THE SEARCH

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- Big data
- Creating a paradigm shift in heart disease
- Let's do the numbers
- Genetics in the clinic

THE SEARCH

A PUBLICATION OF **THE JACKSON LABORATORY**

ON THE COVER

Pictured is an illustration of the human heart. See page 14 to learn how physician-scientist J. Travis Hinson is unlocking the genetics of heart disease.

LEFT

This close-up view shows a robot used to process liquid samples in the Genome Technologies lab at The Jackson Laboratory.

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DEPARTMENTS

The Search

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Mission
We discover precise genomic solutions for disease and empower the global biomedical community in our shared quest to improve human health.

Locations
Bar Harbor, Maine
Farmington, Conn.
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The Jackson Laboratory
Leading the search for tomorrow's cures

President's message

BRINGING IT ALL TOGETHER

What makes The Jackson Laboratory unique? Certainly, part of what distinguishes us is what JAX has long been known for — our mice — and our ability to take genetic data from humans, create better mouse models, and test potential cures in those models, with the ultimate goal of helping human patients.

But there's more to what makes JAX special — and to what makes this virtuous cycle work — than the presence of mice. It's also the absence of traditional academic departments that leads to our distinctly creative and collaborative culture.

With no silos defined by department or discipline, JAX is a place where scientists with diverse interests can bring them all together to accelerate discovery. Whether they focus on mouse genetics, human genomics or both, individual scientists can pursue multiple interests unconstrained by disciplinary boundaries, and collaboration among faculty with different areas of expertise is the rule, rather than the exception.

Assistant Professors Duygu Ucar, Ph.D., and Travis Hinson, M.D., personify this commitment to multidisciplinary approaches and collaboration. A computational scientist, Ucar draws on her expertise in computer science and biology to understand the aging process. Working with JAX immunologist Jacques Banchereau, Ph.D., and UConn physician-scientist George Kuchel, M.D., she seeks to unlock the mechanisms of immune system aging. Hinson, a cardiologist whose research focuses on the genomics of heart failure, leads a research laboratory at JAX while treating patients at UConn Health, thanks to a joint appointment between the two institutions.

It's not just our current faculty who embrace this collaborative, multidisciplinary approach. JAX Summer Student Program alumnus David Brancaccio credits the scientific training he received at the Laboratory with making him a better journalist. As the host of NPR's Marketplace Morning Report, Brancaccio brings intellectual rigor and creativity to bear on topics ranging from the fundamentals of the national economy to more offbeat subjects like the black market for maple syrup.

From groundbreaking research to education programs with an impact extending far beyond the lab, from mouse models to human cures — JAX is bringing it all together.

Edison Liu, M.D.

President and CEO, The Jackson Laboratory

news&notes

GROWING OUR WORLD-CLASS TEAM

We are recruiting the best and brightest in the scientific world to build our research in key areas, including cancer and regenerative medicine.

Here are the latest scientists to join JAX.

Computational biology

Our scientists in computational biology investigate the precise makeup of both mouse and human genomes, and the similarities and differences important for translating preclinical research to clinical benefit. They are also analyzing the whole-genome structure, identifying gene networks and understanding gene expression and its regulation, constructing computational models from genomic data so that function and dysfunction can be predicted based on established patterns.

Peter Robinson, M.D., formerly professor of medical genomics at the Charité – Universitätsmedizin Berlin's Institute of Medical Genetics and Human Genetics in Germany, has joined the faculty as a professor. He specializes in developing medical databases and other bioinformatics resources and algorithms for research and clinical applications.

Roel Verhaak, Ph.D., has been appointed professor and associate director of computational biology at JAX. He was based at the University of Texas MD Anderson Cancer Center in Houston and is a recognized leader in big data analysis, with a focus on brain cancer genomics.

Sheng Li, Ph.D., has joined the faculty as an assistant professor from Weill Cornell Medicine in New York, where she was an instructor in bioinformatics. She studies cancer epigenome dynamics and their effect on cancer initiation and progression.

Computational systems biologist Mingyang Lu, Ph.D., has joined JAX as an assistant professor. He was most recently at Rice University (Texas), where he was a postdoc in the Center for Theoretical Biological Physics.

Stem cells and regenerative medicine

Stem cells may hold the key to breakthroughs in many of the Laboratory's research areas, with particular emphasis focused on their role in cancer and aging.

Martin Pera, Ph.D.

Martin Pera, Ph.D., is a leading stem cell researcher, with associated interests in neuroscience and regenerative medicine. He comes to JAX from the University of Melbourne (Australia), where he is chair of stem cell sciences. He will join the Bar Harbor faculty as a professor, and will begin full time in January.

William Skarnes, Ph.D., an expert in stem cell engineering who began his career studying mouse developmental genetics, has been appointed director of cellular engineering at JAX. Skarnes was previously based at the Wellcome Trust Sanger Institute near Cambridge, England, where he led that organization's stem cell engineering team.

Cancer research

JAX is using the latest research methods and tools to investigate a variety of cancers, including breast, lung, brain, gastric and blood. JAX's National Cancer Institute-designated Cancer Center provides robust support for its innovative research program, which combines patient and experimental data with advanced computational capabilities to better understand cancer and identify therapeutic targets. The goal is to provide oncologists with precise therapy options for each individual's cancer.

Cancer researcher Olga Anczuków, Ph.D., recently joined the faculty at JAX as an assistant professor. Anczuków studies RNA splicing in breast and ovary development, and how changes in splicing can affect tumor initiation, metastasis and drug resistance. She comes to JAX from the laboratory of Adrian Krainer, Ph.D., at Cold Spring Harbor Laboratory in New York.

