INTRODUCTION

The normal heart is a thing of beauty. It pumps between 1,500 and 2,000 gallons of blood every day and sends it on a journey of thousands of miles, all within the confines of a single human body. Over the course of a 70-year lifetime, it beats about 2.5 billion times: 70 times a minute, 100,000 times a day, 36.5 million times a year.

All of this happens thanks to an exquisitely timed and orchestrated dance between the four chambers of the heart—its upper atria and lower ventricles. First, the right atrium receives dark blue, oxygen-poor blood from the rest of the body, where it’s been used as nourishment. It contracts and pumps the depleted blood through the tricuspid valve into the right ventricle, which then pumps the blood through the pulmonary valve into the lungs. There, the blood sucks up oxygen, growing rich and vital and red again, before it’s pumped back into the heart. The newly revitalized blood travels first through the left atrium and then into the left ventricle, which must contract with enough power to send that blood flooding out, through the aortic valve, along the cardiovascular superhighway of blood vessels to the most distant parts of the body. This perfectly calibrated cycle happens about once every second, and most of the time we don’t even notice it.

But when things go awry—a faulty valve, a blocked artery, a clot in the network of vessels and veins that both feed and feed on the heart—this magnificent machine can become the source of untold suffering, or death.

Cardiovascular disease has been the No. 1 cause of death in the United States every year since 1900, except 1918 (the last year of World War I). It claims more lives than the next seven leading causes of death combined, including cancer, accidents, influenza and pneumonia, and diabetes. Today, one of every 2.6 Americans will die of some cause related to their heart. The price of all this heartsickness: nearly $400 billion a year in direct and indirect costs.

The sole mission of Columbia’s cardiology program, one of the oldest and most respected in the world, is promoting cardiovascular health. Our world-class faculty of more than 150 clinicians, researchers, and educators are the leaders in their field, experts in every aspect of cardiovascular medicine, from heart failure and heart transplantation to interventional cardiology, cardiovascular imaging, and heart disease prevention. Just as the chambers of the heart work together in perfect synchrony, so too do the many specialists in our division of cardiology collaborate to bring state-of-the-art diagnostic tools, treatment options, and prevention strategies to more than 50,000 patients every year.

“All of our actions take their hue from the complexion of the heart, as landscapes their variety from light.”

Francis Bacon
A NOTE FROM THE CHIEF

Allan Schwartz, M.D., Seymour Milstein and Harold Ames Hatch Professor of Clinical Medicine and Chief, Division of Cardiology, Department of Medicine, Columbia University College of Physicians & Surgeons

In 2001, Columbia’s cardiology program was ranked 28th in the country by U.S. News and World Report. Just four years later, thanks to visionary investments in faculty, facilities, and technology, the Division of Cardiology ranks in the top ten in the nation.

I don’t think there are any other cardiovascular programs in the country today that have the combined breadth and depth of Columbia’s. From the world’s largest and most renowned heart failure and transplant program, to international pioneers in interventional cardiology, to world-class electrophysiology, molecular cardiology, and atherosclerosis programs, there is no aspect of cardiology that is not represented by top scientists and clinicians at Columbia.

But it is not enough.

Further understanding of the genetic, molecular, and cellular bases of cardiac disease will allow more effective and targeted treatments to be developed.

If we are to develop newer, more effective therapies and make them available to a broader patient population, we must invest in more integrated research, and more efficient translation of basic research findings into new therapeutics. The future of medicine lies in breaking down old barriers both horizontally—between divisions and departments like biology and chemistry, neurology and cardiology—and vertically, between the basic sciences and clinical practice. Our focus, as the Division of Cardiology continues its extraordinary growth, is on cross-disciplinary centers and initiatives that will position Columbia to achieve goals in taming cardiovascular disease that are beyond our reach today.

The field of cardiology is rich with promise as we seek to meld basic science and clinical practice, using approaches such as molecular biology, high throughput cellular screening, genomics, and proteomics. But such 21st-century science requires ambitious investments in people and resources. To make these investments, we will soon launch one of our most visionary campaigns to date, designed to establish Columbia as an unparalleled leader in cardiovascular science. Our goal, and our challenge, with such a campaign is to develop the space, programs, and opportunities needed to continue to recruit and retain the finest minds in our field.

This is not merely science for science’s sake. At the end of the day, it all comes back to the patient. The research we do, the young scientists and clinicians we train—it is all, ultimately, focused on saving and improving the lives of our patients. I believe that tomorrow we will be able to treat the patients we are failing today, because of the things we do here, the clinicians and scientists we train, and the knowledge we create.
“Where complex cases are routine.” That could well be the motto of the Center for Interventional Vascular Therapy (CIVT) at Columbia, whose team of more than 20 interventional cardiologists and other medical experts in minimally invasive cardiac care joined the Division of Cardiology in 2004. The unique expertise of this pioneering group has transformed the treatment of coronary disease at Columbia.

“We’re willing to take on the most challenging cases, the ones that other centers might not want to do. Whether it’s complex multivessel disease, technically challenging anatomy, or patients with multiple comorbidities, we’re used to it,” says the Center’s Director, Jeffrey Moses, M.D., a world-renowned expert in complex angioplasty, who in 2002 served as the lead investigator on the U.S. clinical trial that led to the approval of drug-coated stents. Indeed, name any advance in interventional cardiology over the past two decades, and it’s likely that one or more of CIVT’s cardiologists played a key role in making it happen.

In the first year after CIVT became a part of the Division of Cardiology, Columbia’s angioplasty rate jumped to more than 3,000 per year. Today, it is one of the world’s leading tertiary referral centers for complex cardiovascular and endovascular disease, says Associate Director Martin Leon, M.D., who has been the principal investigator on more than 20 major clinical interventional trials.

The philosophy behind the group’s success, says Dr. Moses, is a patient-focused one. “The hallmark of our group is that we’re always trying to fulfill the unmet clinical need. This isn’t technology for technology’s sake.” CIVT was actively enrolling patients in more than 30 cutting-edge clinical research protocols by the end of its first year at Columbia.

Dr. Leon also created the Cardiovascular Research Foundation, now an affiliate of Columbia, to advance research and education in the field of interventional cardiology. Its studies include several large clinical trials, such as the HORIZONS (Harmonizing Outcomes with Revascularization and Stents) trial, which will enroll 3,400 patients at 200 sites worldwide over the next two to three years to test the efficacy of stents and anticoagulants in heart attack patients, and the NIH-sponsored FREEDOM trial, testing the optimal revascularization strategy in diabetic patients.

These pioneers of stenting are also hard at work on the next generation of cardiac stents. They’re developing new and improved catheter delivery systems to navigate more complex areas of the coronary tree, making stents safer, with less risk of clotting, and more available to a wider group of heart patients. Soon, they expect to conduct human trials of the first bioabsorbable stent, made not of metal but of a unique blend of polymers that are less likely to trigger new blockages in the artery.

