

# research

at THOMAS JEFFERSON UNIVERSITY

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## ALSO INSIDE

Searching for a Universal Cancer Immunotherapy  
Saving Sea Turtles  
Latest Findings



## *When Art Brings Calm*

EXPLORING HOW IMMERSIVE ART CAN REDUCE STRESS PAGE 26



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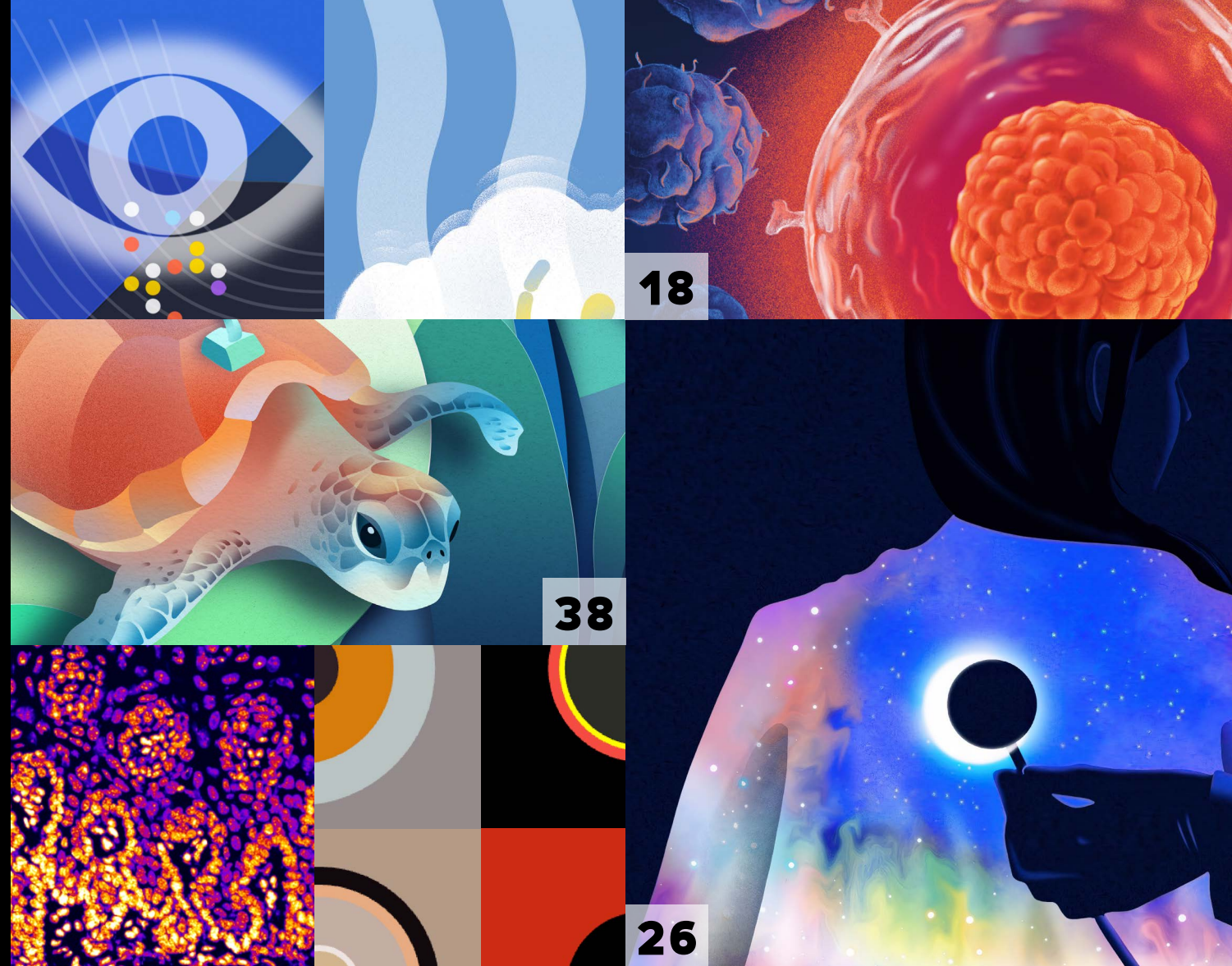
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18

38

26

## CONTENTS

18 Searching for a Universal  
Cancer Immunotherapy

26 When Art Brings Calm

38 The Hidden Virus Threatening  
Curaçao's Sea Turtles

3 Editorial: Building  
Multidisciplinary  
Synergy in Research

4 Six Steps Forward:  
Exploring Recent  
Discoveries at Jefferson

10 Building Sustainably  
with Origami

14 Destigmatizing with  
Dance Therapy

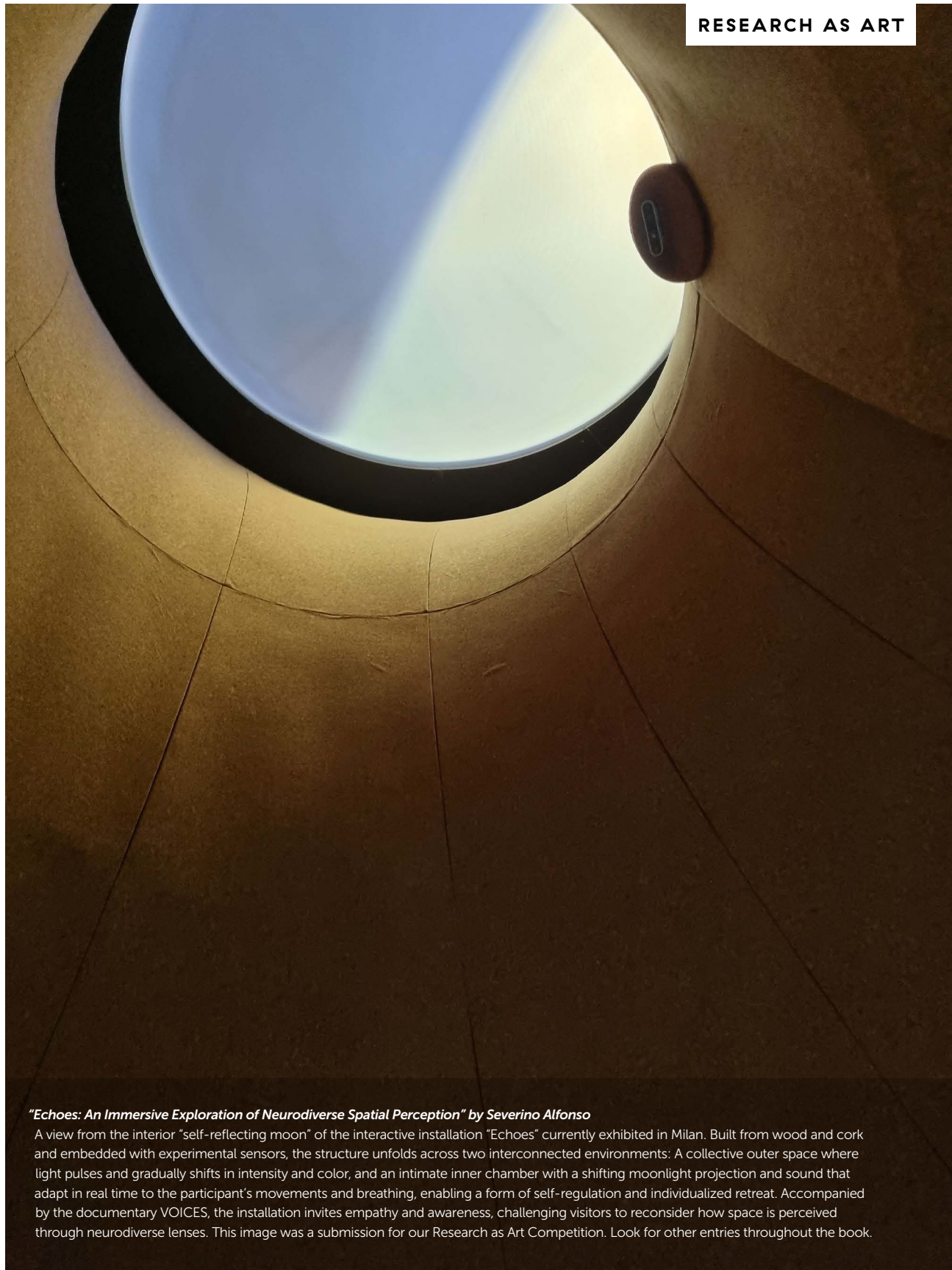
46 Gentle Shaking Could  
Promote Sleep  
and Fight Alzheimer's

48 Seeing the Sounds  
of Nature

52 Back Pain Relief: What  
the Internet Gets Wrong  
and How to Do it Right

54 Research Reads

## RESEARCH AS ART



**"Echoes: An Immersive Exploration of Neurodiverse Spatial Perception" by Severino Alfonso**

A view from the interior "self-reflecting moon" of the interactive installation "Echoes" currently exhibited in Milan. Built from wood and cork and embedded with experimental sensors, the structure unfolds across two interconnected environments: A collective outer space where light pulses and gradually shifts in intensity and color, and an intimate inner chamber with a shifting moonlight projection and sound that adapt in real time to the participant's movements and breathing, enabling a form of self-regulation and individualized retreat. Accompanied by the documentary VOICES, the installation invites empathy and awareness, challenging visitors to reconsider how space is perceived through neurodiverse lenses. This image was a submission for our Research as Art Competition. Look for other entries throughout the book.



## BUILDING MULTIDISCIPLINARY SYNERGY IN RESEARCH

David Whellan, MD

James C. Wilson Professor of Medicine, Deputy Provost for Research

Thomas Jefferson University is entering a new era for pursuing our mission of improving lives. It's an ambitious and exciting strategic vision, emphasizing connection and collaboration, future-focused experiential learning and creative discovery.

A core objective is continuing to build transdisciplinary synergies in research, education and health care — bridging professions and disciplines spanning the research spectrum. Contemplating the plan's goals from my vantage as Deputy Provost for Research, three things are especially exciting.

First: The strong foundation on which we're building is evident in the impact of our long investment in the groundbreaking work of Jefferson's scientists and scholars. You'll glimpse the breadth of that impact in these pages. It ranges from a more universal and efficient method of creating personalized cancer therapies to a role for primary care clinics in reducing opioid addictions; and from preserving ocean biodiversity to clarifying consumers' decision-making in online purchases.

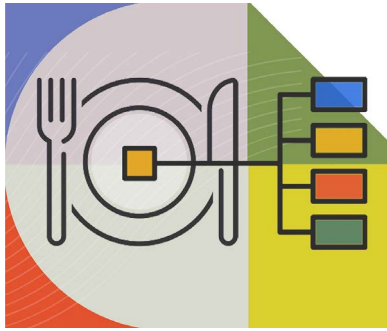
Second: We're working hard to expand the funding base that powers our researchers' increasing impact. Over the past decade, Jefferson's growing investments in creative and intellectually courageous investigators — and the state-of-the-art research technologies they need for their work — have catalyzed myriad discoveries and novel tools used worldwide. Today, we are earning new research funding from donors, foundations, corporations and agencies. At last count, Jefferson faculty submitted 353 grant applications this fiscal year and have received \$91.3 million, an increase of \$6 million over the same time last year. One stellar result is a [\\$12 million NIH grant](#) recently awarded to a multidisciplinary team of Jefferson researchers who are developing an innovative treatment strategy for asthma.

That award validates our faculty's scientific excellence. It illustrates our growing capacity to tackle complex research challenges from multiple perspectives, applying the full range of available knowledge and expertise through "team science." And it reflects Jefferson's long-held commitment to removing barriers that traditionally separated basic and discovery researchers from those pursuing translational, clinical and applied research. In fact, this magazine's cover story *When Art Brings Calm* (about the use of immersive art experiences to reduce patients' stress and enhance their well-being) is a great example of how we are nurturing transdisciplinary collaborations across the research spectrum to find new ways to improve people's lives.

Which leads to the third element that I find particularly exciting: the creation of the [Clinical and Translational Sciences Center \(CTSC\)](#) within Thomas Jefferson University's Sidney Kimmel Medical College. Supported in part through a transformative gift from philanthropists Sidney and Caroline Kimmel, the CTSC will speed translation of scientific discoveries into life-changing treatments and healthcare innovations. The beauty of this initiative is that, beyond improving patients' lives, it will deepen our ability to train excellent clinicians, create high-skill jobs in an array of industries and drive private sector investment.

I'm energized by what our Jefferson Research community is accomplishing today and by the prospect of what we'll achieve in the future. Please read on to learn about those accomplishments and bright prospects. [J](#)





## 03.

### AUTOMATED AND CUSTOMIZED NUTRITION ADVICE FOR CANCER PATIENTS

Good nutrition can contribute to the overall health of cancer patients. However, personalized dietary advice can be hard to access.

In a recent [study](#) published in *Nutrients*, a research team led by researcher [Nicole Simone, MD](#), at Sidney Kimmel Comprehensive Cancer Center tested two widely available large language models (LLMs) — ChatGPT and Gemini — to generate meal plans and grocery lists for specific patient characteristics.

Sidney Kimmel Medical College student and first author, Julia Logan, tested prompts for several variables including cancer stage, other health conditions, budgets, geographic location and cultural preferences.

“It would be nearly impossible to build a specialized model from scratch,” says co-author and computational physicist [Wookjin Choi, PhD](#). “The general LLMs provide a starting place, and then we develop it, score it, adjust it and create a new specialized model.”

“We were pleasantly surprised by the granularity the tools achieved, such as cost and nearby grocery stores with available ingredients,” says Dr. Simone, the Margaret Q. Landenberger Professor of Radiation Oncology. The LLMs were also able to generate meal plans tailored to socioeconomic and cultural considerations, promoting adherence by integrating financial constraints and ethnic food choices.

This study demonstrated the feasibility of creating an AI tool to generate and support dietary advice tailored to cancer patients. The team is now identifying the limits of the AI tool’s reliability and when oversight by professional dietitians is needed.

By Jill Adams

## 04.

### HOW PRIMARY CARE CLINICS CAN HELP CURB THE OPIOID EPIDEMIC

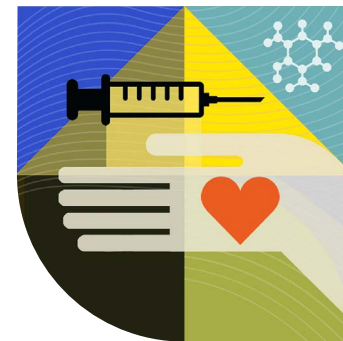
Overdose deaths from synthetic opioids such as fentanyl have increased [more than 100-fold](#) since 1999. Many barriers exist to people with opioid use disorder (OUD) getting lifesaving medications, from lack of provider training to social stigma.

“These things can be major barriers when you’re in the throes of withdrawal or addiction,” explains psychologist [Erin Kelly, PhD](#).

Dr. Kelly led a team along with fellow researcher [Gregory Jaffe, MD](#), to pilot a substance use disorders clinic embedded within the Jefferson family medicine clinic and residency program, aiming to create low-barrier access to lifesaving medications within primary care.

