterium that causes an infection in a patient and is resistant to every drug we test,” says Isabella Martin, MD, medical director of clinical microbiology at DHMC and assistant professor of pathology and laboratory medicine at Geisel. “It means there are no possible active therapies for their infection.”

◀ Mixed bacteria growing on a lab culture plate from a respiratory sample.

What You Can Do

As antibiotic resistance threatens to undo a century of medical progress, small actions can still have a big impact. Here's what you can do to help turn the tide.

- ✓ **Take antibiotics as prescribed.** Stopping early can leave resistant bacteria behind.
- ✓ **Don't pressure your doctor.** Antibiotics don't work for viruses like colds or the flu.
- ✓ **Never share or use leftover antibiotics.** Each infection requires the right drug at the right dose and the right time for the right patient.
- ✓ **Prevent infections.** Wash hands regularly and clean wounds properly.
- ✓ **Support antibiotic stewardship.** If hospitalized, ask about targeted therapies instead of broad-spectrum antibiotics.
- ✓ **Advocate for research.** Policies that incentivize new antibiotic development and infection prevention are crucial.

Despite the urgent need for stronger medications, antibiotic development takes decades and generates far less profit than drugs for chronic conditions. From 2017 to 2023, only 13 new antibiotics were authorized worldwide, according to a WHO analysis.

This “drug discovery void” leaves patients in the lurch. Yet time is of the essence, Martin says. “Knowing how fast bacteria develop resistance—and how slow we are to develop new agents—can feel like a losing battle sometimes.”

Though the scale of the crisis is daunting, researchers and clinicians at Dartmouth and Dartmouth Health are tackling it head-on. Together, they are uniting science, engineering, and technology to optimize existing treatments, refine diagnostic strategies, and develop alternative therapies. The first step? Understanding what gives superbugs their strength—and how to break those defenses down.

Survival of the Quickest

In 1945, Alexander Fleming won the Nobel Prize in Medicine for discovering penicillin, the world's first widely used antibiotic. “There is a danger of underdosage,” he warned during his acceptance speech. “It is not difficult to make microbes resistant to penicillin by exposing them to concentrations not sufficient to kill them.”

Fleming's warning was rooted in a deep understanding of microbiology. Long before humans discovered antibiotics, bacteria were already using these natural chemical weapons to outcompete rivals. In response, other microbes evolved genetic mutations that made them resistant. This microscopic arms race has been unfolding for millions of years, and when we repurpose these molecules for medicine today, resistance is not only possible—it's inevitable.

As weak bacteria die and resistant ones survive and multiply, once-powerful drugs become the breeders of superbugs. It's a relentless dance of survival, and the speed of this evolution depends on how we use—or misuse—antibiotics.

2.8M

Antimicrobial-resistant infections occur in the U.S. each year—contributing to more than 35,000 deaths annually.

Eighty years after Fleming's ominous oration, underdosage is playing out in patients who do not take their antibiotics as directed, leaving bacteria exposed to just enough of the drug to adapt and survive.

But misuse isn't just about taking too little—it's also about taking antibiotics when they're not needed. Antibiotics don't work against viruses, yet they're often prescribed for viral infections. The more times broad-spectrum antibiotics are used when a targeted treatment would do, the more the dose becomes the poison.

“Every unnecessary antibiotic is another chance for microbes to evolve and survive,” notes Daniel Schultz, PhD, assistant professor of microbiology and immunology at Geisel. As an expert in dosing dynamics, Schultz studies how the timing and concentration of antibiotics shape bacterial

\$2.2B

The added cost of antibiotic resistance to the U.S. healthcare system each year, along with over 2 million extra doctor visits.

evolution. Using computational models, his lab simulates “real world” infection sites and analyzes how bacteria spread resistance genes throughout the colony.

In 2024, Schultz published novel research on how drug delivery of tetracycline leads to *E. coli* resistance. His team found that gradual drug exposure frees bacteria to carefully hone their defenses, whereas sudden, high doses trigger more drastic adaptations.

The implications of Schultz's findings are profound. Antibiotic effectiveness isn't just about which drug you use—it's about where, when, how much, and how fast the dose is delivered. For patients, such insights could spell the difference between a treatable infection and a tragic one. For doctors, it could mean making the best of the medicines we have.

2050

The year by which antimicrobial resistance could kill more people annually than cancer does today.

The Right Drugs for the Right Bugs

Because bacteria are always evolving, the “right” use of an antibiotic—its selection, dosage, and duration—is constantly in flux over time and across patient populations. A prescribing doctor must not only know the best “bug-drug combinations,” but also regularly update this knowledge and ensure they are properly put into clinical practice.

That's where antimicrobial stewardship comes in. As of 2017, all U.S. hospitals receiving accreditation by the Joint Commission are mandated to maintain antimicrobial stewardship programs. DHMC is one of the academic medical centers with the oldest stewardship programs, which has grown and evolved since it was established in the 1990s. A leader in the field, DHMC has invested

“Every unnecessary antibiotic is another chance for microbes to evolve and survive.”

—Daniel Schultz, PhD,
assistant professor of
microbiology
and immunology

in data-driven strategies to curb antibiotic misuse and combat resistance.

Members of the stewardship team keep a close watch on antibiotic utilization across the hospital, helping care teams “prescribe the right antibiotics to the right patients at the right dose for the right amount of time,” says Rebecca Wang, MD, MED ’16, medical director of antimicrobial stewardship at DHMC and assistant professor of medicine at Geisel.

To help doctors choose the best antibiotics before lab results come back, Wang’s team uses something called a cumulative antibiogram—a yearly report that shows which antibiotics are most likely to work against the bacteria commonly seen at DHMC. Built from test results in Martin’s clinical microbiology lab, the antibiogram gives clinicians a local, up-to-date snapshot of resistance trends. This helps guide treatment decisions when a patient first comes in, even before more specific test results are available.

Once those results do arrive, Wang and her infectious disease pharmacists collaborate with frontline clinicians throughout DHMC to fine-tune treatment plans, again using susceptibility test results from Martin’s clinical laboratory. Sometimes, her team recommends narrower-spectrum antibiotics that she says are “just as effective but carry fewer side effects and contribute less to

future antibiotic resistance—not only for the individual patient but also for the institution and [public health] more broadly.”

On the other hand, some cases do require broader coverage. “If a patient is immunocompromised or has a history of infections with resistant organisms, for example, we’ll consult with their oncologists or care providers to consider the nuances and arrive at a treatment decision,” Wang says. “It’s always a dialogue about how to balance the likelihood of effectiveness with stewardship.”

A High-Tolerance Defense

Sometimes, even the right antibiotic fails—not due to resistance, but because some bacteria form “biofilms,” microbial communities whose cellular structures shield against antibiotics and immune cells.

Biofilms grant invading bacteria “more physiological tolerance than genetic resistance and can endure antibiotics at concentrations 10, 100, even 1,000 times higher than free-floating bacteria,” explains George O’Toole, PhD, professor of microbiology at Dartmouth.

In his lab, O’Toole researches the defenses that make biofilms so hard to treat. His team has zeroed in on specific molecules in the biofilm matrix that trap antibiotics before they reach their target. By disrupting this barrier, O’Toole

Continued on page 17



▲ Isabella Martin, MD, director of clinical microbiology at DHMC, examines a microscope slide as part of her work in combating antibiotic resistance. By performing antimicrobial susceptibility tests and overseeing critical diagnostics, she ensures accurate treatment decisions and supports both local and global efforts to slow resistance.

An Emerging Foe: Fungi

When it comes to drug resistance, bacteria aren't the only microbes raising alarms. Fungi are quietly evolving, too, dodging treatments and endangering vulnerable patients. And unlike antibiotics, antifungal options are already limited.

"Fungal infections are increasing. We only have three classes of antifungals, and now we're seeing resistance to all three," says Robert Cramer, PhD, professor of microbiology and immunology at Geisel. "It's not good."

In Cramer's crosshairs is the fungus *Aspergillus fumigatus*, which causes deadly infections when its spores are inhaled. His research highlights a disturbing trend: Agricultural use of azoles, antifungals applied to protect

crops, is accelerating resistance in *Aspergillus*. "Agriculture is flooded with azoles," he explains. "That's driving resistance in ways we're just beginning to understand."

Like bacteria, fungi have evolved ways to block, evade, or weaken the drugs meant to kill them, rendering treatments less effective and infections harder to fight. Yet antifungals receive little pharmaceutical investment. "Now it's mostly small biotech and academic labs developing new treatments," Cramer says.

Fungal infections may not grab headlines like superbugs, but their rising resistance is also a growing crisis. As researchers race for solutions, one thing is clear: We're in a fight against microbes on all fronts.

Continued from page 14

hopes to revive the potency of treatments that once worked.

Trauma wounds, especially open fractures contaminated with dirt or debris, create an ideal environment for biofilms to form on damaged tissues and surgical hardware, where poor blood flow fetters the immune response and antibiotic delivery.

"In trauma surgery, rates of infection are much higher than in any other field I can think of," says Leah Gitajn, MD, MS, section chief of orthopaedics at DHMC and associate professor of orthopaedic surgery at Geisel.

In the operating room, Gitajn witnesses how trauma wounds help bacteria to hunker, hide, and thrive—spreading resistance genes. Post-traumatic infection occurs after up to 60% of open bone fractures, and among those treated with antibiotics, infections return more than 30% of the time, Gitajn says. Some infections persist for weeks, months, or even years. For the most virulent strains, treatment options are costly and limited.

"If you can't cure an infection, patients can suffer severe functional deficits, sometimes even amputation," Gitajn says. "The consequences of resistance are profound."

Strength in Numbers

But collaboration is a powerful act of resistance that cuts both ways. And Gitajn has formed her own biofilm of sorts from the evolving colony of researchers and clinicians at DHMC and Geisel.

In 2021, Gitajn, along with Ben Ross, PhD, assistant professor of microbiology and immunology at Geisel, and Carey Nadell, PhD, professor of biological sciences at Dartmouth, received seed funding through a Munck-Pfefferkorn Grant to study microbial communities during infection treatment. Their research aims to enhance treatments for hardware-related infections by using metagenomic sequencing and 3D biofilm imaging to detect and eliminate harmful microbes in trauma wounds and by tracking their evolution during standard therapies.

Together with O'Toole, Ross also researches biofilms in patients with cystic fibrosis (CF), a genetic disease where mucus builds up in the lungs and other organs, causing persistent, and potentially deadly, bacterial infections. Already they've found that people with CF who start antibiotics in infancy to treat lung infections tend to develop microbiome defects that thwart the immune system's ability to ward off future infections.

"If you can't cure an infection, patients can suffer severe functional deficits, sometimes even amputation."