“I thought my heart had been wounded with the claws of a lion.”
William Shakespeare
As You Like It
The blood vessels in the heart aren’t the only ones that can become clogged and need to be reopened. Throughout the body—mainly in the arteries that lead to the brain, kidneys, and legs—fatty deposits can build up, restricting circulation. Approximately 20% of people over age 55 have such blockages in the legs, known as peripheral arterial disease (PAD).

“Atherosclerosis is a systemic problem that affects the whole body,” says Elizabeth Ratchford, M.D., who joined the Division of Cardiology in 2003 to establish its new Vascular Medicine program. “Problems in the heart often mean problems in the circulation of the legs and the carotid arteries of the neck as well, so the people at risk for a heart attack are frequently at risk for PAD and stroke.”

CIVT’s increasing work with peripheral arterial disease—using stents to treat blockages in the legs and the neck, for example, just like in the heart—fits well with the Vascular Medicine Program. “We find the blockages, and the CIVT physicians open them. We follow the patients before and after the placement of the stents, to treat the risk factors that led to the blockages in the first place—such as smoking, hypertension, diabetes and high cholesterol,” says Dr. Ratchford.

Diagnosis of PAD takes place in the Cardiovascular Ultrasound Laboratory. “We use ultrasound to look for plaque and to assess its impact on the blood flow in the legs and in the carotid arteries,” Dr. Ratchford explains. “We also put blood pressure cuffs on the patient’s thigh, calf, and ankle, to measure the pressure, which helps us to find the blockages.” Columbia was one of the first institutions to adopt this model, using the echocardiography lab as a facility for noninvasive approaches to PAD.

“There are many mysteries in vascular medicine,” says Dr. Ratchford—mysteries that Columbia hopes to solve through the PAD program’s research. For example, certain risk factors appear to predispose people to blockages in specific areas. A person with diabetes seems to be equally likely to develop blockages in the heart and the legs, whereas smoking predisposes a person to more severe atherosclerosis in the legs. High blood pressure, on the other hand, seems to have a larger impact on atherosclerosis in the heart. “No one knows why some vascular beds are affected more than others, and why some people never have a stroke or a heart attack and instead only develop pain in their legs,” says Dr. Ratchford. “If we could figure out why it’s happening that way, perhaps we could block the effects.”
A FATHER’S HEART

When Dr. Jeffrey Moses saved Daniel Wiederhorn’s life in 1999, it seemed like a family tradition.

Nearly 15 years ago, Daniel’s father was considered “untouchable” by most cardiac surgeons. After undergoing open-heart surgery to open several blockages in 1976, at the age of 50, the elder Wiederhorn had experienced three more blockages, and three more surgeries. “When he had a blockage again in the early 1990s, no doctor would work on him anymore,” says his son. “His artery disease was just so bad.”

Fortunately, Wiederhorn’s internist knew of a cardiologist who wouldn’t be intimidated by this patient’s complicated cardiac history: Dr. Jeffrey Moses, who was then working on some of the world’s first cardiac stents. When the first FDA-approved stents were introduced in 1994, the metallic, scaffold-like devices for propping open a blocked artery quickly became commonplace. But in the early 1990s, they were still experimental.

“Dr. Moses put the stents in and opened him up, and saved my father’s life,” says Daniel. “From then on, Dr. Moses was his doctor.” In 2003, Daniel Wiederhorn’s father passed away—10 years after other doctors had given up hope on him. “Without a doubt, if he hadn’t gone to Dr. Moses, I would have lost my father long before.”

In December of 1999, the family history struck again. At the age of 50—just about the same age his father had been when he had his first open-heart surgery—Daniel Wiederhorn found himself feeling ill. “My internist had determined awhile before that I had diabetes, but I really had been feeling fine and didn’t think I had any heart trouble,” he recalls. But while walking around during the holidays, he noticed a strange feeling in his jaw and shortness of breath. After an electrocardiogram at his doctor’s office, he was sent straight to Westchester Medical Center, near his home.

“There, the cardiologist said, ‘Your heart is very clogged, and we can’t put stents in you because of your diabetes. We want to do open-heart surgery.’”

At that point, Daniel’s wife arrived, and called a halt to everything while she phoned Dr. Moses. He immediately arranged for an ambulance and had Daniel brought to his office.

“Every single one of the CIVT physicians could be running their own program at a leading hospital, and many of them have been,” says Dr. Moses. “But together, we create something unique, something that is more than just the sum of its parts.”

Aiming to move experimental models and next-generation therapies from the bench to the bedside more quickly, in 2005 the Jack H. Skirball Center for Cardiovascular Research opened under the auspices of the Cardiovascular Research Foundation. It boasts 25,000 square feet of dedicated experimental interventional laboratory space, with state-of-the-art imaging and other technology. “It’s one of the largest and best-equipped cardiovascular research centers in the world,” says Dr. Leon. Some 15 research protocols began at the Center within a month of its opening.

The last piece of the puzzle for CIVT is education, both for the public and for physicians. With interventional therapies for cardiovascular disease expanding and evolving almost every day, new knowledge must be spread widely—and quickly—so that cardiovascular specialists around the world can keep up with the latest advances. Through the Cardiovascular Research Foundation, CIVT’s physicians host Transcatheter Cardiovascular Therapeutics (TCT), the world’s largest privately run medical meeting, attended by more than 11,000 medical professionals in 2005.

Drs. William Gray and Allan Schwartz are currently investigating the Evalve® Cardiovascular Valve Repair System for the treatment of mitral valve regurgitation. With the Evalve technology, cardiologists seek to repair the valve non-surgically by using a catheter to place a tiny clip over the center of the valve leaflets (the two flaps that make up the valve). Initial trial results have been extremely promising, with 75% of the patients who received the clip remaining surgery free at the six-month mark.

Just as with Daniel’s father, Dr. Moses offered to treat Daniel in a way that other doctors wouldn’t. “He said, ‘Listen, instead of cutting you open, we’ll put in three stents, and you don’t have to go in for open-heart surgery.’ A year later, he had to put in one more stent, and since then, with medication, I’ve been trouble-free,” Daniel says. “If I do feel something, I just discuss it with Dr. Moses. He’s a true gentleman. He and his team attend to you in every detail; you really know you’ve got the best.”
Physicians who specialize in caring for heart failure and transplant patients are “the last of the old-time doctors,” says Donna Mancini, M.D., Medical Director of the Center for Advanced Cardiac Care. “We’re intimately involved with our patients and their families. It’s a lifelong relationship with a real bond.”

At the Center for Advanced Cardiac Care, formed in 2004 by the merger of the heart failure and transplant programs, cardiologists like Dr. Mancini may have the kind of close relationships with their patients last seen in the days of Marcus Welby, but they’re also state-of-the-art medical experts with 21st-century tools. The Center is the leading heart failure and transplant program in the nation, with a transplant volume higher than any other center in the country, performing between 85 and 100 heart transplants a year. It’s also the most successful: 93.5% of the Center’s transplant patients are alive one year later, compared with a national average of about 85%.