Primary care providers (PCPs) are often a patient’s first point of contact in the medical system, making them a key route for prescribing OUD medications. PCPs in the practice first received X-Waiver training — a certification that was required up until 2022 to prescribe certain OUD medications. The physicians also completed training in harm reduction and trauma-informed care.

**PCPs are often a patient’s first point of contact in the medical system, making them a key route for prescribing OUD medications.**



From their findings published in *Substance Use & Misuse*, patient feedback was overwhelmingly positive: They appreciated how effective and easy the treatments were to access, noting that they didn’t feel stigmatized by their PCPs.

Dr. Jaffe says programs like these can position PCPs at the front lines of combating the opioid epidemic. Sidney Kimmel Medical College students Sarah Lawson, Allie Hamilton, Jordan Lazarus and postdoctoral researcher Erica Li, PhD, helped conduct the study.

By Marilyn Perkins

## 05.

### HOW BRANDING AFFECTS ONLINE SHOPPING BEHAVIOR

When consumers are bombarded with seemingly endless options online, what determines where shoppers will look first? Fashion merchandising researcher [Shubha Bennur, PhD](#), led research that sheds light on this question.



In a study recently published in the *Journal of Textile Science and Fashion Technology* using novel eye-tracking software, Dr. Bennur looked at consumers’ decision-making process when shopping online for jeans.

The study participants were 75 college students, who looked at mock product pages of branded and unbranded products. As participants browsed, Dr. Bennur discovered that the eye tracker generated different hot spots and gaze plots on areas of interest that they focused on when they compared a branded vs. an unbranded product.

For the branded jeans, participants spent the most time looking at product pictures and focused on

the different color choices for almost eight seconds before going on to read the product description. For unbranded jeans, participants spent about 13 seconds on average looking at product reviews and the description before looking at the photo of the jeans.

“I think that really helps them make their decision. They want to see the product features up close. They want to see the reviews to establish that trust,” says Dr. Bennur.

In the future, Dr. Bennur hopes to explore how consumer behavior is impacted by age, culture, artificial intelligence and shopping on social media.

By Deborah Balthazar

## 06.

### EXPLORING OUR COMPLEX CONNECTIONS WITH SIBLINGS

Research has shown that many people [spend more time with their siblings than with anyone else](#). That means siblings can have as much impact on a person’s perspective and behavior as parents do.

Psychology researcher [Hamide Gozu, PhD](#), has studied how [parenting styles](#) and [varying cultures](#) can each shape sibling interactions. Currently, working toward the goal of strengthening family bonds and reducing conflicts, she’s investigating how specific personality traits shape individuals’ responses to differing patterns of experience in family interactions.

Dr. Gozu is pursuing two research projects designed to assess the myriad factors at work.

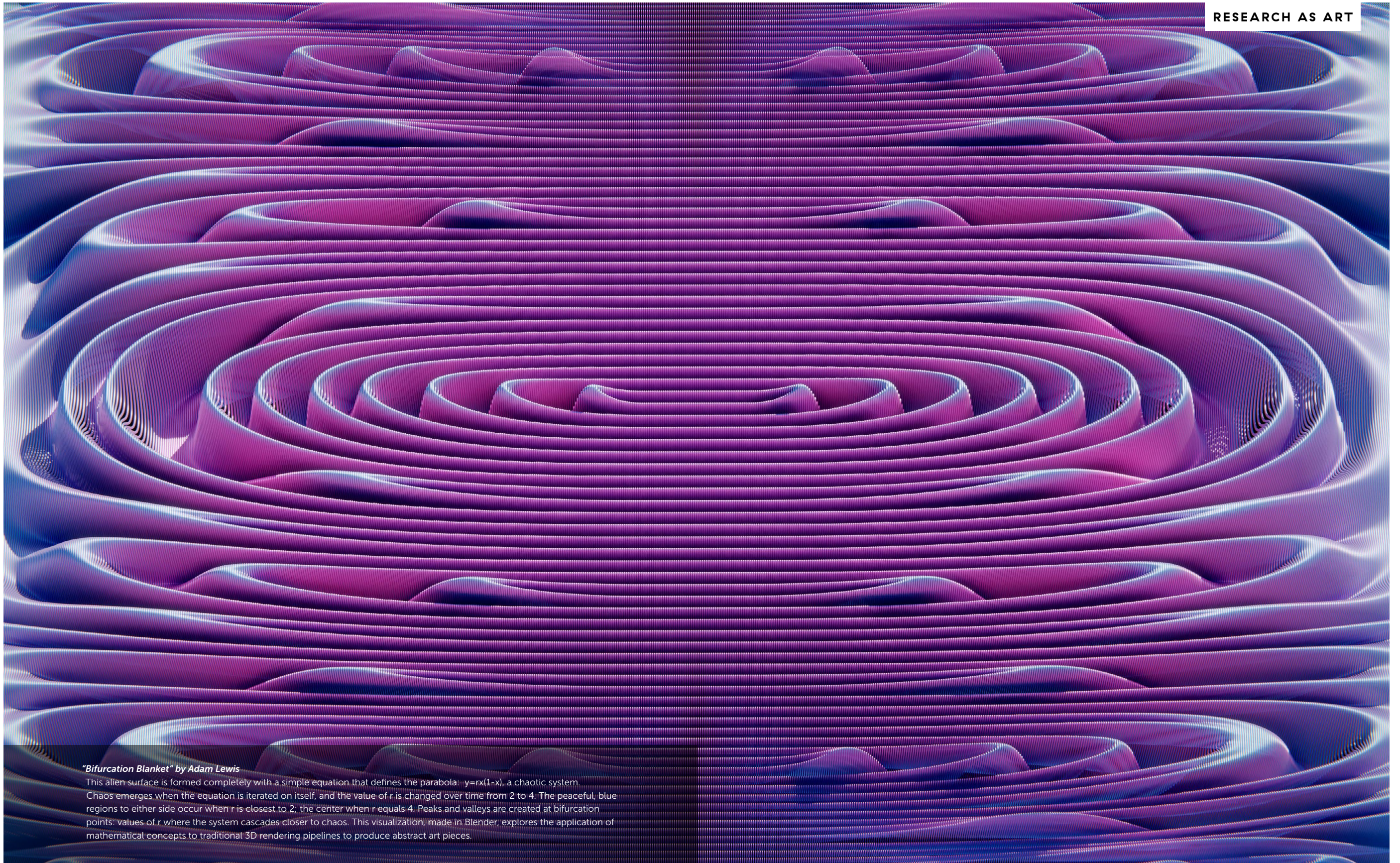
The first, done in collaboration with fellow psychology researcher [Jenna Rieder, PhD](#), examines how a person’s sense of well-being is shaped by different patterns of parents’ treatment of each sibling. The researchers hypothesize that differences in parents’ financial or emotional support for each child — combined with how siblings interact in response to those differences — can have distinctly different effects on the siblings as adults.



**Research shows that siblings can shape our perspectives and behaviors just as powerfully as parents.**

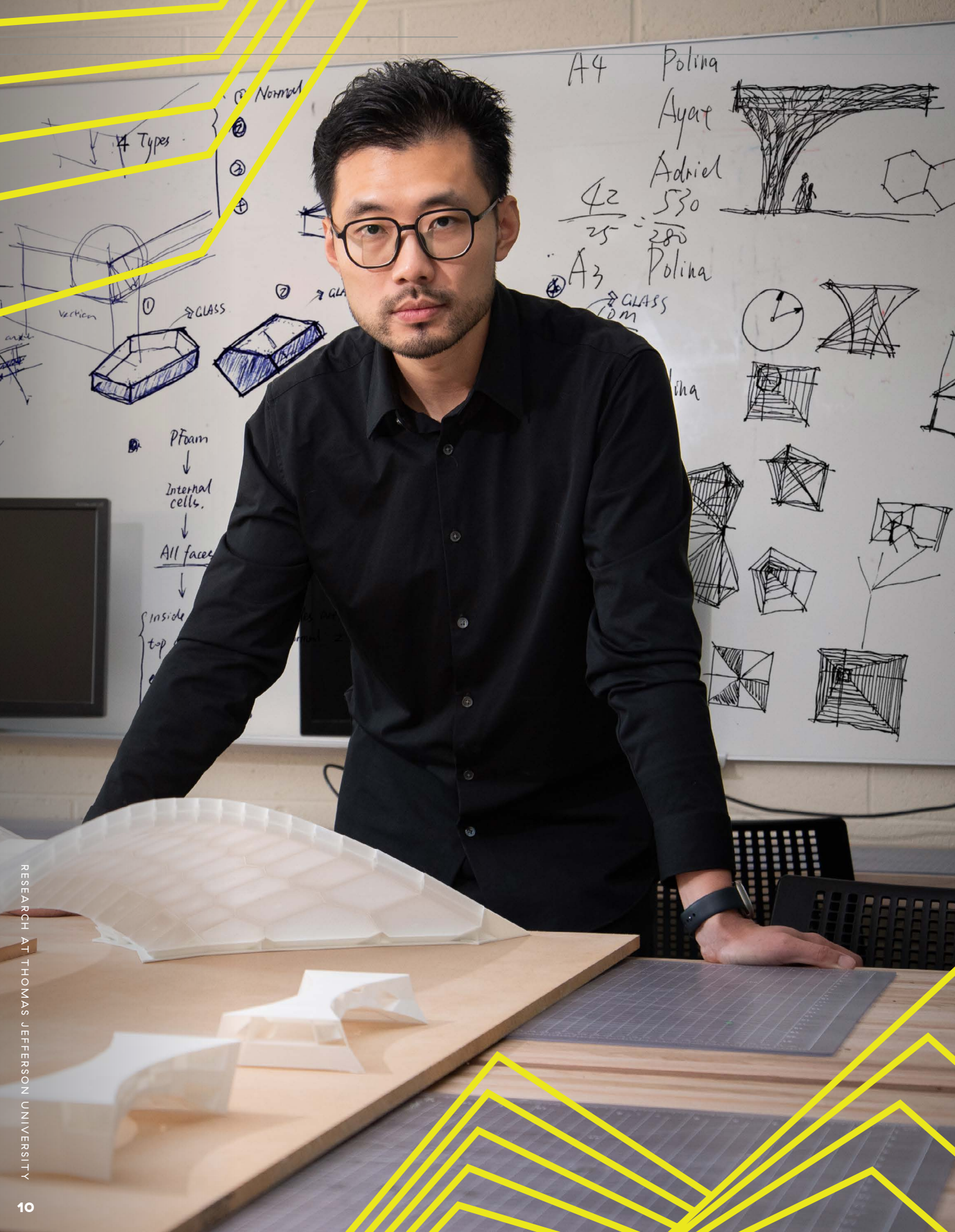
The second study explores how a child’s exposure to aggressive family environments — such as parental aggression or sibling bullying — may contribute to that person engaging in intimate partner aggression as an adult. Dr. Gozu hypothesizes that such experiences may prompt a “moral disengagement” that desensitizes individuals to harmful behaviors in later relationships. “If that is the case, we may be able to design therapies that help people overcome those effects.”

By Deborah Balthazar and Merrill Meadow



**"Bifurcation Blanket" by Adam Lewis**

This alien surface is formed completely with a simple equation that defines the parabola:  $y=rx(1-x)$ , a chaotic system. Chaos emerges when the equation is iterated on itself, and the value of  $r$  is changed over time from 2 to 4. The peaceful, blue regions to either side occur when  $r$  is closest to 2; the center when  $r$  equals 4. Peaks and valleys are created at bifurcation points: values of  $r$  where the system cascades closer to chaos. This visualization, made in Blender, explores the application of mathematical concepts to traditional 3D rendering pipelines to produce abstract art pieces.



Yao Lu, PhD

# BUILDING SUSTAINABLY WITH ORIGAMI

How computational design and folding techniques are transforming architecture to save costs and cut carbon emissions.

By Deborah Balthazar  
Photographs ©Thomas Jefferson University Photography Services

For centuries, architects and builders have relied on geometrical principles to create sound structures: The fan vault of King’s College Chapel in Cambridge, the dome of the Pantheon in Rome, the arches of the Aqueduct of Segovia, and modern examples such as the Oculus Transportation Hub in New York City and the Salginatobel Bridge in Switzerland.

But as the number of built structures on Earth grows, it also comes at a cost to the environment.

Architecture researcher [Yao Lu, PhD](#), is on a mission to make the design and construction process more sustainable. Using innovative methods, like the Japanese folding techniques of origami and kirigami, he creates lightweight, efficient and stable structures that use less materials, saving money and reducing carbon emissions in the process of construction. Find out more about Dr. Lu’s research and the questions he’s trying to answer.



**How would you describe your research to someone riding the elevator with you?**

My research focuses on designing lightweight and strong structures with the help of emerging computational technologies. Instead of relying on high-strength structural materials, I design structures that provide strength through their geometries. Nowadays, advanced computational techniques allow us to create even more complex and efficient shapes. They help reduce material usage and make it possible to use modest non-structural materials for structural purposes.

**How do you create these lightweight, yet strong structures?**

I use flat thin sheet materials, such as metal sheets, wood panels and paper, to create efficient and stable spatial structures through origami folding techniques and kirigami, a variation of origami that involves cutting and folding. The key is the 2D-to-3D transformation, which allows us to take advantage of both configurations and reduce both material cost and energy consumption during fabrication and construction.

The 2D flat configuration is usually easy to process using various computer-aided manufacturing techniques such as laser-cutting, CNC milling and plasma cutting. The flat parts can be packed compactly for transportation. Once onsite, they can be folded into 3D configurations to gain structural strength.

**Why are sustainable approaches like this important for the construction industry, and how does it inform your research?**

On a personal level, I see it as a professional responsibility: The construction industry is one of the largest contributors to carbon emissions and resource consumption, and as architects and designers we have an obligation to rethink how we build. In architecture research, sustainability should not be treated as an afterthought, but as a catalyst for innovation that opens new creative opportunities.

**What first sparked your interest in this field?**

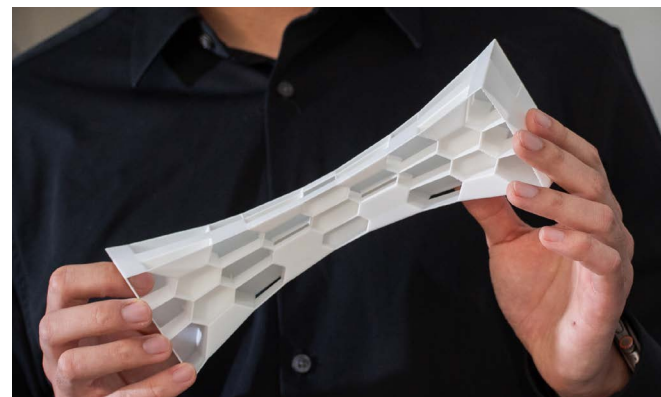
I've been interested in structural design since my undergraduate studies, but one project stands out. During my master's program, I visited the 2016 Venice Biennale and encountered the [Armadillo Vault](#), a large-span structure made of 399 unique limestone pieces, assembled without reinforcement. Spanning 16 meters with a minimum thickness of only 5 centimeters, it demonstrated the immense potential of structural geometry. I witnessed how form alone could create stability and strength. It was inspiring and deepened my commitment to exploring innovative structural design.