—Leah Gitajn, MD, MS,
section chief of orthopaedics



► In DHMC's Pathology and Laboratory Medicine lab, stewardship director Rebecca Wang, MD, MED '16 (left), and microbiology lab director Isabella Martin, MD, work at the intersection of data and diagnostics. Together, they translate lab results into action to stay ahead of antibiotic resistance.



“While antibiotics are essential, they may also have unintended consequences that shape long-term health,” Ross says.

As it happens, *Pseudomonas aeruginosa*—the same pesky germ behind the artificial tears outbreak of 2023—is a major source of chronic lung infections in CF patients.

“*P. aeruginosa* adapts to the CF lung by forming biofilms that behave like microbial fortresses and make it extremely difficult to eradicate,” Ross says. “If we can identify antibiotics that effectively treat *Pseudomonas* without disrupting the microbiome as

much, we might improve long-term outcomes for CF patients.”

Enter Engineers

Fighting AMR requires solutions that go beyond medicine into fields like engineering, where new technologies can help prevent and combat infections in ways antibiotics alone cannot.

One engineer is shining a light on how biofilms take hold in trauma surgeries. Jonathan Thomas Elliott, PhD, an assistant professor of engineering at Thayer School of Engineering at Dartmouth and of orthopaedics at Geisel, has pioneered a new imaging

technique—“fluorescence-guided debridement”—to help surgeons visualize and remove contaminated tissue. Elliott’s technology illuminates areas of poor blood flow and creates a “risk map” so surgeons can see where resistant infections are most likely to occur.

“Right now, surgeons rely on experience and judgment to guide them,” Elliott says. “We’re working on an objective tool to improve decision-making.”

In close collaboration with Gitajn, Elliott’s team has imaged over 200 DHMC patients. But his engineering isn’t just improving prevention efforts. He’s also

developing light-activated compounds to destroy bacteria, also known as “photodynamic therapy.” Unlike traditional antibiotics, this method targets multiple bacterial structures simultaneously, preventing resistance from even starting in the first place.

While one engineer harnesses light, another is designing molecules to fight one of medicine’s deadliest microbes. Karl Griswold, PhD, professor of engineering at Thayer School of Engineering at Dartmouth, has been developing ways to attack methicillin-resistant *Staphylococcus aureus* (commonly known as MRSA), which kills 20,000 Americans annually and has long plagued clinicians and researchers alike.

Conventional antibiotics, which target essential bacterial processes such as protein synthesis or cell wall construction, have traditionally been used against MRSA. But bacteria evolve defenses against these drugs, whether by pumping them out, breaking them down, or changing their own structure so the drugs can no longer latch on—ultimately rendering antibiotics ineffective.

By modifying natural enzymes, however, Griswold and his team have invented a new type of attack that bacteria struggle to resist. One such enzyme, a modified version of lysostaphin called F12, effectively breaks down MRSA’s cell walls and is engineered to evade immune detection.

This “de-immunized” feature solves the problem of previous lysin-based treatments, which triggered immune responses and limited repeated dosing. In lab tests, F12 has demonstrated remarkable efficacy, suggesting it might serve as a reliable new tool in the dwindling arsenal against superbugs.

“Lysins are one of the most promising next-generation antibiotics,” says Griswold. “They kill drug-sensitive and drug-resistant bacteria with equal efficacy, can potentially suppress new resistance phenotypes, and have laser-like precision.”

“Bact” to the Future

Months after the *Pseudomonas* outbreak, Zegans and other ocular microbiologists published a commentary on the infection with Geisel MD-MBA candidate Frida Velcani. By June 2023, he had co-authored a study on the efficacy of cefiderocol—a drug that slips into bacteria using their own iron transport system—in the treatment of corneal infections with the outbreak strain of *Pseudomonas*. The group also obtained NIH funding to further their investigations.

It’s one of many examples of how Dartmouth researchers and clinicians are turning crisis into innovation—and how they might just outrun the superbugs. The more Martin advances lab diagnostics, Schultz models dose dynamics, Wang stewards doctors, Ross breaks up biofilms,

Griswold engineers enzymes, and Elliott lights up wounds, the more physicians like Gitajn can save patients from losing life or limb—and keep resistance at bay.

The community-wide effort has begun gaining global momentum, too. In September 2024, the United Nations General Assembly gathered in New York, where all countries approved a new political declaration to radically scale up efforts to combat AMR. Today, the WHO now openly acknowledges how AMR could “unwind a century of medical progress” and “return us to the pre-antibiotic era.”

Still, how things will pan out is uncertain. There may be no “right answer,” as Wang puts it, only the reward of a collective effort. “We’re working together to figure out how we can get closest to the right answer for each patient, which might be a different right answer for someone else.”

The superbugs may be evolving, but so are we.

To learn more about antimicrobial resistance research and innovation at Dartmouth Health and Geisel, contact Elizabeth Dollhopf-Brown at 603-646-5792 or Elizabeth.Brown@hitchcock.org.

Distilling the Science of Parenting

Two Dartmouth alumni—a psychologist and a Geisel-trained pediatrician—teamed up to guide whole-family care.

By Jeremy Martin

Childhood today looks different than it did for previous generations. Instead of outdoor play and tight-knit neighborhood communities, many children now navigate a world dominated by screens, social media, and increasing isolation. These changes aren't just cultural shifts; they're influencing children's development in profound ways.

Out of concern for their children, modern parents seek guidance from books and podcasts, only to be overwhelmed by conflicting advice. So they also turn to a long-trusted resource—pediatricians—for clarity. But even as new constellations of mental and behavioral health concerns have entered their clinical orbits, pediatricians often have limited training in child psychology.

"Most pediatricians are trained to treat physical ailments, not behavioral ones," says pediatrician Blair Hammond, MD, D '96, MED '03. Nevertheless, challenges like speech delays, social difficulties, and emotional regulation "are now among the most common conditions of childhood."

To bridge this gap in training, Hammond partnered with developmental psychologist and fellow Dartmouth alum Aliza Pressman, PhD, D '96, to co-found the Mount Sinai Parenting Center in 2014. Their mission: Make child-rearing science accessible and actionable for pediatricians and parents alike.



▲ Blair Hammond, MD, D '96, MED '03, pediatrician (left) and Aliza Pressman, PhD, D '96, psychologist

Rethinking Education

The Mount Sinai Parenting Center develops and provides free content—videos, handouts, and an app—for parents and providers. Pediatricians can earn Continuing Medical Education (CME) credits, while online courses allow flexible learning. Today, 195 pediatric residency programs and 344 family medicine programs use its resources across the country.

While pediatricians traditionally focused on physical health, the center's approach acknowledges that mental and behavioral health are closely intertwined with physical well-being. The center trains pediatricians to weave mental and behavioral health into routine care, evolving the model of child health to recognize that physical conditions often have emotional and relational roots.

"For example, during an ear exam, a pediatrician can ask, 'Which ear should I look in first?' This small action fosters a child's autonomy," says Hammond.

In their training resources, the center emphasizes safe, stable, and nurturing relationships (SSNRs), which the American Academy

of Pediatrics calls "biological necessities for all children." Research shows that, by buffering against toxic stress, SSNRs can prevent common diseases and conditions and are essential to healthy child development.

A key focus is training pediatricians to model effective caregiver behaviors for parents during medical visits and praising parents for positive healthy practices. "Creating a nurturing environment supports child development and improves parental well-being," says Hammond.

"Most pediatricians are trained to treat physical ailments, not behavioral ones."

—Blair Hammond, D '96, MED '03, pediatrician

Parenting Overload

Pressman and Hammond's flexible, science-based approach is a direct response to counsel that heightens anxiety; 84% of parents report feeling judged, and nearly half feel overwhelmed most days, according to a recent Ipsos survey.

"The pressure to parent 'correctly' has created a generation of anxious caregivers," Pressman explains. Instead, she and Hammond refine parenting into practical strategies

that fit seamlessly into daily life. "When you tell a parent, 'You did such an amazing job soothing your child during vaccines,' you affirm that this benefits their brain development," Hammond explains.

Pressman embraces the abundance of parenting advice but believes in simplifying it. Her book, "The 5 Principles of Parenting," and podcast, "Raising Good Humans," offer straightforward ways to make parenting more joyful. "It's not rocket science," she says. "Smiling at your child creates millions of new neural connections. Parents don't need elaborate strategies or flashcards—just simple, meaningful interactions."

A Decade of Impact

As the Mount Sinai Parenting Center marks its 10th anniversary, it continues to champion a holistic approach to child development. By addressing psychological concerns, it helps prevent and treat not just mental health challenges in children, but also physical conditions linked to early stress.

Looking ahead, Hammond and Pressman aim to expand their reach, ensuring every family has access to essential support.

"We're guiding families toward a more mindful, intentional way of parenting," Hammond says. "Our job is to praise and support the good things parents are already doing."

To learn more about and connect with other alumni, contact Mae Leonard at 603-646-5313 or Mae.Leonard@dartmouth.edu.

Dr. AI:

Could artificial intelligence replace clinicians?

By Eva Botkin-Kowacki

New tools based on AI technology have the potential to reshape how medicine is practiced—and the role of the provider.

Over the last few years, artificial intelligence (AI) has moved from a nascent futuristic concept to an everyday tool. We've seen an AI-generated video of a murder victim make a statement in court, police using AI chatbots to write crime reports, traffic lights made "smart" with AI, and AI-supported apps that tell you why your houseplant is dying.

As AI matures, its ability to process information like humans—but at warp speed—makes it an enticing way to supercharge endeavors that require synthesizing large amounts of information.

This is particularly true for medicine and healthcare, which require clinicians to use their knowledge of the vast body of existing and ever-changing medical research to interpret patients' symptoms.

"This is going to be the biggest wave to hit medicine," says Asha Zimmerman, MD, a transplant surgeon at Dartmouth Health's Dartmouth Hitchcock Medical Center (DHMC) and assistant professor of surgery at the Geisel School of Medicine at Dartmouth, who is working on his own applications for AI in medicine.

"It's not very farfetched that... they could mimic what your typical physician would do."

—Saeed Hassanpour, PhD, director of the Center for Precision Health and Artificial Intelligence at Dartmouth

Already three in five physicians report that they use AI in their practice, according to a 2024 American Medical Association survey. Physicians reported using AI to help them take visit notes, draft discharge summaries and care plans, and summarize medical research and standards of care.

But AI-driven technologies can increasingly take on more than administrative tasks. As large language models (think ChatGPT) are refined, they're getting better at more complex tasks, inferring next steps unprompted, and interpreting human interactions. Could we one day see AI replacing clinicians on the frontlines of medicine?

"That's the direction we're heading," says Saeed Hassanpour, PhD, professor of biomedical data science, computer science, and epidemiology at Geisel, and the director of the Center for Precision Health and Artificial Intelligence (CPHAI) at Dartmouth. Hassanpour is one of the stauncher advocates for deploying AI tools

in healthcare, but even he says it's unlikely that medicine will ever become an entirely digitized endeavor without a human in the loop.