With the aging of the population, heart failure is on the rise in America. Almost five million people have heart failure already, and 400,000 new cases are diagnosed every year. The causes are many—frequently, heart failure can be the end stage of another type of heart disease, such as coronary artery disease, heart attack, and arrhythmias.

Heart failure doesn’t actually mean that the heart has failed—at least, not yet. Instead, it means that the heart has been weakened to the point that it’s pumping inefficiently and can’t push out enough oxygen-rich blood to the rest of the body. The result is much like what happens on a major highway when the number of lanes is reduced from four to two: a backup of blood “traffic” in the veins leading to the heart. The kidneys retain fluid, and the body’s tissues can swell, sometimes causing breathing difficulty.

Most heart failure patients are treated with medications aimed at boosting the power of the weakened heart and limiting its effects on the rest of the body. Columbia’s cardiologists have played a vital role over the years in identifying many of these drugs, which help heart failure patients not only survive with the disease but often thrive. Physician-scientists with the Center for Advanced Cardiac Care have conducted instrumental research in the use of beta-blockers to manage heart failure. More recently, these physicians have pioneered the use of erythropoietin to improve patients’ ability to exercise.

Ultimately, for many heart failure patients, medication is not enough. “Their weakened hearts are too badly damaged to sustain them, and they will need either some kind of mechanical assist device to keep the weakened heart functioning, or that most precious of all gifts: an entirely new, undamaged heart,” says Yoshifumi Naka, M.D., Director of the Cardiac Transplantation and Mechanical Circulatory Support Program.

“It is the nature of the strong heart, that like the palm tree it strives ever upwards when it is most burdened.”

Sir Philip Sidney
It was hard to slow Kerry Keenan down. An advertising executive with an exciting career, she traveled the world creating award-winning campaigns for clients like McDonald’s and Sony. She’d always been the picture of health, so when Kerry started feeling sick, tired, and run down in early 2001, she assumed that the 16-hour days and constant airline flights were catching up with her.

But things kept getting worse. On a commercial shoot in London, she felt so ill that she couldn’t walk up the stairs, and wondered if she might have pneumonia. The symptoms piled up: “I couldn’t sleep, I’d gained 15 pounds in two weeks, my ankles were swollen. I couldn’t breathe. I went to my regular doctor in April, and he told me I just needed sleeping pills.” On the way out of the office, Kerry turned around and insisted, “Something’s wrong with me. I don’t know what it is, but something’s wrong.”

The doctor reluctantly agreed to a chest X-ray, insisting that it wouldn’t find anything—but after viewing Kerry’s films, the radiologists wouldn’t let her go home. “They said my heart muscle was enlarged, and I had fluid in my lungs and needed to be checked into the hospital immediately.”

Kerry was diagnosed with idiopathic cardiomyopathy—a failure of the heart muscle due to unknown causes. “The first time they told me, I had to hear it like seven times before it sank in,” she says. But then, throwing herself into her diagnosis with the same intensity she approached her advertising career, she began researching. “What was the best place to go in New York for cardiomyopathy? It wasn’t hard to find out that it was Columbia.” She immediately began seeing internationally renowned heart failure and transplant specialist Donna Mancini, M.D.

Despite several experimental protocols, Kerry’s condition continued to decline. But she remained determined to live as normal a life as possible. She and her fiancé, Michael Jarvela, married in September 2001, and she continued to work at her advertising agency. “It wasn’t easy. I’d take a taxi two and a half blocks to work, and then two and a half blocks home again after work, and I’d lie down on the couch, and that was it,” she said. “It was very hard for me and my husband, because we never had that first couple of years of marital bliss, just being a couple having fun.”

By August 2003, Kerry’s condition had deteriorated to the point that doctors upgraded her priority status on the heart transplant waiting list. Dr. Mancini told her the wait for a new heart would likely be about six months—but just three weeks later, on the night of Kerry and Michael’s second anniversary, they woke up to the sounds of beeper, cell phone, and home phone all ringing at once.

Kerry spent 17 days in the hospital after her heart transplant—but says that when she awoke immediately after surgery, she already felt better. “As soon as I was conscious, I realized I felt warm for the first time in years,” she says. “I looked in the mirror and I had color in my face.”

Five months after her surgery, Kerry went back to work, and has been working full-time ever since—although she took a little time off recently, when she and Michael adopted a baby boy. Francis Michael arrived on their fourth wedding anniversary, two years to the day after his mother received her new heart.

At little Francis’s baby shower, there were some very special guests: the family of the young woman whose heart now beats in Kerry’s chest. After several anonymous letters were exchanged, Kerry and her husband were able to meet the parents and brothers of the girl, who had died of a stroke after a brain aneurysm. “She was a twin, the only girl in the family, and they loved her extraordinarily,” she says. “They are so selfless, so giving, and we’re trying to include them in all the wonderful things that have happened to us because of their incredible gift.”

Today, says Kerry, she’s in better shape than ever, running 5Ks and working out with a trainer. “I love Dr. Mancini. She’s excellent at what she does, and she really pushes you to do the most you can with your life,” she says. “The whole team at Columbia is just such a wonderful group. I feel like I have a thousand guardian angels.”
Such gifts are rare. Only about 2,200 donor hearts become available nationwide every year, and most patients spend almost a year on the waiting list before a heart becomes available. For that reason, says Dr. Mancini, doctors must be particularly careful in evaluating patients, making sure that they are good candidates for transplants and have a good chance of long-term survival. “We at Columbia have been leaders in terms of identifying those patients who are most in need of transplant, and we’ve continually raised the bar in selection criteria, making it possible for patients who previously would have been excluded to have the chance at a new heart.”

For example, imagine a 60-year-old man with hypertension who dies in an auto accident. His driver’s license says he is an organ donor, but his age and medical history would mean that his heart wouldn’t be given to a lower-risk transplant candidate. But with Columbia’s new Extended Donor Heart Transplant Program, hearts like this one can be matched to patients whose age or other illnesses would have otherwise ruled them out as transplant candidates. “It brings the possibility of a new heart to patients who otherwise would have no hope, without affecting the hundreds of other patients already waiting for a heart,” says Dr. Mancini.

Physician-scientists at Columbia have also helped improve the odds of a heart transplant’s success, leading the way on research into novel therapies that help suppress the immune system’s natural impulse to reject the “foreign” heart. “We’ve been pioneers in the use of the drug rapamycin as an immunosuppressive therapy,” says Dr. Mancini. “We’re also using novel monoclonal antibodies to prevent rejection, and investigating the use of genetic arrays to detect rejection.”