**What is the best memory you have from conducting your research?**

One of my most memorable research experiences was testing a structure to failure. Nothing can teach us more than pushing a structure to its limit and observing how it fails. During my graduate studies, we built a 3-meter span prototype bridge from standard float glass. Given glass's brittleness, no one trusted the bridge fully, despite simulations showing it would hold. Only after load testing to failure did we see its true capacity; it withstood a weight equal to seven adults at its weakest point!

**What's a unique or surprising fact about built structures?**


The [Cosmic Rays Pavilion](#) in Mexico City, built in 1951, uses a paraboloid shape to span 40 feet with a maximum thickness of just 5/8 inch, making it one of the thinnest reinforced concrete shells.



**What's something you're passionate about outside of your research?**

Long-distance running. It's a great way to stay fit and maintain high energy and endurance. Philadelphia offers numerous running events throughout the year, which keeps me motivated to train regularly. Plus, carb-loading meals before a race is a fun excuse to enjoy good food guilt-free.

**Who's a role model or someone who shaped your journey?**

I am fortunate to have had excellent advisers and colleagues over the years. As a young researcher myself, I try to follow the most valuable advice they've given me: to be patient and persistent in research. Challenges and setbacks are a part of the process, and it's through steady persistence that meaningful progress is made. 



**The construction industry is one of the largest contributors to carbon emissions and resource consumption, and as architects and designers we have an obligation to rethink how we build.** Dr. Lu





Jacelyn Biondo, PhD, MPH, MA

# DESTIGMATIZING WITH DANCE THERAPY

Using dance therapy to help patients with schizophrenia find community and belonging.

By Marilyn Perkins  
Photographs ©Thomas Jefferson University Photography Services

Schizophrenia affects [1 in 300 people](#) worldwide, often inducing symptoms such as hallucinations, delusions and disorganized thinking. It is one of the most complex mental health diagnoses to treat, and it is heavily stigmatized. [People with schizophrenia can feel judged](#) by society, family, friends and even healthcare providers. In fact, research shows that [mental health providers stigmatize people with schizophrenia](#) more than those with any other mental illness.

Health equity researcher [Jacelyn Biondo, PhD, MPH, MA](#), is working to change that, and she's incorporating the less explored method of [dance therapy](#) to do so. In this conversation, Dr. Biondo shares her personal experiences working with people with schizophrenia and how she thinks the field of schizophrenia treatment needs to evolve.



**How would you describe your research to someone riding the elevator with you?**

My research is rooted in creating community, belonging and intimacy for individuals with schizophrenia. Society often discards them out of fear or misconceptions about the illness. My work focuses on creating holistic treatment options, using embodied practices like dance therapy, with the goal of creating pathways to rehumanization and inclusion for these individuals who are so misunderstood by society. We all deserve to be seen, heard and respected. I want to help people with schizophrenia to build a more intimate relationship with their body through dance, which can extend to relationships with others as well.

**What first sparked your interest in dance therapy?**

I spent over a decade as a dance therapist at an inpatient psychiatric hospital on a unit where adults were involuntarily committed. I remember it as if it was yesterday. One day, I held the door open for my patients to enter, as I always did — a woman passed me, openly dialoguing with the voices in her head, gesticulating wildly, not noticing me as she entered the room for a group dance therapy session. Afterward, she looked me in the eyes and said, "This is the first time in as long as I can remember that I feel like my brain can breathe ... thank you for that." That night I went home and began looking at PhD programs in this field. I had to understand precisely how and why she had that experience.

**Why do you believe dance therapy is so powerful?**

I think dance therapy is magical, but also *deeply rooted in scientific theory*. My research has shown that dance therapy for individuals with schizophrenia, even just a single session, can diminish symptoms associated with schizophrenia and create feelings of *agency, belonging and self-efficacy*. In fact, I was recently contacted by a few psychiatrists in Italy who are looking to add dance therapy to their inpatient programming after learning about my research.

**Where is your research taking you next?**

I recently completed the first phase of a research project exploring how individuals with severe mental illness and substance abuse disorders interact with the healthcare system. This project was directly informed by a participant in one of my studies who was experiencing increased symptoms of schizophrenia in a dance therapy session. When I took time to ask him about his sleep, diet and relationships, he asked me if I could teach his doctors how to speak to him like I was. He said it was the first time he felt heard. I first surveyed healthcare students to identify ways in which they may be stigmatizing their patients with severe mental illness (SMI) and substance abuse disorders (SUD). I also conducted focus groups with people with SMI and SUD to learn more about their personal experiences. I'm currently applying for funding for the second phase, in which I collaborate with individuals with SMI and SUD to co-create and co-teach a de-stigmatization training program to healthcare students. The training will incorporate tenets of dance therapy.

**What is the best memory you have from conducting your research?**

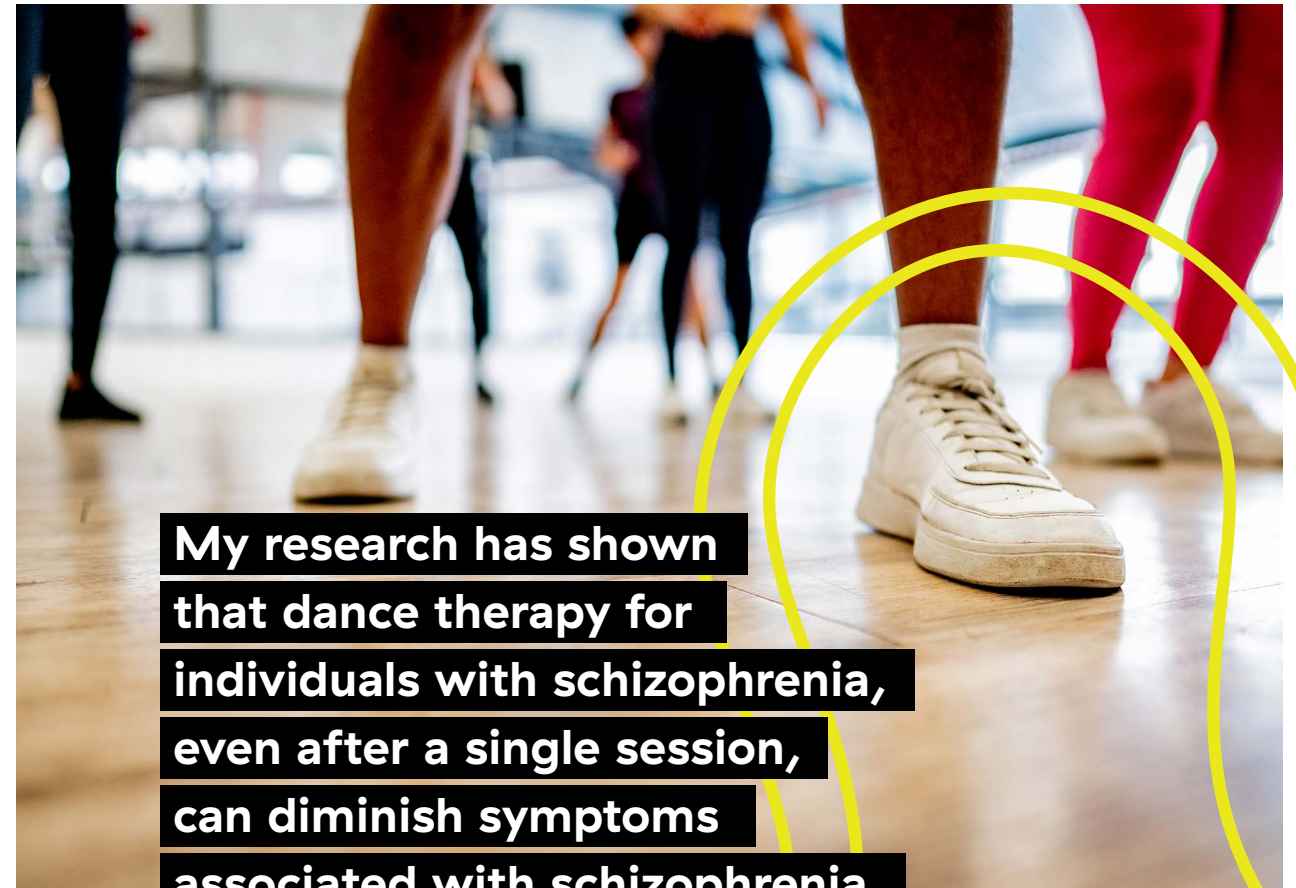
I remember a really special research participant. He had some of the highest symptom acuity I had seen: he was actively and consistently talking to voices in his head, he was extremely paranoid and wary of interactions with others. He believed he was being recorded by hidden cameras in the ceilings and both his thoughts and his movements were hyperactive. Historically, he would have been

excluded from the research, but he joined our study and was randomized to the dance therapy intervention. After the intervention, we interviewed patients about their experience. I remember watching his recorded interview with awe. The way he articulated himself was remarkable. He spoke about his transformative experience, likened himself to a metamorphosing butterfly and exhibited such pride in his role in our group session. He reminded me of why I do this work, and of how everyone told me that I would not get any "good data" from

people with schizophrenia because they were unreliable. I think about him all the time.

**What's a common myth about schizophrenia?**

That individuals with schizophrenia are dangerous. In fact, individuals with schizophrenia are more likely to be victims of violence rather than perpetrators of violence — 75-120% more likely than the general population. [↗](#)



**My research has shown that dance therapy for individuals with schizophrenia, even after a single session, can diminish symptoms associated with schizophrenia and create feelings of agency, belonging and self-efficacy.**

**Dr. Biondo**



# SEARCHING FOR A UNIVERSAL CANCER IMMUNOTHERAPY

An unlikely research partnership may enhance the reach and impact of CAR-T therapy for cancer.

BY DEBORAH BALTHAZAR | ILLUSTRATED BY GRACE RUSSELL

It was the spring of 2018 at Thomas Jefferson University's commencement ceremony, and [Adam Snook, PhD](#), and [Mý Mahoney, PhD](#), had never met before. They worked in two different departments on very different research projects. Dressed in their academic regalia, they shuffled inside to find their seats. Before the ceremony began, Dr. Snook, a cancer immunotherapy researcher, glanced at the name tag on the seat next to him and quickly looked it up on his phone.

"When I walked up to my seat, I saw this man on his phone," recalls Dr. Mahoney, a biomedical researcher who studies skin biology. "The next thing I knew, he leaned over and said, 'Hey, you want to work on CAR-T together?'"

This serendipitous exchange led to the start of a groundbreaking research project. Together, Drs. Snook and Mahoney have set out to work on a new version of CAR-T, one of the biggest advances in cancer immunotherapy. Their goal is ambitious: to potentially solve two of CAR-T therapy's biggest challenges. First, expanding CAR-T to treat a wide range of solid tumors for cancers like breast, colon, pancreatic, lung, prostate and liver, which the therapy currently doesn't effectively target. And second, making CAR-T accessible for more patients. The therapy's current mode of production requires a lot of time and money, and there's a limit to the number of people who can be treated with these potentially curative therapies.

By the time their students were crossing the stage, accepting their diplomas, Drs. Snook and Mahoney had already started charting their next steps.

## IMMUNOTHERAPY — A REVOLUTION IN CANCER TREATMENT

For over 160 years, scientists have searched for [ways to harness the body's immune system to fight cancer](#). Early efforts, dating back to the 19th century, explored whether infections could stimulate the immune system to attack tumors. By the 1960s, researchers had [identified key immune system components](#), like T cells, that played an important role in recognizing and eliminating early cancers. The first breakthrough in this line of research came in the 1980s, when researchers discovered that T cells could be genetically modified to recognize and destroy cancer. This led to the development of chimeric antigen receptor T-cell therapy, or CAR-T.



**“A ‘one donor, many recipients’ model is a challenging proposition, but it’s the only way to be able to scale CAR-T cells to treat many people in a single year.”**

— Dr. Adam Snook

The therapy is made by removing T cells from the cancer patient, turning them into stronger cancer-fighting cells in a laboratory, and then restoring them to the patient. The first-generation CAR-T cells, developed in the 1990s, showed promise in the lab and in mice, but failed in human trials. The modified [T cells struggled to persist in the body, and there was no reduction in tumor size](#). At the same time, other forms of immunotherapy — such as cancer vaccines and immune checkpoint therapies — were being explored as alternative strategies, but they each had their own hurdles.

In 2001, Dr. Snook had started his PhD research in the midst of these exciting times in immunotherapy. His early work focused on developing cancer vaccines, but by 2009, his focus expanded to include CAR-T therapy just as the field was experiencing a turning point. Researchers had developed a new generation of CAR-T cells, improving their ability to persist and attack cancer cells.

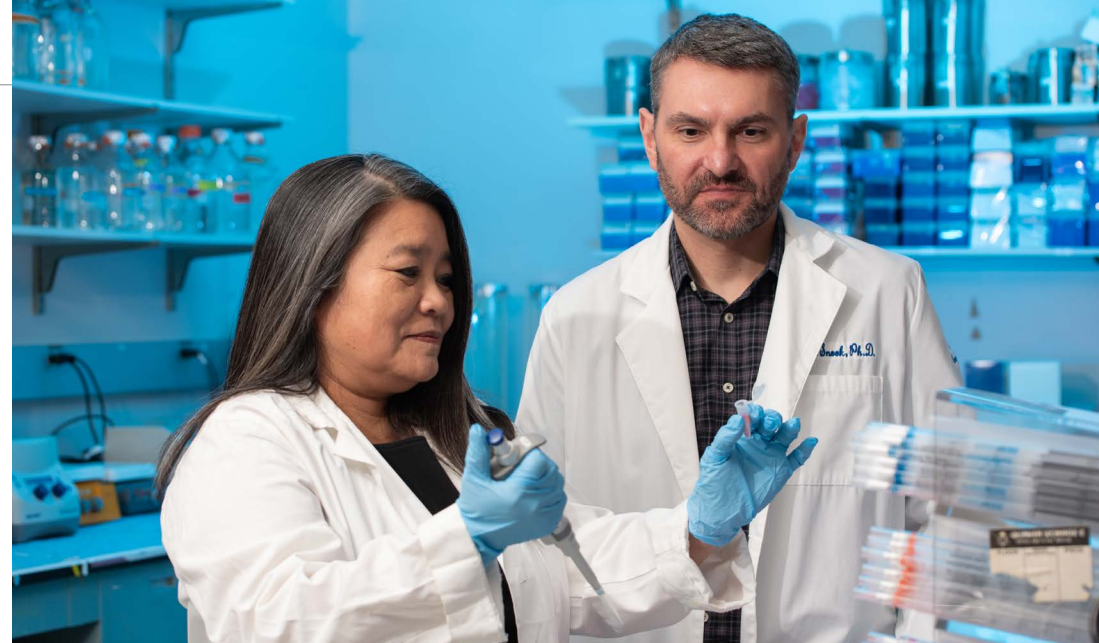
This led to the landmark FDA approvals of [six CAR-T therapies](#) between 2017-2022, which were made possible by years of clinical trials, and early high-profile successes, including the first successful use of CAR-T therapy in a [pediatric patient](#) in 2012.