Gary Ren, Ph.D., has joined the JAX faculty as an assistant professor. Ren investigates the role of the immune system in cancer metastasis and therapy resistance. He was an associate research scholar in the laboratory of Yibin Kang, Ph.D., at Princeton University.

Reproduction and development

Reproductive biology researchers at JAX have played pivotal roles in the field over the years. They developed media and methods that made new discoveries into gamete formation and early development possible, and helped lead to the development of *in vitro* fertilization and other clinical advances.

Beth Dumont, Ph.D., who was a summer student at JAX in 2002, has accepted a position as an assistant professor. Dumont studies variations in the cellular mechanisms of inheritance, including genetic recombination, chromosome segregation and *de novo* mutation. She comes to JAX after completing a postdoctoral research fellowship at North Carolina State University.

Stay up to date with the latest JAX news.
Visit *www.jax.org/news.*

George Sutphin with his son, Callum

From aerospace to aging

George Sutphin

It's not rocket science — George Sutphin's exploration of the processes underlying how and why we age is far more complicated.

"We're just scratching the surface of what's happening in aging. It is a rich field for discovery." – George Sutphin

George Sutphin, Ph.D., matriculated at the University of Washington to study engineering. Aerospace engineering to be exact, a solid choice in the Seattle, Wash., area, longtime home of the aerospace behemoth Boeing. But as he studied high-temperature plasma dynamics and vortex tubes for onboard liquid oxygen collection during space launch, his father suggested he study genetics because of its power and potential to affect people's lives.

Sutphin is now a JAX Scholar working in the research lab of Assistant Professor Ron Korstanje, Ph.D., where the pair is chasing down some of the most intriguing genetic mechanisms associated with life-span effects.

Learn more about George Sutphin and JAX research in aging at ***www.jax.org/spotlight.***

STORY BY MARK WANNER
PHOTOGRAPHY BY TIFFANY LAUFER

Exploring the science of aging

JAX computational scientist Duygu Ucar bridges the worlds of biology and computer science to unlock the secrets of aging and age-related disease.

STORY BY NICOLE DAVIS, PH.D.
PHOTOGRAPHY BY TIFFANY LAUFER
ILLUSTRATION BY KAREN DAVIS

Why and how the body grows old has long captivated both scientists and lay people. But now, as evidence mounts that some of the most devastating human diseases — such as cancer, diabetes and neurodegenerative disease — are intricately linked with the aging process, that curiosity has become a focus on unearthing new insights leading to therapeutic strategies.

To be sure, aging is a complex problem to crack, in part because it involves inherited factors (genes) and external forces, like diet, lifestyle and the environment. One place where those worlds are thought to come together is the epigenome — the layers of information that surround DNA and, like a puppeteer pulling marionette strings, help determine when and where different genes get activated. For JAX Assistant Professor Duygu Ucar, Ph.D., the epigenome forms a kind of ground zero — a place to learn how biological differences, etched into our genomes and epigenomes, contribute to aging and age-related disease.

"If we want to understand what happens when we age, then we need to approach the problem from multiple biological angles," explains Ucar. "Genomic and epigenomic methods allow us to do that, but to integrate and understand those data, we need powerful computational approaches."

Ucar's first love, scientifically speaking, is computing. Formally trained as a computer scientist, she began her academic career in Turkey at the prestigious Bilkent University, ranked among the world's top universities. Because of her high scores on the school's entrance exam, she earned a full scholarship and a rare invitation to matriculate in computer science.

To learn more about Ucar's research, visit *www.jax.org/ucarlab.*

Well versed

After earning her bachelor's degree, she moved to the U.S. to pursue graduate studies at The Ohio State University in Columbus, Ohio. There she began to wade into the vast ocean of biology, first developing algorithms to probe the intricate networks formed by interacting proteins, then uncovering key patterns that underlie their biological functions. As her fascination with biology grew, she began to explore other areas, including how genes get turned on (gene expression) and the DNA-binding proteins that help regulate this process (transcription factors).

For her postdoctoral work, Ucar turned to the laboratory of Stanford's Anne Brunet, a renowned expert on the biology of aging and longevity. There she became the sole resident computational scientist, recruited from a field of several hundred applicants to help Brunet's group make sense of its increasingly large genomic data sets focused on aging.

"Duygu really stood out because she was very strong in computer science, but she was also quite interested — and well versed — in biology," recalls Brunet. "That was quite rare."

Together with her lab colleagues, Ucar set out to study just one piece of the sprawling epigenome — a specific chemical signature, known as H3K4me3, which was considered to be important for longevity in the roundworm, *Caenorhabditis elegans*. The team wanted to know more about the signature and explored a variety of other organisms (including humans, mice and plants) as well as diverse tissue types (such as brain, liver and heart).

