We don't need statistics to tell us that it can take a long time for research to reach clinical practice. But here's one that's often cited in academic medical circles: it takes 17 years (on average) to complete the journey from bench to bedside.

With the opening of its Williamson Translational Research Building (WTRB), the Geisel School of Medicine at Dartmouth hopes to help close that gap.

The state-of-the-art, six-story building, which is seamlessly integrated into Dartmouth-Hitchcock Medical Center's Lebanon campus, is designed to make collaborations between scientists—such as biomedical researchers, engineers, data scientists, physician-researchers, and health policy analysts—and their clinical colleagues, easier than ever before.

"Much of what drives innovation in research are the interactions and dialogues that you have across different disciplines," explains Duane Compton, PhD, interim dean of Geisel.

"When those connections can take place under one roof, with people organized by research theme rather than by department, it creates a really interesting mix that allows you to push things ahead in ways that you couldn't do otherwise," says Compton. "And it provides a much better conduit for facilitating the translation of scientific discoveries into better, safer care for patients."

From its expanded wet lab facilities to its efficiently designed office and meeting spaces to its state-of-the-art auditorium, the 161,000-square-foot WTRB serves as a new and more spacious home for a number of leading research programs from across Geisel and Dartmouth College. These include those within Norris Cotton Cancer Center, SYNERGY: The Dartmouth Clinical and Translational Science Institute, The Dartmouth Institute for Health Policy and Clinical Practice, Biomedical Data Science and the Thayer School of Engineering.

The WTRB is also providing badly needed space for Dartmouth-Hitchcock's (D-H) Clinical Pathology Department, and houses the Connected Care Center, the new hub for D-H's telehealth, telecommunications, and emergency response services.

In addition to advancing medical science at Geisel and Dartmouth-Hitchcock, the WTRB is expanding training opportunities for graduate, undergraduate and medical students, while creating an environment for attracting top scientists and substantial grant funding in the future.

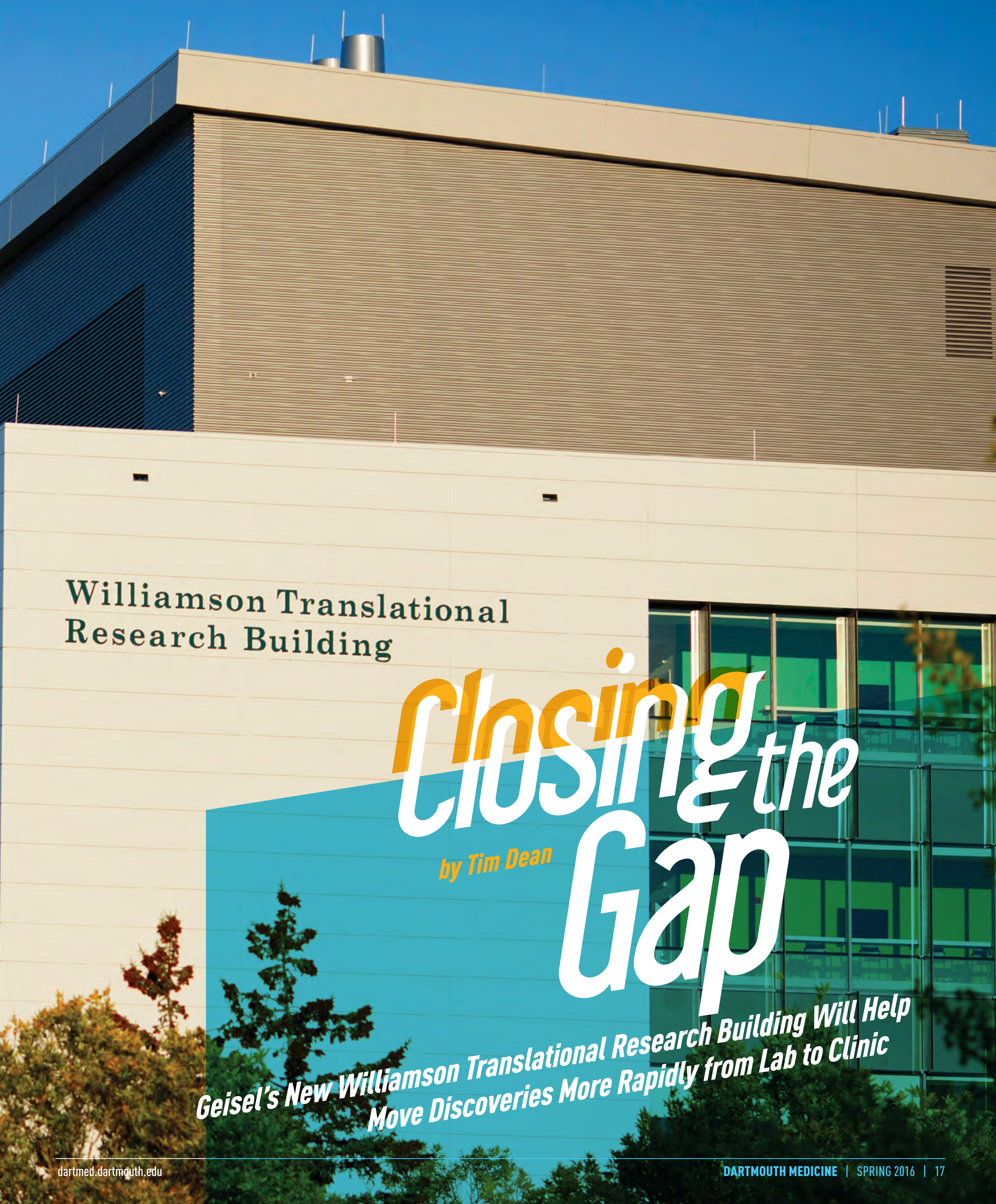
"It's all about building out our faculty and our programs in the right direction and in the right places," says Compton. "The new building gives us the flexibility to think strategically and creatively about how we can best do that."