What humans' role will be in this AI-filled future remains to be seen, and leaders across Dartmouth Health and Geisel are positioning themselves at the forefront of that conversation. From investments like hiring machine learning experts to tackling AI's greatest questions through initiatives like CPHAI, which launched in 2023, both institutions are focused on figuring out how

to shape that future to leverage both the best of AI and the best of humanity to make medicine more effective, efficient, precise, and personalized.

What AI Offers to Medicine

AI has a long history at Dartmouth. In fact, the term “artificial intelligence” was coined in 1956 when researchers gathered at Dartmouth to figure out what it would take for machines to simulate human intelligence.

As a term, “AI” doesn’t refer to a specific technology to achieve that goal. Rather, it is a way to describe the concept of computing that emulates human thinking. One way to achieve this is through “machine learning,” which articulates how a machine can be trained to learn patterns and make inferences from vast datasets without being explicitly programmed to do so. Machine learning caught the public’s attention a decade ago when the AI program AlphaGo beat a human champion at the board game Go.

This is similar to how doctors make diagnoses—identifying patterns in a patient’s symptoms and vital signs, and comparing those to patterns they learned in training, from the latest research, or over time from diagnosing hundreds of patients.

“It’s not very farfetched that, if these models train correctly on a large amount of data, on the body of current knowledge of medicine, they could mimic what your typical physician would do in the same situation,” Hassanpour says.

What Would a “Dr. AI” Look Like?

That’s not to say that AI will take over every task for a clinician. “When we talk about replacing somebody with a generalized AI, we are thinking about their job as if it were a simple task, a single task, that they do repeatedly. And that’s not what a clinician, or most any healthcare provider, does,” says Brandon Hill, MS, a machine learning specialist and cofounder of the Center for AI Research in Orthopaedics at DHMC.

Hassanpour agrees that there likely won’t be a “self-governing, independent AI model that works on its own.” Instead, future patients might not interact directly with a human. This scenario could be realized with technology already at, or close to, our fingertips, though it might require what Hassanpour calls a “multiagent-based approach.”

“Currently most of these [AI] models can be looked at as tools,” he says, explaining that, so far, validated AI-driven technologies in medicine tend to be highly specialized, such as visual systems trained specifically to detect cancerous cells from images or language models that transcribe patient interactions and turn them into appointment notes. “They’re very narrow,” he says. “And that’s different from how medicine is being practiced: You narrow the domain until you arrive at a certain conclusion.”

In a multiagent approach, experts could assemble these narrowly focused AI models into a comprehensive dream team of sorts. “These agents can work together to make a diagnosis,” Hassanpour says, with a manager or coordinator directing and delegating tasks to them.

In this scenario, the physician becomes the supervisor, verifying the AI team’s conclusions rather than going through the process of making an inference “from scratch,” Hassanpour says. And given current technology, he adds, this could be built within a few years.

Zimmerman has a similar vision and is already building an AI-powered platform to make it a reality, along with Thomas D’Angelo, a data analyst in the transplant department at DHMC. Called “Vox Cura,” the team’s platform is already in clinical trial planning stages after winning an award from the Dartmouth Innovation Accelerator for Digital Health last fall.

Vox Cura is a chat application trained to ask questions, just like a physician would, to gather information from a patient. It will then offer a likely diagnosis, along with a few other possibilities. The goal is to deploy this tool to

Continued on page 26

The Digital Couch

While most conversations about AI in medicine focus on diagnostics and physical health, a quiet revolution is unfolding in mental health.

51%

average reduction in depression symptoms in people participating in the Therabot clinical trial

Can a Chatbot Be Your Therapist?

In a landmark trial, an artificial intelligence (AI) therapy chatbot devised at Dartmouth, named Therabot, designed to deliver cognitive behavioral therapy (CBT), led to meaningful reductions in anxiety and depression—on par with in-person care.

“Our results are comparable to what we would see for people with access to gold-standard cognitive therapy with outpatient providers,” says Nicholas Jacobson, PhD, the study’s senior author and an associate professor of biomedical data science and psychiatry at the Geisel School of Medicine.

Now, Jacobson and colleagues at Dartmouth’s Center for Technology and Behavioral Health (CTBH) are building on that success with Evergreen, a first-of-its-kind, AI-driven mental health app created by and for Dartmouth students. Currently in development, Evergreen will combine cutting-edge behavioral sensing, tailored interventions, and personalized AI to help students build resilience and manage stress.

Evergreen and Therabot are part of Dartmouth’s broader pioneering approach to augmenting mental health care with digital tools. This work has earned Dartmouth a leading role in the AI Research Institute on Interaction for AI Assistants (ARIA) initiative, a new national center on AI and mental health backed by the National Science Foundation. ARIA aims to develop next-generation AI assistants that can interpret a person’s unique behavioral needs and provide feedback in real time.

No one’s suggesting AI will replace therapists, but as mental health care demand surges, these digital tools could become an essential ally in helping people thrive, one conversation at a time.

To learn more about Evergreen, go to **dartgo.org/EvergreenApp**

rural and remote populations, in northern New England and around the world, as a way to bring health information to areas where there are no doctors, reducing barriers and costs. The app can't prescribe treatment, but it can provide a starting point for a patient.

Hurdles and Hallucinations

One concern about using AI-driven tools to make life-or-death diagnoses and treatment plans, Zimmerman says, is that large language generative AI tools have been known to "hallucinate," or perceive patterns that don't exist and then spit out inaccurate information with confidence. When asking ChatGPT to explain why the sky is blue, the consequences of a wrong answer are probably low, but with medicine, they could be dire.

Technology is improving, Zimmerman says, but that's one justification for the multi-agent approach Hassanpour espouses, so that if one model hallucinates, others can essentially outvote its conclusions.

Hallucinations aren't the only glitch, however. Some AI-driven tools have learned how to take shortcuts, and that could introduce irrelevant information to the equation. In a study co-authored by Hill, Dartmouth Health researchers dug into the mechanism behind those shortcuts by asking AI to predict whether or not patients eat refried beans or drink beer simply from examining X-rays of their knees. And the models performed shockingly well.

"A knee should have nothing to do with beer or beans," says study senior author Peter Schilling, MD, MS, an orthopaedic surgeon at DHMC and an assistant professor of orthopaedics at Geisel. Instead, "it has

some understanding of where the image is taken, and something about the averages of demographics within that area, so then it can leverage those little hints to draw conclusions." Even if the hints are essentially meaningless.

Another factor that will likely hold AI-powered tools back from being deployed across the healthcare industry is the regulatory process around new tools in medicine, Zimmerman says.

Typically the U.S. Food and Drug Administration (FDA) has to approve diagnostics narrowly, determining their utility for specific diagnoses. So under current procedures, he explains, a generalized "Dr." AI tool would be difficult to vet.

Even with these and other limitations, some AI-powered tools have already shown they can play doctor quite well. For example, a generative AI chatbot developed by a Dartmouth team to provide therapy, called Therabot, was shown in an 8-week clinical trial to meaningfully reduce psychological symptoms of users with depression, anxiety, or an eating disorder.

As AI tools emulate clinicians more and more accurately, Hill recommends continuing to involve humans. "Most AI is trained based on past human diagnoses. That means, in many cases, the AI can only be as good as a second doctor in the room."

Keeping Humanity In Healthcare

Large technology companies are often leading the latest advances in AI, even in the medical sphere. But it's imperative, Zimmerman says, that clinicians are part of the conversation to ensure that AI use in healthcare is ethical, best serves patients, and doesn't make egregious errors that those outside of healthcare might not consider.

"A knee should have nothing to do with beer or beans."

—Peter Schilling, MD, MS,
orthopaedic surgeon

"My hope is that more people start to look for ways to be leaders in this field, because it's important to have a voice at the beginning," he says. Institutionally, Geisel is taking strides so that future healthcare leaders are well-versed in AI, both through initiatives like CPHAI and through new curriculum. For example, training in both the mechanisms behind AI and AI-powered tools is now embedded in medical students' pre-clinical curriculum.

"Traditionally, physicians have received no formal education in AI and machine learning, unless it's been part of a niche specialty or their research," says Thomas Thesen, PhD, associate professor of medical education and of computer science at Geisel, and a faculty leader in developing Geisel's AI curriculum.

Thesen adds that not only has Geisel been one of the first institutions to add AI training to its pre-clinical curriculum, he and other Geisel faculty are also using an AI-generated patient actor to help medical students become better clinical communicators.

The future of AI in medicine might not be such a dramatic pivot as some headlines (including the one atop this story) may make it seem. Rather, the revolution will likely be iterative, Hill says.

"It doesn't replace humans in the way that we think about, where it does somebody's entire job. It means people can do more with less, that's all it comes down to. But that's what computers have been all along," he says.

"The role of the physician has changed through technology," Thesen says. "We don't require physicians to store so much information in their heads anymore. Vast amounts of information are just a click away and physicians can look up information much quicker, much more reliably than before." Now, with the addition of AI, he says, more than ever "the role of a physician is to be human."

To learn more about digital health innovation, contact Bethany Solomon at 603-646-5134 or Bethany.Solomon@dartmouth.edu.



Transplant surgeon Asha Zimmerman, MD (right), says AI "is going to be the biggest wave to hit medicine." Zimmerman, who practices at DHMC and is an assistant professor of surgery at Geisel, is building his own AI tool, called Vox Cura, to provide patients with on-demand medical advice when they can't access human doctors.



◀ Jillian Rork, MD (left), meets with patient Bethany Bursey at the Dartmouth Health Down Syndrome Dermatology Clinic in Manchester, New Hampshire.

A First-of-Its-Kind **Clinic**

This dermatology clinic models personalized, specialty care for patients with Down syndrome.

By Ashley Festa

People with Down syndrome are no strangers to specialty care. They regularly see a host of physicians—geneticists, cardiologists, endocrinologists, gastroenterologists, and others—to keep their vital internal organs healthy. But their largest external organ has not historically received the same attention,

either in medical practice or in research. “The skin is often the forgotten organ,” says Jillian Rork, MD, a pediatric dermatologist at Dartmouth Health’s Dartmouth Hitchcock Medical Center (DHMC) and a faculty member at the Geisel School of Medicine at Dartmouth. “There’s a huge spectrum of

health conditions in children and adults with Down syndrome, and some are severe, so they need a lot of attention. For that reason, skin conditions might be put on the shelf because they aren’t life-threatening.”

Some of the skin conditions that people with Down syndrome often face can be extremely painful and difficult to treat. There are special considerations physicians must consider when taking care of a patient with Down syndrome: an understanding of coexisting health conditions, particular side effects of medications, and most importantly, how to promote effective, patient-centered communication and self-advocacy.

“The skin is often the forgotten organ... skin conditions might be put on the shelf because they aren’t life-threatening.”