With donor hearts so rare and rejection issues so common, over the last decade a revolution has been taking place in the treatment of heart failure: artificial assist devices. Originally conceived primarily as a “bridge to transplant” therapy designed to keep patients alive until a suitable donor heart could be found, options like left ventricular assist devices (LVADs) are increasingly being used as “destination therapies” for patients who would not be candidates for transplants. Columbia cardiologists and surgeons participated in the initial LVAD trials, and spearheaded the multicenter ReMATCH trial, which found that use of the implanted heart pump more than doubled the likelihood that terminally ill heart failure patients would be alive at the end of the year.

Although implantable LVADs may allow the heart muscle to heal, they usually don’t restore full heart function. Columbia is now investigating ways to fill this gap, using innovative approaches like autologous stem cell transplants—that is, from the patient’s own cells—to spur the growth of new heart cells and improve recovery rates.

“Ours is truly one of the flagship programs for heart failure and transplantation,” says Dr. Mancini. “We’re one of the largest and the busiest centers in the world, and we’ve been at the forefront of research for more than a decade. But no matter how much our center grows, we will never lose sight of the physician-patient bond that is essential to the care we provide.”
The Infinite Heart

What if we could grow new hearts? What if, after a heart attack or a new case of heart failure, doctors could instruct that deteriorating heart muscle to replenish itself with new, strong, undamaged tissue? That’s the holy grail pursued by many leading researchers at Columbia, as they seek genetic and molecular solutions to repair or replace damaged hearts.

“Right now, even with the most advanced therapies available to patients with heart attacks, we’re able to salvage, at most, 60% of the heart muscle that was at risk,” says Warren Sherman, M.D., CIVT’s Director of Cardiac Cell-Based Endovascular Therapies. “Despite our best efforts, the fundamental problem of persistent damage to the heart continues.”

That’s why scientists are so excited about research now underway at Columbia that’s exploring cellular therapies aimed at switching on the machinery that creates new heart muscle, or myocardium. One possibility, says Dr. Sherman, are cells found in the bone marrow, known to be a reservoir of reparative cells. “Bone marrow-derived mononuclear cells promote vascular growth after tissue injury,” he explains. “Several years ago, researchers at Columbia demonstrated the fundamental role played by a specific population of bone marrow cells in generating a fresh blood supply to injured myocardium. If new blood vessels can be stimulated in patients with heart attacks using this method, we may have found a formula for effective ‘damage control.’”

Another source for such heart regeneration: the rare but potentially rich population of cells known as mesenchymal precursor cells, also found in each person’s bone marrow. We each have only a few, but Silviu Itescu, M.D., Director of Transplantation Immunology, believes these few cells hold infinite promise for rebuilding damaged hearts. “We’re able to purify these cells to a very high level and then grow them up in very large numbers. If we then introduce the cells back into a small animal model of ischemic heart disease, we get new arterials growing, and we get new heart muscle regenerating. That results in significantly improved heart function.”

Mesenchymal precursor cells have some unique and exciting properties that allow them to fly under the radar of the body’s immune system. They seem to lack certain surface receptors that enable the immune system to recognize them as foreign bodies. So one or two donors of a few mesenchymal stem cells could, in theory, help grow new heart tissue for many unrelated cardiac patients, with cultured cell lines just waiting in hospital laboratories for the next person who needs them.

Dr. Itescu and his team are now awaiting FDA approval for initial human trials of mesenchymal precursor cells. Once it’s proven that they’re safe for use in humans, he’ll test them in patients with acute myocardial infarctions.

Columbia scientists are also pursuing genetic solutions to heart disease. Hina Chaudhry, M.D., was just eight years old when she promised her mother that she would become a heart specialist and help people like her father, who had suffered a heart attack. Nearly 30 years later, her father is doing well—and Dr. Chaudhry thinks she’s stumbled upon what may be the most important gene in the heart for regenerating cells.

It’s called cyclin A2, and as soon as any mammal is born, it goes silent, as surely as a radio that’s been switched off. From that point on, the heart stops developing new cells—it grows larger only because the cells within it grow larger, not because more cells are born. Now, in animal research, Dr. Chaudhry has discovered that when cyclin A2 is artificially switched back on, new heart cells continue to be generated. And when heart attacks are induced in mice that have switched-on cyclin A2, their heart tissue regenerates and retains its ability to pump.

Dr. Chaudhry’s team has also begun testing ways to deliver cyclin A2 as a drug, something that could be therapeutically delivered to people with heart failure or who have just had heart attacks. “Our current therapies for heart failure are very limited, and the mortality rate hasn’t budged,” she says. “We have an imperative need for cellular and molecular therapies to change that picture.”

“Is not the core of nature in the heart of man?”

Johann Wolfgang von Goethe
SEEING WITH THE HEART

They say that every picture tells a story. In Columbia’s cardiovascular imaging program, that story is one of survival. State-of-the-art imaging tools such as MRIs, CT angiography, echocardiography, and ultrasound can paint vivid, detailed pictures of the human heart in real time, pinpointing problems like diseased vessels and areas of damage after a heart attack with astounding precision.

For some 30 years, single photon emission computed tomography (SPECT) has helped cardiologists diagnose atherosclerosis, using low doses of radioactive drugs and gamma cameras to show how blood flow is distributed through the heart. But until recently, it had crucial limitations. The soft tissues of the chest area can “confuse” the SPECT technology, leading to false positive readings that appear to show heart disease when there really is none.

A new approach called attenuation correction, pioneered in part by Lynne Johnson, M.D., Director of the Nuclear Cardiology Laboratory at Columbia, eliminates this confusion. By using one camera that simultaneously takes two pictures—one of the radioactivity emanating from the heart, and the other of the radiation coming from a source that goes through the chest—the SPECT image can be corrected for attenuation and more accurately determine what’s blocking blood flow to the heart—and what isn’t.

Other new tools are creating a brighter picture for heart patients as well. Columbia is one of only five centers in the United States to offer combined SPECT/CT scanning, a technique that fuses the high-resolution anatomical scanning of CT technology with the functional imaging of perfusion SPECT scans to create a more accurate map of heart function, while at the same time providing coronary artery calcium scores. This system can perform both SPECT for blood flow and coronary CT angiography for anatomy.

These calcium scores, says Dr. Johnson, may help cardiologists determine which patients are at greatest risk from coronary artery disease—and therefore need more vigilant management strategies. “Usually, the most advanced atherosclerotic lesions are the ones that calcify, and we can pick that up with a CT scanner,” she explains. “We’re now involved in a multicenter study to determine whether coronary artery calcium scores can help us predict a patient’s prognosis.” If, for example, a patient’s perfusion scan looked normal but his calcium was elevated, doctors might be more aggressive in controlling lipid levels and monitoring heart function than with a patient whose normal scan was accompanied by low calcium levels.

