



Cleveland Clinic Magazine

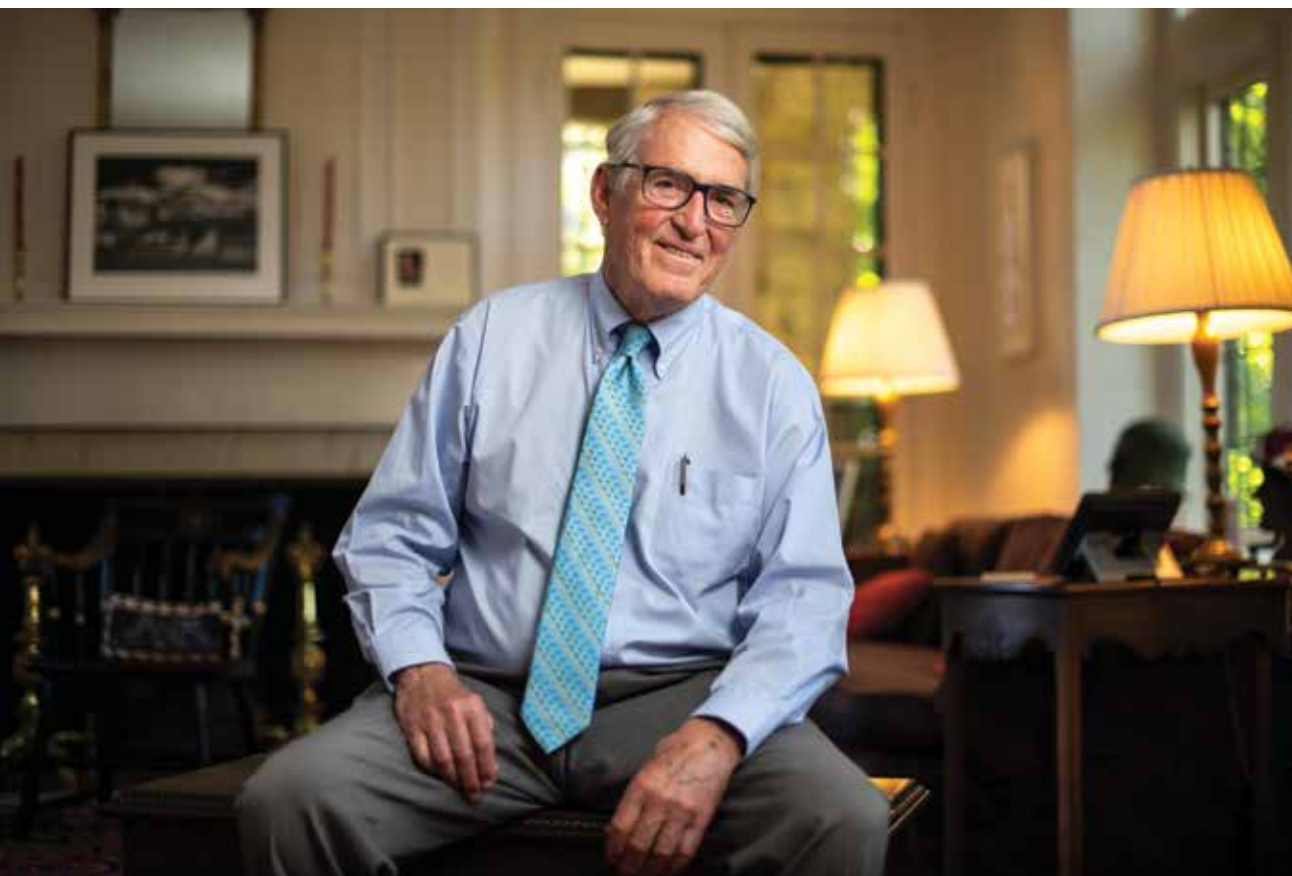
GIVING DOES GOOD | FALL 2022

INNO

VAN

A DEEP DIVE INTO THE
ALL-CONSUMING,
NORM-DISRUPTING,
LIFE-CHANGING
QUEST FOR WHAT'S NEW

TION



NOTES

1. Moore's companies make everything from hospital ventilators to green tray systems so people can grow succulents and grasses on their rooftops.

2. Moore fought for decades to transform a once-desolate mile-long peninsula in Cleveland near the mouth of the Cuyahoga River into an urban park and marina named after his daughter, who liked to roam the area with her camera. The 500-foot-long Wendy Park Bridge, completed in 2021, connects bikers and joggers to Wendy Park's 22 acres of green space, some 260 species of birds and outstanding views of downtown.

3. Moore, a member of the 1921 Society, has served on Cleveland Clinic's Board of Trustees for more than 25 years.

4. Physician-scientists at Cleveland Clinic were among the earliest innovators in deep brain stimulation (DBS) to treat Parkinson's disease, essentially installing a pacemaker for the brain. Moore is helping fund a first-of-its-kind study to investigate the potential for DBS to restore motor and cognitive skills in patients who have suffered a traumatic brain injury.

5. A new home for Cleveland Clinic's Neurological Institute will be the first neurological care center purpose-built for the digitization of patient data and distance health. Doors are expected to open in 2026.

Dan T. Moore

When artist Wendy Moore died at age 29 after suffering head injuries in a skiing accident, her father, Dan T. Moore, an entrepreneur with 39 patents to his name, put his power of invention to work to build a better ski helmet. He spun that idea into headgear for soldiers that can stop a bullet. Today, the foam lining in every helmet used by the U.S. military is made in Cleveland by Team Wendy, the company Moore created to honor his daughter with the motto: "We innovate to protect."

We read you founded 25 companies. Does that sound right?

It's actually more than 30.¹ Some of them are tiny, but some of them are good size. I try to sell them after a while. I like to start 'em. I don't like to run 'em.

That's the entrepreneurial spirit! What inspires you to be so creative?

I think it's always looking for the unmet need and trying to listen very carefully to be sure that you understand what the problem is. Most of the time, it's more difficult understanding the problem than it is solving the problem.

Of the many accomplishments in your life, is there one you're most proud of?

Gosh, that's an interesting question. It's sort of like saying, "Which child do you like the most?" Team Wendy is important. Wendy Park and the bridge are important.² My involvement with Cleveland Clinic is important.³

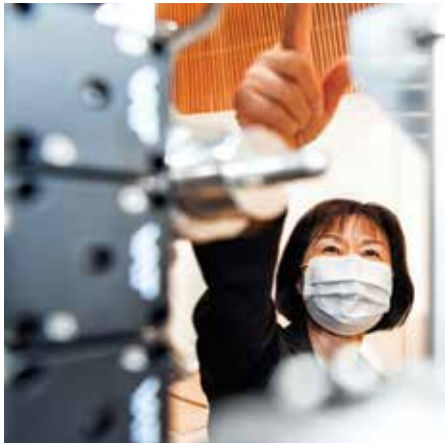
How do you decide where to give?

I focus upon my interests and unmet needs and where I can do the most good. And I do think neurology is the new frontier of medicine.⁴ Currently, half of the people who are 85 years old have some form of dementia, and many will live longer. They're going to need a lot of help. When dementia sets in, you lose who you are. The neurology building? The only thing wrong with it is we couldn't do it earlier. It is a vitally important project.⁵

—Andrea Simakis

Fall 2022

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"If a new method ... seems more feasible than one already employed, I ask a unit to try it out, and we then compare their results with those of other units. It is research on a colossal scale. The methods of years can be overthrown in a night. We have no fixed ideas."

— **GEORGE CRILE SR., MD (1864-1943)**
CO-FOUNDER OF CLEVELAND CLINIC



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ONLINE EXTRA

Cleveland Clinic has established a new standard in medical research, made possible through philanthropy. Go in-depth with our special digital coverage, presented in collaboration with T Brand Studio. Visit cle.clinic/innovation.