But while it has been revolutionary for some cancers, CAR-T therapy has significant limitations. One is that it is highly personalized — each patient’s own immune cells must be collected, modified to recognize and target the patient’s specific cancer type and then infused back into the patient. Essentially, no two patients would ever receive the same therapy. For that reason, the process of making the therapy is both time-consuming and expensive, costing hundreds of thousands of dollars per patient.

“The current capacity is just a few thousand patients who can be treated annually,” says Dr. Snook. Because the therapy is generated for one patient at a time, there is a massive bottleneck on the number of patients that CAR-T can be manufactured for each year. “And so, we need to be able to do something different that could be applied more universally,” he continues.

Dr. Snook and Dr. Mahoney, associate professor and professor, respectively, in the department of Pharmacology, Physiology, & Cancer Biology, began to discuss more of a “one donor, many recipients” model. “It’s a challenging proposition, but it’s the only way to be able to scale CAR-T cells to treat many, many people in a single year,” says Dr. Snook.

Taking a universal approach would also allow for an expansion of the types of cancer for which CAR-T therapy can be used. But that raises a critical question: How do you take a one-person therapy and make it work for thousands without losing its incredible effectiveness? This is where the target protein underlying Dr. Mahoney’s research provided a potential solution.



↑ Dr. Mý Mahoney (left) and Dr. Adam Snook (right) prepare tissue samples for analysis.

## FROM DERMATOLOGY TO CANCER THERAPY: THE ROLE OF DSG2

The ideal target is one that answers one of the stickiest problems in immunotherapy: finding molecules that are unique to cancer cells and not found in normal cells. That way, the CAR-T therapy would not attack normal cells in an autoimmune reaction. Dr. Mahoney’s almost three-decades-long research on a family of proteins called desmosomes has shown that they have unique properties that make them very promising as a candidate for a semi-universal target.

Desmosomal proteins help hold skin cells tightly together and control growth. When Dr. Mahoney started to study the role of these proteins in autoimmune diseases of the skin, she came across a lesser-known type of desmosomal protein called desmoglein 2 (DSG2). It was largely overlooked, most likely because it was expressed in such low levels in the skin.

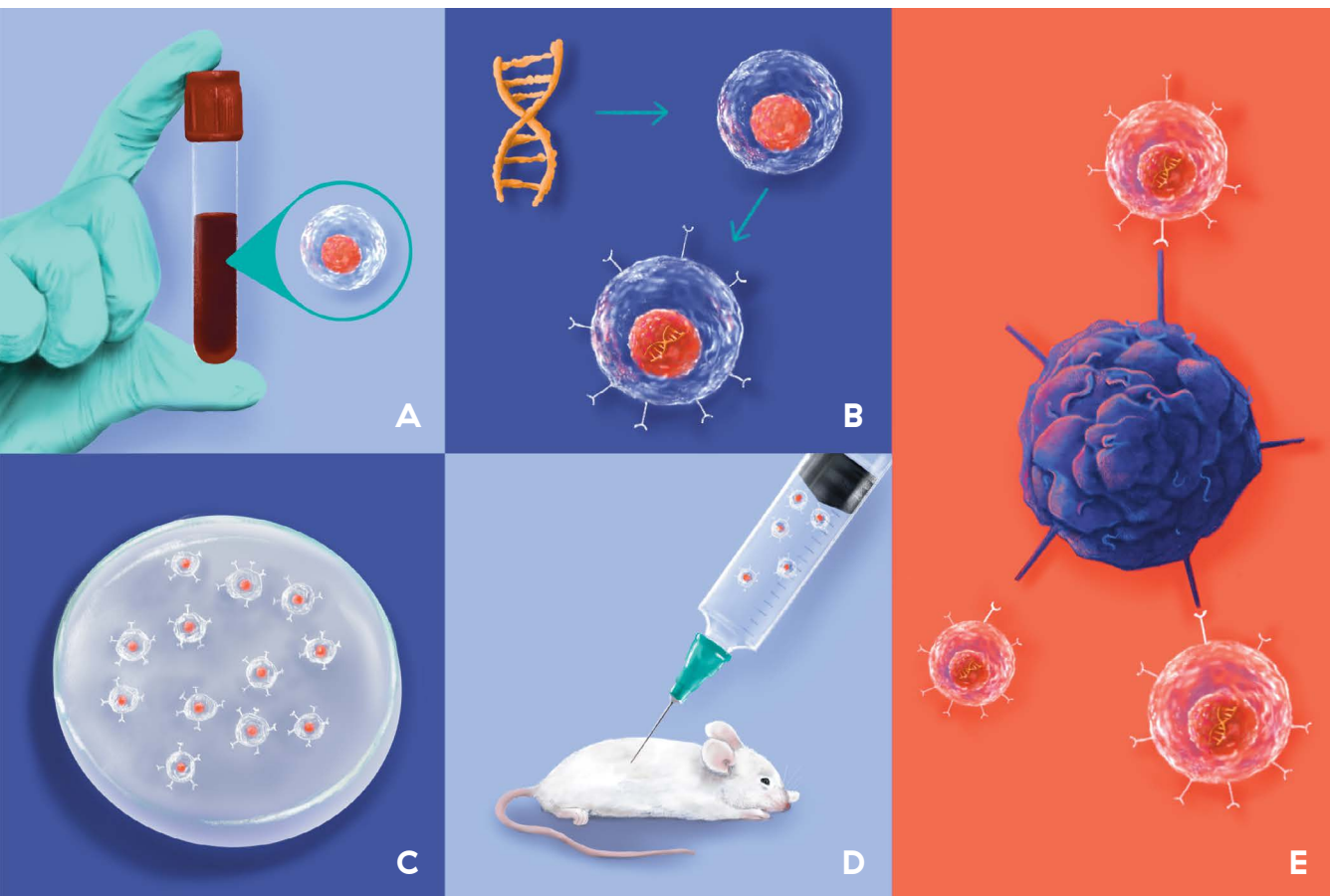
Normally, DSG2 levels drop in adulthood and become essentially hidden from immune cells. But in many epithelial-derived cancers — like breast, colon, pancreatic, lung, prostate and liver — the DSG2 levels persist, making them a strong target for a wide array of cancer types.

But that was not the only reason DSG2 was attractive to the researchers. In the early 2000s, a [breakthrough paper](#) showed that when DSG2 was deactivated, cells didn’t just come unglued — they died. Dr. Mahoney wanted to know why.

“That finding led me to 26 years of studying this protein, inside and outside of the desmosomal structure,” says Dr. Mahoney, who was in the dermatology department at the time she met Dr. Snook. “The most important thing is that cells seem to need DSG2 to survive.” That insight became even more significant when researchers discovered that many cancer cell types continue to express DSG2. If tumors rely on DSG2 to stay alive, then targeting it could be a way to selectively kill cancer cells, making it a potential Achilles’ heel.

Dr. Mahoney’s expertise and deep knowledge of the adhesion protein made the collaboration with Dr. Snook that much more fruitful. Soon, they started calling their future therapy Desmo-CAR-T or “DesmoCART” for short.

She also recognized that while cancers retain DSG2, they lose the other varieties of sticky desmosomal proteins. That means that tumor cells are less tightly held together, making tumors more accessible to the DesmoCART cells that are engineered to find the DSG2 within. This could help solve another problem of CAR-T therapy: that it’s rarely effective against solid tumors.



↑ (A) T cells are extracted from blood. (B) The gene for desmoglein 2 (DSG2) is then added to the T cell, creating a DesmoCART cell. (C) The DesmoCART cells are then grown in a petri dish. (D) In this study, the DesmoCART cells were infused into lab mice who had cancer tumors under the skin. (E) Inside the body, the DesmoCART cells bind to cancer cells to kill them.

Targeting cancerous cells in this way would leave normal cells intact since they don't express DSG2 at all or only deep within the desmosomes, which would be inaccessible to CAR-T cells, which act at the cell surface. This could be a major step forward in preventing toxicity, since many adverse events occur when the CAR-T cells attack molecules on the surface of healthy cells.

"To date, we haven't been able to separate safety and efficacy," says Dr. Snook. "But because of that biology around DSG2 expression, we think we have a window where maybe we can now study them separately."

### PUTTING DESMOCART TO THE TEST

Feeling confident that this idea would work, Drs. Snook and Mahoney started writing grants and creating CAR-T cells right away. To cover all bases, they designed tests to see if the therapy worked against cancer cells, while preventing the autoimmune toxicity that can happen when CAR-Ts attack normal cells.

In one experiment, the researchers injected mice with colorectal cancer cells under their skin. When they were given DesmoCART cells, the researchers observed that tumors disappeared after 28 days and they stayed in remission for at least four months after the experiment.

Testing for efficacy is relatively easy, but testing for safety is a different story altogether. "Safety is not commonly tested at this stage. A big reason is that it's hard," says Dr. Snook. Because there is no perfect way to replicate what would happen in a human body with model systems in the lab like mice and cancer cells, Drs. Snook and Mahoney tried as many systems as they could to come close to replicating human biology.

In general, CAR-T molecules are very specific — for example, they will not bind to other DSG proteins, like DSG1 or 3 or 4. But they also don't usually cross species lines either, meaning that they couldn't use a regular mouse model to test the therapy. They had to create a transgenic mouse that had both human cancer and expressed human DSG2 proteins on its normal cells.

When they gave the DesmoCART cells to those transgenic mice, the researchers found no obvious signs of toxicity: significant changes in body weight, signs of organ damage or diseased tissue, compared to control CAR-T cells. The lack of toxicity is promising because this might mean that cancer cells would be destroyed while healthy cells are left alone.

Another part of that experiment was to look at whether the DesmoCART cells could keep fighting cancer if it came back after the initial treatment. The researchers challenged mice with a second dose of cancer cells after the DesmoCART had successfully fought off the first dose. "We showed there was immune memory," Dr. Snook says. The mice's immune system remembered the cancer and the DesmoCART cells were still there to fight those cells off. "And that's really important! From a patient's perspective, it's crucial to make sure that the T cells can attack a recurrent cancer."

### THE ROAD AHEAD

Now, with promising results in hand, Drs. Snook and Mahoney believe that they have enough preclinical data to get an investigational new drug certification from the FDA to start a clinical trial.

"Raising the money is really the biggest hurdle," says Dr. Snook. "It's probably at least \$10 million to get from where we are today to do a trial."

The uphill battle might be a little easier now that Dr. Snook agreed to license the DesmoCART therapy to the life sciences company Vittoria Biotherapeutics.



**"The lack of toxicity is promising — this might mean that cancer cells would be destroyed while healthy cells are left alone."**

Drs. Snook and Mahoney connected with Nicholas Siciliano, PhD, the CEO of Vittoria Biotherapeutics, who was in the same doctoral program as Dr. Snook. When they learned of the DesmoCART technology, Vittoria was eager to license the innovation and advance it through the next stages of drug development and testing.

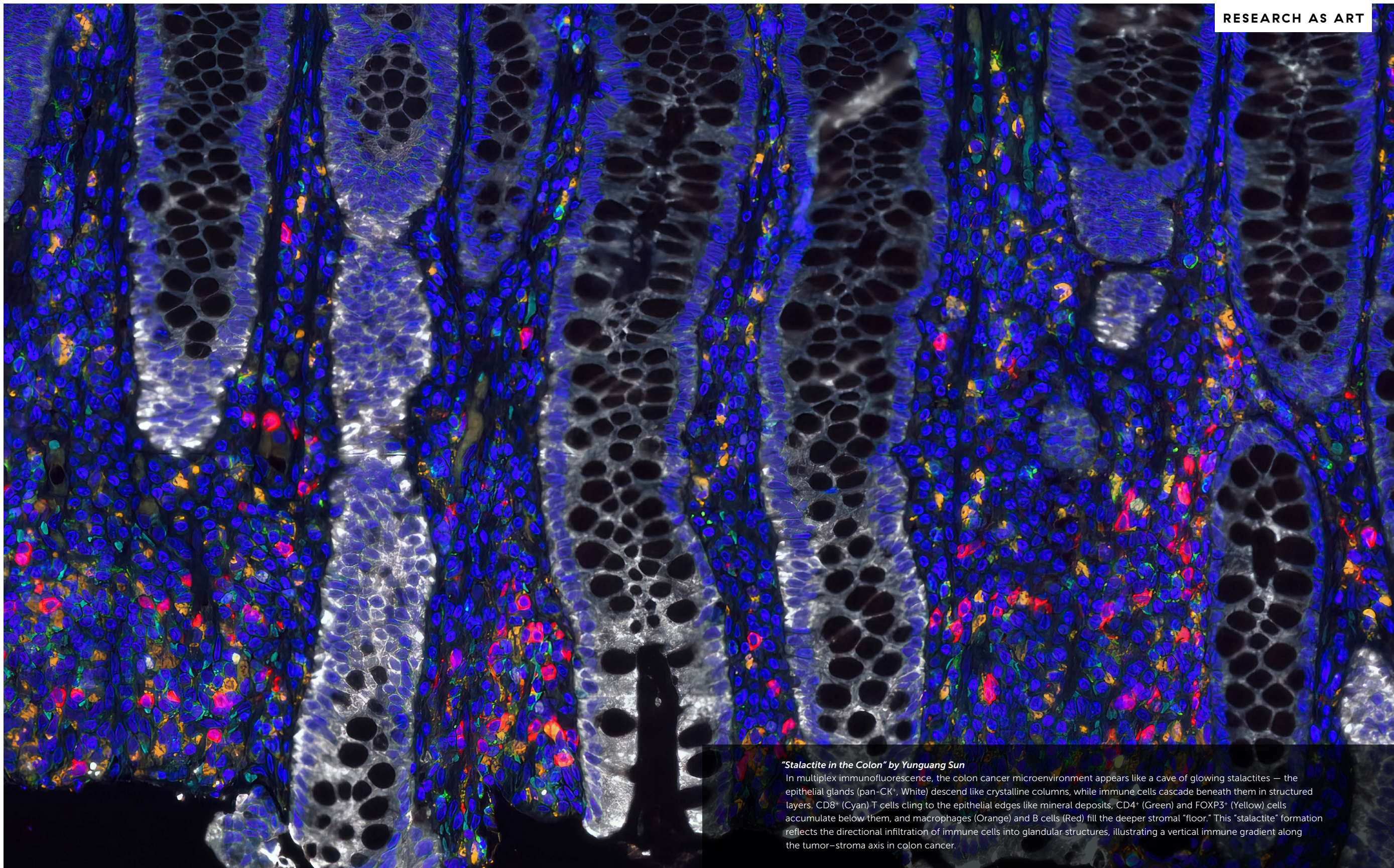
The therapy aligns with Vittoria's focus on developing novel cell-based immune therapies. The company has already been working with the Jefferson team for over a year, and will continue laying the groundwork for a new drug certification. Over the next couple of years, Dr. Snook and Dr. Mahoney hope to progress into a Phase 1 clinical trial, which would be a first safety test in humans. Subsequent clinical trials of their universal solid tumor CAR-T therapy would test for the best dose and efficacy.