Columbia also has an active cardiac PET service, directed by Dr. Sabahat Bokhari. PET (positron emission tomography) is an advanced nuclear imaging technology that can measure blood flow to the heart and the metabolism of the heart muscle. Using a very short-lived PET tracer called rubidium, physicians can perform a complete test to look for blockages in the heart’s blood vessels in less than one hour.

“Nobody has ever measured, not even poets, how much the heart can hold.”

Zelda Fitzgerald
In early 2006, Columbia began using another exciting new tool: coronary CT angiography, an option that allows physicians to view blockages of the coronary arteries without an arterial catheterization. “About a quarter of the people in this country who have a cardiac catheterization don’t have significant coronary artery disease,” says Steven Wolff, M.D., Ph.D., Director of Cardiovascular MRI and CT. “Another quarter of these patients have significant disease, but doctors don’t do an angioplasty—for example, if the disease is so severe that the patient actually needs a bypass. You don’t want to put a catheter in a patient if you’re not going to use it to fix what’s wrong.” Coronary CT angiography, he predicts, will replace a lot of invasive procedures for diagnosing coronary artery disease.

SPECT and CT aren’t the only ways to visualize the heart. Division of Cardiology Associate Chief Shunichi Homma, M.D., has played a key role in developing ultrasound imaging of the heart so that it can visualize cardiac structures in three dimensions, rather than in two flat dimensions. He and his colleagues are now using 3-D ultrasound and other recent advances, like tissue Doppler imaging, to help select which patients are most likely to benefit from devices that resynchronize the heart after an arrhythmia, like left ventricular assist devices (LVADs) and biventricular pacers.

Led by Dr. Homma, a Cardiovascular Ultrasound Laboratories staff of over 50—one of the largest such programs in the world—performs more than 25,000 echocardiograms, vascular ultrasounds, and other studies every year.

In fact, cardiovascular ultrasound, which has long been part of a doctor’s diagnostic arsenal, may also be useful as a therapeutic tool. That’s one of several intriguing possibilities being explored by Dr. Homma and other researchers in the cardiovascular imaging program. Supported by the NIH, they are testing high-intensity, focused ultrasound as a tool for
ablating myocardial tissue to treat patients with arrhythmia. In one of the largest cardioembolic stroke programs in the nation, Dr. Homma and Dr. Marco DiTullio are assessing how well ultrasound can predict adverse events in a large group of northern Manhattan residents. Dr. Homma also organized an NIH-supported multicenter study to demonstrate the efficacy of medical therapy for stroke patients with patent foramen ovale, and now is responsible for a 140-center NIH-supported study to assess the efficacy of warfarin compared with aspirin to reduce stroke or death in patients with low cardiac ejection fraction (the WARCEF trial).

For a picture of the heart that’s really worth a thousand words, scientists are looking toward cardiac MRI. “No other imaging technology has the versatility of MRI,” says Dr. Wolff. Not only can it do many of the same things that echocardiography and nuclear imaging can do, MRI can also produce high-resolution images to quantify heart function, valve function, and blood flow to the heart muscle.

“We can define ventricular function, which is important for patients with heart failure. We can assess how leaky valves are for patients with valve disease. We can assess viability—whether heart tissue is alive or dead—with more precision than any other test,” Dr. Wolff says. Perhaps most exciting, cardiac MRI can even pinpoint exactly where a heart attack has happened—or is still happening. Dr. Wolff predicts that it will become a first-line test for patients with all kinds of heart disease within the next few years.

“As new, advanced therapies become available for cardiovascular disease, we need to develop imaging techniques that are equally advanced, so that we can choose the right patients for the right treatments,” says Dr. Homma.
ELECTROPHYSIOLOGY
The heart isn’t just a muscle. It also has an extensive electrical system that’s just as complex and finely tuned as the one that brings power to your home. With each beat, electrical impulses flow to and from the heart, part of a circuitry so delicate that one missed connection or extra channel can cause the irregular heartbeat patterns known as arrhythmias.

Of course, we’ve all felt our hearts “skip a beat” on occasion—on seeing our true love for the first time, or hearing a mysterious noise in an empty house late at night. Most of the time, these sudden skips and flutters are no cause for alarm. But for more than two million Americans, various types of arrhythmias mean that their hearts frequently beat too slowly, too quickly, or irregularly. This “off beat” problem can lead to shortness of breath, fainting, or even sudden death.

Two million people in the United States today have arrhythmias, and particularly for the elderly, they can pose a serious risk of heart failure or stroke. These persistent arrhythmias were once treated with open-heart procedures or lifelong medication management, but today, a growing number of patients can have their arrhythmias eliminated with a percutaneous procedure called catheter ablation. Ablation involves heating cardiac tissue through radiofrequency current, at frequencies of about 750 kilohertz, or about the same as radio waves. That heat is used to burn away and correct small patches of tissue that are causing the arrhythmia. Once done through open-heart surgery, most arrhythmia ablations can now be done less invasively, by introducing the electrode to the heart by way of a catheter.

“This technique is critically dependent on the accuracy of the mapping that we do beforehand. First, we use three-dimensional electro-anatomical mapping techniques to give us a graphic description of how the electrical waves travel through the chambers of the heart,” explains Hasan Garan, M.D., Director of Cardiac Electrophysiology. “If they differ from their normal pathways, creating an arrhythmia, we collect multiple signals to, in essence, create one giant heartbeat that shows us the path of the arrhythmia.”

“Sensations sweet, felt in the blood, and felt along the heart.”

William Wordsworth
Implantable devices, like biventricular pacers and internal cardiac defibrillators, have also substantially reduced the risk of sudden cardiac death for many patients with arrhythmias, heart failure, and other cardiac conditions. These devices can either “shock” patients out of an arrhythmia and back into normal heart rhythm, or keep the two ventricles of the heart beating in synchrony with each other.

But which patients need them, and which ones don’t? It may be that a substantial number of patients with implantable cardiac devices don’t need them—and some people who do need them aren’t getting them. “Now that we have relatively simple tools to find people who are at reasonably high risk of sudden cardiac death, the next challenge is to identify those apparently ‘high risk’ people who actually don’t need ICDs,” says J. Thomas Bigger, M.D., Medical Director of Columbia’s Clinical Trials Network.
Using a new test called T-wave alternans, which measures tiny heartbeat variations not visible to the naked eye, electrophysiologists can detect those patients whose ventricular arrhythmias are particularly life-threatening. Columbia scientists helped to refine and establish the protocols for this new test, which has proven to be an accurate predictor of dangerous arrhythmias. It is especially good for risk-stratifying patients with heart failure and those with non-ischemic cardiomyopathy.

“We’ve found that as many as one-third of the people who are considered eligible to have an ICD implanted have a normal T-wave alternans test,” says Dr. Bigger. “Those people almost never have any sudden death events. Advanced testing like this really helps us fine-tune which patients can benefit most from these important tools.” T-wave alternans testing also reflects the action of some drugs that are used to treat heart failure, and may prove useful in developing next-generation heart failure drugs.

