

DISCOVERY'S EDGE

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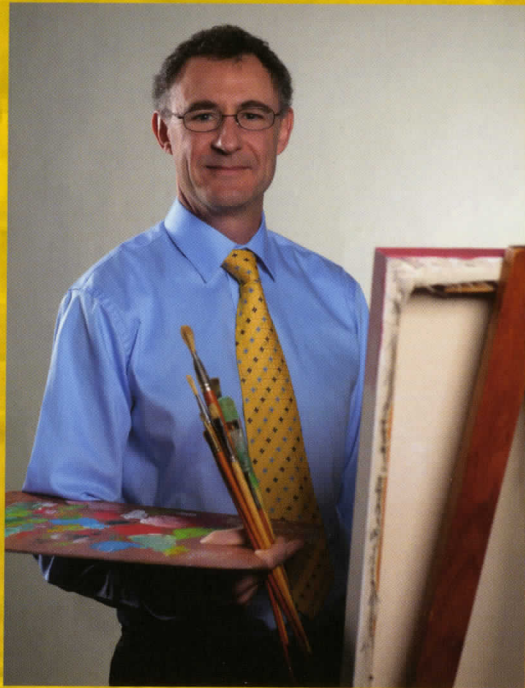


Heart Attack Heroes

CPR Research is increasing
survival after Cardiac Arrest



INSIDE: Artificial Pancreas | Abstract Approach | Diastolic Heart Failure



Art and Science

*The most beautiful thing we can experience is the mysterious.
It is the source of all true art and science. – Albert Einstein*

Art and science have many other parallels. Like great art, great science only happens when talent and creativity collide. In this issue we highlight several stories where Mayo Clinic researchers are creatively applying their unique talents to answer questions that matter to our patients.

Over decades of research on cardiac emergencies, Roger White has saved lives of people he has never seen simply by improving standards of care across the country, thereby ensuring that victims get competent CPR wherever they are. Today he's still involved in local emergency cases, while speaking globally on the importance of advancing the science behind CPR.

Cardiologist Maggie Redfield is changing the textbook on heart failure by adding knowledge and insights into a previously unrecognized subset of patients who have a stiff heart wall. Pursuing questions at all levels of research, she inspires colleagues and patients by her determination to find answers that will improve treatment.

Always looking for a new angle is immunologist Richard Vile. He's an investigator who takes that extra step back from the picture to see it in a different light. His ideas in molecular medicine are innovative, sometimes unorthodox, but often effective in helping the body resist cancer tumors.

Yogish Kudva and Ananda Basu have been teaming up against Type 1 diabetes for over 15 years, pursuing multiple avenues for their patients from regeneration of insulin-producing cells to their current work developing software programs that link glucose sensors and insulin pumps to create an artificial pancreas.

A theme through all of these stories is that, like all great artists, our researchers appear to draw much of their strength and inspiration from the environment in which they work.

We hope you enjoy the art as well.

Cheers!

A handwritten signature in black ink that reads "Stephen Russell". The signature is written in a cursive, flowing style.

Stephen Russell, M.D., Ph.D.



CPR RESEARCH



HELPING HEROES
INCREASE SURVIVAL
AFTER CARDIAC ARREST



Not all superheroes wear capes. Roger White, M.D., who favors button-down shirts and ties, has saved countless lives through groundbreaking work in cardiac resuscitation at Mayo Clinic in Rochester, Minn. His discoveries helped pave the way for defibrillators being placed in airports and other public spaces, better CPR practices and education, and faster emergency response times.

Mayo Clinic made headlines recently when Dr. White directed a flight crew that successfully performed CPR on a man with no pulse. The patient, 54-year-old Howard Snitzer, recovered completely, though he had no heartbeat for 96 minutes.

"I feel awesome. I'm ready to take on the world," Snitzer says. After his record-setting cardiac arrest, he was transported to a Mayo hospital and later treated for underlying heart disease. "I guess you could say I'm pretty lucky. But I know it goes beyond that."

A plainspoken man, Dr. White says simply, "It's a gratifying thing to bring people back to life, and send them home again."