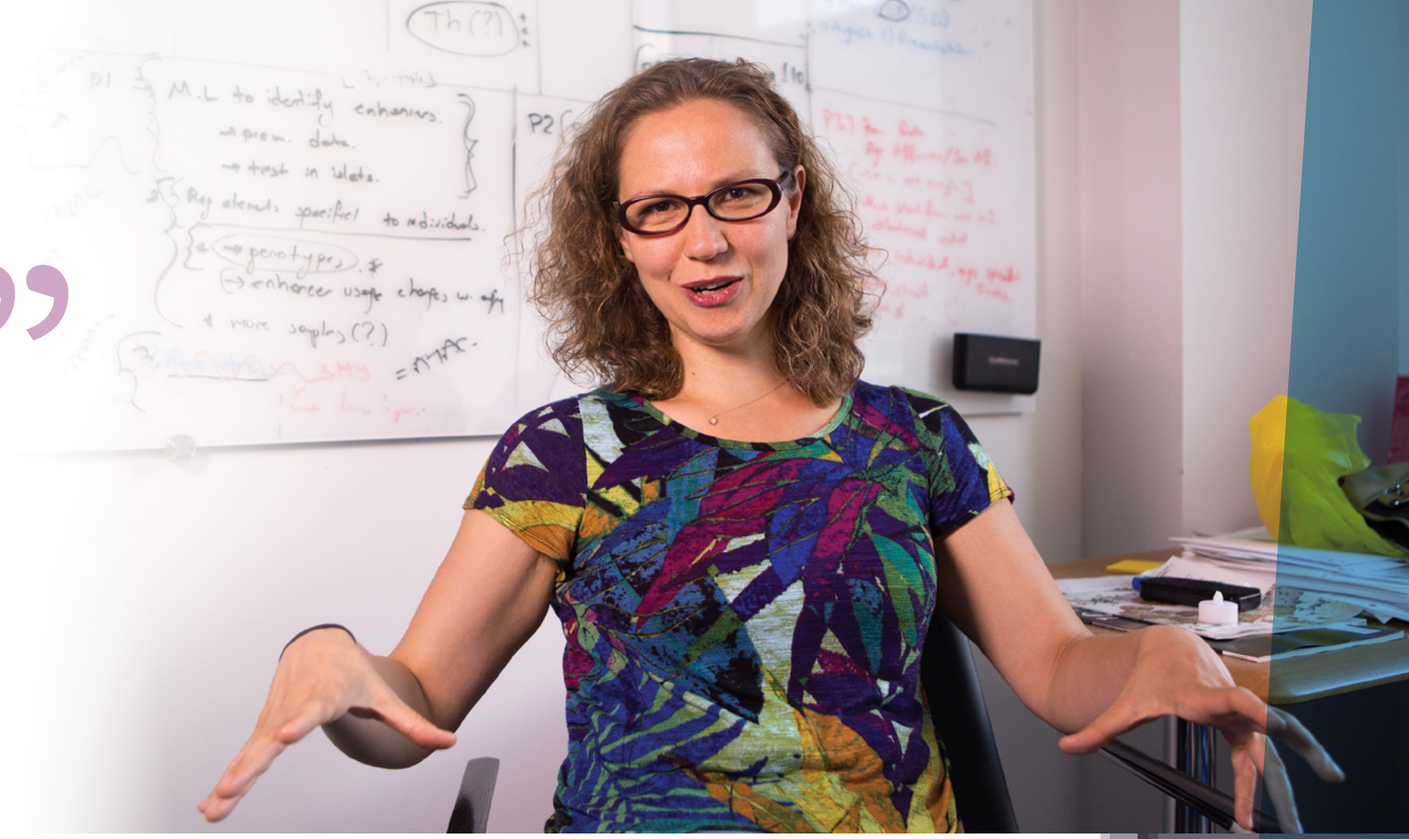
"This was a fairly comprehensive approach. We put together a database that included hundreds of different cell types," says Ucar.

By tracking the signature across diverse epigenomes, using machine learning and other analytical methods, Ucar and her colleagues made a surprising discovery. Instead of flagging short bits of the genome, as had been previously found, H3K4me3 also appears to fan out over much larger swaths, marking the genes that are essential in cell-specific functions. For example, in stem cells, genes that confer the unique capacity for self-renewal are marked by the H3K4me3 signature.

Though Ucar has since moved on and established her own laboratory at The Jackson Laboratory, Brunet's team is still pursuing these findings. It is also extending the scientific legacy that Ucar began. As both a researcher and a teacher, she not only inspired her colleagues to think about biological problems from a mathematical point of view, she empowered them with the skills they need to conduct their own computational analyses.

"Duygu is super smart, so she's able to quickly understand the question at hand," says Brunet. "But she's also very flexible in how she thinks about problems, and will try multiple types of analyses. That's a huge asset."

> *When we start a project, we discover a lot of computational challenges, some of which require further thinking and novel method development...*
>
> – Duygu Ucar, Ph.D.



A rising star

As an assistant professor at JAX, Ucar continues to explore the connections between epigenomics and aging. But for now, she has her sights set on one system — the human immune system.

"As you grow older, your immune cells become less functional, which is known as immunosenescence. Immunosenescence contributes to age-associated increase in diverse diseases." explains Ucar. "Uncovering the mechanisms behind immunosenescence is a first step toward delaying or curing it."

For this work, Ucar is collaborating with JAX Professor Jacques Banchereau, Ph.D., and UConn physician-scientist George Kuchel,M.D. Together, the team is working to unlock the mechanisms of immune system aging by collecting and analyzing blood from roughly 100 individuals — young and old, healthy and frail.

"There are a number of scientific challenges here," explains Ucar. "One challenge is to integrate and analyze 'big data.' Not only do we have a lot of samples, but the data is also multidimensional."

Many of the datasets Ucar and her colleagues are collecting span the entire genome. They include measurements of RNA, transcription factor binding sites, as well as epigenomic characteristics, particularly chromatin accessibility profiles, which classify areas of the genome according to how "open" — meaning they can be read by the cellular machinery — or "closed" they are.