Jefferson's growing leadership in CAR-T therapy is already visible across its health system. Lehigh Valley Health Network, part of Jefferson Health, is currently [the only hospital in the region offering the cell-based cancer treatment](#).

Although it will be years before DesmoCART could possibly be approved for patients, both researchers see that their work will go toward making a difference in a world where over 10 million cancer patients die every year due to lack of effective treatments.

"As a bench scientist, I don't always get to see how my research might help patients. But this has given me an opportunity to see how it can be applied, and one day, could possibly help even one person out there. That would make me happy, and Adam has made that possible," says Dr. Mahoney.

Dr. Snook agrees, saying, "I like creating the tools for physicians to help patients. That is really what gets me excited."



*"Stalactite in the Colon" by Yunguang Sun*

In multiplex immunofluorescence, the colon cancer microenvironment appears like a cave of glowing stalactites — the epithelial glands (pan-CK<sup>+</sup>, White) descend like crystalline columns, while immune cells cascade beneath them in structured layers. CD8<sup>+</sup> (Cyan) T cells cling to the epithelial edges like mineral deposits, CD4<sup>+</sup> (Green) and FOXP3<sup>+</sup> (Yellow) cells accumulate below them, and macrophages (Orange) and B cells (Red) fill the deeper stromal "floor." This "stalactite" formation reflects the directional infiltration of immune cells into glandular structures, illustrating a vertical immune gradient along the tumor–stroma axis in colon cancer.

# WHEN ART BRINGS CALM

**An interdisciplinary team of researchers explore whether immersive art can reduce stress and improve well-being.**

BY KARUNA MEDA  
ILLUSTRATED BY SARA GIRONI CARNEVALE

On the 16th floor of Jefferson Health's Honickman Center, there is a bustle of patients, staff, nurses and doctors. Various information is displayed on the walls and in pamphlets that some patients are distractedly thumbing through. The nervous anticipation of a doctor's appointment is palpable. But, in the middle of the waiting area, there seems to be an oasis of calm. An expansive watercolor painting covers the entire wall, an impressive four-by-eight feet. But it's no ordinary painting — it is overlaid with an animation, making it come to life. The colors dance; fumes of yellow seem to waft upwards and then magically disappear; bubbles of blue and gray play hide and seek, bursting and blooming in a mesmerizing pattern. New waves of light and hues emerge from different vantage points, immersing the viewer in a dynamic interaction with the art. And just as another wave unveils itself, a patient's name is called, breaking the reverie — but the nervous energy has dissipated a little.



↑ An example of the nine pieces in Lyn Godley's "Liquid Horizons" immersive art project, all of which are based on original watercolors brought to life at The Honickman Center.

The art installation, one of nine in the Honickman Center, is motivated by one core question — can immersive art reduce stress and promote well-being in a healthcare setting? This is exactly what a team of interdisciplinary researchers at Jefferson's [Center of Immersive Arts for Health \(JCIAH\)](#) are interested in answering. The average wait time in a doctor's office ranges from 15-30 minutes, inevitably leading to frustration and exacerbating anxiety. In fact, one survey showed that [63% of patients](#) reported the most stressful part about going to go see their doctor was the waiting.

At the same time, healthcare providers and staff are under tremendous daily stress, reflected by the fact that healthcare workers have [burnout](#), [depression](#) and suicide rates twice that of the general population.

In an effort to alleviate stress for both patients and practitioners, more attention is being paid to the ambiance of healthcare spaces like waiting and examination rooms. Many hospitals are

incorporating ample natural light, plants, soothing music and artwork, mostly in the form of paintings, photography and sculptures. A relatively unexplored element is dynamic or interactive art. [Lyn Godley](#), [MFA](#), a professor of industrial design and the artist behind the animated watercolor installations in the Honickman Center, has been on a mission to uncap the potential of dynamic art to improve the overall healthcare experience.

As director of JCIAH, which launched in 2021, Godley has teamed up with other artists and designers, public health and psychology researchers, and clinicians to create and research immersive art environments. "We've built a pipeline from design, to testing in real-world settings and then iterating based on our results — all at Jefferson," she says. "This doesn't exist anywhere else."

"When art is dynamic, it invites curiosity, movement and calm. That's what made me start asking whether the immersive art could support well-being, especially in healthcare settings." — LYN GODLEY

**LIGHT AND SHADOW — CREATING IMMERSIVE ART**

Over her prolific career as an artist, Godley has always used her work to engage in a dialogue with the viewer. More than two decades ago, she began incorporating light into her artwork to create movement and shadows, offering a more dynamic and immersive viewing experience. "There is something inherently magical about light," says Godley. "Think about sunlight shimmering on a lake, or filtering through tree branches, or a burst of fireworks in the sky. Light has the ability to excite or calm."

A solo exhibit she put together 15 years ago in Cologne, Germany, ignited her interest in actually measuring these effects. She had a created a panel

of images of birds in flight, and had threaded fiber-optic cables so that there were pixels of light along the edges of the wings and tails of the bird. One evening, she got a call from the gallery owner that people were acting curiously when they got to her exhibit — they were spending up to hours at a time sitting in front of it, just quiet observers, seeming to relish in the serenity of the space. Godley suspected the nature-based imagery, which has shown to be calming, was partly responsible. But, she later found out that the wavelength of the fiber optics was the same as used in light therapy to alleviate depression. "That really got me thinking about how light can not only create experiences that are deeply engaging for the viewer," she says, "but also positively impact emotional well-being."

↓ Godley's "In Flight" exhibit in Cologne, Germany.



New developments in technology and digital media have allowed artists like Godley to combine light with sound to create an even more immersive experience. This is the basis of virtual and augmented realities, where a person wears a headset and is transported to different environments through animations and sound. Researchers have explored the use of virtual reality headsets in healthcare settings as part of an approach called “distraction therapy” that engages a patient in a task or experience to distract from discomfort or anxiety. In one [study](#), cancer patients reported that using virtual reality made chemotherapy treatments seem shorter. Another [study](#) showed that a virtual reality headset can reduce procedural pain by 35-50%.

“But there is a learning curve to getting comfortable with the headset,” says Godley. “So when we launched JClAH, we really wanted to know — can we create an immersive environment without a headset, and still elicit the same calming effect?”



↑ Godley’s “Light Ripple” was a centerpiece of the “Waiting Room” exhibit at Hot Bed gallery. Photo by Emma Lee/WHYY News.

### REIMAGINING THE WAITING ROOM

In the fall of 2022, Godley and several researchers wanted to test this idea by creating intimate spaces with immersive, light-based art. They decided to recreate a waiting room, the starting point of most medical interactions.

“It felt like the ideal place to start — if we can improve a patient’s experience from the time they get to their appointment, it could set them up for a more positive visit,” says Godley.

The Hot Bed gallery in Philadelphia’s Old City became home to the “Waiting Room” exhibit, which featured the work of six artists, including Godley. In total, there were 11 installations, each set up as a waiting area. All the art involved dynamic light, either with a light source in the art itself or projected onto it: a 3D printed structure with light shining through it; a convex mirror that reflected flexible LED arrays; sculptures and mobiles made of plexiglass pieces and metallic surfaces hanging from the ceiling, creating sparkling reflections of light on the wall. Godley’s installation featured a panel of six tiles with a video of swirling blue light projected onto it, creating a ripple effect on each tile. Each piece immersed the observer by using a complex interaction of light and shadow.

They were also each accompanied by a QR code that took the viewer to a survey — this is where art meets research. The surveys were designed by population health researcher [Rosemary Frasso, PhD](#), (the Victor Heiser, MD Professor of Population Health) and her student Julianna LeNoir to enable viewers to assess how the art made them feel. They gathered 195 responses, and overwhelmingly, viewers [reported](#) a sense of “calm” and “peacefulness” after experiencing the dynamic light-art installations. The researchers had successfully created an immersive environment — without headsets — that had a calming effect.

The attendees were also asked if they would like to see similar artwork in a doctor’s waiting room. One person reported, “Yes, since it would be a good form of distraction while waiting for an anxiety-ridden appointment.” Another said, “Yes, it’s calming; it’s something to focus your attention on; something to take you outside of whatever else is going on and stop and just imagine something completely different.”

### TRANSPORTING A CHAPEL TO OCEANS AND GALAXIES

Buoyed by the positive effects of the “Waiting Room” exhibit, the research team at JClAH wanted to build on that study and turned their attention to a larger space — the Ravenhill Chapel on Jefferson’s East Falls campus. The goal was to create a fully immersive art installation and test the potential positive effects on well-being in another population that faces many stressors — college students.

The installation was completely undertaken by Godley’s students in her “Lighting as Public Experience” class. They used a technique called projection mapping to create a fully immersive large-scale environment.

“Basically, you project content through a projector onto a surface,” says Godley. “But the mapping allows you to create shapes for every arch, every flat surface, every corner, and then you can drop in different content for every one of those surfaces.”

The technique has taken off in the last decade to create digital art for entertainment. But, whether immersive experiences like this can positively impact well-being has never been measured.

→ Godley’s student Pooja Anil Bhoge uses the projection mapping technique with a laptop and projector.





“The results showed statistically significant decreases in 12 negative affect scores like distress, fear and nervousness; and increases in nine positive affect scores like calm, rejuvenation and wonder.”

The students researched and selected different imagery that have been shown scientifically to lower stress, like nature, sunsets, ocean waves, etc. They also created music to accompany the visuals, taking inspiration from meditation and mindfulness playlists.

The installation “A Deep Dive into Calm” at Ravenhill Chapel opened in the fall of 2023 to all Jefferson students and staff over three evenings. As people milled around, the projectors switched on and the chapel was transported to the Milky Way, a swirl of stars twinkling above on the vaulted ceilings. A few minutes later, every inch of the chapel walls was imbued with the hues of a gorgeous sunset. Images of golden tinted clouds seemed to move seamlessly across the ornate architectural details and stained glass windows. In an instant, the clouds morphed into the swirling tendrils of a jelly fish, its ethereal movement mesmerizing the onlookers.

Dr. Frasso and Virginia O’Hayer, PhD, who serves as director for Jefferson Health’s Center City Clinic for Behavioral Medicine, along with a number of student researchers, developed questionnaires that visitors could take before and after experiencing the immersive environment. The questionnaire included a validated instrument called the [Positive](#)

and [Negative Affect Scale](#) (PANAS) that is designed to measure mood and emotions like stress.

“We also included open-ended questions to gauge how often participants might like to engage in something like this, images they would have liked to see, etc.,” explains Dr. Frasso.

A total of 155 participants completed both the pre- and post-visit questionnaires. The [results](#) showed statistically significant decreases in 12 negative affect scores like distress, fear and nervousness; and increases in nine positive affect scores like calm, rejuvenation and wonder. Overall PANAS scores increased, indicating improved mood after experiencing the installation. In response to the open-ended questions, many participants expressed the desire to have such installations available year-round to promote mental health.

“This is a critical first step in demonstrating a measurable effect of immersive environments on well-being and its potential as a mental health intervention for rising rates of anxiety and burnout in college students,” says Dr. O’Hayer. It also indicates promise in other high-stress settings like hospitals.

← Scenes from the immersive art exhibit “A Deep Dive into Calm” at Ravenhill Chapel at Jefferson’s East Falls campus.



↑ Participants from Dr. Wendy Ross' cohort of neurodiverse patients experience the art in Ravenhill Chapel.

### TESTING THE UNIVERSALITY OF IMMERSIVE ART'S IMPACT ON WELL-BEING

While Ravenhill Chapel is far from a healthcare setting, the exhibit presented an opportunity to test the effects of immersive art on the well-being of specific patient populations. [Wendy Ross, MD](#), the director of Jefferson Health's Center for Autism and Neurodiversity and part of the JCI AH research team, hosted a cohort of neurodiverse patients to the Ravenhill exhibit to understand how they experienced the space. The response was promising.

"My son can often experience sensory overload," says Erica Daniels, who runs the non-profit [Hope Grows for Autism](#) and has worked often with Dr. Ross in raising awareness around autism. "But he was so calm in this environment. I wish we could replicate this at home."

Dr. Ross heard similar observations from other patients and their families. "It's been shown that mothers of autistic children experience as much stress as combat soldiers — if we're able to show a potential benefit, immersive art experiences could change the way we care for neurodivergent patients and their caregivers."

However, given the unique sensory needs of neurodiverse people, the research team wanted to better understand what imagery this population found most calming. Dr. Ross tapped her collaborator Dr. Joseph McCleery at nearby St. Joseph's University, where he leads the Kinney Center for Autism Education and Support, along with his student researcher Sophia Borrello to explore this question.

Godley and her students put together a second exhibit at Ravenhill Chapel in 2024, and this time visitors were exposed to two different dynamic art experiences — 20 minutes of nature-based images followed by 10 minutes of abstract imagery. Of the 214 people who completed the surveys, 67 identified as neurodivergent. The team found that both neurotypical and neurodivergent participants preferred nature-based scenes over abstract ones. This supports the calming effect of nature-based imagery for the neurotypical population and is among the first evidence to show that neurodivergent people experience similar benefits.

"It also suggests that we could use a universal design to positively impact people with different needs," says Godley. "But to fully explore that, we need to take this into the clinic."



↑ Godley (middle), stands with Nathalie Bouchard and Jessica Jahnle in The Center for Excellence in Surface Imaging, where the art pieces for the Honickman Center were printed.

### BRIDGING THE GAP BETWEEN DESIGN AND HEALTH CARE

Godley knew, however, that she wouldn't be able to recreate a fully immersive environment in a healthcare setting. But she could still use projection mapping on a smaller scale to overlay animation onto existing artwork. This is how the immersive installations in nine waiting areas in the Honickman Center came to be.

But the work has hit a few roadblocks. This largely unexplored question occupies a unique intersection of design, health care and research, making it tricky to identify funding sources that are the right fit. In fact, philanthropy was crucial to bringing the Honickman installations to fruition.

"Design is rarely evaluated in real-world settings," says Godley. "Conversely, in health care, research typically focuses on analyzing environments that already exist, rather than designing interventions specifically to test their impact."