Sometimes, there’s nothing wrong with the structure of the heart itself. The valves, the ventricles, the chamber size—everything is perfectly normal. And yet this “perfectly normal” heart can suddenly lurch dangerously off beat, developing an arrhythmia that can easily become fatal.

The problem may lie within the complicated network of valves found on the cell membrane surrounding every cell in the heart, known as ion channels. As electrically charged ions (such as sodium, calcium, and potassium) flow across the membrane through these channels, they spark the electrical impulses that radiate from the heart’s “pacemaker,” the sinoatrial node. If even one of the dozens of ion channels found in the heart has a flaw, those impulses can become as jittery and uncoordinated as a dancer hitting a patch of ice.

For Geoffrey Pitt, M.D., Ph.D., it’s all about calcium. Calcium ion channels, he explains, are the ultimate signal transmitter for electrical activity within cells. “We know that calcium regulation is abnormal in conditions like heart failure and hypertension,” he says. By studying intracellular calcium and the ion channels that transmit it, he hopes to understand how abnormal regulation of calcium can provoke the arrhythmias that often strike people with heart failure—and ultimately, to fine-tune decision-making about which patients receive implantable cardiac defibrillators (ICDs).

“Not all people with heart failure develop arrhythmias, and not all of them need these devices. But right now, we don’t know which ones will and which ones won’t,” Dr. Pitt says. “If we understand how calcium and its ion channels interact, we could potentially develop a test that would identify who would benefit most from ICDs.”

Another important ion channel has been dubbed BK. Since K is the chemical label for potassium, the name just means “big potassium” (the channel has “big potassium”-conducting properties). It’s a channel responsible for relaxing the smooth muscles of the heart, and Columbia scientist Steven O. Marx, M.D., Ph.D., is studying what role it might play in a variety of cardiovascular diseases, such as hypertension and stroke.

“Big potassium” may also play a role in coronary artery spasm—the sudden, unpredictable narrowing of the coronary arteries that temporarily limits blood flow to the heart and increases the risk of a heart attack. Although it’s more common in people with existing coronary artery disease, coronary artery spasm can happen even in relatively young and healthy people with no signs of cardiovascular disease. Abnormalities in the BK channel may be one factor behind the spasm, and he and his colleagues are now studying a “BK-channel agonist” compound that may act to prevent this kind of spasm.
In the 1950s, if a baby was born “blue”—with a heart defect called transposition of the great vessels, in which the aorta and the pulmonary artery are connected to the wrong chambers—the parents were usually told that there was no hope. Eight out of 10 of these infants died within their first year of life. Virtually none lived to their fifth birthday. But in 1963, Dr. William Mustard performed a groundbreaking surgical procedure that would be named after him, restoring the circulation while reversing the blood flow in the heart—and radically reversing the survival rate for these children. It would soon be followed by many other surgical innovations designed to correct other defects.

Twenty years later, as a fellow at Massachusetts General Hospital in the mid-1980s, Marlon Rosenbaum, M.D., found himself treating some of these “Mustard graduates”—the first generation of children with complex heart defects to survive into their 20s and 30s. He realized that he was present at the creation of a new subspecialty: adult congenital cardiology.

About half a million adults in the United States are living with complex congenital heart conditions. And just as pediatric heart patients aren’t “small adults,” adults who have had congenital heart disease since childhood aren’t merely “big children.” They have outgrown the expertise of their pediatric cardiologist, but the average adult cardiologist is often baffled by the unique anatomy and complex medical issues that these patients face.

“They often have residual abnormalities, such as leaky valves, and they can frequently develop complex arrhythmias,” says Dr. Rosenbaum, the founder and Director of the Joan and Michael Schneeweiss Center for Adult Congenital Heart Disease at Columbia, one of only a handful of such programs in the country and one of the few to offer three full-time surgeons with expertise in adult congenital heart disease. “They really need to be treated at a center that specializes in their needs.” But there are only 22 physicians in the entire country specializing in adult congenital heart disease full-time.

As surgical approaches to congenital heart defects have evolved, each new generation of patients present with different repairs, different heart structure—and different ongoing needs. “Someone born in the 1970s with a transposition of the great arteries would have had the Mustard procedure, for example, which creates its own problems,” says Dr. Rosenbaum. “On the other hand, someone with the same anatomy born in 1990 would have undergone an arterial switch, which returns the two arteries to the appropriate chambers—and which creates an entirely different set of issues. Every patient who comes to see us is different.”

“And thus the heart will break, yet brokenly live on.”

Lord Byron
Just as the surgeries that correct congenital heart defects are changing, so too is the specialty of adult congenital heart disease. “It’s a continually evolving field. What I recommend today in terms of replacing a pulmonary valve, for example, I didn’t do even two years ago,” says Dr. Rosenbaum.

Many adult congenital heart patients have arrhythmias—heartbeats that are too slow, too fast, or irregular. In the normal heart, the source of an arrhythmia can usually be determined with little trouble. But in congenital patients, localizing an arrhythmia can be a detective story worthy of Sherlock Holmes. “Probably 20% of our patients have arrhythmias, and finding them and treating them isn’t easy,” says Dr. Rosenbaum. “Areas of abnormal conduction can be difficult to reach because of scarring, pathways may have been changed, and multiple circuits can be involved rather than just one.”

That’s why the adult congenital program has its own state-of-the-art echocardiography lab, along with a close collaborative relationship with other cardiac specialists, such as electrophysiologist Hasan Garan, M.D. “We have a depth of local expertise that makes our program different from all the others,” says Dr. Rosenbaum.

That expertise—and Columbia’s renowned maternal-fetal medicine program—plays an important role for the increasing number of young women with congenital heart defects who hope to have children of their own. Until very recently, women who had undergone surgeries for severe congenital defects as children and now wanted to become pregnant were given very simple advice: don’t. Pregnancy was thought to place too much of a strain on an already overtaxed heart.

**YOUNG AT HEART**

When Betsy Carlough was born in 1955, doctors knew there was something wrong with her heart within two days. X-rays showed that she had Ebstein’s anomaly, a malformation of the heart’s tricuspid valve. One or two of the three leaflets of the valve were stuck to the wall of the heart, which meant they couldn’t move normally.

But back then, there was nothing they could do except hope that the defect’s effects on her heart function would be mild. The infant Betsy went home with her parents and spent the next 50 years seeing cardiologists regularly. She knew that it was possible that the malformed valve was leaking and blood from the right ventricle was flowing backward through the valve with each heartbeat, but as she grew up, she didn’t feel like a heart patient.

“I started running at the age of 20, and I would run about 10 miles a day with no problem,” says Betsy, an office administrator for a general surgeon. “But in my 40s, I began to notice that I couldn’t run as far, and I’d have to stop and rest more often. At first I put it down to just getting older.” In early 2001, Betsy’s cardiologist told her that it was time for her to see a specialist. “He couldn’t take me further, so he sent me to Dr. Rosenbaum.”

