



Innovators *at* Heart

News from the
Lillehei Heart Institute
at the University
of Minnesota

Continuing a proud legacy Members of the Lillehei Heart Institute build on a tradition of innovation that began more than five decades ago

University of Minnesota investigators were hard at work more than 50 years ago inventing devices and perfecting procedures that would eventually evolve into today's heart treatment mainstays.

In 1952, for example, F. John Lewis, M.D., Ph.D., performed the world's first successful open-heart surgery, which used hypothermia. Two years later, C. Walton Lillehei, M.D., Ph.D., led the world's first successful open-heart surgery using cross-circulation. In 1957 Lillehei worked with inventor Earl Bakken to create a portable battery-powered pacemaker, which served as the foundation for the Medtronic, Inc., pacemaker that keeps millions of hearts beating today.

And 30 years ago, University surgeons performed Minnesota's first heart transplant. Shortly thereafter, physicians here developed the first new therapy to slow the progression of heart disease.

Steeped in a legacy of innovations and "firsts," University physicians and researchers are building on their history and discovering new ways to care for people's ailing hearts and even stave off cardiovascular disease altogether.

With a generous gift from Katherine Lillehei (see page 3) in 1999, the University established the Lillehei Heart Institute (LHI), an interdisciplinary coalition of scientists and physicians who collaborate on cardiovascular research and share core resources to accelerate the translation of laboratory findings to better patient care.

Today more than 130 LHI members are combatting cardiovascular disease from several angles, using cell-based therapies, genomics, and the body's own signaling mechanisms to detect disease earlier and treat it.

"These areas are really the future of heart disease treatment and prevention," says Daniel Garry, M.D., Ph.D., executive director of the



University surgeons pioneered several "world firsts" in the 1950s.

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A cadaver rat heart was washed of its cells in a process called decellularization (top three images). Then it was reanimated using new cells (bottom two images).



‘If you’re going to try to change the way we treat heart disease, it’s critical to be in an environment where you can try new, crazy ideas.’

—Doris Taylor, Ph.D.

LHI and director of the Division of Cardiology in the University’s Department of Medicine.

Testing ‘crazy ideas’

In one mind-boggling breakthrough in January, Doris Taylor, Ph.D., and her team removed all the cells from a cadaver rat heart using a process known as decellularization—leaving only the scaffolding that Taylor calls the “extracellular matrix.” Then the team repopulated the scaffold with the healthy heart cells of a newborn rat, and in just over a week, the once-defunct heart was again beating on its own.

Taylor’s team has since transplanted the heart into the abdomen of a rat to show it could live and survive. And it has.

The team also has successfully decellularized and reanimated a pig heart and kidney, demonstrating that the process works in larger animals and with other organs.

“If you’re going to try to change the way we treat heart disease, it’s critical to be in an environment where you can try new, crazy ideas,” says Taylor, who directs the University’s Center for Cardiovascular Repair and holds the Bakken Medtronic Chair in Cardiovascular Repair. “Because others have allowed us to try these

crazy ideas, we believe that we’ve opened a new door in the field of organ transplantation.”

Predicting—and preventing—disease

While Taylor explores ways to repair damaged organs and build new ones, her LHI colleagues across campus are working to prevent damage to the heart altogether.

At the Rasmussen Center for Cardiovascular Disease Prevention, Jay Cohn, M.D., and Daniel Duprez, M.D., Ph.D., are using 10 novel “bio-markers” to predict the level of heart disease in their patients.

“These are not tests that reveal cardiovascular risk factors such as high cholesterol or high blood pressure,” Cohn says. “These tests actually measure the stages of cardiovascular disease progression that leads to heart attacks, strokes, and other lethal conditions.”

Since the Rasmussen Center opened in 2000, more than 1,500 people have walked through its doors. So far, Duprez says, the center’s risk measurements have been quite accurate in predicting adverse events.

Duprez, who holds the Donald and Patricia Garofalo Chair in Preventive Cardiology, also works with cardiovascular genomics researcher Jennifer Hall, Ph.D., to analyze the genetic makeup of the center’s patient population. Hall and Duprez hope that the information they gather will shed new light on what predisposes a person to heart disease.

“The studies are designed to identify genes that put you at risk for cardiovascular disease, but there are likely genes that protect you as well,” explains Hall.

Garry, holder of the St. Jude Medical Cardiovascular Chair in Biomedical Engineering, says this collaborative approach to heart research gives University physicians and scientists a rich environment in which to work.

