Electrophysiology cardiologists who specialize in heart rhythm disorders soon may be able to place sensitive electronics inside their patients’ hearts with less invasiveness, enabling more sophisticated and efficient diagnosis and treatment of arrhythmias.

Electrophysiologists often use multiple catheters for mapping arrhythmia patterns in the heart—often in a point-by-point fashion as the catheter is maneuvered in search of irregularities. They then use a specialized ablation catheter to cauterize the site where the arrhythmia originates. “The new catheter is all in one, so it maps and zaps,” says John A. Rogers, PhD, a professor of materials science and engineering at the University of Illinois, who led a research team that included Marvin Slepian, MD, of the UA Sarver Heart Center. He worked with other cardiologists to determine features that would be most useful for patient care. For example, the researchers added temperature sensors and mapped temperature distribution on actual tissue as areas were ablated. “Adding such a feature gives us greater insight as to what we are actually doing to the tissue,” said co-author Dr. Slepian. “This will enhance the safety and effectiveness of ablation catheters, providing a new level of precision that we have not had to date.”

Veronica Smith, age 26, was the first person in Arizona to receive a new pulmonary valve without having open-heart surgery.

The procedure, known as the Melody Transcatheter Pulmonary Valve (TPV) Therapy, was approved by the FDA in 2010 and performed in March at the University Medical Center cardiac catheterization laboratory by pediatric interventional cardiologists Ricardo Samson, MD, G. Michael Nichols, MD, and the UMC catheterization lab team.

Veronica was born with the congenital heart defect known as tetralogy of Fallot and has undergone a previous heart surgery to replace the pulmonary valve in her heart.

“Over time, the artificial valve wears out such that it would need to be replaced approximately every seven to 10 years,” says Dr. Samson, a UA Sarver Heart Center member. "In the past, pediatric patients who had their artificial valve placed during their first decade of life had to face multiple open-heart surgeries over the course of their lifetime. So, placing the Melody TPV by catheterization saves them from having numerous surgeries.”

University Medical Center’s catheterization lab opened a new hybrid room that gives surgeons and cardiologists the ability to work in phases to do procedures that are most appropriate for an individual patient’s needs. Many factors are considered when physicians decide whether a blocked artery should be unblocked by bypass surgery or catheterization. “For example, we consider the size of the arteries and veins, how hard it is to get to a spot and whether the patient also needs valve surgery,” explains Molly Szerlip, MD, an interventional cardiologist.

When teaming up with Robert Poston, MD, chief of cardiothoracic surgery, his robotic skills for bypass surgery combined with a cardiologist inserting a stent with a catheter make these procedures less invasive for more patients.

The first patient was a 54-year-old man with unstable angina and a left main blockage who had very small vessels. “In the past, this patient would have been treated with a full sternotomy (cutting the breastbone) and two bypass grafts. The hybrid procedure technically was more advantageous for his circumstances, giving him the minimally invasive nature of stenting and the longevity of connecting the LIMA to the LAD,” says Dr. Poston. (That is, connecting the left internal mammary artery to the left anterior descending coronary artery.) Next, Dr. Szerlip inserted a stent in the left circumflex artery (the artery to the bottom part of the heart).
A new pacemaker that can be used safely in a magnetic resonance imaging environment (MRI) is now available. The older patients get, the more likely they are to develop arrhythmias and possibly need pacemakers. They also are more likely to develop a condition in which an MRI may be needed for diagnosis. However, the magnetic field may interfere with the pacemaker.

Up until now, doctors have turned to other imaging modalities, such as a CT Scan, or they carefully selected and monitored patients who were able to undergo an MRI safely.

So, is this MRI-safe pacemaker for everyone? Both Julia Indik, MD, and Peter Ott, MD, recommend that age-old advice: talk to your doctor and make a decision that is best for you.

“It’s important to distinguish between ‘wanting’ an MRI and ‘needing’ an MRI,” says Dr. Indik. She also is concerned about the larger size of the MRI-safe pacemaker and says the long-term performance is not yet known. “Clearly situations come up where this technology is useful and this gives physicians options to consider.”

“If a patient has preexisting pacing leads from a prior device implant, these would prohibit safe MRI scanning and may need to be removed if the MRI is vital, a procedure that is not without risk,” says Dr. Ott. “Most likely I would consider this device for patients who need only basic pacing support and are very likely to need MRI scans in the future, such as patients with cancer or those at high risk for stroke.”

This MRI-safe technology does not yet apply to implantable defibrillators. Plus, the MRI-safe pacemaker limits how the MRI scan can be done with regard to the body area scanned (currently not approved for chest MRI) and the MRI magnetic field strength, says Dr. Ott.

Marcela Padilla, 21, became the first Total Artificial Heart (TAH) patient in Tucson to leave the hospital while awaiting a heart transplant. She walked out of University Medical Center Jan. 20 with a backpack slung over her shoulder. Inside was the 13.5-pound Freedom portable driver, powering the SynCardia temporary TAH implanted in her chest.

Marcela gave birth to a baby boy in April 2010, but four days later, she struggled to breathe. “I was short of breath. I couldn’t sleep at night. I couldn’t take care of my baby. I was too weak and my body was really swollen.”

M. Cristina Smith, MD, director of Heart Transplant and Ventricular-Assist Device Services, and assistant professor in the UA Department of Surgery, is unsure what caused the idiopathic cardiomyopathy. Pregnancy could have strained a heart that was already genetically weak. By September, there were no options but to remove the dying portion of Marcela’s heart and implant the TAH.

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Dr. Smith says the Freedom gives hope to those awaiting transplant. “Up until now if you had biventricular failure — the failure of both sides of your heart — and your only option was the Total Artificial Heart, you knew you were stuck in the hospital until we could find you a matching donor heart.” In such cases, patients have been tethered to “Big Blue,” a 418-pound machine that powers the TAH.

“What we’re really hoping is down the road the Freedom can be an option for people who are walking that fine line between being a transplant candidate and not being a transplant candidate because their organs are starting to fail,” says Dr. Smith. “People can be on this a couple of months to improve organ function and make them transplant candidates where they were not,” she adds.

After extensive training in the care of the Freedom for Marcela and her family, she is continuing to wait for her new heart at home. “It was so exciting to go home and be with the baby,” Marcela says.