The WTRB is named in honor of Dr. Peter Williamson and his wife Susan, who made a landmark $20 million gift commitment to Geisel towards the building in 2007 (see story on page 23). The $104 million WTRB—which was completed on time and under budget—is also being funded by Dartmouth-Hitchcock and other philanthropic sources.

"I think it really shows the impact of what donors can do for the institution," Compton says. "The lead gift from the Williamson family, as well as the funds from other donors, has transformed that whole campus—it's changing the way in which people interact and work together."

"Much of what drives innovation in research are the interactions and dialogues that you have across different disciplines."

Mark Washburn



Closing the Gap

by Tim Dean

Geisel's New Williamson Translational Research Building Will Help Move Discoveries More Rapidly from Lab to Clinic

Untangling Genetic Factors in Rheumatoid Arthritis

by Jennifer Durgin


Mark Washburn

Christopher Amos, PhD and William Rigby, MD

Imagine feeling like you have the flu every day, week after week. Your joints ache. You can't get comfortable. Your body is in a constant state of inflammation, like it's fighting off a virus. That's what full-blown rheumatoid arthritis (RA) feels like, explains William Rigby, MD, a physician-researcher at Geisel and a rheumatologist at Dartmouth-Hitchcock. If you're diagnosed early and receive the right medications, "you can have a completely normal life," says Rigby. But that's not always easy.

Early stage RA can be mistaken for other illnesses, and there's no way to predict how severe one's disease will be or which medications will work best for which person. Research by Rigby and Geisel biomedical data scientist Christopher Amos, PhD, may one-day help solve those problems, by revealing how certain genes influence RA.

"Genetic variability is not just due to differences in your DNA sequence but also how many copies of particular genes you inherit," says Rigby.

In previous studies with colleagues at The Ohio State University, he found that people with RA tend to have fewer copies of the genes known as C4A and C4B. C4 genes assist in clearing complexes of antibodies—immune cells that have already latched onto their targets—from the blood stream.

"One theory is that rheumatoid arthritis might be a disease where these immune complexes are not cleared very well, particularly from the joints," explains Rigby.

Rigby and Amos are looking for a connection between copy number variations in C4A and C4B and the prognosis and treatment response of patients. Doing so requires a highly specialized lab, like Rigby's, and advanced computational expertise, like Amos's. Amos and his team of biomedical data scientists collaborate with numerous physician-researchers—collaborations facilitated by the group's new location in the Williamson Translational Research Building.

"It's quite difficult to tease out the effects of any particular genetic factor," says Amos, who is associate director for population sciences at Dartmouth-Htichock's Norris Cotton Cancer Center and a world-renowned expert in complex genetic analyses of populations. "This study requires that we create as homogenous a population of participants as possible, matching patients with rheumatoid arthritis with healthy participants who are genetically very similar."