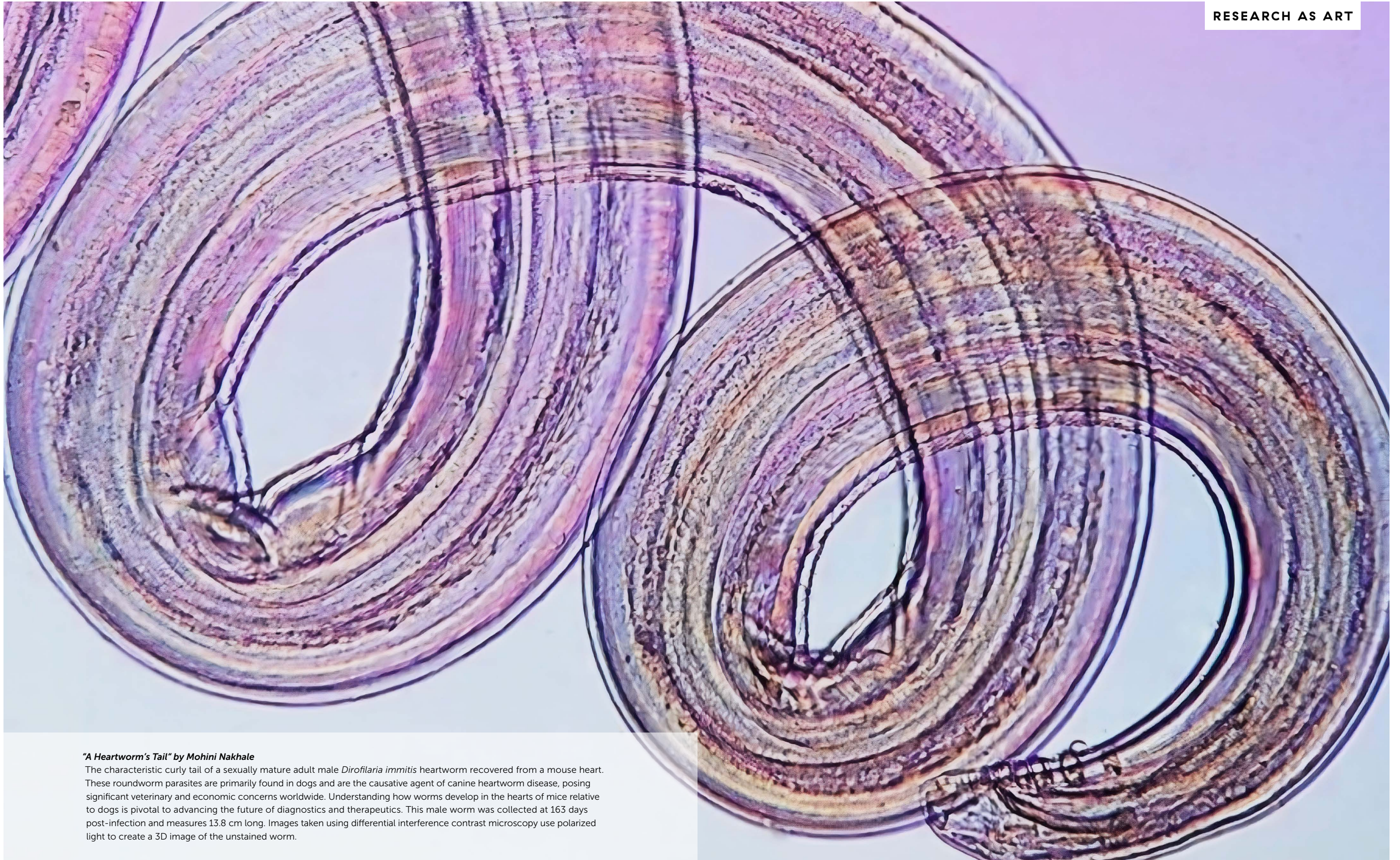
This creates a persistent gap which Godley has been trying to bridge by getting key stakeholders in health care involved — for example, [Edmund Pribitkin, MD](#), the executive vice president of Jefferson Health, who was instrumental in getting Godley's art installed in the Honickman Center.

"Lyn and JCI AH's mission gives Jefferson a unique opportunity to apply design principles to the hospital environment as a tool for improving patient outcomes," says Dr. Pribitkin. "This integrated approach is virtually unheard of."

Sophia Borrello, who ran the 2024 Ravenhill research and is now a medical student at Sidney Kimmel Medical College, will be leading a preliminary study on the Honickman waiting rooms. The team aims to measure more direct indicators of stress, like cortisol levels and blood pressure, to better understand the effects of immersive art on the well-being of patients and healthcare workers. The team also plans to make these experiences more interactive, allowing the user to control aspects of the immersion, like color, speed and the imagery itself.

"It's a start," says Godley, who is retiring soon. While she will remain a fellow at JCI AH, she is handing the reigns over to design researchers Loukia Tsafoulia, PhD, and Renée Walker, PhD, who will serve as co-directors.

"I'm excited about the future of JCI AH," continues Godley. "As the technology evolves, we can really push the boundaries to create immersive art spaces where people can hopefully pause and experience some calm." ↵



**"A Heartworm's Tail" by Mohini Nakhale**

The characteristic curly tail of a sexually mature adult male *Dirofilaria immitis* heartworm recovered from a mouse heart. These roundworm parasites are primarily found in dogs and are the causative agent of canine heartworm disease, posing significant veterinary and economic concerns worldwide. Understanding how worms develop in the hearts of mice relative to dogs is pivotal to advancing the future of diagnostics and therapeutics. This male worm was collected at 163 days post-infection and measures 13.8 cm long. Images taken using differential interference contrast microscopy use polarized light to create a 3D image of the unstained worm.

# THE HIDDEN VIRUS THREATENING CURAÇAO'S SEA TURTLES

A strange virus is spreading tumors in sea turtles. Researchers are uncovering new clues as to why.

BY MARILYN PERKINS | ILLUSTRATED BY SIMBIE YAU

On Christmas Eve in 2022, Blue Bay Beach in Curaçao went dark. The resort where biology researcher [Manuela Tripepi, PhD](#), was vacationing with her family had turned off all its lights for a special occasion: not the holiday, but sea turtle hatching season. Dr. Tripepi had seen volunteers preparing the beach for days in anticipation, and it looked like tonight would be the big night.

They had told her this was one of the last nests of the season to hatch. Dr. Tripepi watched as the tiny sea turtles emerged one by one from the nests their mothers had dug in the sand months before. The tiny hatchlings — only about 2 or 3 inches long — made their way to the ocean, orienting themselves by the light

of the moon. If the resorts don't turn off their lights, the turtles can't find their way to the sea.

Sea turtles typically lay multiple nests per season, each with over 100 eggs. Only about 1 in 1,000 of these hatchlings will make it to adulthood, facing many threats along the way. In fact, as Dr. Tripepi talked to the volunteers watching over the hatchlings, she learned of a disease that was causing sea turtles in Curaçao and across the world to grow tumors at alarming rates, with no known cause.

"I made a promise that I would come back and help," she says.

That promise led Dr. Tripepi on a years-long journey to study the disease-ravaged sea turtles in the Caribbean and beyond. She may be on her way to uncovering some answers about the disease's origin, but conducting research nearly 2,000 miles away from home has posed its own challenges.

**PROBLEMS IN PARADISE**

Curaçao is known for its cerulean water, white sand beaches and marine wildlife. The island is home to three species of sea turtle: green, hawksbill and loggerhead. Tourists flock to Curaçao's beaches for the guarantee of swimming with these creatures, but the turtles face major threats. According to the International Union for Conservation of Nature, each of these three species is endangered or critically endangered. Habitat destruction, climate change, fishing boats and pollution all jeopardize turtles in Curaçao. But a more mysterious threat has become apparent in recent years: a disease called fibropapillomatosis (FP).

FP is a virus in the herpes family that primarily affects green sea turtles. First documented in 1938 in Key West, Florida, it's now been spotted worldwide. The condition causes tumors to sprout over sea turtles' faces, flippers and the rest of their skin. The tumors themselves are benign, but they eventually grow so large that turtles can no longer see, eat, swim or reproduce, ultimately causing their death.

Ard Vreugdenhil, field director of [Sea Turtle Conservation Curaçao](#) (STCC), says that he first began to see turtles with FP in Curaçao about eight years ago. An outbreak among just a few turtles quickly snowballed, with more and more turtles around the island succumbing to the tumors.

"It was shocking to see how fast it was developing," Vreugdenhil says. "In certain areas, we went from seeing no turtles with the disease to 100% being affected."

Today, FP affects up to seven out of 10 sea turtles in Curaçao, though rates vary in different locations around the island.

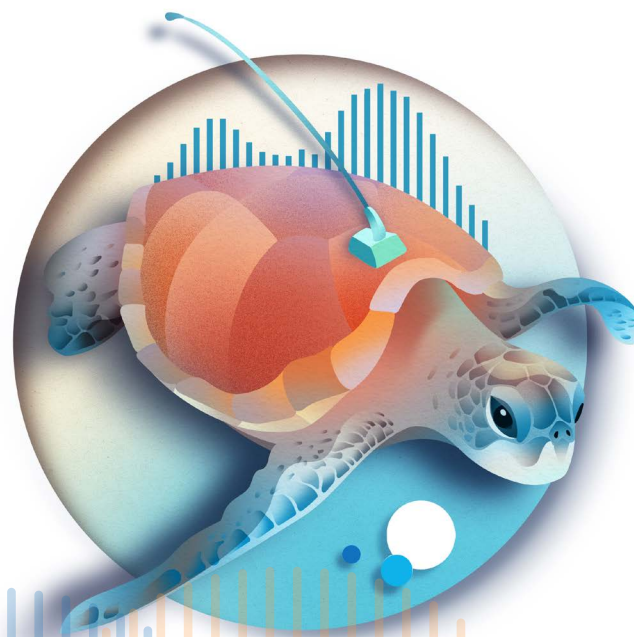
FP is an ancient virus, and it likely evolved alongside sea turtles for millions of years. Like human herpes viruses, FP can lay dormant for years without causing any outward symptoms because the turtles' immune system keeps the virus at bay. In fact, many turtles likely carry FP without ever developing tumors. The problem with FP, Dr. Tripepi says, is not just that more turtles are being infected, but rather that the virus is "activating" at rates never seen before.

So what makes FP activate in some sea turtles, but not others? The leading theory — and the one that Dr. Tripepi is investigating — is stress.

"Pollution, human activity and other disturbances may be causing stress to the turtles," Dr. Tripepi says. "That stress may somehow dysregulate these animals' bodies, which allows the virus to activate and cause these tumors to grow."

**"In certain areas, we went from seeing no turtles with the disease to 100% being affected."**

— ARD VREUGDENHIL



↑ Top left: A sea turtle hatchling. Top right: Dr. Tripepi (purple shirt) works with STCC volunteers to measure a sea turtle and take vitals. Bottom left: A radio transmitter affixed to a turtle's shell to track its movement. Bottom right: Volunteers carrying a sea turtle.

**FOLLOWING THE TURTLES**

As a [researcher](#) who studies how stress impacts organisms, Dr. Tripepi was uniquely positioned to study FP — but getting a study started in Curaçao wasn't easy.

Curaçao is a small nation, with a population of only about 150,000 people. The country has limited scientific resources, meaning that most equipment needs to be bought elsewhere and flown onto the island. The majority of Curaçao's conservation work is done by volunteer organizations, such as STCC. With 100 active volunteers but only one full-time paid staff member, STCC already juggles rescuing sea turtles injured by boats, protecting eggs during nesting season and educating the public.

But in the [spring](#) of 2023, Dr. Tripepi was able to secure an internal grant from Jefferson to return to Curaçao. The money was enough to cover 10 radio tracking devices, which she planned to use to map the sea turtles' feeding grounds.

Dr. Tripepi hoped if she could find where turtles with FP were eating, she might be able to find a nearby stressor that was causing the virus to activate. She worked with STCC to capture and affix the radio transmitters to turtles in Caracas Bay, a rocky beach on the southern coast of Curaçao. It was not an easy task. Dr. Tripepi paddled a kayak hundreds of meters out from shore, watching as the seafloor dropped off and the water turned from aquamarine to pitch black.

**“It could mean that exposure to these chemicals reduces feeding behavior, sexual behavior, migration behavior — all potential stressors.”**

— DR. JEFFERY ASHLEY

Vreugdenhil waited below the surface in scuba gear, scanning the dark water for turtles. Once he spotted one, he dove to retrieve it. The turtles were difficult to wrangle, weighing as much as 100 pounds. They were also angry.

“Twice, the turtle ripped the regulator out of my mouth, so I was without my oxygen source at a depth of 20 meters,” Vreugdenhil says.

With the help of another volunteer in the water, Vreugdenil hoisted each turtle into Dr. Tripepi’s kayak, leaving her to paddle against the wind as she attempted to calm the thrashing creature in her lap.

Back on shore, more volunteers waited to check the turtle for tumors, take pictures and affix the radio transmitter. Over the course of two weeks, Dr. Tripepi and the STCC volunteers were able to capture and affix radio devices to eight sea turtles in Caracas Bay. Five of them had tumors, making them prime candidates to track.

Once the sea turtles had been released, the team began searching for radio signals from the turtles’ feeding ground. They pinpointed a small inlet off the main beach where the turtles were feeding on seagrasses near a marina.

**“SENTINELS OF AQUATIC POLLUTION”**

Green sea turtles are primarily herbivores, with a diet consisting mostly of seagrass and algae. Dr. Tripepi thought if she could find any pollutants in the seagrass the turtles were eating, it may provide clues as to why they were getting sick.

Dr. Tripepi, though, had to return to Philadelphia. So, Ingo van Veghel, a field assistant at STCC, set out to collect seagrass samples from the feeding grounds they’d identified earlier, as well as from other locations around the island. The samples were dehydrated and sent back to Philadelphia.

There, Dr. Tripepi’s colleague at Jefferson and analytical chemist [Jeffrey Ashley, PhD](#), who studies how man-made chemicals travel through and accumulate within urban aquatic ecosystems, took them to his lab. Working with a team of undergraduate researchers — premedical studies majors Emily Valenzuela, Aliya Bilimoria, Giorgia Penesso and Isabella Vitales, and medical laboratory studies major Ellianna Ruggeri — he began looking for clues in the seagrass.

Seagrass, it turns out, is a powerful indicator of environmental conditions. It absorbs whatever pollutants are present in the water where it grows, making it a promising tool for monitoring marine contamination.

“We could use these seagrasses as stationary sentinels of aquatic pollution,” Dr. Ashley says.

In his initial tests, Dr. Ashley focused his analysis on heavy metals, particularly those that could come from a nearby shooting range on the island. The data revealed elevated levels of lead and copper in the seagrass from Caracas Bay, the same area where most of the turtles with FP were found. Still, the findings raise more questions than they answer. If heavy metals are playing a role in FP, researchers will need to detect elevated metal levels in the turtles themselves — and determine whether those levels correlate with tumor growth. It also remains unclear how, exactly, such pollutants might trigger the virus to activate.

“It could mean that exposure to these chemicals reduces feeding behavior, sexual behavior, migration behavior — all potential stressors,” says Dr. Ashley. “Or these trace metals could be knocking out an important biochemical mechanism in the turtle’s ability to fend off the virus.”

Because the link to heavy metals remains tenuous, Dr. Tripepi plans to expand the search for other sources of stress affecting turtles around the island. A number of pollutants are still on her radar: municipal water treatment is limited, so cesspools of raw sewage leach into the nearby ocean. A legacy of oil refining may have left behind contaminants in soil and water, and boat activity introduces pollutants as well. But many of these chemicals are hard to test for — and often don’t survive the dehydration and shipping process needed to bring samples back to Jefferson, meaning the road ahead will be difficult. “The search continues,” says Dr. Tripepi.

**COMING FULL CIRCLE**

As Dr. Ashley’s lab analyzed the samples, Dr. Tripepi returned to Curaçao in December 2024. She wanted to catch the turtles they had previously tagged and see if their tumors had worsened — or, perhaps, healed.