“In 10 years, the therapies that we have for heart disease will be radically different from what they are today, and I think we will be able to say that we pioneered these advances,” Garry says.



Photo by Emily Jensen

In gratitude for education and opportunities, family gives back to the University

C. Walton Lillehei, M.D., Ph.D., known to many as “the father of open-heart surgery,” earned all five of his degrees at the University of Minnesota. His widow, Katherine “Kaye” Lillehei, earned two degrees in nursing here. His brothers are all University graduates, as are their wives.

“The University is close to us,” Kaye Lillehei says. “It enveloped all of us.”

In fact, Walt and Kaye met while Walt was an intern at Minneapolis General Hospital and Kaye was taking nursing classes there through the University. Kaye still remembers the first time she saw her future husband.

“He was younger than the other doctors,” she says. “He had white-blond hair and a pressed white uniform. All of the other doctors had wrinkled uniforms, but his was just so.”

And even before he participated in several “world firsts” in heart surgery at the University—including the first successful open-heart surgery using cross-circulation and creation of the heart-lung machine, pacemaker, and mechanical heart valve—Kaye Lillehei knew that Walt was a creative person. But what impressed her more was his demeanor with patients.

“I don’t know if that’s important, but it was to me,” she says.

Walt and Kaye (Lindberg) Lillehei were married in 1946 and had four children. During the 1950s, a time rich in medical experimentation and breakthroughs, Walt Lillehei and his colleagues would often have their postmortem conferences at the Lilleheis’ home across the river in St. Paul. “It was very, very exciting,” Kaye says.

When Walt Lillehei died in 1999, Kaye wanted to honor his accomplishments at the University and show gratitude for the education their family had received. So, making the largest gift in University history at the time, she pledged \$13 million to create the Lillehei Heart Institute (LHI) and another \$3 million to create the Katherine R. and C. Walton Lillehei Endowed Chair in Nursing Leadership.

Thanks to Kaye Lillehei’s gift, the LHI has brought together researchers from several disciplines to translate new cardiovascular knowledge into treatments and prevention strategies for patients more quickly than they would have been able to working independently, says LHI executive director Daniel J. Garry, M.D., Ph.D.

“The generosity of Kaye Lillehei has invigorated the spirit of discovery in the studies of stem cell biology, cell therapies, and regenerative medicine,” he says.



Kaye Lillehei

Did you know?

In fiscal year 2007, nearly one-third of all health-related gifts to the University of Minnesota through the Minnesota Medical Foundation were designated for research.



To learn how you can make a gift to cardiovascular research, education, or service at the University of Minnesota, contact Julie Crews Barger of the Minnesota Medical Foundation at 612-273-8593 or jcb@mmf.umn.edu.

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Dear friends,

I'd like to introduce the Lillehei Heart Institute's new newsletter, *Innovators at Heart*. You are receiving this newsletter because you have supported or otherwise shown interest in cardiovascular research, care, and service at the University of Minnesota.

With this publication, we will keep you informed of the many advances we're making toward better treatments for cardiovascular disease and ways to prevent damage to the heart altogether.

We'll also tell you about our mission of educating the next generation of outstanding heart physicians and researchers. Effective in July, we'll be offering a redesigned three-year cardiovascular fellowship that provides our fellows with time to develop and implement a research project of their choice. Training under our skilled faculty, these new scientists will develop a deeper understanding of the heart and how disease develops, which we hope will lead to innovative new therapies and disease prevention in the future.

You may have heard that the state legislature recently approved the Minnesota Biomedical Research Program. This is a huge victory for the University and for cardiovascular research. The

five-year project will allow the University to build four new state-of-the-art research buildings, one of which will be designated for the Lillehei Heart Institute and will house interdisciplinary heart research. The new space will be a tremendous asset in helping us recruit the brightest researchers and retain our own top-notch faculty members.

The \$292 million project will be backed by university-sold bonds. The state will help repay 75 percent of those bonds, but the remainder will be financed by philanthropy and other sources.

That's why your support is so important to our work. Now that our legislators have shown their faith in the University, we want to prove that private citizens, corporations, and organizations believe in us, too. Your gifts help us do that. Thank you for your continued support.

Sincerely,

Daniel J. Garry, M.D., Ph.D.
Executive Director, Lillehei Heart Institute
St. Jude Medical Cardiovascular Chair in
Biomedical Engineering

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