Rigby and Amos hope their research will lead to more accurate ways of calculating a person's risk of developing RA.

"The risk of RA is about 1 in 300," says Rigby. "If you have any of the known genetic risk factors, your risk goes up to 1 in about 60. We want to find additional markers that can more precisely predict the risk of disease, so we screen and monitor those people closely."

As for using genetic information to guide treatment for RA? "We are just starting to figure that out," he adds.


Mark Washburn

Mark Washburn

“Now that we share space at the new WTRB, it makes collaborations between researchers and clinicians much easier.”
~ Carrie Colla

Nancy Morden, MD, MPH, and Carrie Colla, PhD

Mapping Low-Value, Potentially Harmful Care

by Tim Dean

By now, you likely know that where you live influences the amount of health care you receive. New research reveals with increasing confidence that your geography also determines the value and quality of care you receive, specifically how likely you are to receive potentially harmful care.

For many years, researchers at The Dartmouth Institute for Health Policy and Clinical Practice (TDI) have been documenting striking variations in practice and spending across the U.S., showing that high spending areas do not achieve better results, quality, or patient satisfaction.

TDI colleagues Nancy Morden, MD, MPH, and Carrie Colla, PhD, with a grant from the Robert Wood Johnson Foundation, are working to advance and build on this foundational research by documenting which regions provide high rates of care—procedures, prescriptions, and tests—labeled by the national Choosing Wisely initiative as having little value and as being potentially harmful.

“Choosing Wisely was started in 2012 by the American Board of Internal Medicine Foundation as an effort to get physician specialty societies to develop lists of low-value services that patients and physicians should discuss and question before pursing,” explains Colla, a health economist and assistant professor of TDI, who notes that sharing space in the new Williamson Translational Research Building makes collaborations between researchers and clinicians easier.

“At TDI, we have access to all of the claims from every Medicare beneficiary in the U.S., which is a powerful tool for researchers to have when exploring variations in spending, for example,” Colla says. “But we haven’t been able to say whether that spending is good or bad. With Choosing Wisely, we now have a label for low-value care and a way to measure it.”

Still, even with expansion of the initiative—which now includes more than 70 specialty society partners and a coalition of consumer groups—the lists vary widely in their potential impact on care and spending.

“We’d like to see more robust lists developed that can lead to quality metrics that will inform health care policies and physician practice patterns, but I think we’re off to a great start,” says Morden, a physician-researcher and associate professor of Community and Family Medicine and of TDI. “It’s wonderful to see physicians stepping up to name low-value care explicitly—it’s vital that we own our role as stewards of limited health care resources.”

“But the most important thing,” Morden adds, “is to empower patients to know about low-value care, to shop carefully for care quality and value, and to make sure they’re at least avoiding harmful care.”

Closing the Gap

A system developed by Drs. Hal Swartz and Lesley Jarvis and colleagues could revolutionize the treatment of tumors.

Mark Washburn

Using Oxygen to Amplify Tumor Treatments

by Jennifer Durgin

Here's a surprising fact: Although radiation is often used to treat cancer, tumors can be less sensitive to radiation than normal tissue. That's because cancer cells are inherently low in oxygen and oxygen is a potent enhancer of radiation.

"Published data show that the single most important factor by a wide margin that predicts whether or not someone will respond to radiation therapy is the oxygen in their tumor," explains Harold "Hal" Swartz, MD, PhD, MPH, a professor of radiology, radiation oncology, physiology, and Community and Family Medicine at Geisel.

The problem is that doctors don't have a good way to measure how much oxygen is in a tumor—at least not yet. But they may in the future, thanks to inventions developed by Swartz and his team, in collaboration with Geisel physician-researchers Lesley Jarvis, MD, PhD, and Philip Schaner, MD, PhD, who are radiation-oncologists at Dartmouth-Hitchcock (D-H), and Eunice Chen, MD, PhD, an otolaryngologist at D-H.