Ucar, Banchereau and Kuchel are also incorporating data from large consortium efforts including the Roadmap epigenomics project and the ImmGen database from the Broad Institute that have been made publicly available, further intensifying the data integration challenges. Despite these hurdles, the team's findings will help illuminate the genomic changes in immune system aging, and highlight potential biomarkers of healthy and unhealthy aging. Ucar and her colleagues plan to extend these studies to include frail elderly and individuals with diseases (such as systemic lupus) to uncover genomic patterns that are associated with pathologies.

Further insights into age-related diseases will also flow from another project Ucar is leading together with JAX Assistant Professor Michael Stitzel, Ph.D., whose lab studies type 2 diabetes. Together, the team is taking a close look at the genomics of human pancreatic islets, which are considered to be the disease's epicenter. Ucar and Stitzel are co-mentoring a graduate student, Shubham Khetan, who is studying the changes in the epigenomes of healthy and diabetic islet samples. Through this work, the team hopes to gain a clearer understanding of what goes wrong on a cellular and molecular level in type 2 diabetes.

This collaborative project underscores a common theme that runs throughout Ucar's work. By leveraging her and her lab's expertise in bioinformatics, network theory and machine learning they seek to drive innovation both in informatics and in genomics of human aging and aging-associated diseases.

"When we start a project, we discover a lot of computational challenges, some of which require further thinking and novel method development," says Ucar. "By studying these big data sets in the context of aging or age-related diseases, we not only understand the data more, we also understand what algorithms are missing and how we can develop novel computational methods." One such tool developed in the Ucar lab was recently published at Plos CB and is accessible online (*https://quin.jax.org*) for the integration of diverse genomics data in the form of interaction networks.

Indeed, just as genomic technologies can propel scientists into unexplored worlds, Ucar and her colleagues are helping to pave the way toward a deep knowledge of human biology and disease.

"She is really poised to make great discoveries," remarks Brunet. "I'm looking forward to seeing how high her star will rise."

CREATING A PARADIGM SHIFT IN HEART DISEASE

Physician-scientist J. Travis Hinson harnesses modern tools and technologies to unlock the biology of heart failure, laying the foundation for more precise, effective therapies.

STORY BY NICOLE DAVIS, PH.D.
PHOTOGRAPHY BY TIFFANY LAUFER
ILLUSTRATION BY ZOË REIFSNYDER, DANIELLE MEIER AND MATT WIMSATT

Some of the most transformative discoveries happen when different disciplines come together.

Indeed, these "scientific borderlands" can be particularly fertile ground for physician-scientists, like J. Travis Hinson, M.D., who blend clinical medicine and biomedical research to tackle important problems in human health. Hinson joined the faculties of The Jackson Laboratory and UConn Health as an assistant professor some six months ago, and is applying interdisciplinary tools and approaches to understand inherited forms of heart disease, especially disorders that affect cardiac muscle cells (known as cardiomyopathies).

"In academic medicine, we identify people as being a 'triple threat' if they have excellence in research, clinical skills and teaching — because that's our tripartite mission. And yet, these individuals are increasingly rare, as it grows harder and harder to do everything," explains Thomas Michel, M.D., Ph.D., a cardiologist at Brigham and Women's Hospital and professor at Harvard Medical School who mentored Hinson during his clinical and research training. "Travis is one of the few individuals, of really any generation, who has outstanding accomplishments in all of these areas."

Travis Hinson, M.D., holds a joint faculty appointment with UConn Health and JAX.

MAKING A DIFFERENCE

Hinson moves so seamlessly between fields perhaps because his own career began at the intersection of multiple scientific specialties. As an undergraduate at the University of Pennsylvania, he took a summer internship at DuPont in New Jersey to pursue his interests in chemistry and engineering. But he soon realized his passion for science needed a real-world focus. "While I loved science, I didn't necessarily love science for the sake of making chemicals for the automotive industry," says Hinson. "I wanted to do science that made a difference in people's health."

That same summer, he decided to delve into clinical medicine by volunteering in the emergency department at a local hospital. One day, while shadowing the cardiologist on duty, a patient was wheeled in, clearly in distress and suffering from a heart attack. Unfazed, the doctor sprang into action.

"I was immediately impressed, not just by his understanding of medicine but also by his calm, cool and collected approach," recalls Hinson. "When everyone else was basically freaking out, he was very comfortable. I really respected that."

Those early clinical experiences also cemented Hinson's interest in the heart. "It's a relatively simply organ, in the sense that it pumps blood. Really all of its function is around that capability, which is something I was very familiar with from my engineering studies," he says.

DRAWN TO THE LAB

When Hinson returned to college after that formative summer, he switched his major from engineering to chemistry. He also joined the laboratory of Robert J. Levy, M.D., a pediatric cardiologist and researcher at The Children's Hospital of Philadelphia. There he worked on a project harnessing gene therapy techniques to make artificial heart valves and other cardiovascular devices more durable. Through this early foray into biomedical research, Hinson not only deepened his interest in basic science, he also began to appreciate how rewarding and intellectually satisfying the work of a physician-scientist could be.

So, after earning a bachelor's degree in 2002, he moved to Boston to begin medical studies at Harvard Medical School. Even before classes began, he was back at the laboratory bench — this time under the mentorship of Christine Seidman, M.D., a cardiologist and human geneticist who runs a lab jointly with her husband, Jonathan Seidman, Ph.D.