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From left are Dr. René Favaloro,
Dr. Delos “Toby” Cosgrove
(at left) and Dr. Darrell Cass.



Innovation Happens Here

*“Our blueprint
is simple: Provide
the best care
possible, invent it
through research
and innovation,
then share it
with the world.”*

— TOM MIHALJEVIC, MD, CEO
AND PRESIDENT OF CLEVELAND
CLINIC AND THE MORTON L.
MANDEL CEO CHAIR

Welcome to The Innovation Issue! In this special themed installment of *Cleveland Clinic Magazine*, we celebrate the relentless forward thinking that has propelled our nonprofit health system for more than a century. As Cleveland Clinic CEO and President Tom Mihaljevic, MD, says: “Our blueprint is simple: Provide the best care possible, invent it through research and innovation, then share it with the world.”

George Crile Sr., MD; Frank Bunts, MD; William Lower, MD; and John Phillips, MD, founded Cleveland Clinic in 1921 with an innovative approach to medicine: a multispecialty group practice where caregivers could exceed the sum of their parts while advancing patient care, research and education.

It proved to be fertile ground for breakthroughs. At Cleveland Clinic, F. Mason Sones, MD, was the father of moving cine-coronary angiography; René Favaloro, MD, pioneered coronary bypass surgery; and Delos “Toby” Cosgrove, MD, performed the first minimally invasive heart valve surgery. Those are just a few examples.

Today, the spirit of innovation is stronger than ever here. I’m thinking of trailblazers such as Vincent Touhy, PhD, and Darrell Cass, MD. Dr. Touhy, the Mort and Iris November Distinguished Chair in Innovative Breast Cancer Research, has invented a vaccine to prevent triple-negative breast cancer. Dr. Cass is breaking new ground in fetal surgery.

You’ll meet many other innovative Cleveland Clinic caregivers in this issue, in print and online. How do they do what they do? They tell us in their own words — and I hope you’re as inspired as I am by their insights into the art of innovation. We’ll also retrace the innovation journey of a team that is harnessing the power of artificial intelligence to optimize spine care. “Innovation is expensive, and philanthropy drives innovation,” Michael Steinmetz, MD, says in the latter story. “Philanthropy takes kernels of ideas that have promise and launches them into the stratosphere.”

At Cleveland Clinic, we dream big. And with your ongoing support, the sky is truly the limit for our innovators. Thank you.

— LARA A. KALAFATIS
Chair | Philanthropy Institute

***We’d Like to
Hear from You***

Cleveland Clinic Magazine welcomes letters from readers. Email ClevelandClinicMag@ccf.org or drop us a line at *Cleveland Clinic Magazine*, Philanthropy Institute, 9500 Euclid Ave. | AC312, Cleveland, OH 44197-9905.

FIRST

The Future of Innovation

Cleveland Clinic and IBM have begun deployment of **THE FIRST PRIVATE-SECTOR, ON-SITE, IBM-MANAGED QUANTUM COMPUTER** in the United States, to be located on Cleveland Clinic's main campus.

The first quantum computer in healthcare, anticipated to be completed in early 2023, is a key part of the Cleveland Clinic-IBM Discovery Accelerator, a partnership between the two organizations that is aimed at fundamentally advancing the pace of biomedical research through high-performance computing.

"The current pace of scientific discovery is unacceptably slow, while our research needs are growing exponentially," said Lara Jehi, MD, Cleveland Clinic's Chief Research Information Officer. "We cannot afford to continue to spend a decade or more going from a research idea in a lab to therapies on the market. Quantum offers a future to transform this pace, particularly in drug discovery and machine learning."

"A step change in the way we solve scientific problems is on the horizon," said Ruoyi Zhou, PhD, Director, IBM Research - Cleveland Clinic Partnership. "At IBM, we're more motivated than ever to create with Cleveland Clinic and others lasting communities of discovery and harness the power of quantum computing, AI and hybrid cloud to usher in a new era of accelerated discovery in healthcare and life sciences."

Cleveland Clinic and IBM have already begun several collaborative projects that benefit from the new computational power, including a research study developing a quantum computing method to screen and optimize drugs targeted to specific proteins; an improved prediction model for cardiovascular risk following noncardiac surgery; and the use of artificial intelligence to search genome-sequencing findings and large drug-target databases to find effective, existing drugs that could help patients with Alzheimer's and other diseases.

Invest in Innovation

The Discovery Accelerator serves as the technology foundation for the new Cleveland Innovation District, a \$1 billion dollar initiative launched with a \$500 million investment from the State of Ohio, Jobs Ohio and Cleveland Clinic. We're seeking to raise another \$500 million to support programs like the Discovery Accelerator, recruit and train a 21st century workforce and expand Cleveland Clinic's global reach. With your vital support, we can double our research capacity and bring more breakthroughs to more patients. Visit give.ccf.org/innovation.



Dr. Ruoyi Zhou, left, and Dr. Lara Jehi inspect the new IBM quantum computer that is being installed on Cleveland Clinic's main campus.



Aviation pioneer Louise Timken served in the Civil Air Patrol during World War II.

RESEARCH

Initiative Sets Its Sights on AMD

One in four people over the age of 70 will develop age-related macular degeneration (AMD) that will threaten their central vision. AMD is the leading cause of permanent blindness worldwide.

At Cleveland Clinic, the new **LOUISE TIMKEN INITIATIVE FOR AGE-RELATED MACULAR DEGENERATION RESEARCH** will set out to change that. It has been established with a \$10 million gift from the Timken Foundation of Canton, Ohio.

The initiative promises to build upon the Cole Eye Institute's existing strengths and recruit the brightest AMD researchers in the field. A key focus will be discovering biomarkers that will lead to significant changes in treatment for patients. In addition to aligning its efforts with the Lerner Research Institute and the new Cleveland Innovation District, the initiative plans to leverage synergies across Cleveland Clinic's global health system to offer the most innovative AMD care in the world.

"Our goal is twofold," says Cole Eye Institute Chair Daniel F. Martin, MD, the Barbara and A. Malachi Mixon III Institute Chair of Ophthalmology. "First, we aim to identify new

therapeutic targets and to develop drugs for those targets in an effort to improve outcomes in those who develop AMD. Second, we hope to significantly advance our understanding of the mechanisms that cause the disease so that we might prevent it altogether. We are deeply grateful to the Timken Foundation for providing a catalyst for new research that we are confident will lead to important progress in the fight against this disease."

The new initiative is named in honor of Louise Timken (1910-1998), a high-flying pioneer who served in the Civil Air Patrol during World War II. She later became the first woman to pilot her own private jet. She kept flying into her 80s, until AMD grounded her. Her joy of flying was shared by her husband, the late H.H. Timken Jr., former Chairman of the Timken Company.

The Timken Foundation has a track record of generous support for Cole Eye Institute. Previous gifts provided funding for the expansion of the institute as well as for the creation of the Louise Timken Microsurgical Education Lab and the Louise Timken Ophthalmic Education Center.

RANKINGS

Heart of the Matter

For the 28th year in a row, Cleveland Clinic is America's **NO. 1 HOSPITAL FOR CARDIOLOGY AND HEART SURGERY** in U.S. *News & World Report's* 2022-23 Best Hospitals rankings, while earning a Top 5 overall ranking for the 24th consecutive year. Cleveland Clinic's main campus hospital, which ranks No. 4 in the nation and No. 1 in Ohio, placed nationally in 13 specialties, including nine in the Top 10 and six in the Top 5. "These rankings are a recognition of our caregivers' compassion and expertise," said Cleveland Clinic CEO and President Tom Mihaljevic, MD, the Morton L. Mandel CEO Chair. "Every day and with every patient, we strive to improve our high standards and outcomes."