For several years, biomedical scientists and engineers at Geisel's EPR Center for the Study of Viable Systems, which Swartz directs, have been developing tools and techniques

> *"Almost all of our collaborations are between physicians and our own basic scientists, and that's what the Williamson Building is for."*
> ~ Hal Swartz

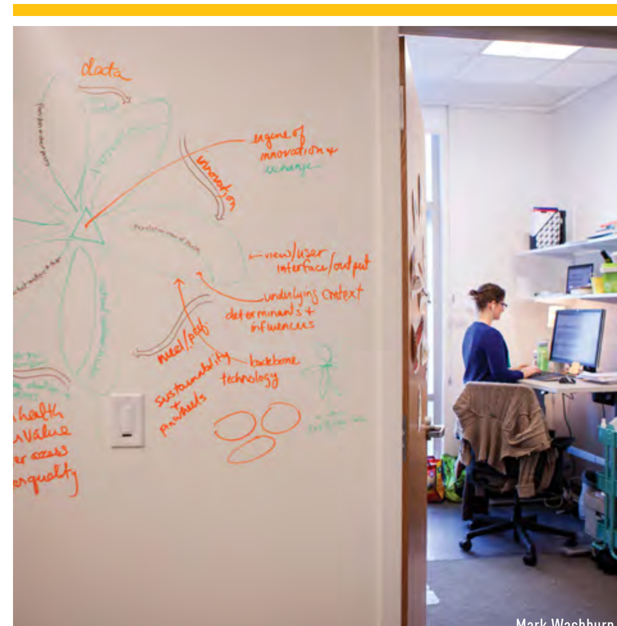
for measuring oxygen in living tissue. They use a technology called electron paramagnetic resonance (EPR), which is similar to the magnetic resonance technology used in MRI machines.

"Having the EPR Center located in the Williamson Translational Research Building is a dream come true," says Swartz, who as a physician-researcher has focused throughout his career on developing clinically relevant technologies. "Almost all of our collaborations are between physicians and our own basic scientists, and that's what the Williamson Building is for."

The system that the EPR Center team has built is now entering the first stage of clinical trials at D-H, Emory University Hospital, and Universite Catholique de Louvain in Belgium. The goal, initially, is to prove the safety of the devices and strategies, and then, in subsequent trials, to show their value in improving outcomes in patients.

Simply being able to measure the oxygen levels in a tumor will unlock opportunities to increase those levels and dramatically improve the effectiveness of radiation therapy.

"We envision that one day every patient receiving radiation therapy will have their tumor oxygen levels monitored," says Jarvis. "Their doctors will then use that information to select appropriate therapies, such as increasing tumor oxygen, either through medication or simply by the patient breathing oxygen through a mask. The benefits may exceed any interventions thus far."



Mark Washburn

SYNERGY Grant Funds Collaborative Breath Work

by Jennifer Durgin

A single exhaled breath contains thousands of molecules that can reveal what's happening inside a person's lungs.

"Think of it as a breath-print," explains Jane Hill, PhD, a professor at the Thayer School of Engineering at Dartmouth. She's collaborating with molecular biologists and physicians from Geisel and Dartmouth-Hitchcock to match certain biomarkers—or breath-prints—with particular bacterial infections. If successful, her approach could revolutionize the diagnosis and treatment of acute and chronic lung diseases, such as tuberculosis and the chronic infections that affect people with cystic fibrosis.

"Some patients with cystic fibrosis, especially young children, cannot produce a sputum sample for us to send to the lab for analysis," explains Alix Ashare, MD, PhD, a physician-researcher at Geisel and a pulmonologist at Dartmouth-Hitchcock. "So it can be difficult to know which drugs to give them to fight the bacteria in their lungs." Using the breath, is a non-invasive way to diagnose these bacterial infections.

Ashare and Hill are collaborating on a study funded by a pilot grant from SYNERGY: The Dartmouth Clinical and Translational Science Institute, located on the third floor of Geisel's new Williamson Translational Research Building. (SYNERGY receives funding from the National Center for Advancing Translational Sciences, part of the National Institutes of Health.)

Mark Washburn

Mark Washburn

Jane Hill, PhD and Alix Ashare, MD, PhD

"When you reach out across disciplines, you'll find a smile, intellectual interest, and this combination results in meaningful and enjoyable collaborations."
~ Jane Hill

Hill and Ashare are focusing on two of the most common bacteria affecting patients with cystic fibrosis, Pseudomonas aeruginosa, and Staphylococcus aureus. If they can figure out the breath-print for those bacteria among patients with CF, Hill's team can create a clinical test that can guide physicians to choose the right antibiotics for the right patients.

"The end goal is a point-of-care device that can collect the breath sample from the patient and rapidly generate a diagnosis," says Hill. One day she envisions patients with CF being able to monitor their lung health at home, but that goal is still several years away. First, she and her collaborators have to build a comprehensive database of breath-prints and validate the accuracy of their tests.