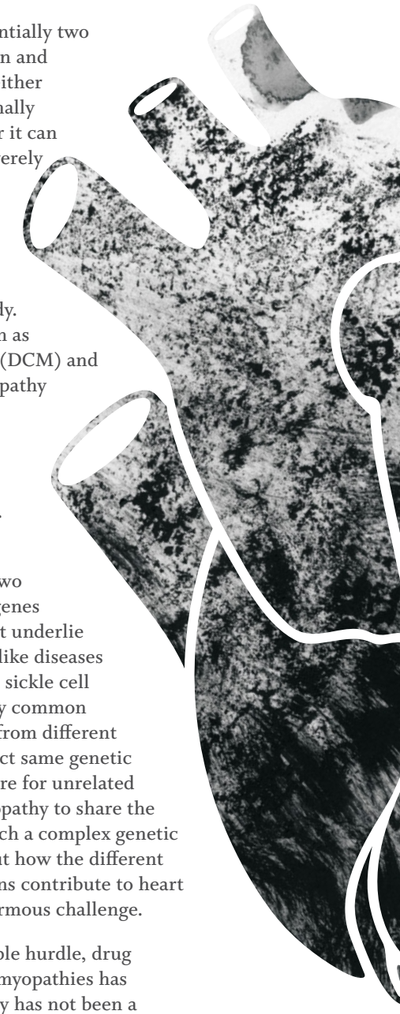
Although a primary focus of the Seidmans' research is heart disease, Hinson chose to lead a project focused on a rare, inherited condition known as the Björnstad syndrome, which is characterized by hearing loss and twisted, brittle hair. At the time, little was known about the molecular causes of the disorder, although the genetic culprits were thought to reside within a large swath of chromosome 2. Using genetic mapping techniques and DNA sequencing, Hinson homed in on the precise mutations, which map to BCS1L, a gene that functions in the assembly of key protein complexes in mitochondria, the cell's powerhouse.

In addition to casting light on disease biology, he also got an early glimpse of the power of genomic information. "I was fascinated by the potential for understanding new genes that cause human diseases, and how important that was to humankind." His research on the Björnstad syndrome was published in The New England Journal of Medicine.

After earning his medical degree in 2007, Hinson went on to Massachusetts General Hospital, where he trained in internal medicine, gaining broad skills in multiple clinical areas, including cancer, infection and cardiovascular disease. He then completed two years of subspecialty training in clinical cardiology at Brigham and Women's Hospital.

MATTERS OF THE HEART

Through his diverse training in science and medicine, Hinson realized that there were some significant stumbling blocks to gathering a deep, nuts-and-bolts knowledge of heart disease, particularly the cardiomyopathies. "One of the things that was clear through all of my experiences with heart disease was that we couldn't figure out anything mechanistically because we had no *in vitro* system to study the heart."



Cardiac muscle has essentially two paths toward dysfunction and ultimate failure. It can either dilate — become abnormally large and distended — or it can thicken. Both routes severely impair how well the heart performs as a pump, sending blood to the lungs, where it takes up oxygen, and then throughout the body. These conditions, known as dilated cardiomyopathy (DCM) and hypertrophic cardiomyopathy (HCM), can stem from pre-existing disorders of the heart, such as coronary artery disease, or from DNA mutations.

Fueled by advances in genomics over the last two decades, more than 40 genes have been identified that underlie cardiomyopathy. But unlike diseases such as cystic fibrosis or sickle cell anemia, where it is fairly common for affected individuals from different families to carry the exact same genetic type, it is exceedingly rare for unrelated patients with cardiomyopathy to share the same mutation. With such a complex genetic architecture, figuring out how the different genes and gene mutations contribute to heart disease has been an enormous challenge.

Because of this formidable hurdle, drug discovery for the cardiomyopathies has languished. "There really has not been a paradigm-shifting drug developed for heart failure in the last 20 years," says Hinson. Moreover, the few treatments that do exist are primarily aimed at controlling patients' symptoms, not slowing or halting their disease.

Hinson aims to improve this picture. Using a novel system he pioneered during his postdoctoral fellowship, he and his team are

now unraveling the effects of genetic mutations on cardiac biology. “We basically try to rebuild a little piece of a patient’s heart in a dish,” he explains.

He combines cardiac muscle cells with support cells, such as fibroblasts, and other key factors, including extracellular matrix proteins. Although these tiny, three-dimensional structures do not pump blood, they do contract rhythmically, and their pace of beating can be regulated.

Importantly, this system harnesses multiple recent advances in both stem cell and genome editing technologies. With these capabilities, Hinson and his colleagues can isolate skin or blood cells directly from cardiomyopathy patients and coax them to form heart muscle cells, making it possible to study the biological effects of patients’ own mutations. Moreover, he can correct those mutations, or create additional ones, to further probe how genetic differences influence heart biology.

Part of the allure of Hinson’s heart-in-a-dish approach is that it can be readily applied to study other forms of heart disease. It can also be leveraged for drug discovery, providing a platform to screen and test compounds with therapeutic potential in a wide range of cardiovascular diseases.

THE PROMISE OF PRECISION MEDICINE

In addition to his research lab based at JAX, Hinson continues to practice cardiology at UConn Health. He helps run a specialized clinic focused on genetic forms of heart disease, including cardiomyopathies, as well as arrhythmias, connective tissue disorders and other conditions.

