

Thinking Small:

PINT-SIZED MRI WILL HELP DIAGNOSE PROBLEMS IN PREEMIES



Framed artwork of a lemon, tomatoes, bell peppers and other still life objects line a hallway in the basement of a research building at Cincinnati Children's.

Each color photograph is juxtaposed alongside a black-and-white magnetic resonance image, hinting at the purpose of a room nearby that looks more like a garage workshop than a medical research lab.

Test tubes are scarce here in the Imaging Research Center laboratory. Instead, it is full of electrical supplies, coils and magnetics software.

The laboratory, operated by the Cincinnati Children's Research Foundation and the Department of Radiology, is where engineers and scientists develop noninvasive methods for imaging and diagnosing disorders of the brain and body using MR imaging.

This is where they make images clearer and scanners faster. Where they do animal-based research with MR scanning. And where they have developed a prototype for a pint-sized MRI that will be up and running this fall in the Newborn Intensive Care Unit.

"This is the first of its kind," says Charles "Chuck" Dumoulin, PhD, director of the Imaging Research Center. "This will be the first time we are putting

high-field MR scanners within the walls of the NICU and the first time one of these small scanners is going to be used for premature babies."

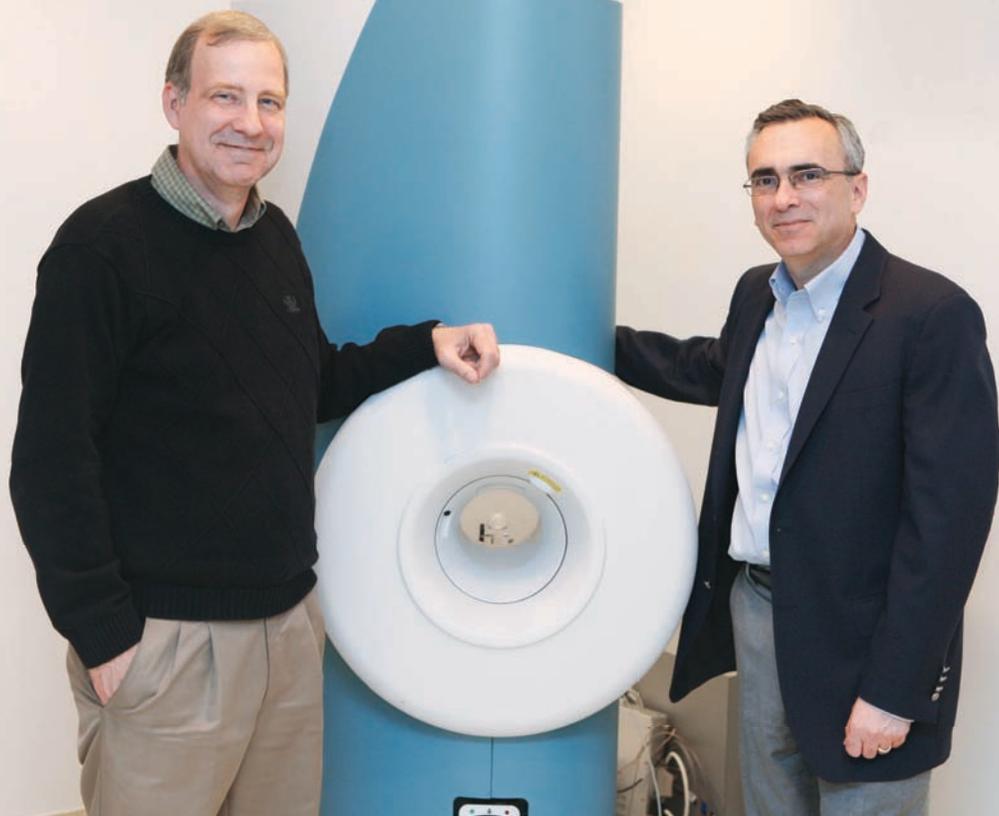
BETTER FOR BABIES

Cincinnati Children's has two of these smaller scanners, one for research use and one for the NICU. The prototypes are based on an orthopaedic MR scanner used for adult knees and elbows.