COMMUNITY

'STRENGTHENING THE NEIGHBORHOOD'

A groundbreaking ceremony was held in September to mark phase one of **THE AURA AT INNOVATION SQUARE**. The mixed market-rate apartment development will serve the community and workforce in Cleveland's Fairfax neighborhood, which also is home to Cleveland Clinic's main campus. Scheduled to open in late 2023, the Aura will include 82 one- and two-bedroom rental units. In addition to assisting with site acquisition, Cleveland Clinic has invested \$10 million to support the project. "Cleveland Clinic is committed to strengthening the neighborhood we call home and creating a healthier community," said Tom Mihaljevic, MD, CEO and President of Cleveland Clinic and Mandel CEO Chair. "When we all come together to identify and address community issues, we can make a difference."

GIFT

A BOON TO LEADERS AND INNOVATORS

A transformational gift of \$30 million from the Jack, Joseph and Morton Mandel Foundation will catalyze **LEADERSHIP DEVELOPMENT AND INNOVATION** at Cleveland Clinic.

The gift endows the position of the Chief Executive Officer of Cleveland Clinic. The inaugural holder of the Morton L. Mandel CEO Chair is the current CEO and President, Tom Mihaljevic, MD.

"We wanted to honor the legacy of Mort Mandel," said Jehuda Reinharz, PhD, President and CEO of the Mandel Foundation. "He believed in leadership, and he felt that the leadership of Cleveland Clinic was outstanding."

The gift also establishes an endowed fund for innovation. Funds drawn annually from the endowment will be available to the CEO to seed innovative ideas that impact the communities served by Cleveland Clinic and to advance priorities in support of the CEO's vision.

"We wanted to give a powerful tool to the CEO of Cleveland Clinic to be able to spark innovation," said Mandel Foundation Chairman Stephen H. Hoffman. "There's no one better positioned to understand what needs to be encouraged. We think that's a big part of what leadership is about."

The Mandel Foundation's long history of support for Cleveland Clinic includes a \$23 million gift in 2019 for preparing future healthcare leaders at the Jack, Joseph and Morton Mandel Global Leadership and Learning Institute, as well as previous gifts to support the Morton L. Mandel Chair for Urologic Cancer Research at the Glickman Urological Institute; the Jack, Joseph and Morton Mandel Preventive Medicine Suite; and the Jack, Joseph and Morton Mandel Conference Center at the Health Education Campus.

"I'm convinced that it's not a crazy idea to think you can change the world by changing the leaders," Mort Mandel told *Cleveland Clinic Magazine* shortly before his passing in 2019. "The quality of Cleveland Clinic or almost any institution is, to a great extent, a function of the quality of the people at the top."



Top: Cleveland Clinic CEO and President Tom Mihaljevic, MD, is the inaugural holder of the Morton L. Mandel CEO Chair. Bottom: Morton Mandel, center, with his brothers Joseph, left, and Jack, right.



LAB REPORT

Priming the Immune System

Researchers from Cleveland Clinic's Florida Research and Innovation Center (FRIC) have discovered that disruption of a cellular structure known as the actin cytoskeleton is a **"PRIMING SIGNAL" FOR THE BODY TO RESPOND TO A VIRUS**. These findings, published in the journal *Cell*, potentially lay the groundwork for new antiviral vaccines and treatments. "It's a fundamental new way of considering how the immune system can be activated," said Michaela Gack, PhD, (pictured) the Arthur and Marilyn Levitt Endowed Chair and Scientific Director of the FRIC. "This could lead to broad antiviral therapeutics." The FRIC team collaborated on the study with researchers from multiple institutions, including Konstantin Sparrer, PhD, of Ulm University in Germany. (For more on Dr. Gack, see page 28.)



MARK YOUR CALENDAR

The 26th annual POWER OF LOVE gala is set for Saturday, February 18, 2023, at MGM Grand Garden Arena in Las Vegas. The star-studded benefit for Cleveland Clinic Lou Ruvo Center for Brain Health will honor Rock and Roll Hall of Famer Steven Tyler and present the Community Leadership Award to entrepreneur and philanthropist John Paul DeJoria. For details, visit keepmemoryalive.org/PoL.

1921 Society Dinner

May 21, 2022 | Cleveland

The 1921 Society, which honors donors who have contributed \$1 million or more to Cleveland Clinic, welcomed more than 160 new members at its latest induction dinner — its first in-person event since 2019. “Tonight we celebrate the impact of philanthropy,” Chair Norma Lerner told guests in the glittering Cosgrove Courtyard of the Sheila and Eric Samson Pavilion. Serpil Erzurum, MD, Chief Research and Academic Officer of Cleveland Clinic, received the Alfred and Norma Lerner Humanitarian Award, while *The Power of Every One* Centennial Campaign Co-Chairs Larry Pollock (honored alongside his wife, Julia) and Stewart Kohl donned white coats and joined the elite ranks of Distinguished Fellows.



*Cleveland Clinic Board of Directors Chair
Beth E. Mooney and Chase Rynd*



Norma Lerner, right, and Ronald J. Ross, MD, FACR



*Larry Pollock, left, and Stewart Kohl, right, with Cleveland
Clinic CEO and President Tom Mihaljevic, MD, the Morton L.
Mandel CEO Chair*



Dr. Serpil Erzurum



*Lara Kalafatis, Chair of Cleveland Clinic's Philanthropy Institute, welcomed 1921
Society members.*

Derby Day Soirée

May 7, 2022 | Cleveland

The inaugural Derby Day Soirée raised more than \$2.1 million for Cleveland Clinic Children's patients and their loved ones. Funds will help seed and speed critical research, expand family services and educate the best and brightest caregivers.



DJ Lily Jade entertained the crowd.



Derby Day Soirée Chair Emeritus Umberto Fedeli, center, with his wife, Maryellen, and their family

Cole Building Groundbreaking

May 20, 2022 | Cleveland

Cleveland Clinic hosted a ceremonial groundbreaking for construction of the new Jeffrey and Patricia Cole Building and renovation of the existing Cole Eye Institute building. The two structures will be connected to create an integrated eye center designed to deliver leading-edge patient care, research and education. The 150,000-square-foot expansion was made possible by a lead gift of \$31.5 million from Jeffrey A. Cole and his wife, Patricia O'Brien Cole.



From left are Joe Cole, Graham Cole, Patricia O'Brien Cole, Jeffrey A. Cole, Jackson Cole and Kristen Cole.

Goombay Bash

June 11, 2022 | Jensen Beach, Florida

Guests enjoyed Caribbean food and music at the 20th annual installment of the signature event of the Cleveland Clinic Martin Health Foundation LifeSavers, which raised more than \$173,000. Since 2002, Goombay Bash has generated more than \$2 million for infant, pediatric and family programs at Cleveland Clinic Martin Health.



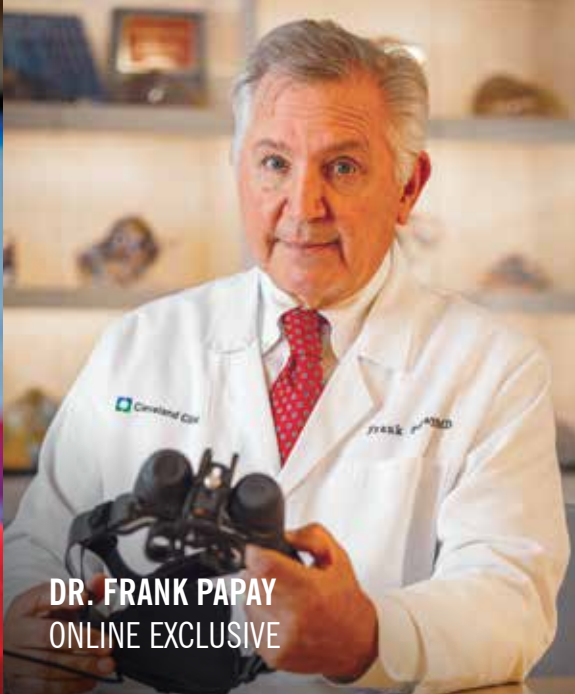
From left are Cleveland Clinic Martin Health Hospital Presidents Madhu Sasidhar, MD, and Rishi Singh, MD.