“We have an exciting opportunity to provide clinical services in cardiac genetics in the corridor between New York and Boston,” he says. That means state-of-the-art genetic testing, including gene panels and genome sequencing, as well as genetic counseling for both patients and family members to help inform disease diagnosis and guide treatment. Although there are only a handful of treatments now available,

Heart cells beat on their own. Their movement is illustrated in this artist’s rendering and is inspired by Hinson’s work with bio-engineering pluripotent stem cells. Learn more and watch a video of these heart cells in action at *www.jax.org/hinson*.

Hinson believes this clinic will be uniquely poised to take advantage of a new generation of personalized treatments that are precisely tailored to patients’ specific gene mutations.

He adds, “It is important for the community to know that many of our patients can be taken care of with their existing providers, once we do our evaluation.” He encourages other health-care providers in the area to contact him if they suspect their patients suffer from a heart condition with a genetic basis.

“Travis really is a quintessential physician-scientist,” says Bruce Liang, M.D., dean of UConn School of Medicine and director of the Pat and Jim Calhoun Cardiology Center at UConn Health. “He has a remarkable ability to link basic science with important clinical problems, and his work holds a great deal of promise for developing new treatments for patients with cardiomyopathy.”

Liang adds, “I wish there were two or three Travis Hinsons.”

David Brancaccio is the host of NPR's Marketplace Morning Report and a 1977 alumnus of The Jackson Laboratory's Summer Student Program.

LET'S DO THE NUMBERS

STORY BY
JOYCE PETERSON
PHOTOGRAPHY BY
TIFFANY LAUFER

David Brancaccio brings the scientific method to business reporting

If you listen to National Public Radio when you're pouring your first cup of coffee in the morning, or in the car on the way to work, you know that warm, familiar voice, and that unique combination of insightful reporting and sly wit.

David Brancaccio is the host of American Public Media's Marketplace Morning Report, a brisk, informative and entertaining summary of the day's business and financial news. In about eight minutes, Brancaccio and his colleagues cover the expected interest rate predictions, pharma mergers and so on, but also aspects of the economy you've never thought about: a black market for maple syrup, the environmental impact of avocado farming, the technology used to determine the winners at this year's Olympic Games.

Brancaccio started his distinguished broadcasting career at Marketplace in 1989 as the program's European editor based in London, becoming senior editor and host in 1993. He left Marketplace in 2003 to join Bill Moyers on the PBS program Now, and to contribute to many other broadcast, electronic and print media, returning to Marketplace in 2011. He has earned the highest honors in broadcast journalism, including the Peabody, the Columbia- duPont, the Emmy and the Walter Cronkite awards.

His 2000 book, "Squandering Aimlessly," recounts a pilgrimage across America to learn how people apply their personal values to their money, and his 2012 feature documentary film, "Fixing the Future," explores sustainable options for the economy.

Brancaccio credits his ability to condense complex, unfamiliar topics into jargon-free radio reports in part to the scientific training he received almost four decades ago, when he was a 17-year-old high school junior participating in The Jackson Laboratory's Summer Student Program.

Fresh from the morning's broadcast, and relaxing in the coffee lounge of the newly renovated Marketplace offices in midtown Manhattan, Brancaccio recalls the summer of 1977. "Plunging into the deep end of immunology" in the laboratory of Marianna Cherry, Ph.D., he says, emboldened him to communicate about complicated subjects.

"If I could get enough of an understanding of something at the professional level, in a short amount of time," he says, "and not embarrass myself in front of a senior staff scientist at The Jackson Laboratory, I knew I could probably acquire whatever it is I need to know."

Brancaccio, who in the last week interviewed a Nobel laureate and several government officials and scientists, says he always questions the sanctity of expertise. "You often have these high priests of a subject communicating, either with body language or directly, that this isn't for the unwashed. I never accept that."

During the months before the great economic crisis of 2008, he recounts, "We knew that bubble was going to pop, but there were these very smart people saying to me, 'Oh, if you had an advanced degree in economics, you'd understand that all this stuff is hedged and it's very sustainable.' Partly because of my experience at the lab those years ago, I can learn enough about something so that I can ask educated questions. I think that really did help me a lot in the work that I do."

Growing up with radio, travel, biology

By the time Brancaccio came to The Jackson Laboratory's headquarters in Bar Harbor, Maine as a summer student, he was already a world traveler and experienced radio professional.

Brancaccio was born in New York; when he was three years old his family moved to Waterville, Maine, where his father was a professor of American literature at Colby College. (Today pronouncing the word odd like awed is the only audible trace of northern New England in his diction.) His mother taught at the junior high Brancaccio attended, and was an actress and theater director. The family traveled extensively, including a year in Italy and summers in Europe for his father's research.

The radio bug hit Brancaccio early. "My Uncle Sam was an amateur radio operator, and when I was three, he let me talk on the air," he recalls. "I still remember the call sign, WB2EZL, Easy Zanzibar Lover." By the time he was in high school, Colby College had started a 10-watt FM station, WMHB; when no college students signed up for the Saturday 6 a.m. block, Brancaccio stepped in to read the news off the wire.

In the spring of 1974, the Brancaccio family moved to Madagascar, funded by his father's Fulbright fellowship. "It was this amazing place, with beautiful tropical beaches and lemurs everywhere. We survived a cyclone that ruined the town, and there was a coup d'état and martial law, with shooting in the streets. But if you read my letters home to my friends, they're all about radio! Who's in and who's out at the local station."

In high school Brancaccio had an interest in science and participated in science fairs, which, he observes, is how many American kids come to science. He recalls being "not the swiftest card in the deck in some of the math classes," but clicked with biology in his sophomore year with the support of a great Waterville High School teacher, Jane Abbott.