Sudden cardiac death is one of the six leading causes of death in the United States. Like Snitzer, many cardiac arrest patients have no prior history of heart disease yet suddenly experience ventricular fibrillation — a rapid, erratic heartbeat that causes the heart's pumping chambers (ventricles) to quiver uselessly instead of pumping blood. As a result, blood supply to vital organs, including the brain, is cut off. Prompt CPR and shocks to the heart (defibrillation) can boost survival rates.

"If you do it right, you have a good chance of patient survival," Dr. White says.

A PILLAR IN EMERGENCY RESUSCITATION

"Doing it right" is possible in large part because of Dr. White. When he joined Mayo 40 years ago, emergency medical services (EMS) were in their infancy. The chances of surviving cardiac arrest outside a hospital were slim. Over the years, many of Dr. White's published findings have been incorporated into the American Heart Association (AHA) resuscitation guidelines.

"We have used his experience and research to shape the science of resuscitation," says Mary Fran Hazinksi, a registered nurse who served on national emergency care guideline panels. "His influence is not just a drop in a pond. It's a major torrent that goes beyond the patients he touches."

"Dr. White is a pillar in the field of critical resuscitation," says Daniel Hankins, M.D., a Mayo Clinic emergency medicine physician. "He was into EMS before EMS was cool."

Dr. White trained in internal medicine and anesthesiology and was interested in resuscitation from the very beginning. "I was fascinated by ambulances. Yet their minimal equipment limited what they could do. I was convinced that victims of cardiac arrest were dying needlessly. I felt that we could do much more to improve survival."

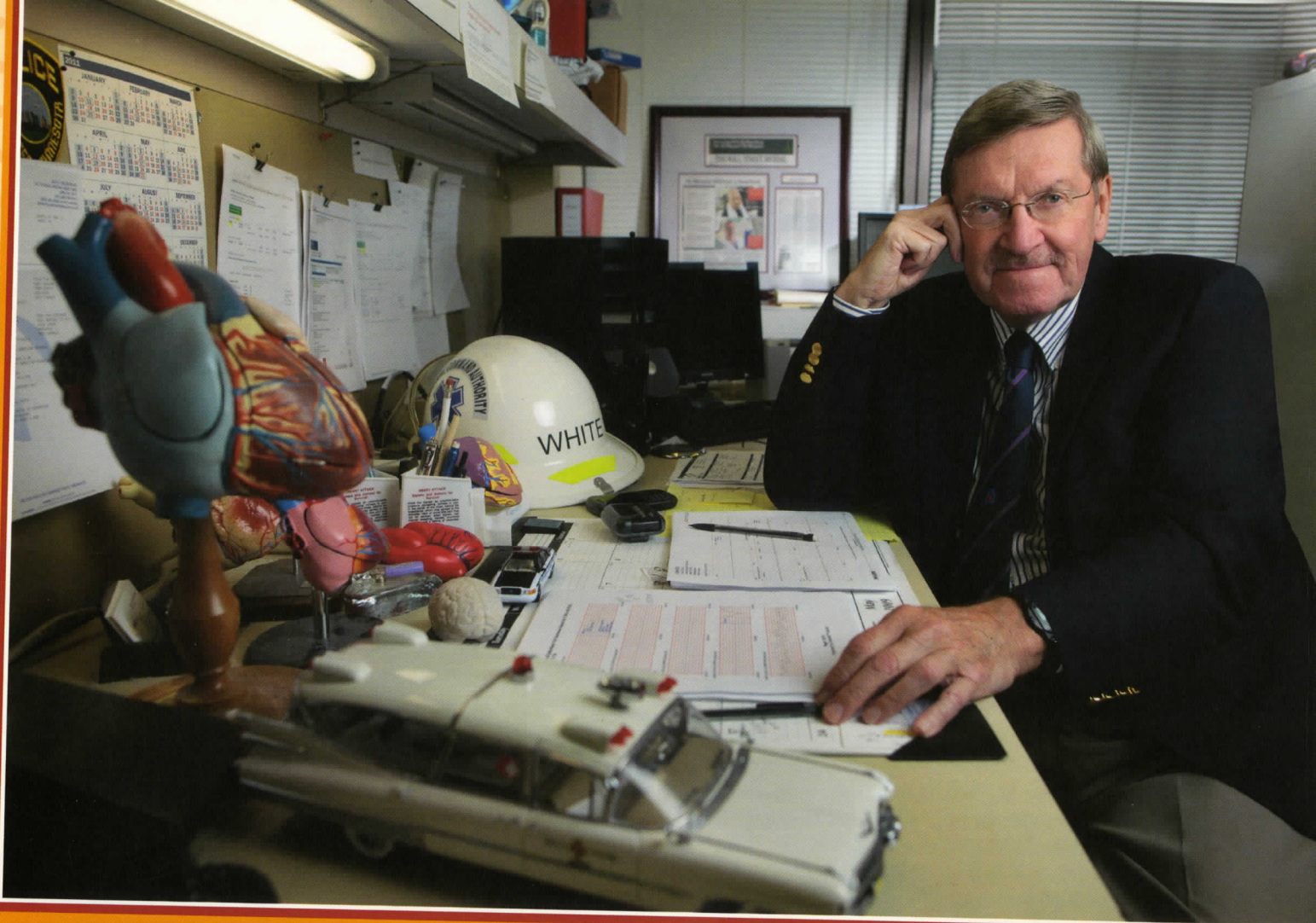
On his first day at Mayo in 1970, Dr. White contacted the local ambulance service to volunteer his time training emergency medical technicians. Three years later, he became the service's medical director. That position, which he still holds, has been an ideal springboard for his innovative research.