Brookelle Perkins and Stephen Ngo

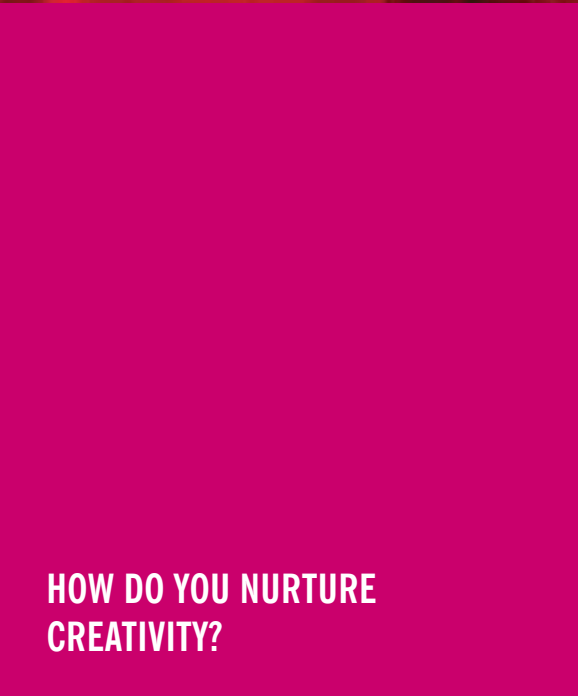


DR. CHARIS ENG
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DR. FRANK PAPAY
ONLINE EXCLUSIVE

THE



**HOW DO YOU NURTURE
CREATIVITY?**



DR. PAUL MARASCO
PAGE 14



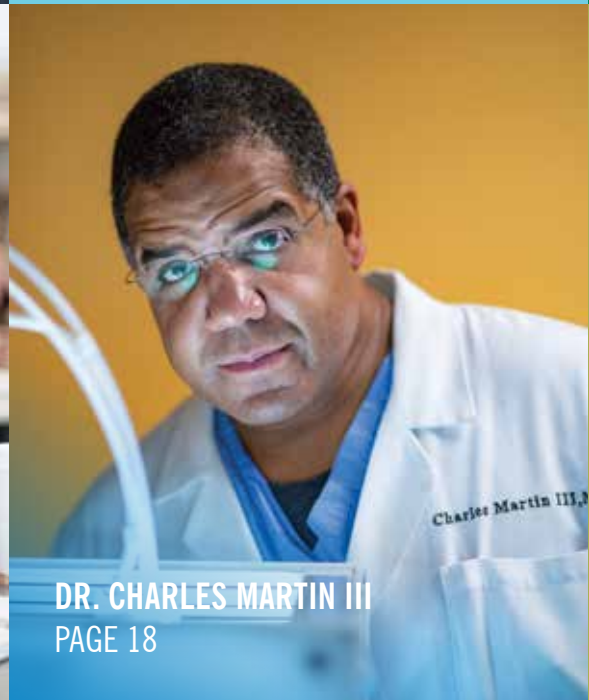
**WHERE DO GOOD IDEAS
COME FROM?**



**WHAT CAN WE LEARN
FROM FAILURE?**



DR. ERIC YUDELEVICH
ONLINE EXCLUSIVE



DR. CHARLES MARTIN III
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DR. JOSE NAVIA
PAGE 12

**WE ASKED CAREGIVERS WHO
EXEMPLIFY THE SPIRIT OF
INNOVATION AT CLEVELAND
CLINIC TO TELL US HOW THEY
DO WHAT THEY DO.**



DR. ANDRE MACHADO
ONLINE EXCLUSIVE

INNO VA TORS



DR. VIJAY KRISHNA
ONLINE EXCLUSIVE



JANE HARTMAN
PAGE 16

INTERVIEWS BY
JOHN SOEDER

PHOTOGRAPHS BY
ANNIE O'NEILL
LISA DEJONG
SHAWN GREEN
STEVEN GILBERT



DR. BAHAR BASSIRI GHARB
ONLINE EXCLUSIVE



TO MEET MORE INNOVATORS
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magazine.clevelandclinic.org



Charis Eng

MD, PhD

Innovation isn't limited to commercialization. Innovation is much broader. It's a new idea, a new method or a new device for the greater good.

To be innovative, you need an innovative hard wiring — geneticists would call it genotype — and it has to be nurtured by your environment. My parents always encouraged me to think differently. I do the same for the trainees in my lab.

You have to be creative. Young children are a good example. They're closer in age to the genetic event of birth, when creativity flows more naturally. They haven't been nurtured to inhibit creative thoughts, which are usually crazy, right? Eventually, the environment often encourages them to conform.

Fortunately, I had mentors like the late Ed Garber, who taught genetics at the University of Chicago. He was all about freeing your mind — there is no such thing as a crazy idea. From history, Marie and Pierre Curie are role models of mine. When they had an idea, they stuck with it. **You need**

stick-to-itiveness, because even if you have the best idea, the world might not be ready for it.

Today, my patients and their families inspire me to do good research, to pursue research-based evidence to help them.

I do my best thinking in a quiet environment, usually at home. An idea might come to me anytime. Sometimes when I'm cooking. Scientists are usually good cooks, probably because we like to experiment. I'm innovative in the kitchen, too. I like to do hybrid foods — a combination of Chinese and Italian, for example.

I might listen to a lecture or read an article about something completely out of my field, but it can still spark a thought that I can adapt for my research. Innovation isn't confined by arbitrary boundaries. ■

Charis Eng, MD, PhD, is the inaugural Chair of Cleveland Clinic's Genomic Medicine Institute. She holds the Sondra J. and Stephen R. Hardis Endowed Chair in Cancer Genomic Medicine. An expert in genomics-informed precision healthcare and population health, Dr. Eng is an elected member of the National Academy of Medicine and the author of more than 500 peer-reviewed articles. She was the first to show that alterations in the cancer-fighting gene *PTEN* predispose not only to cancer but also to autism.

PHOTO: LISA DEJONG

Jose Navia

MD

You have to have a spirit of innovation. It has to come from within you. You can't buy it somewhere.

I'm always looking at the patient's needs. In the OR, in the ICU, wherever the patient is, there's always room for improvement. In cardiothoracic surgery, we see more and more complex cases every year. So we have to be dynamic in terms of innovating different surgical techniques, different procedures and different devices.

You need to understand the problem. If you don't understand the problem, you can't fix it. Every time I'm performing surgery, I'm thinking: Can we improve this by doing it differently? It's paradoxical, but a simple solution can be the most elegant way to resolve a complex case.

By the time I was 10 years old, I knew I wanted to be a physician. I also liked to draw. A lot. My mom kept a huge book of drawings that I made when I was a boy. I did all these drawings of different animals. I think it helped me to start to understand anatomy. Even now, I love to draw. Translating the ideas in my mind to paper helps me to understand them, whether it's an idea for a new device or an idea for a new surgical procedure. **When an**

idea comes to me, it can be very powerful — so powerful that I have to address it.

It can't wait. Sometimes I'll wake up at 3 o'clock in the morning with an idea, and I quickly write it down so I don't forget. When I have an idea, I need to work on it. Write more notes; make more drawings. My wife is used to it. She knows I need to focus, and I won't rest until I'm finished.