"Being able to make a diagnosis from a breath sample would be a huge improvement over the expensive and invasive methods we currently have to use when a patient can't produce a sputum sample," says Ashare.

In addition to Ashare, Hill works closely with Geisel microbiologist Deborah Hogan, PhD. She also collaborates with Geisel infectious disease specialists Elizabeth Talbot, MD, and Ford von Reyn, MD, to develop breath-prints for tuberculosis.

Dartmouth is rather small compared to other research universities, Hill notes, but that's what makes it special. "When you reach out across disciplines, you'll find a smile, intellectual interest, and this combination results in meaningful and enjoyable collaborations."

Closing the Gap

Mark Washburn

Inspiring Hope

by Susan Green

Four colored pencil drawings by Benjamin Blais (Med'15) grace the walls of a large conference room in the main mall area connecting Geisel's Williamson Translational Research Building to Dartmouth-Hitchcock Medical Center (DHMC).

The 22 x 30 inch drawings on cold press paper, a slightly textured paper that grabs pigment, are part of Blais's *Metastasis Series*, which is meant to convey the disconcerting act of metastasis. "His work is part of the newly installed permanent collection, which includes commissioned pieces by Gloria King Merritt, George Sherwood, and artistic collaborators Elizabeth Billings and Andrea Wasserman," says Marianne Barthel, DHMC's Arts Program Coordinator.

Rounding out the collection are works from Brooklyn-based artist Susan Kaprov and a striking piece donated by local artist Georgina Forbes in memory of her mother, Barthel adds. The carefully selected works reflect both the origins of research and ideas as well as new discoveries.

"We felt that Ben's art was a perfect fit because his work represents both today's medicine and tomorrow's research," Barthel says. "It fits beautifully in the new building and an added benefit is that he is one of our own—it demonstrates how art and medicine can intersect both on the canvas and off."

In each delicately rendered drawing a pair of gloved hands holding a petri dish appear to be breaking through the paper invading the viewer's space. "The color and positioning of the gloved hands each represent an organ and are held over the cancer site," Blais says, "and each petri dish—if one looks close enough—contains a single cell, the origin of every tumor, as well as the name of a researcher whose work contributed to advances in cancer research." One of the drawings bears the name of a family friend lost to cancer when Blais was young, and is part of his motivation for the series.

Much like medicine, drawing is often a process of continuous problem solving. "It requires pulling many thoughts together, turning them into a complete story, then systematically taking that story and giving it a composition that highlights the subject without missing important details," Blais explains. These same skills of careful observation acquired as an artist, have also helped him to become a better observer in the clinic. "Some of the best clinicians are master observers—I hope to continue learning from them and developing this throughout my life."

Blais is a pediatric resident at University of California, Los Angeles David Geffen School of Medicine.


John Gilbert Fox

The Williamson Legacy

by Jennifer Durgin

"Teaching and research bring a very important element of vitality and innovation to an academic medical center like Dartmouth, where you're learning new things and bringing the very latest in knowledge to the care of the patient."
~ Peter Williamson, 2007

Dr. Peter Williamson and his wife, Susan, led by example. Peter, a 1958 graduate of Dartmouth College, was a world-renowned neurologist who pioneered treatments for intractable epilepsy. At Dartmouth-Hitchcock, he built one of the nation's top epilepsy referral centers. As a professor of neurology at the medical school, he mentored many young physicians who have since made important contributions to the fields of neurology and epilepsy, in particular. Susan, a 1959 graduate of Skidmore College, dedicated much of her time to volunteering and supporting organizations that focused on youth and athletics. Together, they were generous philanthropists and a source of inspiration for others.

The naming of the Williamson Translational Research Building recognizes their generosity to the Geisel School of Medicine, their vision for the building, and their belief in the promise of collaboration, innovation, and scientific discovery to advance medicine and patient care.

"Teaching and research bring a very important element of vitality and innovation to an academic medical center like Dartmouth, where you're learning new things and bringing the very latest in knowledge to the care of the patient," said Peter when he and Susan pledged a landmark gift of $20 million in 2007, during the Transforming Medicine Campaign.

Sadly, neither Peter nor Susan lived to see the opening of the building named in their honor. Peter died in 2008 and Susan in 2015. But both knew that their gift stands as a shining example of the power of philanthropy to transform lives.