Unfortunately, the glue binding the radio transmitters they’d affixed the year prior had already broken down, leaving the transmitters at the bottom of the ocean and the turtles nowhere to be found. Dr. Tripepi hoped they may be able to find them again, but the odds were slim. It was clear she needed a more reliable way to track the turtles.

Fortunately, she was able to secure a second Jefferson grant to acquire higher-tech microchip Bluetooth devices known as PIT tags. Unlike the bulky radio transmitters, the PIT tags are easier to read and cause less stress to the animals. Moreover, the grant allowed her to expand her research operations — at the end of 2025, she returned to Curaçao, this time with Dr. Ashley and seven Jefferson students in tow.

Over the course of the week, the researchers, students and STCC volunteers captured 35 sea turtles and implanted the PIT tags. The technology will allow researchers to more accurately estimate the total turtle population around the island, determine what proportion is affected by FP, and track how tumors progress over time.

The team also collected 22 DNA samples to analyze the turtles’ microbiome — the community of bacteria and fungi that live on and within all organisms. In humans, changes to the microbiome have been linked to immune dysfunction and disease. Dr. Tripepi hopes similar patterns may help explain why FP activates in some turtles but not others.

For Dr. Tripepi, the trip was a culmination of everything she’d been working on since she first visited Curaçao. During the visit, she and her students witnessed sea turtle hatchlings emerge from their nests — the same population she had first seen nesting on the island three years earlier. Seeing the turtles return, this time alongside students, felt like coming full circle.





↑ Top left: Dr. Tripepi and student Isabelle Vitales bring a turtle to shore. Top right: Dr. Tripepi releasing a turtle back after a netting session. Bottom left: Drs. Manuela Tripepi and Jeffrey Ashley with Jefferson students Joseph Hough, Ellianna Ruggeri, Emily Valenzuela, Isabella Vitales, Sarah Balkiewicz, Spencer Talbot and Aliya Bilimoria. Bottom right: A green sea turtle resting on the ocean floor. Photographs taken by John R. Gooding.

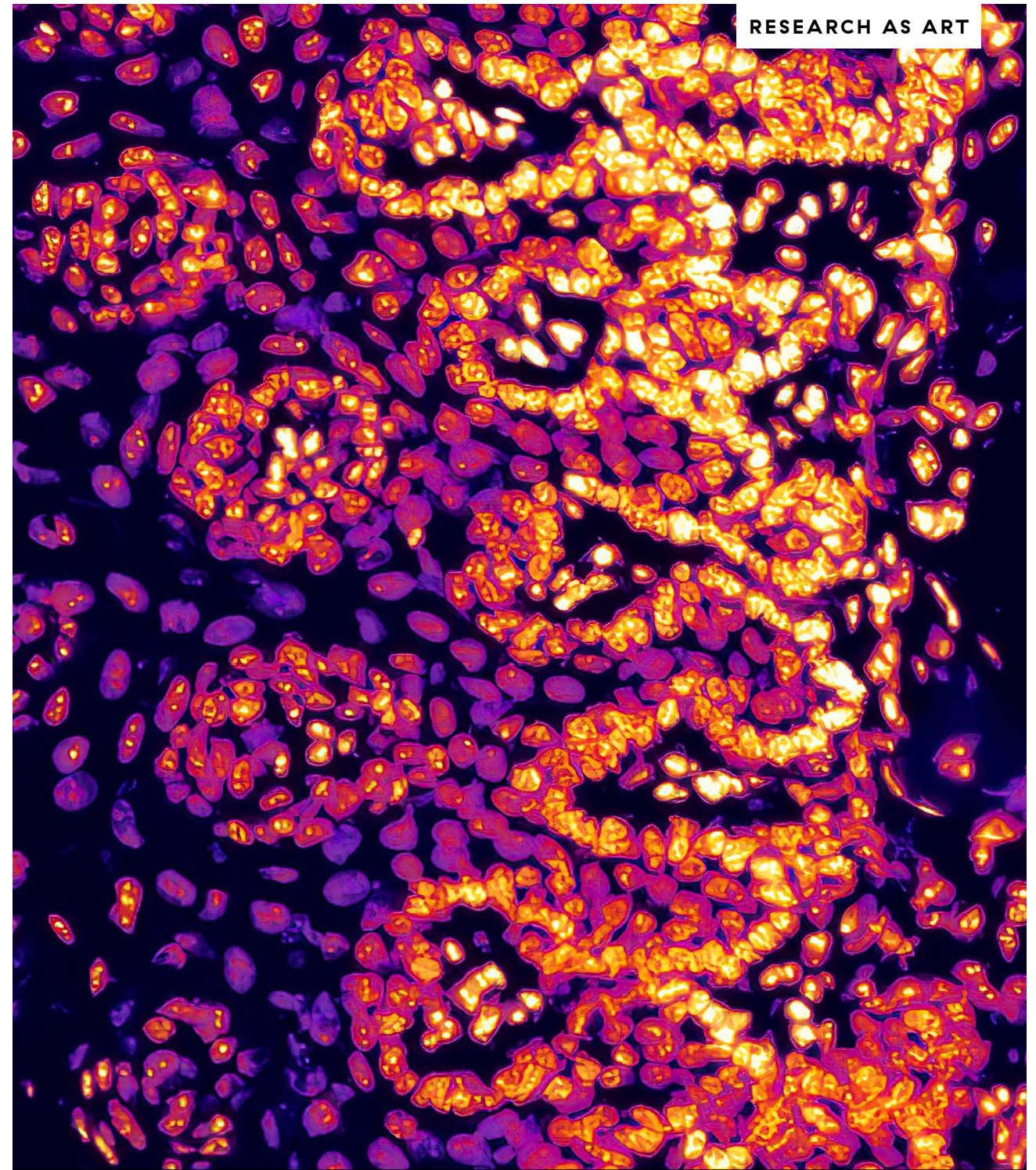
And after all these years, her research is gaining traction. She recently published the first formal scientific report documenting FP in Curaçao in the *European Zoological Journal*, helping put the island on the scientific map. During the 2025 trip, she and her students were received by the governor of Curaçao, a sign that government attention to the disease may finally be growing.

Meanwhile, Sea Turtle Conservation Curaçao is building its own physical center and research infrastructure, including an AI-assisted photo database to identify individual turtles.

"My dream would be to create a small research space we can keep coming back to," Dr. Tripepi says. "When I'm down there and I think about all of these volunteers, that's what brings me hope."

"I miss it," she adds. "I'm already thinking, when can I go back to help?"

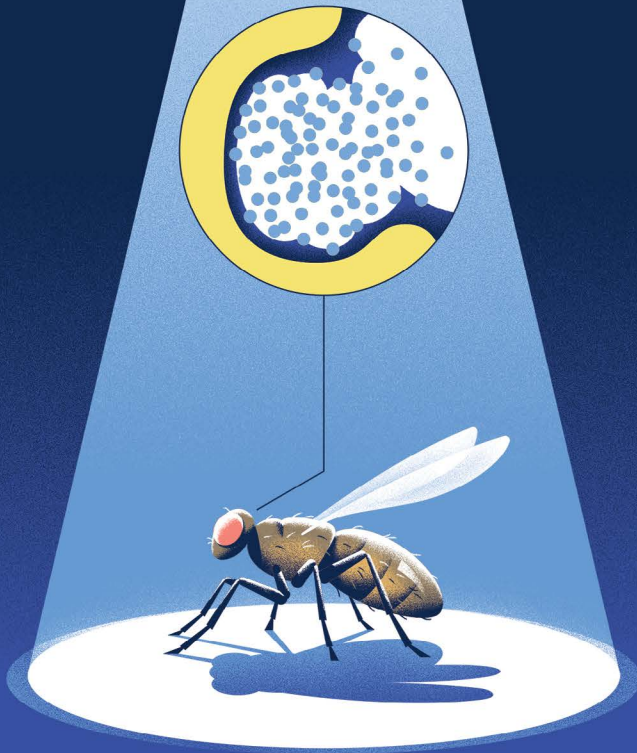
RESEARCH AS ART



"Taste Buds on Fire" by Elham Javed

This image reveals the intricate world of mouse taste buds, glowing fiery hues that capture the energy of sensation itself. The tongue tissue was stained with DAPI, a nuclear dye used to identify each cluster of taste bud cells — gateways where chemicals from food ignite electrical signals that travel to the brain to create the perception of taste. The depth of the tissue is color-coded in the hues of fire, adding dimension to the image. Beneath the microscope, what appears as flames is, in fact, the beauty of biology — where flavor begins and the science of sensation comes to life.

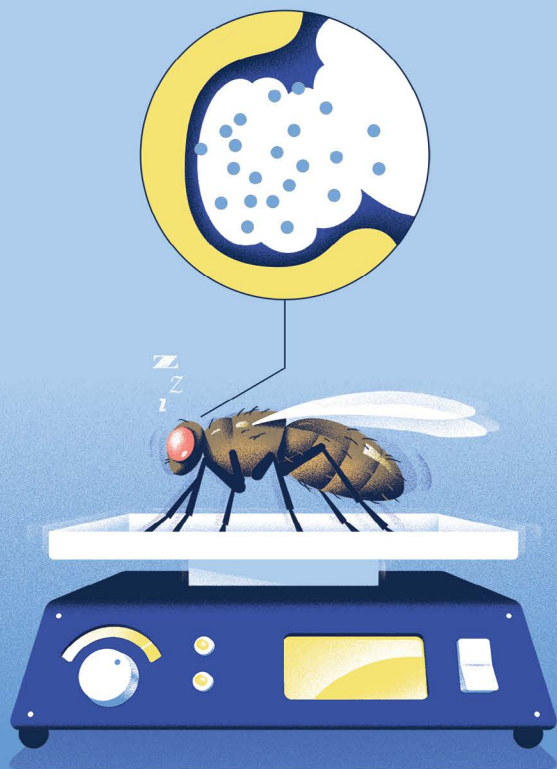
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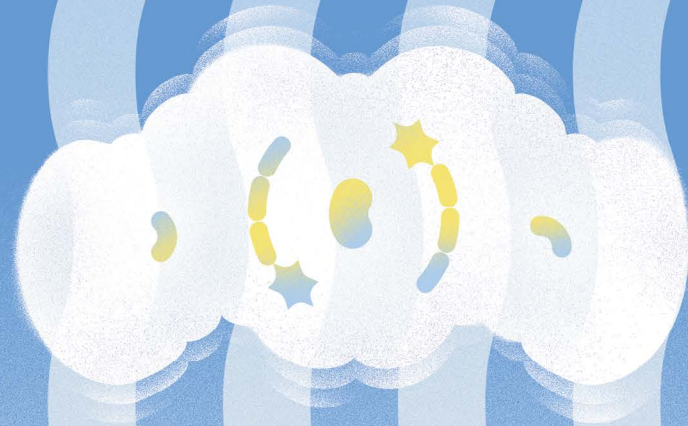
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# GENTLE SHAKING COULD PROMOTE SLEEP AND FIGHT ALZHEIMER'S

by Deborah Balthazar

Illustrations by Michele Marconi

Scientists uncover how vibration improves sleep and reduces cognitive decline in fruit flies.

**W**e know that gentle motions like rocking or a long car ride help fussy babies drift off to sleep, but what if the benefits extended to adults with sleep disorders and could even slow down the progression of Alzheimer's disease?

Scientists at Thomas Jefferson University [recently discovered](#) that gentle vibrations might offer a powerful solution for some individuals with sleep conditions, providing benefits in brain health and cognitive function.

Neuroscientist [Kyunghye Koh, PhD](#), and her team [previously](#) found that mechanical stimulation, or vibration, could effectively induce sleep in fruit flies.

"In the current study, we wanted to know: Does the sleep induced by vibration provide the same benefits as natural sleep?" says Dr. Koh.

The new research revealed that vibration-induced sleep, like natural sleep, helps normalize brain activity. When we are awake, synapses in our brains — connection points that allow neurons to communicate — tend to strengthen or "light up." During sleep, those synapses are "powered down" or scaled back, preparing the brain to take in new information when we wake the next day. This is a process called synaptic downscaling. Sleep-deprived flies were not able to scale down their synapses, which led to memory problems. But when the researchers induced sleep with vibration, synaptic downscaling was restored and the cognitive performance of the flies improved.

Interestingly, the control group — the flies that were able to get a normal amount of sleep — did not benefit from vibrations, likely because they did not have cognitive problems.

The study also uncovered potential implications for Alzheimer's disease. It is well established that flies engineered to express high levels of TAU and Amyloid  $\beta$ , the toxic proteins that accumulate in Alzheimer's, suffer from insomnia. In this study, when these flies received gentle vibration, their sleep improved and, importantly, they showed a significant decrease in toxic protein levels: Approximately 50% less TAU and 25% less Amyloid  $\beta$ .

"One of the problems for many patients with neurodegenerative diseases is that they can't sleep well. They often fall asleep during the day and get poor-quality sleep at night," says Dr. Koh.

While the findings are preliminary and cannot be immediately applied to humans, they offer a new research direction that could help patients with sleep disorders and cognitive decline.

"It's important to know whether this could potentially be used as a way to manage and perhaps slow down the progression of Alzheimer's disease or other neurological diseases," says Dr. Koh. [J](#)

← (A) A sleep-deprived fruit fly shows an accumulation of synapses (blue dots) due to impaired synaptic downscaling, a natural process during sleep that helps the brain reset and work better.

(B) In genetically modified flies that model Alzheimer's disease (AD), sleep deprivation leads to a buildup of toxic proteins associated with AD: Amyloid  $\beta$  (pale blue) and Tau (yellow).

(C) After vibration-induced sleep, the fly's brain displays fewer synapses (fewer dots), showing that sleep has restored synaptic downscaling and improved brain function.

(D) This sleep also correlates with a visible reduction in Amyloid  $\beta$  and Tau, suggesting that enhancing sleep through vibration may help clear harmful proteins from the brain and help slow neurodegeneration.



# SEEING THE SOUNDS OF NATURE

Multisensory design can enhance our digital experiences and bring us closer to the natural world.



by Karuna Meda

It's a beautiful summer morning and Renée Walker sits in a park, looking at her phone. An image of concentric circles appears on her screen — orange, grey and brown bands that seem to be constricting and expanding in time with some unknown rhythm. At first glance, it may seem Walker is playing some type of game, like many of us who become engrossed in the digital world on our smartphones. But in fact, Walker's screen is bringing her closer to her surroundings — the radiating circles are visual representations of bird songs, and the rhythm and colors tell her what bird it is. Walker's screen, rather than a barrier, is a portal to nature.

As a visual communication and information designer at Thomas Jefferson University, [Renée Walker, MFA](#), teaches and studies how to represent data and information in emotionally engaging and easily understandable ways. And while the field is advancing at a rapid pace, Walker worries about the demands on our visual energy.

"As our eyes grow weary and our backs are bowed from the near-constant interactions with our beloved screens, how can we encourage the next generation of designers to enhance our sensory experiences rather than deplete them?"