Innovation never stops. Never. That's the beauty of it. ■

Jose Navia, MD, is Director of the Heart and Vascular Center at Cleveland Clinic Florida. He holds the S. Donald Sussman Distinguished Chair in Heart and Vascular Research. With 30 patents to his name, Dr. Navia has made numerous advances in minimally invasive procedures for heart valve repair and replacement as well as mechanical assist devices for cardiovascular patients.



"LET'S FIX
THE PROBLEM"
Dr. Jose Navia

Cleveland Clinic

Jose L. Navia, M.D.A.C.

E ANNALS
OF
RADIOLOGY



Paul Marasco

PhD

I commute by bike to and from work. Riding through the city, you have to be nimble and risk-tolerant. It's the same when you're innovating. You need the right environment. As long as I have some peace and some breathing room, interesting thoughts will pop up.

Cleveland Clinic gives us the space to be creative. In my experience, not every institution does. Here, we're surrounded by amazing colleagues. They're really engaged. They're moving things forward. They're trying to show people what the future looks like.

Sometimes it doesn't work. The key is to turn every failure into an advantage. A few years ago, we had a grant for some ideas that we couldn't get to pan out. We didn't feel good about the outcome, but it sent our lab in a new direction that ended up being the bread and butter of the cognitive technologies that we're working on now.

Before I became a scientist, I went to art school. I studied sculpture and printmaking, but I didn't feel like I had anything to say as an artist. When I went back to school and studied neuroscience, I realized that science actually is my art.

Science and art are both different ways of explaining the world around you.

In our lab, everyone has a creative background. I want people who see things that aren't obvious, people who are in tune with things that are unexpected, that are challenging, that don't make sense. We have a saying: You need to stay the hell out of your comfort zone.

People who engage in the creative process aren't comfortable with the mundane. They're always poking around places that are odd and surprising. That's where the magic is. That's where innovation happens. ■

Paul Marasco, PhD, is a Cleveland Clinic scientist in the Lerner Research Institute's Department of Biomedical Engineering. His team develops bionic limbs with natural touch and an intuitive sense of movement. Dr. Marasco's work has been recognized with innovation-focused research awards from the National Institutes of Health and the Defense Advanced Research Projects Agency, as well as a Presidential Early Career Award for Scientists and Engineers. He won a 2022 Clinical Research Forum Top 10 Clinical Research Achievement Award for bionic arms that allow their wearers to function like able-bodied people.

PHOTO: LISA DEJONG

Jane Hartman

MSN, APRN, CPNP-PC

I'm an inquisitive person. I'm not afraid to ask: Why are we doing it that way?

When I was in middle school, we had a science project where we had to come up with a product that nobody else had invented — which, of course, is difficult. My invention was windshield wipers for eyeglasses. I've worn glasses since I was 8 years old, so I know that rain on your glasses can be a problem if you don't have a tissue.

It's true what they say: Necessity is the mother of invention. When you're a nurse, there are times when you have to figure out a problem and not have what you think you need. If you're jerry-rigging something, you need to figure out what can be done better.

The four P's of innovation are passion, persistence, patience and perseverance. If you're not passionate about your idea, no one else is going to be. Even when naysayers are all around you, if you believe, you persist. That's when patience and perseverance are key. It took years to make the High-Line™ a reality. Believe in what you're doing, no matter how long it takes. If it's the right thing to do, don't let it go.

For me, this was a family affair. My older son, Jonathan, is an innovation director in the aerospace industry. He told me, "If all you have is an idea on a piece of paper, nobody will get it." My younger son, Nathaniel, made a 3D-printed prototype of the High-Line. Then we were off and running.

At Cleveland Clinic, I've been fortunate to have the support of Dr. Nancy Albert and Dr. Mary Beth Modic as mentors. They've inspired me to be fearless. My grandchildren — Juniper, Arlo and Elianna — inspire me, too. Their sense of wonder and their eagerness to learn give me great joy. ■

***Jane Hartman, MSN, APRN, CPNP-PC**, is an advanced practice nurse at Cleveland Clinic Children's. She created the High-Line, a novel color-coded IV carriage system that organizes and elevates IV tubing to prevent it from dragging on hospital floors. Originally conceived for the benefit of pediatric patients, Hartman's invention proved invaluable during the pandemic, when IV pumps placed outside ICU patient rooms to decrease caregivers' exposure to COVID-19 spurred thousands of High-Line usages.*

PHOTO: ANNIE O'NEILL





Charles Martin III

MD

I don't see innovation as something static. To me, it's a verb. It's a dynamic process that revolves around a willingness to see the world in a different way through a different lens, as well as through the eyes of others.

One of my favorite books is *The Medici Effect* by Frans Johansson. It talks about how magical things happen when multiple people from multiple specialties who are thinking about things in different ways come together.

Innovation requires a degree of humility. You have to be open to the possibility of failure. But failure creates value. It can inform your understanding of limitations and how to proceed.

Some of my best ideas come when I'm spending time with my family. It puts everything in perspective. **There are those**

**moments when your head meets your heart,
and everything coalesces.**

My colleagues and I were preparing a telecollaboration between Cleveland Clinic teams in Cleveland and in Florida for a procedure involving augmented reality. Once we felt that we had the process figured out technically, we needed a dry run before going live with our experiment. While spending time with my family, I realized that we could try the equipment with them. I ran to the store and brought home a little Lego set. I set my daughter at our table with the Legos, took away the instruction booklet and gave it to my son, who was in a separate part of the house. While she was downstairs wearing the augmented-reality headset, he was upstairs with our app on a phone, relaying her instructions for building the Lego set. And we were able to get the remote collaboration to work! I was able to bring those insights back to my colleagues, and we figured out how to apply them clinically.

My kids tease me because I always walk around with a bunch of paper in my pocket. It's kind of unsightly, covered with scribbled ideas. I get my ideas down quickly, then I'll run them past friends who can help me figure out if something is worth pursuing. Bringing other people into the conversation is so important. Innovation is never just about "me." It's always about "us." ■

Charles Martin III, MD, is a Cleveland Clinic interventional radiologist. He subspecializes in interventional oncology, minimally invasive/percutaneous cancer therapies, hereditary hemorrhagic telangiectasia, pulmonary arteriovenous malformation embolizations and embolotherapy. Beyond his clinical experience, Dr. Martin is actively engaged in research, and has led or served as co-investigator on multiple clinical studies. He is passionate about innovating new devices for interventional radiology and investigating technologies capable of better engaging patients or developing more effective and more efficient procedures.



Dr. Thomas Mroz performs spine surgery.

EVOLUTION OF AN IDEA

Can artificial intelligence point the way to better spine care? Go behind the scenes on one team's journey from innovation to invention.

BY JOHN SOEDER

Heterogeneity. Big word; potentially big problem. Particularly if we're talking about spinal care. Let's say you have lower back pain, one of the most common spinal conditions. Consult 10 different surgeons, and you might come away with nearly as many different recommendations for treating the issue. That's heterogeneity: essentially, a hodgepodge of approaches. These variations exist for a multiplicity of reasons, including differences in the experience and training of the surgeons as well as a host of patient-specific factors.

Led by Thomas Mroz, MD, and Ghaith Habboub, MD, a team of Cleveland Clinic innovators is developing a platform that harnesses the power of artificial intelligence (AI) to optimize spine care. This is their story.

CAST OF CHARACTERS



Thomas Mroz, MD,
is Chair of Cleveland
Clinic's Orthopaedic &
Rheumatologic Institute.



Ghaith Habboub, MD,
is a Cleveland Clinic
neurosurgeon.



Michael Steinmetz, MD,
is Chair of Cleveland Clinic's
Department of Neurosurgery
and Director of the Center
for Spine Health.