—Jillian Rork, MD, pediatric dermatologist

Whole-Body Care

People with Down syndrome, or trisomy 21, have three copies of chromosome 21 instead of the standard two. This affects the development of both brain and body, and leads to a suite of chronic or recurring health conditions. People with Down syndrome often have more difficulty fighting infections and a greater occurrence of autoimmune disorders, such as autoimmune thyroid disease and celiac disease, among other health challenges.

They are also at higher risk for hidradenitis suppurativa (HS), alopecia areata, psoriasis, and other skin diseases. “These skin conditions can be really challenging to treat,” Rork says,

That’s why Rork established the Dartmouth Health Down Syndrome Dermatology Clinic in Manchester, New Hampshire. The clinic, which is offered once a month, provides specialized treatment to both children and adults with Down syndrome. Opened in 2021, it’s the only clinic of its kind in the nation, and patients come from all over the country—sometimes even crossing international borders from Canada—for appointments.

“Dr. Rork’s work establishes a compassionate standard of care that serves as a model for other dermatologists around the country,” says Shane Chapman, MD, MBA, chair of the Department of Dermatology at DHMC and Geisel.

especially when patients have coexisting medical conditions.

Take HS, for example. “One of the drugs used to treat HS can work really well, but it can lower the patient’s blood pressure, and people with Down syndrome are historically known to have lower blood pressures,” she explains.

And it doesn’t stop there: “People with Down syndrome are more prone to respiratory conditions, and some of the medications for HS turn down the immune system, making patients potentially more vulnerable to respiratory infections,” Rork adds. “These patients are also more prone to specific types of blood cancers, and some HS medications can

increase the risk of blood cancers. We need to be constantly asking: ‘What are these risks like for someone with Down syndrome?’”

These co-occurring challenges are also the subject of Rork’s research. Consideration of heart health in these patients is the basis of her new study, “Down Syndrome and Psoriasis: An Investigation of Cardiometabolic Risk.”

“Dr. Rork looks at the whole person, not just the skin,” says Susannah Hakeem, whose daughter, Martyria “Marmar” Hakeem, has been a patient at the clinic for more than two years. “She always considers, ‘What is this medication going to do to Marmar’s kidneys or stomach or

liver?’ Dr. Rork looks at every piece of the puzzle, not just her piece.”

Empowering Providers

Rork’s specialty knowledge brings patients from far and wide to visit her clinic—“Even if we were to move out of state, we’re going to go to wherever she is,” says Hakeem, whose family already lives about an hour and a half from the clinic. And, as one of the few researchers studying the intersection of dermatology and Down syndrome, Rork has become a go-to resource for providers who have questions about the best ways to treat their patients with Down syndrome.

“Dr. Rork’s work establishes a compassionate standard of care that serves as a model for other dermatologists around the country.”

—Shane Chapman, MD,
MBA, RES ’99
Chair and Professor,
Department of Dermatology

She often serves as a medical management consultant for dermatologists across the country, advising her colleagues on treating patients with Down syndrome. Recently, Rork also worked with the Society for Pediatric Dermatology and the patient advocacy and research group LuMind to develop specialized handouts for skin conditions in people with Down syndrome, and she ensured they were vetted by other pediatric dermatologists. The handouts were published earlier this year and are serving as educational material for both providers and patients about what to expect with common skin conditions experienced by people with Down syndrome.

Rork is also working to build a network of informed dermatologists and is already helping her patients who live far from New Hampshire locate someone with this expertise closer to home. “There’s an amazing community of other dermatologists that we’ve identified in every corner of the U.S.,” Rork says.

Modeling Specialized Care

Rork’s subspecialty clinic is the first of its kind in the nation, and she hopes it will inspire other healthcare systems to create similar clinics. “Over the past few years, we have learned a lot,” says Rork, who is also co-director of the Down syndrome subgroup for the Pediatric Dermatology Research Alliance (PeDRA). “We would love to be a model for other clinics.”

But she emphasizes that “you can’t wing it”—starting this kind of program takes significant preparation. Dartmouth Health has been instrumental in the success of the clinic, accommodating the unique needs of this patient population, such as longer appointments.

“I never want to feel rushed in this clinic,” says Rork, who allots an hour for each appointment. “Those are the ‘little extras’ that make all the difference in the world; they make people feel comfortable coming back to see us.”

These “extras” also include social and behavioral considerations, as well as encouraging patients to be self-advocates.

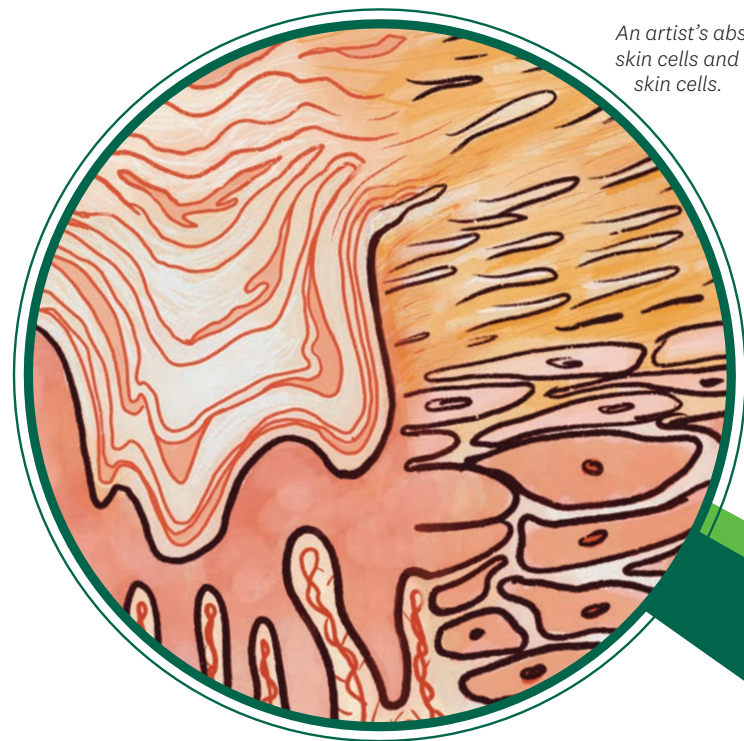
“We involve them in the decision-making process,” she adds.

“Sometimes physicians assume that people with

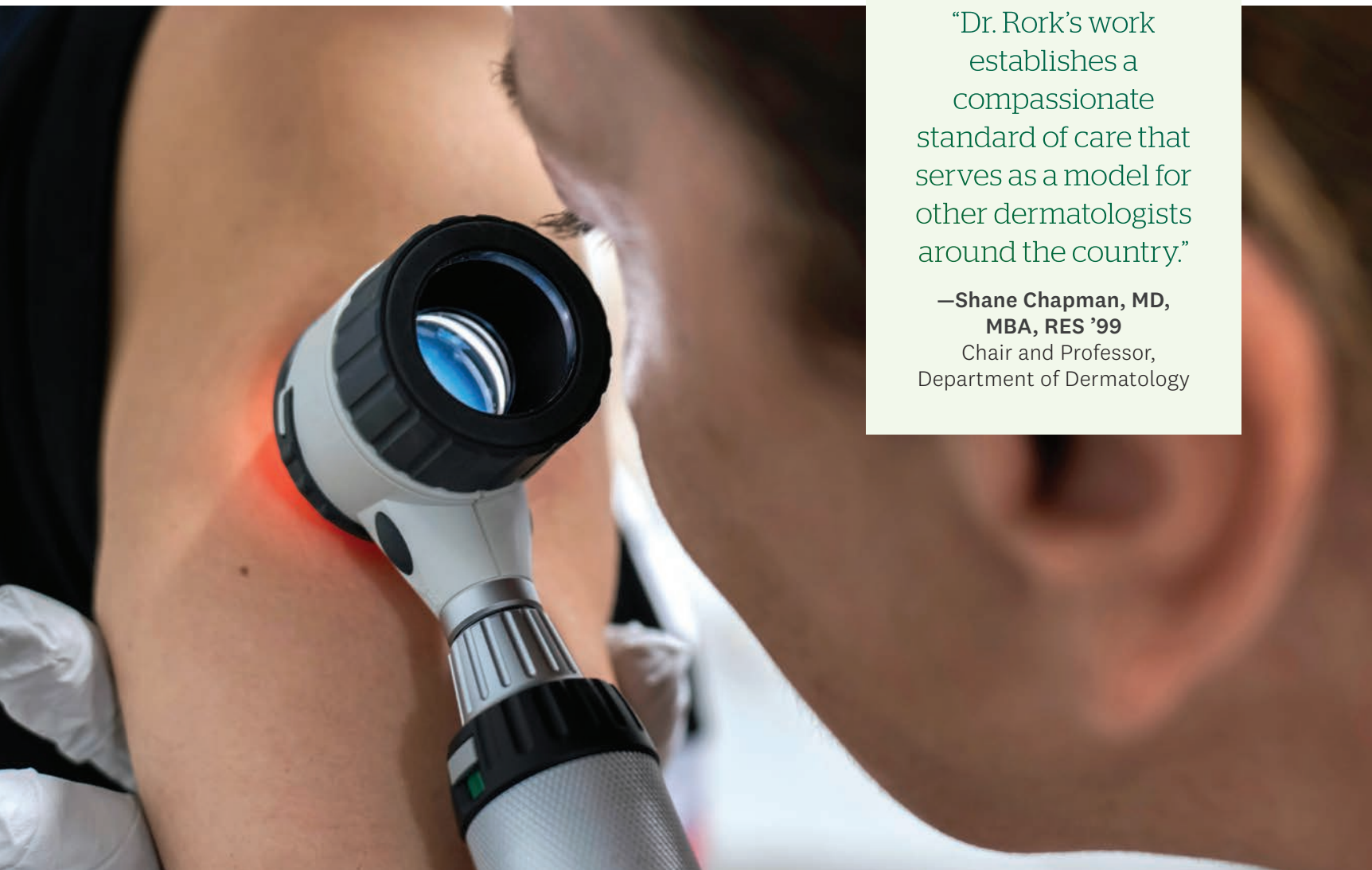
Down syndrome won’t want to pursue certain treatments. So, we must ask them and not exclude them from helpful treatments because you think they won’t be able to deal with a needle [for injections], or have a biopsy, or have something frozen off.”