Tests at Columbia revealed that although Betsy may have felt fine, her heart was in terrible shape. “My echocardiogram looked horrendous,” she recalls. It revealed that she had advanced heart disease and severe arrhythmias. “Dr. Rosenbaum came back and told me that I needed surgery and that I probably should have had it 10 years ago. I hadn’t even known there was a surgery for me 10 years ago!”

Columbia’s surgical team repaired the tricuspid valve defect. At the same time, they performed a MAZE surgical procedure, curing Betsy’s atrial fibrillation by making incisions in both atria, interrupting the circular electrical patterns that cause arrhythmias and channeling the normal electrical impulses in the proper direction.

“I walked out of the hospital feeling 20 years younger!” she declares. “I was kicking myself, wondering why I hadn’t done this before. I can’t believe how good I feel.”
As more surgical breakthroughs happened and more adult congenital heart patients felt healthy and strong, some of these women took a leap of faith—and so far, it appears that many are doing well. “Anecdotally, we’ve learned that if a woman with congenital heart disease is asymptomatic before getting pregnant, she probably can successfully get through the pregnancy—although regular and careful cardiac evaluation is important,” says adult congenital heart disease expert Deborah Gersony, M.D.

But that’s not the end of the story. “What kind of toll does it take on their body in the long term?” she asks. Could pregnancy ultimately damage a woman’s right ventricular function, leading to increased levels of valvular disease and potential complications down the road? Those questions need to be answered, says Dr. Gersony, so that women can make the most informed decisions possible about pregnancy. To help find answers, she is now leading a prospective, multicenter study evaluating the changes in ventricular function that occur during pregnancy among women with three of the more complex congenital heart conditions.

“This is an exciting field to be in,” she says. “It’s very young, and it’s very positive. There’s so much promise.”

DOES THE HEART RULE THE HEAD?

There’s a one-in-five chance that you could have a heart defect without even realizing it. The defect is called a patent foramen ovale (say it “oh-VAL-ay”), and it’s simply an opening in the septum, or wall, between the two upper chambers of the heart (the right and left atrium). About 20% of the population has an opening like this, and for most of these people, it never causes any problems.

But in some cases, when a person with a patent foramen ovale coughs, sneezes, or otherwise creates pressure inside the chest, unfiltered blood with debris—like small blood clots—can pass through the hole between the two atria and lodge in the brain, heart, eyes, or kidneys. Blood traveling between the atrial chambers of the heart may cause fatigue, shortness of breath, atrial fibrillation, or other arrhythmias. Scientists are now studying whether or not these defects may also be associated with an elevated risk of stroke in some cases. “Why do some people with PFOs have problems, while most others never even know they have them? It’s unclear,” says Robert Sommer, M.D., Director of the Adult Invasive Congenital Heart Services at the Center for Interventional Vascular Therapy, who has performed more than 1,000 closure procedures for PFOs and other atrial septal defects.

When surgeons like Dr. Sommer began operating to close PFOs, they made a serendipitous discovery. Some of these patients, who had suffered from severe, classic migraines complete with “auras” for much of their lives, suddenly found that their migraines were gone.

Scientists aren’t sure precisely how PFOs might contribute to migraines, but there appears to be an association. Some 12% of all people have classic migraines, and of that group, about 70% to 75% have PFOs—far more than in the general population. Two smaller studies published in early 2005 found a dramatic reduction in migraines among patients who’d had PFO closure surgeries. Now Dr. Sommer and his team are among the investigators launching two large, randomized clinical trials designed to assess whether closing PFOs helps to prevent migraines—one using radiofrequency energy to seal the wall, and the other using a device that closes the hole.

“Migraines are extremely debilitating, and if closing the PFO can alleviate migraines, it would make an enormous difference for so many people,” says Dr. Sommer.
You have your mother’s eyes and your grandfather’s nose. You trade clothes with your sister, and never miss spending the holidays with your cousins. But you have a lot more in common with your family than just resemblances and memories. With our families, we share both our genetic heritage and our daily lives: two things that can put us all at higher risk for heart disease.

Heart health is a family affair, says Lori Mosca, M.D., Ph.D. The founder of Columbia University Medical Center’s groundbreaking Preventive Cardiology Program, Dr. Mosca is on a mission to reach out to at-risk families and educate them on how to live heart healthy. It’s a very personal lesson: her father suffered a heart attack during her second year in medical school. Fortunately, he survived, but the ordeal her family went through inspired in Dr. Mosca a passion for prevention: intervening to stop cardiovascular disease before it causes damage.

“We don’t live in isolation,” she says. “With our families, we share our lifestyles as much as we share our genes, so if someone in your family is at an elevated risk of heart disease because of inherited factors or because of their lifestyle habits, you may be at risk too.”

With that in mind, Dr. Mosca and her team created the “Passport to Heart Health” program, a unique screening project aimed at the families of patients who have been admitted to Columbia University Medical Center in a cardiac crisis. “This is a motivational moment at which we can help families assess their own risk,” she says. “If we can identify people at elevated risk and direct them to early intervention, we can reduce the burden of cardiovascular disease.”

Cardiac prevention counselors screen family members of heart patients not only for traditional risk factors such as blood pressure, cholesterol, and glucose but also for newer risk factors such as C-reactive protein, an indication of inflammation. Then they talk with the families about heart-healthy lifestyles. After its first four years, the program has found a previously unrecognized and undermanaged level of heart disease risk among screened family members. What’s more, says Dr. Mosca, early research suggests that those risk factors improve after education from Passport program counselors.

The first-of-its-kind program has proven so successful that it’s being exported to other hospitals that serve a variety of socioeconomic groups, both elsewhere in New York and as far away as Canada. Recently, the National Institutes of Health awarded Passport to Heart Health a $2 million grant to study the effectiveness of its interventions.

All too often, prevention messages about heart disease miss an enormously important target: women. Heart disease is the No. 1 killer of women—but although it kills 10 times more women every year than breast cancer, many surveys show that women worry far more about breast cancer.

Women—and all too often, their doctors—are likely to miss the signs of heart trouble, says
Elsa-Grace Giardina, M.D., founder and Director of Columbia’s Center for Women’s Health. “Women with a heart attack may present with very different complaints than do men,” Dr. Giardina says. “They often experience vague and nonspecific symptoms like shortness of breath, nausea, fatigue, or left arm pain.”

And after heart attacks, women fare less well than men. Women under 50 are about twice as likely as men to die following a heart attack. And women are almost two times as likely as men to die after bypass surgery. Meanwhile, they’re less likely to receive certain vital therapeutic interventions, like angioplasty, aspirin therapy, and cardiac stents.