Engineers at Cincinnati Children's are developing incubators that are compatible with the magnetized room inside the NICU used for imaging, says Dumoulin, who developed MR technology at General Electric for nearly 25 years before coming to Cincinnati Children's. With the new approach, a baby can stay tethered to monitors, and staff can wheel an incubator right up to the MR scanner without any disruption.

For Jim Greenberg, MD, director of the Division of Neonatology and associate director of the Perinatal Institute at Cincinnati Children's, that is one of the scanner's biggest advantages.

"Until now, if you wanted an MR scan, you'd have to put the baby in a transport isolette, move him to an elevator, travel down four floors to the MRI suite, make sure the MRI suite is ready and be able to monitor the baby during the procedure – which may take 30 minutes, sometimes longer," Greenberg says. "And



Drs. Charles "Chuck" Dumoulin (on left) and Jim Greenberg with an MR scanner being developed for use in the NICU.

then repeat the process in reverse. It's done infrequently because it's logistically complex."

Having MR scans close at hand is vital when Greenberg and others on the NICU team need precise information that might change the infant's course of care, such as the severity of brain damage after a traumatic birth.

"The NICU scanner opens the door to evaluating disease in sick, small infants who cannot be safely transported to other areas of the hospital," says Beth Kline-Fath, MD, chief of Fetal Imaging at Cincinnati Children's. Kline-Fath says MR scans are a tremendous help in shedding light on disease processes and how a premature baby's organs are affected, helping guide medical care.

RESEARCH POTENTIAL

There is hope that MR imaging can do even more for diagnosing problems in neonates.

An MR scan provides image soft-tissue information content that is superior to a computed tomography, or CT scan, with no radiation. Doctors like it because it gives them an anatomical map of how the brain is put together or even provides clues about abnormalities in the plumbing of the heart. It can provide data as diverse as the metabolic state of various tissues within an organ to how extensive injury is and how well that injury is resolving.

Animal research suggests MR imaging also can allow researchers to find out more about gastrointestinal disease and lung development, Dumoulin says.

"If your goal is to make music, a CT scanner is sort of like a jukebox. Drop your quarter in, and you're guaranteed to get a high-fidelity result all the time," he says. "But an MR scanner is more like a pipe organ. It really takes a true expert to pull the best result out of that instrument."

Stephanie Merhar, MD, a clinical fellow in the Division of Neonatology and Pulmonary Biology, is joining the staff this summer in the Perinatal Institute and will focus her research on improving long-term outcomes for babies with brain injuries.

"Much of what we do in the NICU, such as nutrition, medications, and surgical procedures, affects brain development in ways we don't understand," Merhar says. "The MRI will give us a tool to start learning about when and how brain injury takes place in the sickest premature infants."

The next step will be for researchers to study areas that are poorly understood, such as gastrointestinal disease, Greenberg says.

"There is extraordinary power to MR imaging and measurement of function that's relatively

underutilized," he says. "The best analogy is that most people use only about 10 percent of what their cell phones can do. Similarly with MRI, there are a lot of capabilities that have not been explored."

NOT MORE – BUT BETTER

Greenberg cautions that technology – or the idea of doing more MRIs – is not the point. The value in this new MR scanner is to allow doctors to use data in a way that improves outcomes.

"The way that one becomes an expert physician is actually to see and touch as many patients as possible," he says. "There is a presumption that diagnostic studies, whether they are MRI, X-rays or ultrasound, substitute for classical physical diagnosis, and that's a bad assumption."

Images and tests are static and represent one moment in time, he says. Patients, especially newborns, change rapidly because they're growing and developing.

"That's where the art comes in," Greenberg says. "One of the challenges of modern medicine is we have much more information than we've ever had before. We have a much more profound need to synthesize that data and analyze it. It becomes very important to resist the temptation to act on everything that we see." ///