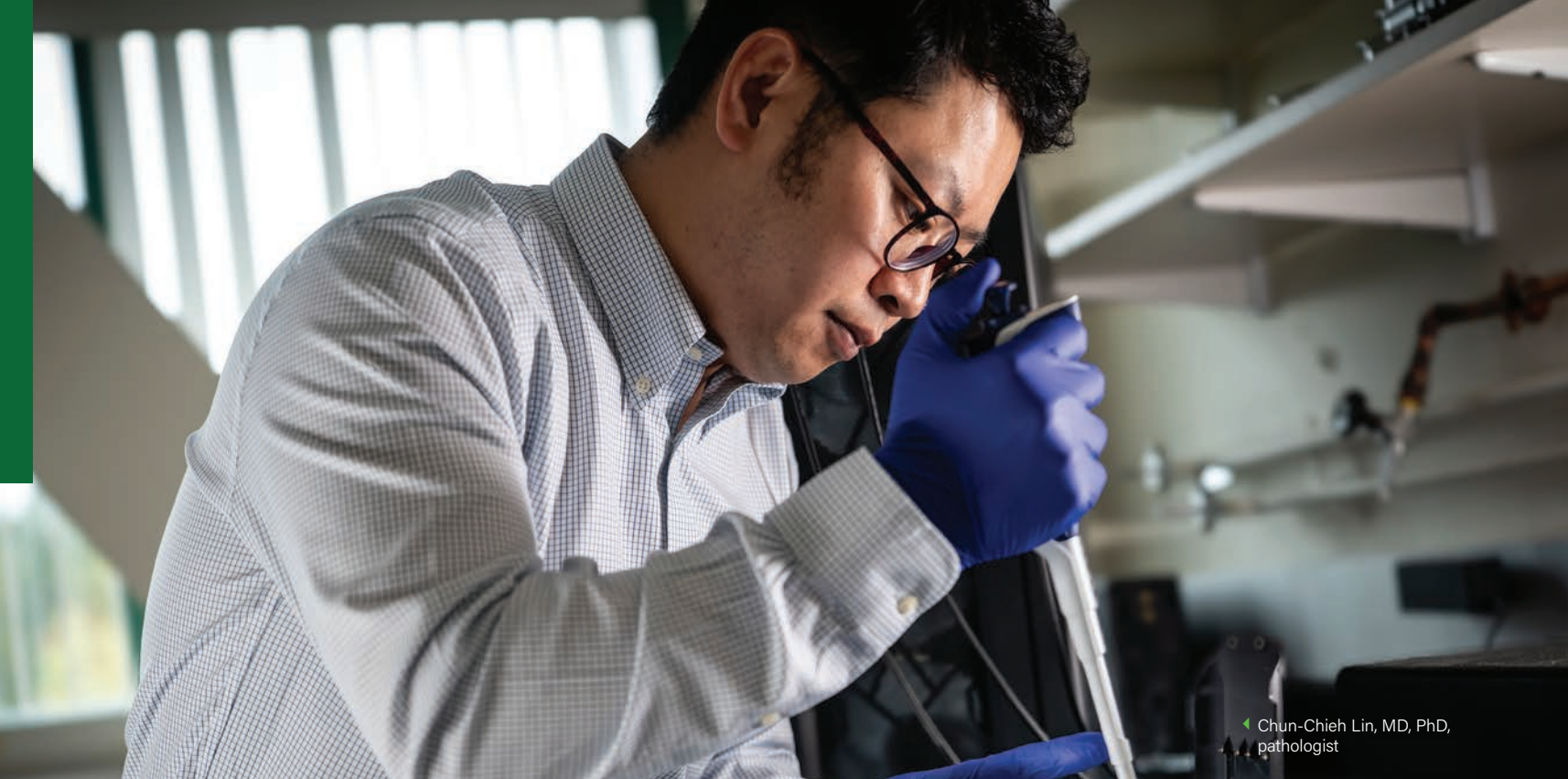
“Marmar gets very nervous when going to doctor appointments, but Dr. Rork explains things to her at her level, not just to me and my husband as the parents,” Hakeem says. “She talks to Marmar herself and treats her as a person, not as the caseload of the day. She makes everything personal to Marmar. If other doctors would follow in Dr. Rork’s footsteps, that would be a very good thing.”

To learn more about the Dartmouth Health Down Syndrome Dermatology Clinic, contact Matthew Hall at 603-667-6309 or Matthew.R.Hall@hitchcock.org.



An artist's abstraction of normal skin cells and psoriasis-affected skin cells.





Chun-Chieh Lin, MD, PhD,
pathologist

Diagnosing Brain Cancer in Real Time

This new tumor diagnostic tool could dramatically accelerate treatment.

By Mara Johnson-Groh

Patients often endure a long wait for brain cancer diagnosis. First, they have to undergo brain surgery to remove tumorous tissue, then that tissue is sent to a lab to determine the type of tumor—and those tests can take weeks. With 120 types of brain tumors, each of which respond differently to the dozens of cancer treatment options, this long wait often delays life-saving follow-up care.

But that is changing, thanks to Dartmouth Health researchers. They developed a new diagnostic method that can identify tumor type in a fraction of the time—even as a patient is still in surgery.

“Our method is currently the cheapest, fastest, and most comprehensive method of its kind,” says Chun-Chieh Lin, MD, PhD, a pathologist at Dartmouth Health’s

Dartmouth Hitchcock Medical Center (DHMC) and assistant professor at the Geisel School of Medicine at Dartmouth, who led development of the new method. “We’re very excited about it because instead of waiting weeks for results, this method can be done in just hours.”

The method, called “irreversible Sticking Compatible Overhangs to Reconstruct DNA,” or iSCORED for short, works by identifying a key characteristic of cancer: abnormal numbers of a gene. All of our cells carry two copies of our genes, but cancerous cells can have hundreds of copies, a phenomenon known as gene amplification.

Knowing which gene has been amplified helps identify cancer type and is an essential part of directing treatment strategy.

Researchers have traditionally looked for gene amplification using a technique called next-generation sequencing, which requires mapping the entire genome of cells from a tissue sample. This method is comprehensive but incredibly time consuming. iSCORED, on the other hand, splits up the genome and samples random genes. This reduces the testing time from multiple weeks down to just 105 minutes.

So far, Lin has tested the technique on brain tumor samples provided by a clinical team as well as from a tissue bank. In both cases, iSCORED performed remarkably well. Even though the

gene sampling is randomized, iSCORED was able to identify gene amplification just as well as next-generation sequencing and other methods. The method also offers a unique capability called methylation profiling, which allows for accurate tumor classification—something that is not possible with next-generation sequencing alone. Clinical trials are now underway at DHMC as well as other partner institutions.

In addition to speed, iSCORED promises to reduce the cost of sequencing analysis from thousands of dollars to just \$150 to \$200 per sample. Since it uses an off-the-shelf system called a nanopore sequencer and a desktop computer for data analysis, setting up a laboratory to run iSCORED tests costs only \$30,000 to \$35,000—much less than the \$500,000 to \$1,000,000 needed for a traditional setup. This makes iSCORED more affordable for small hospitals to quickly run tests in-house instead of sending samples to a specialized lab.

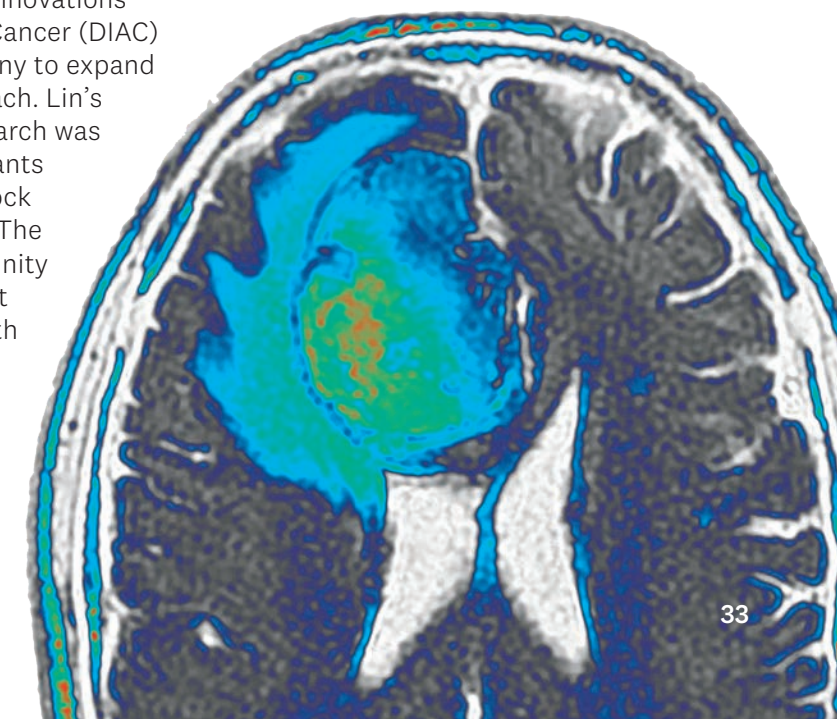
Lin has submitted a patent for iSCORED and is working with the Dartmouth Innovations Accelerator for Cancer (DIAC) to start a company to expand the method’s reach. Lin’s preliminary research was supported by grants from the Hitchcock Foundation and The Prouty, a community fundraising event for the Dartmouth Cancer Center that provides

pilot funding for the early stages of promising cancer research projects. The work has been published in *Genome Medicine*.

While iSCORED has only been verified on brain tumors thus far, Lin says that in the future it could be applied to any type of cancer. The new method can also determine specific genomic mutations in tumors, which are used by clinicians to select drugs and tailor treatments.

“Hopefully in the future this method developed at Dartmouth can be a gold standard for resolving tumor type in just hours, allowing patients to get treatment in a much faster manner,” Lin says.

To learn more about cancer research, contact Jaclynn Rodriguez at 603-646-5287 or Jaclynn.Rodriguez@hitchcock.org.



Building a New Era of Care

An ambitious expansion of Dartmouth Hitchcock Medical Center's Patient Pavilion aims to help meet the needs of patients across northern New England for decades to come.



In 2023, the opening of the new Patient Pavilion at Dartmouth Health's Dartmouth Hitchcock Medical Center (DHMC) in Lebanon, New Hampshire, brought an additional 64 state-of-the-art patient rooms and 240,000 square feet of space and technological enhancements to the hospital—an important step toward a reimagined academic medical center.

At the time, the Pavilion's second and fifth floors were left intentionally unfinished. Construction is now underway to complete those spaces with new and expanded facilities dedicated to the medical challenges that most acutely affect our communities: cancer and heart and vascular care.

The spaces and services made possible by the expansion stand to give more patients better space to heal. From the cardiac patient who no longer needs to travel 100 miles away for a lifesaving procedure, to the leukemia patient with unfettered access to their care team in a private recovery space, to the newly hired teams who have advanced systems and support at their fingertips, the impact of this expansion has the potential to reverberate across the region.



A Wraparound Approach to Cancer Care

The Patient Pavilion's second floor will support the treatment of complex cancers that require multifaceted care regimens. ICU-convertible rooms equipped with advanced, real-time monitoring capabilities will have the capacity to transform into positive-airflow environments, providing stem cell or bone marrow transplant recipients with a sterile, high-tech recovery hub.

This build-out will also support pioneering research that builds on more than 25 years of Dartmouth Cancer Center-led discovery and advances. The new facilities will fuel initiatives that marry foundational and translational research, clinical trials, and patient care innovations to flip the script on how cancer is treated.