IMPROVEMENTS FOR FIRST RESPONDERS

Early on, Dr. White noticed that Rochester police officers, who had long provided first aid in response to EMS calls, frequently arrived at the scene before the ambulance. If the police had defibrillators, Dr. White reasoned, they could shock a patient's heart before

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—DANIEL HANKINS, M.D.



Mayo Clinic anesthesiologist Roger White, M.D., has indirectly saved countless lives through his research-based improvements to CPR and emergency medicine technology.

paramedics arrived, improving the chances of survival.

"It was kind of weird to consider police officers operating a defibrillator. It had never been done before," Dr. White says. "But it worked."

Before Rochester police carried defibrillators, only 35.7 percent of patients with bystander-witnessed, out-of-hospital cardiac arrest from ventricular fibrillation survived without brain damage. Within five years, the survival rate increased to 43.4 percent. In a 1996 study, Dr. White found that rapid defibrillation was the major factor and that lowering the time between the 911 call and the first shock by even one minute increased the likelihood of restoring the patient's circulation.

Firefighters and sheriff's officers were later added to the program. By 2008, the survival rate was up to 49.5 percent — a huge improvement that compares favorably to elsewhere in the U.S., where it ranges from 7.7 to 39.9 percent.

"If you're in a shockable heart rhythm in Rochester and somebody sees you collapse, we'll get you back home about 50 percent of the time," Dr. White says.


RELYING ON EVIDENCE

Mayo's evidence-based approach requires meticulous attention to detail. For Dr. White, one challenge was tracking EMS response times down to the second. Bruce Goodman, the Mayo One paramedic at Snitzer's resuscitation, has worked with Dr. White for 15 years. He recalls having to synchronize his defibrillator to the Universal Time Coordinate at the start of his shifts.

"Dr. White is very knowledgeable and very supportive. At the same time, he is very demanding," Goodman says with a laugh. "It's all about learning what we can do better."

"It was very onerous," Dr. White agrees with a smile. "But when we published our research, we knew we were publishing honest numbers. I am still obsessed with that level of detail. I insist that the data we collect, analyze and report be precise."

That credibility gives Mayo research its wide reach. As one of the authors of the AHA resuscitation guidelines, Dr. White helps to set standards for CPR administration, the most effective mix of CPR and defibrillation, and the amount and type of energy used in shocks.



Paramedics arrive at cardiac arrest scenes armed with that knowledge, along with fastidious training. “Dr. White teaches us to use critical thinking skills as well as technology,” says Daniel Anger, who manages Mayo’s medical helicopter paramedics. “He reminds us to look at the patient, not just the monitors.”