Thad Meese, MBA,
is Associate Director of
Innovations Technology
Development at
Cleveland Clinic.

ORIGINS

Rewind to 2015. The roots of virtually any innovation, including this one, can be traced back to someone looking around and thinking: There must be a better way. That's what happened seven years ago at Cleveland Clinic.

DR. MROZ: I saw the gaps in spine care. The heterogeneity across the country is well documented. Surgeries for one particular problem can be disparate, for a lot of reasons. If a patient has lumbar spinal stenosis, they should be getting one surgery. It should be consistent because we should be doing the absolute best thing for a patient, regardless of where they're entering the healthcare system, anywhere in the nation.

At the same time, I also saw an opportunity to better utilize the advanced computing that we now have at our fingertips. We have capabilities that few people even dreamed about 50 years ago. There's so much data about every patient in their electronic medical record.

My goal was to use advanced computing to analyze a comprehensive set of data points, in real time, to provide a more meaningful encapsulated vision of a patient and to help us make the best decision for improving the quality of care while driving down the cost.

DR. HABBBOUB: I was still a resident when the project began. It grew out of a series of conversations. Dr. Mroz and I talked all the time about the future of spine care. Could we sum up all these patient characteristics in a way that would tell us a story about the patient and help us make a better decision about care?

Dr. Mroz was senior staff. I was a trainee. But we shared a vision.

DR. STEINMETZ: I've been involved more or less from the beginning. My role has been to provide clinical perspective. I'm a sounding board for the pragmatic application. How do we do this?

MEESE: In the innovation field, we use the term "white space" to describe where opportunities exist to disrupt the market. At Cleveland Clinic Innovations, we work with inventors to develop their ideas and bring them to market in order to positively impact patients' lives. To get things rolling, they'll submit an invention disclosure form with us. The first time I reviewed the disclosure for the AI-guided spine care project, I was immediately excited about its disruptive potential.

HOW TO BUILD A BETTER CRYSTAL BALL

If this were a case study about, say, a new heart valve, we could show you a blueprint or a photograph of a new heart valve. It's a little trickier to paint a picture of the invention at the center of this story — somehow, a flowchart or line after line of computer code just wouldn't do it justice. So what is AI-guided spine care, anyway?

DR. MROZ: It's a decision-making tool to help us predict which intervention is going to result in the best outcome for a patient. It can tell us your chances for meaningful improvement if you have surgery. If surgery isn't the best option, it can send you down a different care pathway that will be more advantageous for you. It's precision medicine.

DR. HABBBOUB: The innovation is a modular algorithm. It's complex enough to get the job done, but it's also the simplest it can be to get the job done. That's known as Occam's razor.

DR. MROZ: For us, the biggest turning point was developing a quantifiable method to judge a patient's outcome. We came up with something called "the utilization metric." Essentially, it's a mathematical formula that looks at everything that happens to a patient after surgery: How many office visits and phone calls? How many imaging studies? And so on. We look at all these factors to determine if an outcome was successful.

After the project was launched, it took the better part of two years just to navigate the necessary internal reviews and approvals. Then the team created a beta model. They named it HAL, after the supercomputer in 2001: A Space Odyssey. In addition to having a healthy sense of humor, Dr. Mroz and Dr. Habboub play off each other's strengths.

DR. STEINMETZ: Everybody was talking about big data. But what does that really mean, and what do you do with it? Dr. Mroz had the foresight to say, "We can use this in a meaningful way." That was a light-bulb moment. He had this big idea, and Dr. Habboub had the technical expertise to pursue it. He's a savant, a self-taught expert who really understands artificial intelligence and machine learning.

MEESE: Early on, we had a meeting where Dr. Mroz and Dr. Habboub fully committed themselves to this process. It takes a lot of sweat equity, not to mention blood and tears. They give everything of themselves.

“Innovation is expensive, and philanthropy drives innovation. Philanthropy takes kernels of ideas that have promise and launches them into the stratosphere.”

— DR. MICHAEL STEINMETZ

A DONOR SAVES THE DAY

To keep the project moving forward, philanthropic support was essential. A generous gift from the Connor Group Kids & Community Partners of Dayton, Ohio, provided critical funding for an external partner with healthcare data expertise.

DR. MROZ: Philanthropy was incredibly important. Without it, we couldn't have pulled this off.

At the time, we didn't have the data scientists or the data engineers in-house who could pull this off. So we contracted with an external company to engineer the data in such a way that it could be used.

In the 21st century, data is an invaluable natural resource. As a health system, Cleveland Clinic has a tremendous opportunity and obligation to use our data to do things like this.

DR. STEINMETZ: Philanthropy made this happen. It's hard to get a federally funded grant to support an innovation like this because it's not necessarily research. It's really driving patient care. Innovation is expensive, and philanthropy drives innovation. Philanthropy takes kernels of ideas that have promise and launches them into the stratosphere.

TEST DRIVE

At the 2018 annual meeting of the Congress of Neurological Surgeons, the team presented a preview of their work in progress. Over the course of a decade, approximately half of the 3,300 patients who underwent lumbar laminectomy (surgery to remove bone from the lower spine) at Cleveland Clinic had a successful outcome, with “minimal clinically important differences” in key metric categories. When the team fed data from those patients into the AI system, it predicted that the success

rate would have improved to at least 75% with AI guidance. A simulated cost analysis demonstrated cost savings of up to \$25,000 per case.

DR. HABBOUB: To see that big jump in the success rate — that was very exciting for us.

DR. MROZ: It was a milestone. But there hasn't been just one epiphany. We've hit so many little milestones along the way. We've probably had at least two meetings per week over the past few years. We have different milestones we need to make. With each milestone comes a quantum of progress.

DR. STEINMETZ: Through it all, I've been cautiously optimistic. There were times when I thought: Can we pull it off? But Dr. Mroz is very charismatic. Like, “We're going to do this!” I believe in him, and I believe in Dr. Habboub's expertise.

THE SHAPE OF THINGS TO COME

The team continues to fine-tune the platform. If all goes well, it could be up and running next year.

DR. MROZ: What we're doing now is trying to enhance the model with a different type of artificial intelligence called deep learning. It will likely involve image recognition and quantification of features in each target image. If we're looking at an MRI, for example, we want to be able to automate the measurements of the spinal canal to see how tight it is, then use those numbers to enhance our decision-making capability. We're creating one more layer of information for the model to run on, to see if we can improve the accuracy of our output.

The next step is to validate it, to make sure what the model is predicting is in fact occurring. From there, our hope is that the platform will be deployed within Cleveland Clinic by mid-2023. We're maybe 12 to 18

months away from an opportunity to license this technology to a company that would help us bring it to market.

Beyond spine care, the technology could pave the way for similar AI tools to inform and improve care for hypertension and other chronic diseases.

DR. MROZ: This journey has created a pathway for other types of discovery. Hopefully, we've built a runway for future efforts when it comes to utilizing our data repositories.

MEESE: It's all about a more personalized approach to medicine. When treatment decisions are based in part on data from a patient's specific medical care over time, the opportunities for optimal outcomes of current clinical decision go up.

DR. STEINMETZ: For some, the idea of having a computer guide clinical care might be scary. How can a machine tell you what to do? The computer can't see everything we see. It's more than zeroes and ones. The person-to-person interaction will always matter. But we're learning to live better and work better in harmony with these technologies.

DR. HABBOUB: You start with good intentions and a clear goal. Then you realize you have a lot of missing pieces that you need to put together to make everything work. As is the case with many innovations, the complexity of the problem has been eye-opening. But this project ultimately has been extremely rewarding.