To learn more about the Patient Pavilion expansion, contact Matthew Hall at 603-667-6309 or Matthew.R.Hall@hitchcock.org.

Making Space for the "Heart" of Healthcare

Heart disease is the nation's leading cause of death and disability. More than 1,000 heart attack patients are treated each year across Dartmouth Health—among the most in New England. The opening of the Patient Pavilion in 2023 improved acceptance rates, but the urgent need for more space for these patients is ever present.

The completion of the Pavilion's fifth floor will double inpatient heart and vascular capacity. It will also free up critical space elsewhere at DHMC for other patients to receive the types of cutting-edge procedures that make DHMC's Heart and Vascular Center a leader in the nation.

Global Health on Equal Terms



Reciprocity in Geisel-led partnerships is advancing care across the globe.

By Jeremy Martin

On a cool morning, as the sun cast golden light over the hills of Rwanda, Amal Cheema, MD, MED '24, stood outside the Centre Hospitalier Universitaire de Kigali (CHUK), the country's largest teaching hospital. Patients and families gathered in the courtyard, sharing meals and solace in a place that, mere decades ago, was at the epicenter of one of the world's greatest health crises.

Rwanda, a nation of 14 million in the heart of East Africa, saw its healthcare system decimated by genocide in 1994. Over just 100 days, 800,000 Rwandans—primarily Tutsi, along with moderate Hutu—were killed, with well over a million lives lost over the course of the broader conflict. Among the dead were countless physicians, nurses, and other healthcare professionals. The country's medical infrastructure lay in ruins. Resources were depleted. Cholera ran rampant. Hospital wards stood empty. Buildings had been destroyed. Everything had to be rebuilt from the ground up.

"We had lost knowledge," says Agnes Binagwaho, MD, PhD, former Minister of Health of Rwanda and adjunct professor of pediatrics at the Geisel School of Medicine at Dartmouth. "We were not in the condition to provide continuous quality care, and the little we were providing was absolutely out of standard."

Three decades later, in 2024, then-Geisel medical student Cheema's six-week clinical rotation at CHUK provided her a window into the rebirth of the Rwandan healthcare system. Her visit was possible thanks to



▲ Steve Bensen, MD, MED '90 (right), collaborates with Rwandan physician Vincent Dusabejamba, MD, (left), and his team during a gastroenterology training session in March 2025—a relationship now more than a decade strong.

Geisel's Center for Global Health Equity (CGHE), through which the school's faculty train physicians in low-income countries both in their home country and in the U.S., helping develop curricula, mentor students and residents, and expand access to advanced medical education. Geisel students, including Cheema, participate in CGHE's Rwanda program through global health electives at hospitals like CHUK, where they gain practical experience and contribute to patient care while learning from local healthcare practices.

CGHE's work extends well beyond Rwanda. From Haiti and Peru to Kosovo and Tanzania, Geisel has built partnerships around the globe, all following the same model: letting local experts lead.

"Our job is to support—and get out of the way," says Lisa V. Adams, MD, MED '90, associate dean for global health and director of CGHE. "Equity demands we check our privilege at the border. Without this awareness, we risk replicating the very inequities we seek to mitigate."

Healing Old Wounds

Adams is acutely aware of the dangers of repeating history. After spending six months helping launch the Rwandan-led Human Resources for Health (HRH) program in 2012—designed to rebuild Rwanda's medical workforce and establish specialty training—Adams directed Geisel's efforts in curriculum development and long-term faculty placements.

Her goal was to ensure HRH was a true partnership rather than a paternalistic extension of Western aid. Originally built in 1918 under Belgian colonial rule, CHUK prioritized European interests over those of Rwandans. Colonial healthcare policies not only deepened existing inequities but also inflamed ethnic divisions—tensions that would later erupt in the 1994 genocide.

"Colonialist attitudes permeate every aspect of global health, from the metrics we use to the way we describe interventions," Adams says. "We need to radically shift our language and attitudes so that neither power nor pity determine our ability to collaborate."

"Rebuilding Rwanda's health system therefore required more than monetary aid or physical



▲ Top: CHUK colleagues delivering procedural supplies. Bottom: Amal Cheema, MD, MED '24 (left), during her rotation at CHUK in 2024, alongside fellow medical residents from Rwanda, Jean D'Amour (CHUK medical intern, middle), and Caley Dickinson, MD, MED '24, photographed outside the wards.

Photos courtesy of Amal Cheema

infrastructure—it demanded that Rwandans lead, foreign partners empower, and both sides learn continuously from one another. “Equity in partnership is the means to achieve equity in health,” she says. “So we ask our partners what matters most to them, rather than seeking input on plans we’ve already designed.”

Today, through CGHE, Geisel faculty provide hands-on clinical training in specialties like gastroenterology, oncology, and emergency medicine—fields that previously had little or no local expertise. In partnership with CHUK and the University of Rwanda, CGHE also helps design medical curricula and establish residency and fellowship programs to train future generations of Rwandan physicians, ensuring that medical knowledge and expertise remains in the nation’s borders.

Geisel faculty like Steve Bensen, MD, MED '90, regularly travel to Rwanda to help specialists become independent leaders in their fields. “When Geisel joined HRH, Rwanda had no trained gastroenterologists,” says Bensen, who is a professor of medicine at Geisel and gastroenterologist at Dartmouth Hitchcock Medical Center (DHMC). “Today, the country has several who have trained abroad as well as the first four graduates of the newly established Rwanda GI fellowship.” Additionally, Geisel faculty and Rwandan colleagues co-founded the Rwanda Society of Endoscopy in 2016 and launched Rwanda Endoscopy Week in 2017.

The Power of Reciprocity

Beyond sending students and faculty abroad, Geisel’s program also brings Rwandan medical professionals to DHMC in Lebanon, New Hampshire, for training. Since 2015, CGHE has sponsored over 30 Rwandan medical professionals for specialized training at DHMC. Each year, multiple Rwandan residents

complete rotations in the U.S. before returning home to apply their knowledge in Rwanda. By embedding long-term training and bilateral exchange into its global health strategy, Geisel aims to avoid the pitfalls of “one-off” medical missions.

Geisel students visiting Rwanda also study the influence of their presence. During their four-week rotation in CHUK’s pediatric emergency room, Caley Dickinson, MD, MED '24, and Sirey Zhang, MD, MED '24, also conducted research on how visiting medical students impact Rwandan training and education. “It forced us to reflect on how global health must be about partnership, not paternalism,” Dickinson says.

Their preliminary findings revealed “a broad imbalance of people coming to learn about Rwandan medicine but not a lot of Rwandans who come to high-income countries,” Zhang notes. Between 2019 and 2024, for example, CHUK hosted over 4,000 medical students from more than 70 countries, whereas only a few hundred Rwandans had the opportunity to train in high-income countries.

This discrepancy is all too common in international partnerships, Bensen says. “At some institutions, they fund just a few international students to come to the U.S. compared to the number they send abroad. At Dartmouth, our ratio is better than one to one—we bring more Rwandans than [students] we send.”

A Reverberating Impact

This approach leaves a lasting impression overseas. In 2024, Amer Al-Nimr, MD, director of the Global Child Health Program, arranged for Rwandan physician Gaspard Habimana to complete a 24-week pediatric gastroenterology training at DHMC. In all of Rwanda—a nation where almost half the population is children—

there were no pediatric gastroenterologists. When Habimana returned home in early 2025, he became the first.

Similarly, Vincent Dusabejambo, MD, the former academic head of internal medicine at CHUK, received an American College of Gastroenterology grant to train at Dartmouth for three months, where he recruits American physicians like Bensen to provide training, but on Rwandan terms.

“Vincent decides which hospitals we go to, what we teach. He’s making those decisions,” Bensen says.

Yet another success story is Jean Pierre Sibomana, MD, who Bensen first met at Dartmouth in 2013. A decade after his training in echocardiography at DHMC, Sibomana is now internationally known as the pulmonologist who identified Rwanda’s first Marburg virus cases and led the country’s outbreak response. In 2024, Sibomana published an essay about his experience in the *New England Journal of Medicine*.

This exchange of ideas across continents has not only enriched Rwandan healthcare leaders, it’s also transformed how Geisel students see global health.

“My Rwandan colleagues taught me so much—not just about medicine, but about resilience, resourcefulness, and cultural humility,” Cheema reflects. “Global health isn’t about charity; it’s about solidarity.”

To learn more about the Center for Global Health Equity and global health education at Geisel, contact Mariam Aghayan at 603-646-5152 or Mariam.Aghayan@dartmouth.edu.

Research Briefs

Innovators at Dartmouth Health and the Geisel School of Medicine at Dartmouth are developing cutting-edge ways to revolutionize health and medicine.



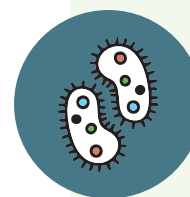
Neonatal Herpes Might Lead to Cognitive Impairment—But There's A Solution

Newborns exposed to any amount of herpes simplex virus (HSV)—even if they are asymptomatic at the time of infection—could experience cognitive decline later in life, according to a study of infected infant mice conducted at Dartmouth and published in the journal *PLOS Pathogens* in February.

The research team, led by Abigail Dutton, an MD/PhD candidate at the Geisel School of Medicine at Dartmouth, and by Evelyn Turnbaugh, a PhD candidate at the Guarini School of Graduate and Advanced Studies at Dartmouth, introduced HSV to day-old mice at a very low dose, then six months later, when the mice were mature, ran them through cognitive and memory tests derived from tests used to track Alzheimer's disease progression in humans. They found that the infected mice weren't able to learn the tasks as well as uninfected mice.

"If this is true in humans, this is really scary," says David Leib, PhD, chair and professor of microbiology and immunology at Geisel, who served as a corresponding author on the study. But there's "good news," he adds: The team also tested whether vaccinating mouse moms against HSV would help prevent neurological issues in their offspring—and it did. These findings could help shape future medical approaches to disorders such as Alzheimer's.

To learn more, go to dartgo.org/HSVlongterm.



First Optical Test to Detect "Flesh-Eating" Infection in Patients

Physicians can now detect life-threatening necrotizing soft tissue infections (NSTIs)—so-called "flesh-eating" bacteria—within hours, thanks to a first-of-its-kind imaging tool developed at Dartmouth Health. Until now, diagnosing NSTIs has relied on slow, often inconclusive clinical exams or exploratory surgery. Quick, accurate detection is critical: Untreated, the infection can spread rapidly, leading to amputation or death.

The innovation, led by Eric R. Henderson, MD, an orthopaedic surgeon at Dartmouth Health's Dartmouth Hitchcock Medical Center, uses fluorescent dye injected into the bloodstream. The dye flows through healthy tissue but is blocked by infected, necrotic areas, making them appear as "signal voids" on an MRI. In a study of 14 patients, the new tool reliably flagged infected tissue that standard visual exams often miss.