"I could just see biology visually; math was a little more opaque to me. I was fascinated by how things work, which is probably the key concept of science," he says. It was Abbott who encouraged him to apply for the summer program at The Jackson Laboratory.

Science and science literacy

After four decades Brancaccio can recite verbatim the title of his 1977 research paper: "The effects of certain parameters on agarose suppression of the non-specific cytotoxicity of rabbit serum complement." Handed a photocopy of the paper from the JAX library, he thumbs through it and immediately critiques the writing style: "Pompous. Passive voice." He notes that although his research that summer failed to prove his hypothesis, "it wasn't pointless, and it advanced the cause of human knowledge, one part per quadrillion."

He says his experiences growing up, including the tumultuous year on Madagascar, had led him not to be physically afraid, "but this experience at the lab allowed me to never be intellectually afraid. If you give me a little bit of time, I'll be able to crack the basics of something so that as a reporter, I can ask some decent questions, and kind of understand the answer, and hopefully write a decent story."

Brancaccio did not pursue science in college, receiving a Bachelor of Arts in African studies and history from Wesleyan University in 1982 and a master's in journalism from Stanford University in 1988. But he is an eloquent supporter of science and science literacy.

David Brancaccio's mentor in the summer of 1977 was Marianna Cherry, Ph.D., seen in this photo with JAX faculty colleagues Ed Leiter, Ed Les and David Myers.

"I'm aware that journalists are generally horrible at science," he says. "And that often, scientists are aghast or outraged, justifiably, by some coverage. I'm also aware that some scientists aren't very good at communicating this stuff. And you'd hope that our elected officials would get expert advice, and sometimes they do. But we all have to sort of move in the direction of better science communication. Otherwise, these decisions are left to closed-door discussions, and I'm not sure that serves society.

"Also, we have an economy that needs people who think scientifically. We're desperate for young people to graduate in the STEM fields, and that means science education needs to start early, so that younger people are not afraid of learning science."

In 2000, Brancaccio came to Bar Harbor with his wife, poet and educator Mary Fortkort Brancaccio, and their three children to attend a reunion of JAX summer students. He gave a talk to the full auditorium in which he recounted how his summer of research had helped him to be a better journalist and citizen. He completed his talk by challenging The Jackson Laboratory to "take on a science writing summer student,"

Tamsyn Brann was a science writer working as part of JAX's Summer Student Program. She is a senior at Ardsley High School in Ardsley, N.Y.

to increase the pool of young writers who are able to grasp and communicate the complexities of biomedical research.

Since then JAX has hosted seven science writing summer students, who have produced a wide range of print, broadcast, web, photo and video projects. The 2016 student, 17-year-old high school yearbook editor Tamsyn Brann, had the opportunity to interview Brancaccio (see sidebar), after which he shared with her his interviewing tips and walked her around the Marketplace offices to introduce her to his journalist colleagues. "He was so great! I've heard his voice since before I was born," Brann exclaimed later with a big grin.

Asked what he would tell people about The Jackson Laboratory, Brancaccio replies, "I would tell them that there is this world-class medical and scientific research lab at the front doors of Acadia National Park, in Maine. It's a much more high-profile institution than it was when I was there, and I think that's good, because the work being done there is solving some of the great problems."

I grew up listening to NPR.

STORY BY
TAMSYN BRANN

I could recognize David Brancaccio's voice long before I understood the intricacies of Marketplace Morning Report. As I began my internship at The Jackson Laboratory, though, the world of radio (and Brancaccio) existed only on the periphery of my consciousness. Little did I know that the friendly voice that had informed me about the condition of the NASDAQ for almost two decades was partly responsible for the next 10 weeks that I would spend in Bar Harbor, Maine.

In 2000, David Brancaccio had suggested the inclusion of a science-writing internship at JAX — the position I occupy. Brancaccio was a summer student at JAX in 1977, doing wet lab research in the lab of the late Marianna Cherry. In the world of science, 40 years can be an extremely long time. JAX summer students today have technologies available to them of which Brancaccio could have only dreamed. Yet, as my conversation with Brancaccio conversation shifted toward life in Bar Harbor, very little seems to have truly changed.

He lived in the same place that the students live today — the historic Highseas mansion in Bar Harbor. He saw the original "Star Wars" where I now venture to watch "Finding Dory," and he probably walked to the same ice cream shops afterward. Brancaccio easily recalled the names of hiking trails I had walked along only days before we met.