DR. MROZ: There's a need for this. We want to improve patient care, not only at Cleveland Clinic, but across the nation. We want healthcare to be different. We want it to be better. ■

Innovations in Imaging



< THEN

A Cleveland Clinic radiologist analyzes a head X-ray in the 1920s. **EARLY MEDICAL IMAGING** included X-rays, discovered in 1895, and ultrasound, first used for medicine in the 1940s. It wasn't until the 1970s that computerized axial tomography (CAT), a device capable of directly imaging pathology of the brain in a cross-sectional display, was developed. Realizing its potential, Chair of Radiology Thomas F. Meaney, MD, purchased the fourth such device in the world for Cleveland Clinic. In his honor, the Eastman Kodak Company established the Thomas F. Meaney, MD, Research Scholars Endowed Chair; today, it's held by Imaging Institute Chair Greg Borkowski, MD, FACR. In the early 1980s, Cleveland Clinic's Department of Diagnostic Radiology led the way in developing nuclear magnetic resonance imaging, later called magnetic resonance imaging (MRI). Instead of using X-rays to produce images like a CT scan, MRI uses a large magnet, radio waves and a computer to produce detailed images.



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NEXT

A team led by Cleveland Clinic neurosurgeon Sean Nagel, MD, uses **HIGH-INTENSITY FOCUSED ULTRASOUND (HIFU)** to pinpoint treatment for a patient with Parkinson's disease. Similar to how a magnifying glass focuses light on a target, HIFU produces multiple beams of ultrasound concentrated on the exact tissue area requiring treatment and uses the energy to destroy the targeted area. The ultrasound beams are able to pass through layers of tissue, leaving them unharmed, until they reach their target — essentially, surgery without a scalpel. Patients with debilitating tremor are already being successfully treated by precisely targeting the spot in the brain causing the tremor with HIFU, but researchers are excited about its broader potential. "We're investigating other brain diseases that may benefit from HIFU treatment, such as major depression and epilepsy," says Stephen Jones, MD, PhD, Vice Chair of Research and Academic Affairs in Cleveland Clinic's Imaging Institute. "Researchers from our Imaging Institute and Neurological Institute also are exploring other new ways to precisely image potential targets — using 7T MRI, for example, to help treat disease without an incision." — *Jill Stefancin*



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NOW

Cleveland Clinic is one of the few institutions worldwide with a **7-TESLA (7T) MRI SCANNER**. MRI scanners come in different magnet field strengths, measured in tesla units. The higher the tesla, the greater the image resolution and tissue contrast. Cleveland Clinic built a dedicated 2,300-square-foot research facility to house the machine with its 80,000-pound magnet. This advanced imaging technology, approved for clinical use by the FDA in 2017 but used for research at Cleveland Clinic since 2014, has had a notable impact on the diagnosis and treatment of multiple sclerosis, epilepsy, traumatic brain injury, degenerative brain disorders and brain tumors.

Kathy Hart, wearing sunglasses and a white helmet near the center of the front row, and the Big Galoots were ready to ride in September at the starting line for Bike to Cure Benefiting VeloSano.

Driving the Future of Cancer Research on Two Wheels



Sometimes you have to be a Big Galoot to make a big difference.

That's the sentiment that has driven Kathy Hart to pour her heart and soul into organizing the Big Galoots for the first eight years of VeloSano. The team of riders, led by Bob Rich, 1921 Society member and Chairman Emeritus of the Board of Directors and Board of Trustees at Cleveland Clinic, travel to Cleveland every year from Buffalo, New York, to participate in VeloSano Bike to Cure weekend.

Hart recently retired after working more than 42 years at Rich Products Corporation in Buffalo, where she spent a number years as Bob Rich's Executive Assistant. When the idea of VeloSano, the fundraising event supporting cancer research at Cleveland Clinic, became a reality, Rich was asked if he would take part. He charged Hart with rallying together a team of riders.

Hart was up for the challenge — not only because she believed in the cause, but because she also had a personal connection to Cleveland Clinic. In 2008, her daughter,

Caitlin, had a life-threatening illness and needed to be airlifted to Cleveland Clinic.

"This was my first exposure to such a world-class hospital — and a little premonition of the future," says Hart. "Thanks to the care we received at Cleveland Clinic, Caitlin is alive and thriving today: married, a mother of three and working as a physician assistant."

Following her family's life-changing experience at Cleveland Clinic, Hart felt the need to give back. When the opportunity to participate in the VeloSano Bike to Cure event presented itself, she jumped at the chance. "I love working with people, so I said, 'Well, this sounds like fun!'" she recalls. "Admittedly, I was a little nervous because I didn't really know exactly how it was going to go, but we got a small group of us to participate, and we loved it. We've been building on it ever since."

And the Big Galoots have built quite a bit. Having participated in the Bike to Cure event every year since the inaugural event in 2014, the team has raised more than \$1.2 million for cancer research at Cleveland Clinic.

You can't miss them in their fluorescent bike

jerseys. "When the Big Galoots come into downtown Cleveland for the Friday Night Kickoff Party, it's a scene," says VeloSano Director Kandis Schreiber. "Everyone knows the Big Galoots. Kathy and her team not only bring the dollars to support cancer research at Cleveland Clinic, they bring the fun to Bike to Cure."

When COVID-19 put a halt to the in-person Bike to Cure event in 2020, Hart built a virtual team with 64 members. They raised more than \$71,000. The addition of the virtual fundraiser option has made it even easier for team members who can't make the trip from Buffalo to support the cause.

"To have the opportunity to support cancer research at Cleveland Clinic alongside Bob and Mindy Rich and the many Rich Products associates — it has truly been one big team effort, and I'm so happy and honored and privileged to even be able to be a part of it all," says Hart. "From the first time the Big Galoots showed up at Bike to Cure through now, it has just been fantastic. The support we've received from Cleveland Clinic has been amazing." — *Elizabeth Misson*



The new **VELOSANO TOGETHER TO CURE WALL** is an interactive online space for sharing a tribute to anyone who has been impacted by cancer. Celebrate the life of a friend or loved one by creating a post in their honor or memory. Encourage those who are still fighting. Remember those we've lost. To create your tribute or view others, visit velosano.org/togetherforcure.

Robotics Reinvents Rehabilitation



Patient Peter Evans uses a robotic glove with help from Dr. Richard Aguilera.

THE FACTS

In the past several years, various technological innovations in rehabilitation have involved robotics. Richard Aguilera, MD, of Cleveland Clinic's Department of Physical Medicine and Rehabilitation identified the importance of staying current on this evolving trend and submitted his Rehabilitation Robotics and Technology Initiative for a Catalyst Grant in 2020. He was awarded \$8,200.

THE NEED

Robotics is being used in rehabilitation in a variety of settings. Different types of robotic gloves can improve hand

function for patients with severe hand impairments as a result of a brain injury or a stroke. For patients with locked-in syndrome (a rare neurological disorder characterized by paralysis of voluntary muscles) or amyotrophic lateral sclerosis (aka Lou Gehrig's disease), robotic platforms can be used to mount devices with apps that allow users to communicate by blinking their eyes. All of the above devices were part of Dr. Aguilera's grant.

THE IDEA

The Rehabilitation Robotics and Technology Initiative sought to increase access to rehab robotics to offer advanced patient interventions, improve patient

outcomes and facilitate more medical education and research. The technologies were to be used as training tools for occupational therapists, physical therapists, respiratory therapists and speech therapists, as well as physicians, nurses, residents and medical students.

THE IMPACT

Dr. Aguilera's grant connected patients with rehab robotics at four Cleveland Clinic locations. The initiative also provided invaluable training for caregivers in this rapidly evolving field and opened avenues for further research opportunities. — *Chloe Maxwell*

“

This grant allowed us to put innovation into action. I could now offer my patients a diversified approach in achieving their rehabilitation goals, using traditional techniques as well as modern techniques that are in tune with the times. The technologies created an environment of excitement and curiosity, fostered creativity and brought forth new ideas.”