To help understand which women are at particularly high risk for heart disease, Dr. Giardina is studying novel markers for cardiovascular risk. “We all know about cholesterol and high blood pressure,” she says. “I’m interested in a class of markers that help us predict which women have an elevated risk of heart

Dr. Shimbo has been studying the effects of anger on endothelial function—that is, how blood vessels behave—by conducting a series of interviews with groups of volunteers. Some interviews are “neutral,” with no provocative questions asked; in others, the interviewer asks condescending and patronizing questions designed to provoke anger. The results, he says, have been dramatic. “Beginning about 30 minutes after the ‘angry’ interviews, the arteries’ ability to dilate just plummets. They become almost as constricted as they would be if the person had been smoking for 20 years.”

Next, Dr. Shimbo plans to study how long it takes the endothelium to recover from the “shock” of anger, and also to explore what can be done to prevent long-term damage for people who are chronically angry.
disease without any of the traditional signs.” These markers, called hemostatic and fibrinolytic factors, fluctuate over the course of a woman’s menstrual cycle. “We’ve just begun to define their role, but they may be useful to help us understand what role estrogen plays in heart disease and stratify risk so that we can intervene early for high-risk patients.”

Dr. Mosca and Dr. Giardina are also working with the Sister to Sister/Everyone Has a Heart program, to get the word out about women and heart disease. In 2005 alone, Columbia physicians provided free heart disease screenings for more than 10,000 women as part of the Sister to Sister program. “It’s imperative that we keep women healthy, or we’ll be a nation that takes care of a huge population of debilitated, elderly women,” says Dr. Giardina. “The question isn’t just whether you’re going to live or die—it’s how well are you going to live?”
Today’s fledgling cardiologist must master tools and technologies that were virtually unknown to their predecessors entering the field just 10 years ago—from drug-eluting stents to using magnetic resonance imaging to study the heart. Cardiovascular medicine is evolving so rapidly that Columbia’s cardiovascular fellowship program, a leader in training the heart specialists of tomorrow for more than 20 years, has reshaped its curriculum extensively to meet the evolving needs of its fellows.

“In the past few years, there’s just been an explosion in technical knowledge, therapeutic modalities, and evidence-based medicine documenting what cardiology should be,” says James Coromilas, M.D., Director of the Cardiology Fellowship Program. “Areas that were nonexistent 15 years ago, like cardiac MRI and fast CT, device therapies, and electrophysiology with ablation, are now a part of everyday practice.”

The highly competitive program attracts more than 500 applicants for six slots annually. Fellows can choose either a three-year or four-year program: a three-year clinical track that includes a standard two-year core curriculum and a third year divided between clinical rotations and subspecialty research, or a four-year research track that adds two years of intensive research training to the initial two-year curriculum.

To its standard rotations in cardiac catheterization, echocardiography, nuclear cardiology, adult congenital heart disease, and the coronary care unit, Columbia’s fellowship program has added new rotations in peripheral vascular disease, rehabilitation medicine, preventive cardiology, and noninvasive imaging. “That’s in addition to our heart failure and transplant rotations, which are among the most extensive in the country,” says Dr. Coromilas. Columbia is one of only a handful of cardiovascular fellowships in the nation offering rotations in transplant and in adult congenital heart disease.

As the depth, breadth, and complexity of the fellowship program has increased over the years, so has the caliber of its fellows. “We’ve always had outstanding candidates for our fellowship program, and their qualifications just continue to improve,” says Dr. Coromilas. “The skills, knowledge base, and prior research experience of each incoming group is much more extensive than in past years.” In recognition of the excellence of our faculty and our commitment to training leaders in academic cardiology, the program is partially supported by a competitively awarded NIH training grant.

These Columbia-trained thought leaders in cardiology will play an essential role in bringing new ideas, energy, and perspective to a specialty whose importance will only increase as the population ages. “With the aging of the Baby Boom generation, the volume of cardiovascular disease is already increasing greatly, and we can expect that to continue,” says Dr. Coromilas. “Meanwhile, there’s a growing shortage of cardiovascular specialists in the country.”

In the midst of an expanding knowledge base, ever-evolving technologies, and increasing pressures on young physicians, Dr. Coromilas maintains a clear focus for the fellowship program: creating the next generation of leaders in cardiovascular disease. “As cardiology becomes more and more specialized, it’s more important than ever that cardiologists have a strong grounding in the fundamental principles of cardiovascular medicine,” he says.

“Where my heart lies let my brain lie also.”

Robert Browning
THE FUTURE OF CARDIOLOGY AT COLUMBIA

Just as the valves, vessels, chambers, and membranes of the heart work as a seamless, integrated whole to pump blood through the body, so too do Columbia’s many expert physicians in many subspecialty areas of cardiology work together to bring extraordinary care to our patients. For example, interventional cardiologists and electrophysiologists consult with clinical cardiologists to determine the optimum treatment for patients with coronary disease. Cardiovascular ultrasound experts and nuclear cardiologists collaborate with heart failure specialists to determine the extent of heart damage. And all of these leading cardiovascular physicians collaborate on the cutting-edge basic, translational, and clinical research that will lead to the breakthrough therapies of the future.

To bring these experts together in a way that best meets the needs of our patients, we are creating an entirely new facility: The Vivian and Seymour Milstein Family Heart Center, uniting the world’s finest cardiovascular physicians and nurses, and the latest in diagnostic and treatment tools and technologies, all under one roof. In this remarkable five-story, 115,000-square-foot building adjacent to the Milstein Hospital Building and Herbert Irving Pavilion—a first-of-its-kind facility for New York City—science will be brought to the bedside as clinical experts work closely with basic science researchers, translating the latest scientific discoveries into new treatment options.

But the Heart Center is only one piece of the puzzle. If we are to bring tomorrow’s discoveries to our patients—if we are to take advantage of the revolution in molecular biology, genomics, and proteomics—we must have the kind of 21st-century laboratories and facilities that will attract and retain the finest minds working in cardiology today.

With a strong cadre of nationally recognized senior cardiovascular scientists, as well as a growing number of aggressively recruited young investigators who represent cardiology’s future, Columbia’s cardiovascular research program has already pushed the boundaries of possibility. But with research taking place in multiple different departments, geographically dispersed across campus without any coordinating infrastructure, only so much can be achieved. To integrate basic and applied research and speed the progress of discovery into clinical practice, we must bring these researchers and their programs together.

To achieve that goal, we will soon be launching an ambitious campaign. Our plan is to ensure that Columbia University Medical Center is second to none in our programs for state-of-the-art cardiovascular science, bringing together researchers from physiology, pharmacology, surgery, and medicine to build a bridge between the bench and the bedside. As these plans proceed, our challenge will be to provide the space and resources needed to recruit and retain the best and the brightest in fields such as cardiovascular genetics and vascular biology, two of the most important growth areas in cardiology today. As these plans move forward, we hope to work with all of you in making this dream a reality.