Supported by the National Institute of Allergy and Infectious Diseases, the tool adds a powerful new capability to emergency care.

"Some limbs could have been saved if diagnosed earlier," says Dr. Henderson, underscoring how this first-in-kind test brings lifesaving clarity to a terrifying condition.

To learn more, go to dartgo.org/FleshEatingBacteria.



Shortening Leukemia Diagnosis From Weeks to Hours

A new discovery at Dartmouth Cancer Center could dramatically speed up how doctors diagnose acute myeloid leukemia (AML). Using an in-house genomic platform, researchers can now deliver a full genetic profile in less than 24 hours—significantly shortening a process that often takes weeks. These profiles are key to tailoring treatment, since genetic mutations help determine which therapies are most likely to work.

Built to analyze the entire genome and transcriptome, the platform handles massive amounts of data quickly and affordably, something rarely done in clinical settings. With internal testing complete and clinical rollout underway, the project is already attracting national attention for patients facing one of the most aggressive blood cancers.

Supported by Prouty pilot funding, the work is part of Dartmouth's push to make precision medicine more accessible. "We're not talking about research as something abstract or 10 years away," says Parth Shah, MD, director of genome informatics. "We're doing it now, bench to bedside, in real time."

To learn more, go to dartgo.org/AMLProuty.

New & Noteworthy

Institutional milestones from across Dartmouth Health and the Geisel School of Medicine at Dartmouth

Dartmouth Cancer Center's Federal Designation Renewed

Dartmouth Cancer Center has been redesignated as a Comprehensive Cancer Center by the National Cancer Institute (NCI), with a score of "outstanding," marking 50 years of NCI designation. This renewal includes a grant of \$13.9 million over five years.

dartgo.org/DCCRenewal25



DHMC Named Best Hospital for 2025-2026 by U.S. News & World Report

Dartmouth Health's Dartmouth Hitchcock Medical Center was ranked as the number one hospital in New Hampshire. Alice Peck Day Memorial Hospital (APD), a Dartmouth Health member, was also recognized as high performing in hip replacement.

dartgo.org/USNewsWorld25

Radiation Oncology Opens in Southern N.H.

With the opening of the new unit in July, Dartmouth Cancer Center now offers a full suite of treatments to patients at the Dartmouth Hitchcock Clinics Manchester campus, bringing the same level of comprehensive care available in Lebanon to hundreds of patients in southern New Hampshire.

dartgo.org/ManchesterDCC

First Maternal Mental Health Navigator in Pediatrics in the U.S.

Heather A. Martin was named Dartmouth Health Children's inaugural maternal mental health navigator, the first in any pediatrics program in the nation. In this role, she identifies and coordinates support for new moms and their families.

dartgo.org/MaternalNavigator

Two New Master's Programs: Health Data Science and Implementation Science

This fall, the first cohort of students began courses in Geisel's online Master of Science in Health Data Science degree program, and in the unique new Master of Science in Implementation Science program, jointly offered by Geisel and the Guarini School of Graduate and Advanced Studies at Dartmouth.

dartgo.org/HealthDataScience
dartgo.org/ImplementationScience

Adolescent Inpatient Medical Psychiatry Unit Opens at DHMC

The new unit, which opened in April, addresses the ongoing shortage of pediatric mental health beds, significantly increasing the capacity of Dartmouth Health to provide intensive inpatient care for adolescents.

dartgo.org/InpatientPedsPsych

First Cohort of MD Graduates Certified to Provide Clinical Care in Spanish and English

Eight members of the Geisel School of Medicine's MD Class of 2025 have been certified to provide clinical care in both Spanish and English as part of the newly developed Medical Spanish Pathway of Distinction.

dartgo.org/MedicalSpanishGrads

First in N.H.: Nurse Residency Program at APD Receives National Accreditation

In May, Alice Peck Day Memorial Hospital (APD), a member of Dartmouth Health, became the first hospital in New Hampshire to be officially awarded by the American Nurses Credentialing Center with the Practice Transition Accreditation Program designation for its Nurse Residency Program.

dartgo.org/APDNurseResidency

Record 268 Dartmouth Health Doctors Ranked Among New Hampshire's Best

In *New Hampshire Magazine's* 2025 Top Doctor rankings, Dartmouth Health saw its highest number of physicians ever recognized.

dartgo.org/TopDocs2025

N.H. Pediatrician of the Year

Dartmouth Health Children's primary care community chair, Erik M. Shessler, MD, was named Pediatrician of the Year by the New Hampshire chapter of the American Academy of Pediatrics.

dartgo.org/PediatricianOfTheYear

Alumni Perspectives

Vitals Magazine asked three alumni to share their perspectives on the most urgent challenges to health and medicine today, and how their work is shaping a healthier future.



► **Pamela L. Kunz, MD, D '94, MED '01**
Professor of Medicine (Oncology)
Division Chief, GI Medical Oncology
Yale School of Medicine and
Smilow Cancer Hospital

Not Just Surviving

As a practicing gastrointestinal (GI) oncologist and cancer researcher, I believe that one of the most urgent challenges in human health is addressing the increasing number of cancer survivors. Cancer survivors are people who have received treatment intended to cure their cancer and those who live with chronic cancers. There are over 18 million cancer survivors in the U.S., representing approximately 5% of the population.

In the last decade we've seen incredible advances in cancer diagnostics and treatments leading to increased rates of cure and longer survival. However, many patients experience long-term side effects from cancer treatments or chronic symptoms of their cancer. These side effects can be physical, emotional, and financial. In providing patient-centric cancer care, I hope that we can focus on issues of cancer survivorship.

As the division chief of GI medical oncology at Yale Cancer Center and Smilow Cancer Hospital, I am working with my team to provide comprehensive survivorship care to patients with GI cancers to help them live better following a diagnosis of a GI cancer. Areas of focus include healthy lifestyle, fertility and sexuality, psychosocial needs, specialist care, and routine healthcare maintenance. Two groups of patients who warrant special attention in their survivorship journey are those who are diagnosed with early-onset cancers (diagnosed under the age of 50) and those who face barriers to social determinants of health.

Inviting Dartmouth and Dartmouth Health **ALUMNI**

If you would like to share your perspective in a future issue of *Vitals Magazine*, contact managing editor Eva Botkin-Kowacki at Eva.Botkin-Kowacki@dartmouth.edu.

Accelerating Diagnosis

The most urgent challenge to human health today is the gap in access to timely, high-quality diagnostic studies—for acute and chronic diseases that can be life-threatening if missed or delayed. Limited access to diagnostic tools and specialist expertise in many parts of the world can delay care and worsen outcomes. Even in well-resourced settings, societal barriers may prevent patients from receiving preventive care until the disease becomes critical.

From my perspective as an emergency physician and researcher, I see point-of-care ultrasound as a transformative solution. It allows clinicians to answer critical questions in real time, right at the bedside. But this requires skill, and training takes time, resources, and constant practice. That's why I'm working on integrating artificial intelligence into point-of-care ultrasound. Artificial intelligence can help less experienced clinicians obtain high-quality ultrasound images and aid in making confident, life-saving decisions. I'm also exploring how ultrasound can help us detect chronic diseases during acute visits to allow early intervention and public health outreach.

Expanding the use of ultrasound can move us towards a future where faster and better care is available for everyone.

Building Bridges

Ethnoracial health disparities represent a public health crisis in the United States. Gaps in life expectancy have increased over the past two decades, and Black mothers and infants have continued to die at more than twice the rate of their white counterparts—a devastating trend that has persisted for more than four decades.

As a former pediatrics resident and now a public health scientist, I've had an opportunity to examine these inequities across multiple viewpoints. Today, I provide scientific support for the California Black Infant Health Program (BIH), which is housed within the California Department of Public Health's Maternal Child and Adolescent Health Division.

Established in 1989 to address disparities in birth outcomes, BIH has evolved to become an evidence-informed, group-based, social support and empowerment focused program helping participants navigate their pregnancies. My work consists of utilizing data to help inform several different aspects of the program, including its administration, development, implementation, monitoring, and evaluation. BIH has served countless Black birthing persons and families in California, with its most recent evaluation finding positive impacts across a range of health or health-related outcomes. California's BIH Program represents a strong step in the right direction toward effectively addressing American ethnoracial health disparities.



◀ **Cristiana Baloesco, MD, MPH, MED '13**
Assistant Professor of
Emergency Medicine
Yale School of Medicine



◀ **Aaron Briggs, MD, MPH, D '15, MED '19**
Research Scientist I,
Black Infant Health Program
Perinatal Program Evaluation
& Data Unit Maternal Child and
Adolescent Health Division
California Department of Public
Health



20 Years On The Road to \$1M

From scrappy beginnings, the CHaD HERO celebrates two decades of healing kids by breaking seven figures for the first time.

By Jeremy Martin

For Jeff Hastings, asking people for money didn't come naturally. But when he was appointed as a board member at the Children's Hospital at Dartmouth Hitchcock Medical Center (CHaD) in 2004, he recognized that children and families in his community needed support—and began brainstorming how to help.

"[CHaD] needed people who would ask for money," Hastings says. "So I wondered if there was a way to do it by providing something in return, and raising awareness at the same time."

That planted the seed for a community-led half marathon, initially called "CHaD Outrun the Sun." "The idea was to start at 4:00 p.m. and challenge runners to cross the Dartmouth Green finish line before sunset," Hastings says.

He took the concept to Sharon Brown, then director of CHaD Community Relations. Nothing like this had ever been done in the Upper Valley, but Brown believed it was just crazy enough to work.

"We were hoping to expand our events to invite broad community participation and give people

a chance to fundraise for CHaD," Brown recalls. "I trusted Jeff would do his homework. And he did not disappoint."

Back then, the event was modest; just 700 runners, a finish line, and the goal to raise critical funds for CHaD's programs and services. The inaugural event started in Etna, New Hampshire, in 2006 and raised \$120,000, thanks in large part to volunteers.

"The event had incredible energy with the founding members," Hastings says. "Everybody knew we were breaking new ground."

Twenty years later, that scrappy afternoon race has grown into the CHaD HERO, a full-day celebration of movement, community, and cause. The event has changed course numerous times, moved from summer to fall, and now includes runs of different lengths, walks, virtual events, and a festival on the Dartmouth Green.

What sets the CHaD HERO apart from similar fundraisers is its grassroots, youth-driven spirit—powered by local families, patients, and kids themselves, many of whom are participants. It's now the largest community fundraising event supporting a children's hospital in northern New England.

In October, the CHaD HERO celebrated 20 years with more than 3,600 participants raising a record-breaking \$1 million. Since its inception, the event has garnered more than \$11.6 million, with funds supporting CHaD programs not typically covered by insurance, including Child Life, Family Support, and Child Advocacy & Protection.