DOING IT RIGHT: A CASE STUDY

In Snitzer’s case, that knowledge and training came together in spectacular fashion. His collapse in rural Minnesota was witnessed, and CPR quickly started by a bystander and a nearby trained first responder. Additional first responders arrived within minutes, and administered defibrillation and continued CPR. Thirty-four minutes after the original 911 call, Goodman arrived at the scene with the Mayo One medical helicopter.

That’s when yet another piece of Dr. White’s research came into play. Mayo’s defibrillators are equipped with capnography, a technology that measures how much blood is flowing through the lungs and thereby to other organs. It has long been used in operating rooms to guide anesthesiologists. Back in the 1980s, Dr. White realized the potential benefit for resuscitation: If capnography during CPR showed sufficient oxygen reaching the patient’s brain, neurologic recovery was possible, and rescuers might persist in resuscitation efforts. At the time, out-of-hospital capnography wasn’t practical. The technology has since improved, but capnography still isn’t widely used in sudden cardiac arrest.

Throughout Snitzer’s long cardiac arrest, capnography indicated sufficient oxygenated blood was reaching his brain — thanks to 22 first responders who lined up, bucket brigade-style, and took turns doing forceful chest compressions. His heart rhythm, although in ventricular fibrillation, remained amenable to shock. So Dr. White, speaking on the telephone from Rochester, instructed Goodman to keep going.

“With that combination of a treatable rhythm and good oxygenated blood flow, we couldn’t just stop,” Dr. White says.

Snitzer marvels at the sequence of events. “There are so many things that fell exactly into place — the capnography, Mayo One, the people so committed to doing CPR,” he says. “Mayo arguably is the only place this could have happened.”

DIRECTING RESUSCITATION FROM AFAR

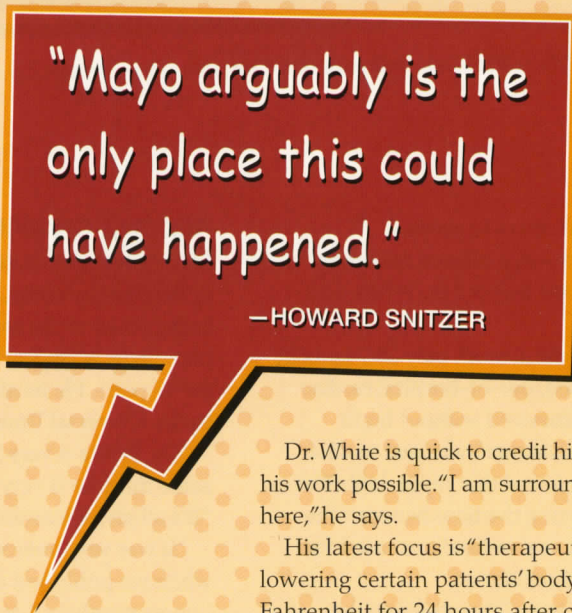
Dr. White’s telephone presence that evening was no quirk of scheduling. He is notified of every cardiac arrest 911 call, even when he’s out of the country. “The most unusual was a cardiac arrest I directed from a hotel in Zagreb, Croatia,” he says.

He also routinely gives his cell phone number to first responders so they can call him when needed. “That can be at 2 in the morning or 9 at night,” says Goodman. “It doesn’t matter. Dr. White is that dedicated to patient care and to his research.”

That accessibility has made Dr. White a popular mentor at Mayo. “He is the epitome of the Mayo collaborative model of patient care,” says Dawit Haile, M.D., a Mayo anesthesiologist. He is approachable at work, off work, or if you are calling him at odd hours of the night.”

Dr. White is quick to credit his Mayo colleagues for making his work possible. “I am surrounded by tremendous support here,” he says.

His latest focus is “therapeutic cooling,” which involves lowering certain patients’ body temperature to 91.4 degrees Fahrenheit for 24 hours after cardiac arrest to promote neurological recovery. “After patients are resuscitated and in the hospital, you take the next step to protect the brain, so they have still another opportunity to go home,” he explains. “Underneath it all is the science of resuscitation. It’s what intrigues me and propels me to keep finding better ways to do these things.”



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—HOWARD SNITZER