— DR. RICHARD AGUILERA



Cleveland Clinic's **CATALYST GRANTS** pool donations to fund the brightest ideas from our caregivers to improve patient outcomes and experiences. To date, 178 grants have been awarded, representing a total of \$8.1 million in support.

‘We Can Help You’

February 2017 started out like any other month for Carol and Tom Crouse of Seminole, Florida. It was Super Bowl weekend, and Carol had a busy schedule playing tennis and entertaining a house full of guests. The following Monday morning, she woke up and suddenly couldn't breathe.

“Tom rushed me to the ER,” Carol recalls. “When I woke up, I saw this line of doctors in front of my bed. They asked, ‘Who is your cardiologist?’ Well, I didn't have one because up until then my heart had been fine.”

Carol had always taken good care of her health, but she had congestive heart failure due to a deteriorating tricuspid valve. It soon became clear that the level of care she would need to survive could not be handled by a regional hospital where she was being treated.

“Tom started calling around all over the U.S.,” she says. “He sent my records to several different places, and I was able to get an appointment at Cleveland Clinic's main campus. That's when we met Dr. Kapadia. He sat with us for a good hour and explained everything. He was the first doctor we saw who said the four words that changed my life: ‘We can help you.’”

Following successful surgery, Carol spent 10 days recovering at Cleveland Clinic. Once she was back home in Florida, she had two months of rehab. Soon after, she was back to playing tennis again.

Carol and Tom had some experience with philanthropy, having given annuities to their Evangelical Lutheran church, but had never before considered making a gift to a hospital. They were so moved by the way that Carol's doctors, Samir Kapadia, MD, and Gosta Pettersson, MD, treated them like family that they wanted to show their gratitude in a meaningful and lasting way.

Tom picked up the phone and called Cleveland Clinic again — this time, not in search of treatment, but in search of a way to make a donation.

The Crouses settled on a series of charitable gift annuities, made in honor of Dr. Kapadia and Dr. Pettersson, which will support education and research within the Sydell and Arnold Miller Heart, Vascular & Thoracic Institute at Cleveland Clinic. They chose charitable gift annuities because they are both easy to establish and provide tax and life income benefits.

“When we think about the things that are possible at Cleveland Clinic now, the treatments that weren't even available just five years ago, it makes us feel good to know that our contribution, combined with the contributions of others, will help people in the future,” says Tom.

Carol and Tom also hope that their giving inspires their children and grandchildren to follow their path of gratitude.

“We're not wealthy, but we've learned that whatever you can give helps,” says Carol. “Just about everybody can give something, even if it's donating their time. Tom and I believe that while we have to take care of ourselves, we also have to take care of others.”

— Elizabeth Misson



Carol and Tom Crouse (right) made a charitable gift annuity in honor of Dr. Samir Kapadia (top) and Dr. Gosta Pettersson (bottom, at left).



MANY WAYS TO GIVE

Through estate and tax planning, you can provide for Cleveland Clinic and your heirs in ways that maximize personal, family and philanthropic goals while also minimizing cost.

OPTIONS INCLUDE:

- **Gifts that provide income**
(e.g. charitable gift annuity)
- **Gifts of appreciated property**
- **Gifts through a will or trust**
- **Gifts through beneficiary designations**
(i.e., retirement plan or life insurance policy)

Innovation 101

What advice would you give to aspiring innovators?



GEOFF VINCE, PhD

Believing in yourself as you embark on the innovation journey is key to success. Inventing is a mindset. Learning from your setbacks and being persistent in creating your solution creates better ideas, which lead to better patient outcomes. The first and most important step is clearly defining the problem you are trying to solve. What is the unmet clinical need? A different way is not always a better way. Finally, when you have an idea, run it past your technology transfer office, which can provide valuable assistance in guiding you through the innovation process.

Geoff Vince, PhD, is Executive Director of Cleveland Clinic Innovations, which turns breakthrough inventions into patient-benefiting medical products and companies. He holds the Virginia Lois Kennedy Chair in Biomedical Engineering and Applied Therapeutics and chairs the Department of Biomedical Engineering in Cleveland Clinic's Lerner Research Institute.



MICHAELA GACK, PhD

We've seen tremendous innovation and progress in the field of infectious disease and immunobiology over the past few years, including the mRNA technology and novel host-based antiviral therapy approaches. Key to any innovation is team effort and tapping into the insights of the creative people around you, especially those who have a different viewpoint or expertise. Considering all opinions, including the ones that are not fully in line with your own, will provide new perspectives and lead to even faster innovative progress.

Michaela Gack, PhD, is the Arthur and Marilyn Levitt Endowed Chair and Scientific Director at Cleveland Clinic's Florida Research & Innovation Center. With philanthropic support as well as a Director's Pioneer Award from the National Institutes of Health, Dr. Gack is leading the development of broad-spectrum antivirals effective against a range of diseases (see page 5), which could thwart future pandemics.



MOHAMED H. RAMADAN, PhD, MBA

Sometimes "innovation" and "invention" are used interchangeably, but they're different. Every invention begins with an innovation, but not every innovation results in an invention. Innovation is a new way of solving problems, even if it's using old technology in a new way. The No. 1 critical task for every innovator is to precisely understand the problem. The path from identifying the problem to identifying the solution is never linear, nor easy. Innovation is not for the faint of heart. Don't fall in love with your idea. True innovators tinker with an idea, and if doesn't work, they quickly move on to the next idea.

Mohamed H. Ramadan, PhD, MBA, is General Manager of Innovations Development at Cleveland Clinic, where he is responsible for transforming inventions from vetted ideas to commercial products. He leads a team of technology development experts in digital health, medical devices and therapeutics/diagnostics.



VINCENT TUOHY, PhD

If you want to do important work, ask important questions. It takes courage. You have to be ready to fail. We're defined not only by our successes, but by our failures. Whenever I failed, it motivated me to refocus and work even harder. I've been told that I'm a dreamer; that I'm trying to do the impossible. Plenty of people are smarter than I am, but I have tenacity and a vivid imagination. Some brilliant scientists are satisfied asking minor questions that are easy to answer. If you want to innovate, I say: Swing for the fences!

Vincent Tuohy, PhD, of Cleveland Clinic's Lerner Research Institute holds the Mort and Iris November Distinguished Chair in Innovative Breast Cancer Research. With philanthropic funding, he invented a vaccine to prevent triple-negative breast cancer. He is developing similar vaccines for ovarian cancer and endometrial cancer.

SHOP TALK

Sparks fly as Surgical Instrument Technician Scott Ineman operates a grinder in the **Lerner Research Institute's Mechanical Core**. Cleveland Clinic's main campus is home to one of the few on-site machine shops in a U.S. hospital. In this hive of high-precision activity, members of the Medical Device Solutions team fabricate, customize and repair a wide variety of innovative devices for clinical and research applications. — **John Soeder**

PHOTO: LISA DEJONG

ONLINE EXTRA: Take a video tour of the Medical Device Solutions team's capabilities.



The Cleveland Clinic Foundation
Philanthropy Institute
9500 Euclid Avenue/DV3
Cleveland, OH 44197-9905
give.ccf.org

OUR BACK PAGES *In 1958, F. Mason Sones, MD, of Cleveland Clinic invented moving cine-coronary angiography, a method for viewing the heart and its vessels with X-rays recorded on motion picture film. The pioneering cardiologist adhered to his own set of guiding principles, aka "Sones' Laws." Among them: Simplify the problem and aim for perfection. Dr. Sones died in 1985 at the age of 66, but his spirit lives on at Cleveland Clinic, which bestows the annual Sones Innovation Award on caregivers for advances in patient care.*