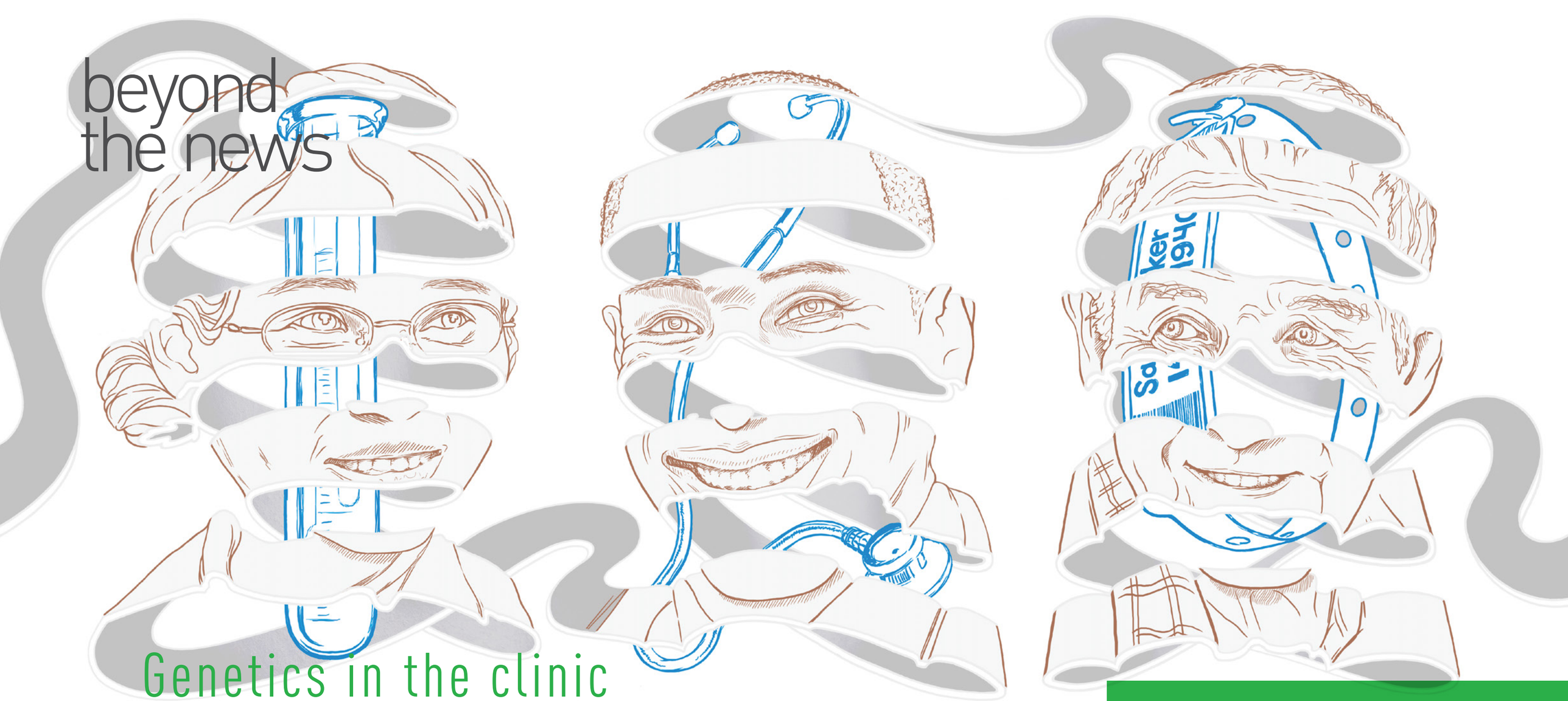
The JAX summer program is timeless. Though microscopes may be infinitely advanced, and research is hurtling toward cures faster than ever before, the experiences of students who live and work together are removed from expiration dates.

"It's one of the great life experiences," Brancaccio said, "being with a bunch of smart students in this magnificent mansion overlooking one of the most beautiful places on Earth, learning a complicated, difficult but very important way of exploring human knowledge."

As a science writer intern, my job is to make accessible to the public the incredibly complex and vital work being done at JAX. I'd assumed that whatever abilities I learned this summer would be helpful, yet specific — science writers write about science. But Brancaccio showed me how this skill set extends much farther: into Marketplace, for example.

"We need people who are mediators; they stand in between scientists and policy makers and the wider public," he said. "[We need people] who can understand this stuff, who can translate, and that's what I think a good science writer can do."

Though global economics and immunology research at JAX are on rather different ends of the scientific spectrum, the same knowledge of how to be intellectually unafraid is needed by both a seasoned radio host and a high school intern. Ten weeks at Highseas feeds into the creation of such a phenomenon within students, whether we aim to have our own labs or radio shows, the experience of hiking, cooking, rooming, working and bonding with other young, like-minded individuals is what crafts the unique confidence in our own abilities that lasts a lifetime.



Genetics in the clinic

STORY BY KATE REED
ILLUSTRATION BY
MATT WIMSATT

How do we educate physicians and nurses about the changing landscape of genetics and genomics?

Advances in genomics are rapidly uncovering the genomic contributors to disease and the number of evidence-based clinical applications is growing. However, there is often a long lag time between the generation of evidenced-based findings and adoption into practice. One reason for this is that many health-care providers feel unprepared and lack confidence to incorporate genomics into their practice.

Providing education in this area is a challenge, especially since genomics must compete for providers' attention in increasingly complex health-care settings. Research and experience tell us that knowledge alone is insufficient to change the behavior of practicing providers. It is necessary to develop resources that motivate them to change their practice and meet their needs in a variety of settings.

A number of groups including The Jackson Laboratory is working to develop genomics education to increase health-care providers' ability to maximize the use of genomic information to improve their patients' health.

The Clinical and Continuing Education Program at JAX is developing a suite of case-based, interactive programs to help increase the genomic literacy of health-care providers. Online modules use cases to help providers identify individuals at increased genetic risk for disease and apply genetic testing appropriately. Currently there are 10 modules that focus on genetic risk for cancer (***www.jaxge.org***), and future modules will address use of genomics in other areas of medicine (***www.jax.org/cepm***). In-person workshops allow providers to learn and practice clinical skills with the support of a genetics expert in real time (***www.jaxge.org/genomicmedicine***).

The Jackson Laboratory

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Actor Patrick Dempsey represented the Patrick Dempsey Center for Cancer Hope & Healing this summer during his visit with JAX President and CEO Edison Liu.
Photograph by Tiffany Laufer