"It's so much more than a fundraising event or race for a cause," says Olive Isaacs, senior director of community fundraising and engagement. "It's a unique

opportunity for this community of neighbors and friends, people who have been cared for by CHaD, to come together and celebrate. It's why the HERO punches above its weight—because it's rooted in gratitude and love for this incredible hospital."

A HERO from the Start

Few people embody the HERO spirit quite like Joanna Miller, who has run every single CHaD race since it began.

At 16, Miller was hospitalized at CHaD for chronic inflammatory demyelinating polyneuropathy (CIDP), a rare neurological condition that causes sudden and debilitating muscle weakness.

"I couldn't peel the top off a yogurt container," she says. After five days of intravenous immunoglobulin therapy at CHaD—"which worked like magic"—she remembers running around her backyard, jumping in the air, which had been impossible before treatment. So when her mother encouraged her to run the inaugural CHaD Half Marathon in 2006, Miller signed up, despite never having run more than a 10K.

"I am very thankful for the treatment that I received," Miller says. "I've been able to live a full life, and I want to be able to give back if I can."

Miller has raised nearly \$75,000 for CHaD, and her whole family always participates. This year, Miller's 13-year-old daughter began to fundraise, collecting donations from neighbors.

"Everyone shows up in support of these kids and families," Miller says. "CHaD HERO is such a joyful day. It's like a big hug from the community."

Kids Helping Kids

One of the most fervent early members of the organizing team was Nini Meyer, a runner and mother of two. At three weeks old, Meyer's son was treated at CHaD for meningitis, so when she heard about the race, she "leapt at the opportunity" to volunteer.

Generations of Meyer's family joined as participants, volunteers, and supporters. "It became this labor of love that was all about play," she says.

In 2008, Meyer's son's friend, Cam Marshall, was being treated for leukemia at CHaD. And Meyer wanted to help.

"People were bringing over lasagnas [for Cam and his family], and I do not cook," Meyer laughs. "We thought we could do something in his honor at the CHaD Half Marathon."



▲ The Blouin Family at the 2024 CHaD HERO

Within a week, Meyer helped organize a tribute run. “It was all very last-minute, a real mad dash,” she says, adding that a horrible rainstorm threatened participation. “But so many people showed up anyway. Watching those kids take action—soaking wet, proud, and strong—was one of the most powerful things I’d ever seen.”

Today, Cam’s Course, a one-mile fun run, remains a CHaD HERO cornerstone. It also inspired Meyer to launch Positive Tracks, a nonprofit that empowers young people to use athletics to drive change.

“An enormous amount of our [CHaD HERO] participants are kids,” Isaacs says. “Programs like Positive Tracks and Finding Our Stride show them early that activity and movement can be about helping others, not just competing, which teaches gratitude. Kids learn they can give back—to their community and even to strangers. That’s powerful.”

The Making of a HERO

As the event evolved over time, so did its identity. Renamed the CHaD HERO in 2009 in a nod to everyday heroes—patients, families, and community members—the event celebrates

the resilience and courage of kids receiving care, as well as the spirit of everyone who participates, fundraises, or volunteers.

That year, race organizers took the HERO energy even further.

Thanks to large-scale community mobilization and hundreds of costumes, the CHaD HERO set a Guinness World Record for the most people dressed as superheroes in one place—1,016 in total—and later broke it again.

“Something happens when you put people in a cape,” Meyer says. “They get a little bit wacky. They feel like a hero. They act like a hero. Also, it’s really fun to run in a cape.”

Building on 20 Years of Impact

Today, the CHaD HERO community is striding into its third decade with an eye toward the future.

“As we look to the next 20 years of the CHaD HERO, we’re committed to deepening the connections between our hospital and the communities we serve,” says Keith Loud, MD, physician-in-chief at Dartmouth Health Children’s.

“We’re exploring new ways to bring the HERO spirit to families across New Hampshire and Vermont—whether that’s expanding events, building new partnerships, or making it easier for kids and families to get involved. The heart of the HERO will always be community and compassion, but innovation will help us reach even more children in the future.”

Hastings agrees wholeheartedly. “The possibilities are great,” he says. “We started with a vision that’s now reinventing itself. Everybody loves CHaD. It’s why people keep coming back.”

The 20th Annual CHaD HERO BREAKS \$1M

CHaDHERO.org

▼ Volunteer Nini Meyer, who helped launch Cam’s Course, celebrates CHaD HERO’s 2009 Guinness World Record with one of her sons.



START

2006

- First race launched as CHaD Outrun the Sun
- 700 participants
- \$120,000 raised

2007

Officially renamed the CHaD Half Marathon

2009

- Guinness World Record set: 1,016 superheroes gather on the Dartmouth Green
- “CHaD HERO” name coined

2011

Hurricane Irene forces early rescheduling and a shortened race format

2010

- HERO expands with 5K Run
- First Positive Tracks youth fundraising challenge

2008

Inaugural Cam’s Course Fun Run

2014

Kid HERO ambassador program launches

2012

HERO adds 5K Walk

2013

- 10K hike introduced
- Viral video garners 5.6M+ views

2020

First virtual HERO event due to the COVID-19 pandemic

2015

- First Flash Dash event held at CHaD for young patients
- 10th anniversary of CHaD HERO

2024

\$825,000 raised

2021

Return to in-person race with a virtual option available

2023

- First year with no registration fee
- 35% growth in participation
- First year the entire event footprint was held on the Dartmouth Green

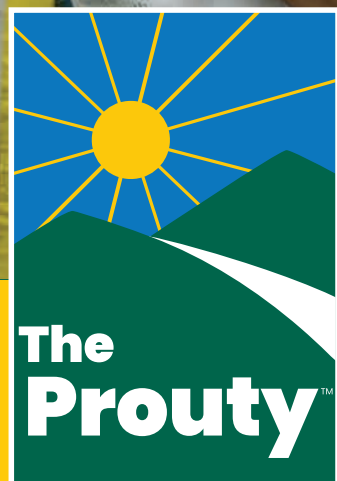
To learn more about the impact Dartmouth Health Children’s has on the health and well-being of patients and their families, contact Polly Antol at 603-646-5316 or Polly.Antol@hitchcock.org.

THE PROUTY RIDES TO NEW RECORD:

\$10.2 Million Closer to Ending Cancer

The 44th Annual Prouty smashed records by raising more than \$10.2 million to support Dartmouth Cancer Center. More than 4,300 cyclists, walkers, rowers and golfers, along with 750 volunteers, came together this July to eclipse last year's impressive \$8.2 million total.

The impact of The Prouty goes far beyond numbers. At its core, The Prouty is a philanthropic powerhouse—a collective movement that channels community and generosity into real, measurable progress. The funds raised enable groundbreaking advancements in cancer research, clinical trials and pilot research projects, and they support crucial patient services. Just as critically, by raising more than \$10 million this year, Prouty participants ensured that \$1 million would be allocated to support the expansion of vital mental health services for patients and their families, a lifeline for individuals facing the emotional toll of a cancer diagnosis.



Friends of
Dartmouth Cancer Center



To learn more about The Prouty, contact Patrick McBride at 603-646-5150 or Patrick.JMcBride@hitchcock.org, or visit theprouthy.org.

Save the date for the
**45TH ANNUAL
PROUTY**
JULY 10-11, 2026

Thank You

Over the past year, more than 21,123 people, foundations, and corporations came together to give over \$76 million to advance care, discovery, and education through the Geisel School of Medicine at Dartmouth and Dartmouth Health. Because of you, we are transforming lives. And for your support, we are profoundly grateful.

Your generosity is driving meaningful progress every day. It's fueling breakthroughs in medical research, enriching education for students and faculty, strengthening care for children and families, and easing the burdens faced by patients with cancer and other serious illnesses. You're also helping lift up communities across the Northeast—through your advocacy, your volunteerism, and your unwavering commitment to a healthier future for all.

We would like to particularly acknowledge those of you who made gifts or commitments between July 1, 2024 and June 30, 2025. Please know that every gift, at every level, makes a real and lasting impact.

Thank you for being part of this extraordinary community. Your support continues to inspire hope, compassion, and progress—and we're honored to have you by our side.

Donor **Spotlights**

First-Time Donors

Eight years ago, Heidi Allen Goodrich made her first gift to Dartmouth Health to support friends who were participating in The Prouty. In doing so, she was drawn into a community that felt instantly like home. Five years later, she was diagnosed with ocular melanoma and turned to that same community for strength. Suffice it to say, she found it. And today, she is cancer-free.

This year, 7,574 new donors made their own first gifts, joining a growing movement of generosity and compassion. Together, they contributed more than \$13 million to advance equitable care and life-changing research across northern New England.

Tribute Donors

When Kerry Reynolds was diagnosed with breast cancer, she traveled from Cape Cod to New Hampshire to receive care from surgical oncologist Kari Rosenkranz, MD.

“She just made us feel listened to and cared for,” says Kerry’s husband, Jason. “We are grateful beyond words.”

Dr. Rosenkranz was one of nearly 300 caregivers recognized through the most recent Honor a Caregiver campaign. Tribute gifts like the Reynolds family’s—along with hundreds of heartfelt messages from across our community—raised more than \$100,000 to celebrate the compassion and excellence at the heart of Dartmouth Health.

Lifelong Donors

“I want to help people,” says Loren Lortscher, MD, reflecting on his path from Dartmouth undergrad to psychiatric resident at Dartmouth Hitchcock Medical Center.

Over the years, Dr. Lortscher and his partner, James Couto, found ways beyond clinical practice to help people, inspired by the students and faculty they met through Dartmouth alumni events. “These incredibly smart kids were doing such remarkable research,” Couto recalls.

Moved by their experiences, the couple made a \$3 million bequest to the Geisel School of Medicine to support student-based oncology research. “Even if it changes just one student’s life,” Couto says, “I would be happy.”

Health Leaders Circle

Annual support is the foundation of excellence for our academic medical enterprise.

We gratefully acknowledge the donors who have become members of our Health Leaders Circle through their annual gifts of \$5,000 or more to priority funds at Dartmouth Hitchcock Medical Center, Geisel School of Medicine, Dartmouth Cancer Center, or Dartmouth Health Children’s. The following are Health Leaders Circle members as of June 2025.

For more information about joining the Health Leaders Circle, contact [Cate Meno](#) at [603-646-5794](tel:603-646-5794) or Cate.Meno@hitchcock.org, or visit DHGeiselGiving.org/HLC.

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Former patient Les Haynes believed in giving back. His \$6.7 million estate gift to the Dartmouth Health Advanced Response Team (DHART) is now driving a critical expansion of the program that brings advanced emergency care to even the most remote parts of northern New England.

A promise like his will save lives.

In total, Pinnacle Society members have committed more than \$75 million in planned gifts to support the future of Dartmouth Health and the Geisel School of Medicine. Their generosity ensures that generations to come will benefit from compassionate care, groundbreaking research, and innovative medical education.

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