To answer this question, Walker's [research](#) and teaching have shifted to making digital experiences and communication design more multisensory — this means incorporating sound, vision and even touch in designs. "Designing for a range of sensory experiences allows people to tap into senses they might overlook," she says. "And that enables us to deepen our awareness of our surroundings and nature."

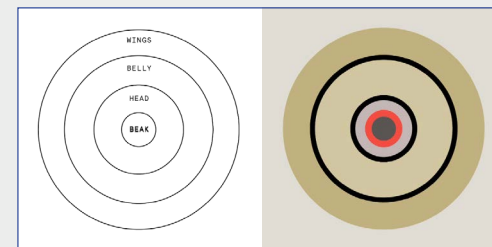
Walker saw an opportunity to use technologies and sensory data found in our daily lives as vehicles for multisensory design. Strolling around one day last fall, she observed the sounds around her: the cars from the freeway, the airplanes overhead. Then as she entered a park, she found herself amid a cacophony

of chirping birds and it struck her — what if there was a way to visualize bird songs?

Walker took out her phone and began recording the different bird songs she heard. "I came home and sat down in front of my computer and thought 'OK, what can I do with these bird sounds?'" Auditory data like bird songs can be represented visually by a spectrogram, a computer-generated graph that shows how a sound changes in frequency and loudness over time. She wanted to create a visual that was less technical.

She first translated the auditory data using coding software that linked visual elements to specific properties of the spectrogram, like the decibels or frequency. Using this code and her knowledge of how people relate to and retain visual information, she created a simple visualization: A time-based animation that radiates bursts of circles scaled to the decibel levels of the sounds, and colored based on the colors of the bird species. This fluttery graphic mimicked the sound of the bird making the song.

**They applied a size logic, so that the inner-most circle is the beak, and the outer-most circle is the wing, producing a visualization that mirrored the bird's coloring.**

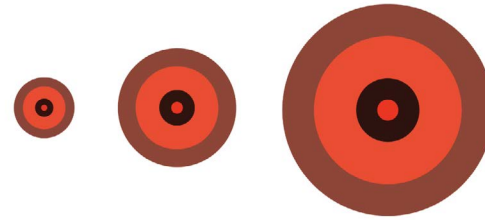
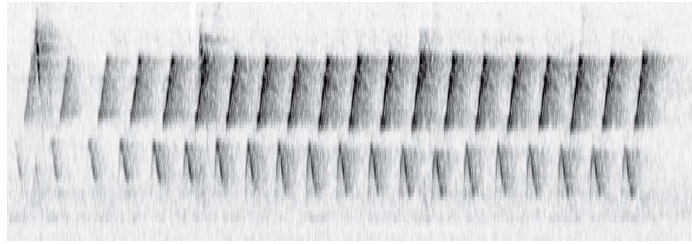


With this method in place, Walker recruited two research assistants to expand the work — Annika Zitto, a junior in the visual communication design program, and Sarah Stern, a master's student in the health communication design program (both have since graduated). Annika, coincidentally, had spent the previous summer birding and knew the popular sites in the area where they could

collect audio of various bird songs.

Meanwhile, Sarah joined birding expeditions to learn more about the intricacies of bird identification. "For example, birders don't just look at the overall colors of the bird, they look at the crown and the beak and the tail feathers," she explains. "We needed to refine the code." They applied a size logic, so that the inner-most circle is the beak, and the outer-most circle is the wing, producing a visualization that mirrored the bird's coloring.





(left) Spectrogram view of the cardinal call. (right) Stills from the time-based visual of the cardinal song.

They soon had a catalog of these animations for a number of local bird species — the next step was to explore potential applications for birders. “As an amateur birder, I noticed having both the visual and sound cues helped me recognize the bird songs more easily,” recalls Annika. This was an intentional part of Walker’s multisensory design approach.

She created a prototype app for a wearable device like a smartwatch, where the user is alerted by the visualization when a bird song is detected, rather than having to click through a screen on a smartphone,

as is the case with other birding apps. A gentle vibration would also accompany the visual, adding tactility to the design. Almost like a birding information system, it could be particularly useful for people who are hearing impaired and/or have limited dexterity to toggle a screen.

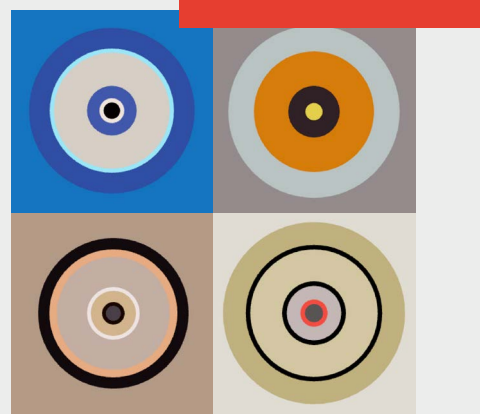
Indeed, inclusivity and the demographics of the birding community was top of mind during Walker’s design process. A 2024 [report](#) from the Fish and Wildlife Service estimates there are more 96 million birders in the U.S. However, a [study](#) found that 39% identify as having challenges to access, due to a range of limitations including mobility, vision, hearing and intellectual disabilities, as well as social barriers. There has been a recent movement to make birding more accessible, led by organizations like [Birdability](#).

Walker began exploring similar local organizations and events where they could share the visualizations. She and Annika attended a “bird sit” organized by the [Pennsylvania Center for Adapted Sports \(PCAS\)](#). Many of the birders they spoke to found the visualizations intuitive and were able to quickly identify the different bird species.

For Katie Samson, the founder of PCAS’ birding program, Walker’s app immediately captured her imagination. “As someone with limited mobility and hearing, I really appreciated that Renee’s app allowed for multiple ways to engage with bird identification,” she says. “And it’s playful and engaging, especially compared to reading a spectrogram.” She also believes it would level the playing field not just for critical users or those with disabilities, but for everyone. “The reality is our world is becoming more digital, so something like this helps more people contribute to the citizen science of birding.”

Looking forward, Walker hopes to expand her user testing and get the apps in the hands of more birders and non-birders alike. She’s also exploring other sensory modalities in her data visualization research, like different ways of reading the [weather](#) that use visuals linked to temperature rather than text or number-heavy apps.

“Ultimately, I hope this work shows that sensory data can enrich our lives, and that digital design and tools can enable us to be more connected to each other and our surroundings.”



Top left: Blue jay, Top right: American robin, Bottom left: Song sparrow. Bottom right: Northern flicker →



“Without Borders” by Pamela Talero Cabrejo

This artwork, created for the cover of *Occupational Therapy Without Borders*, configures the world map without borders, dissolving it into a vibrant background of people, animals and landscapes. The continents become inseparable from the living mosaic of creatures, symbolizing how human and ecological life are intertwined. Figures move together in rhythm, representing the shared struggles and hopes that connect humankind.

# BACK PAIN RELIEF: WHAT THE INTERNET GETS WRONG AND HOW TO DO IT RIGHT

by Deborah Balthazar

**Many turn to YouTube to learn how to relieve lower back pain, but could misinformation make things worse?**

**W**hen you feel tightness or pain in your lower back, it's tempting to search YouTube for videos professing quick relief. A simple stretch or yoga pose might feel good in the moment, but is the information in the video really helping?

Recent research is shedding light on the fact that 80% of the most-viewed YouTube videos on yoga for lower back pain contain problematic or [outdated information](#). While yoga can be beneficial, the wrong advice may worsen your pain. And it's not just limited to YouTube. [Other studies](#) have shown that short-form videos like TikToks can also give misleading advice.

So, how can you tell good advice from bad? Here's what to watch out for and what works when managing [back pain](#), according to exercise scientist [Dr. Travis Pollen](#).

## BEWARE OF THESE COMMON MYTHS

### 1. Oversimplified explanations

Many videos claim that back pain is caused by one issue, such as poor posture or tight hamstrings or glutes, but pain is complex. In addition to musculoskeletal biomechanics, stress, bad sleep habits and even a change in your overall mindset can all contribute to pain.

### 2. Fear-based advice for back pain

Some videos warn against certain movements, like forward folding or bending over as if to tie your shoes, saying they'll "damage" your spine. This messaging can actually make pain worse.

Instead of avoiding movements altogether, finding short-term alternatives and eventually learning how to move confidently and in a variety of ways is key to resolving pain.

### 3. Unqualified advice

Keep in mind that most YouTube yoga instructors are not medical professionals. They aren't trained to diagnose or treat pain like physical therapists. Looking for content from physical therapists or doctors specializing in rehabilitation could provide more evidence-based and up-to-date information.

### 4. Results may vary

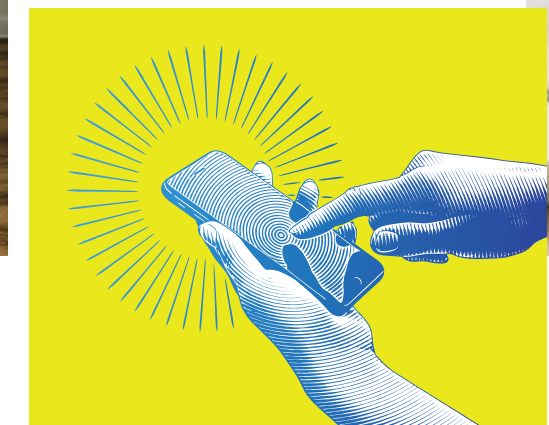
If a video claims a specific stretch will "cure" your back pain, be skeptical. Pain is experienced differently by everyone. What works for one person might not work for another.

## WHAT ACTUALLY HELPS: A SMARTER APPROACH TO LOWER BACK PAIN

Instead of following a one-size-fits-all approach, Dr. Pollen suggests taking a more balanced, [evidence-based approach](#):

### 1. Just move

When Dr. Pollen read the comments of several Yoga YouTube videos, he saw thousands of people writing about their positive experiences, which is not a bad thing. Yoga can be great for back pain, but exercise in general can help with pain reduction and overall, it feels good.



"It's not because yoga has something special or magical or specific from a biomechanical standpoint that's leading to pain reduction," says Dr. Pollen. "So, keeping active, continuing to do the things that you like, engaging in the activities that you find meaningful is helpful. So, if you like to do yoga, Pilates, walk, or strength training for back pain, that's great."

So, focus on the overall benefit of movement and exercise in a way that works best for you.

### 2. Consider the bigger picture

Stress, sleep, mental health and levels of social interaction all play a role in how you perceive and manage pain.

"When you're more stressed or underslept maybe your back pain is worse, but maybe when you experience more social interaction and meaningful relationships, your back pain is lessened," says Dr. Pollen. "So just looking at your whole life and trying to find the ways that you can be healthier overall, that would be the multi-pronged approach to back pain treatment, as opposed to just here's this one stretch that's going to solve your problem."

A holistic approach addresses all factors and can help you focus on the importance of a positive mindset and social connection.

### 3. Be realistic

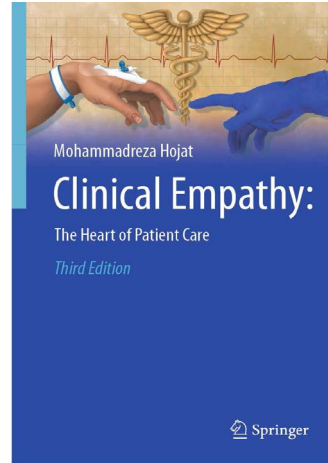
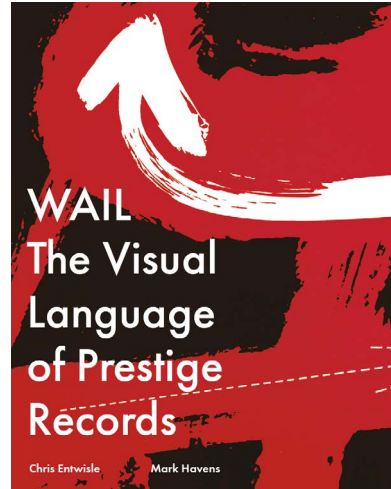
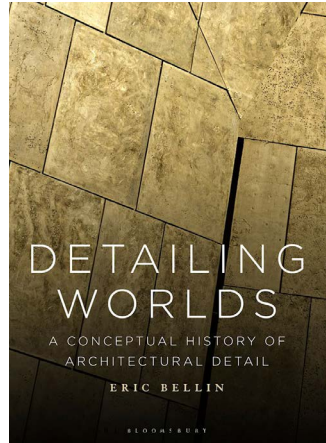
No single movement or yoga pose is a magic fix, and no one can promise that you'll never have back pain again. Having back pain is a risk factor for future back pain, after all. So, adjusting or setting realistic expectations will allow you to effectively manage pain over time.

### 4. When in doubt, seek a professional

It's difficult to get an individualized assessment through a video. If your back pain lasts for more than two weeks – especially if you are older, as back pain in older individuals is often more structural than muscular – it is recommended that you be assessed by a licensed health professional, such as an [orthopedic specialist](#), physical therapist, [neurosurgeon](#) or athletic trainer. [J](#)

# RESEARCH READS

by Moriah Adde



## ***Detailing Worlds: A Conceptual History of Architectural Detail***

Bloomsbury Visual Arts, February 2025

**Eric Bellin, PhD, MArch**

"Detail" has not always been used to describe architecture, but it has since evolved to become a critical part of architects' disciplinary vocabulary. While other books focus on the history behind building details, *Detailing Worlds* explores the history of detail as a concept specific to building practices, examining how the term's collection of meanings has originated and evolved in dialogue with changing conditions of technology, society and culture. Richly illustrated with more than 200 images, including figures from rare texts, archival student drawings and practitioners' construction documents from the 18<sup>th</sup> through 20<sup>th</sup> centuries, *Detailing Worlds* offers insights on how we think and speak about the practice of building.

## ***WAIL: The Visual Language of Prestige Records***

RIT Press, October 2025

**Chris Entwisle, Mark Havens, MID**

Prestige Records, an independent jazz recording company from the 1950s, had a diverse group of artists committed to visualizing music, including abstract expression painters, photographers and designers. In their new book, Jefferson associate professor of

industrial design Havens and co-author Entwisle reassess the role of visual art in presenting jazz. Although album covers are typically seen as ancillary to music, *WAIL* demonstrates that graphic design was integral to the listener's experience. The book houses all of the album covers Prestige produced in one place. *WAIL* tracks the evolution of Prestige's graphic designs through sharing some of the personal stories of the graphic designers who shaped it.

## ***Clinical Empathy: The Heart of Patient Care, 3<sup>rd</sup> Edition***

Springer Nature, February 2026

**Mohammadreza Hojat, MD**

Empathy is at the heart of patient care. In the newest edition of his book, Dr. Hojat highlights the impact of clinical empathy on patient outcomes. Using the Jefferson Scale of Empathy (JSE) developed by Dr. Hojat, national and international researchers acquired empirical data to support the importance of clinical empathy of physicians in diabetes management. The book is highly data-driven, with over 1,700 references, acting as a powerful resource to understand and increase clinical empathy. The book and the publications referenced give measurable action items to teach medical and other health professionals in training and in practice how to effectively use the JSE to improve empathy in patient care.

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