AN EMERGENCY ROOM IN YOUR CHEST

Vice President Dick Cheney is protected by one, as are thousands of other Americans. Implantable cardioverter defibrillators reduce the risk of having sudden cardiac death to almost zero.

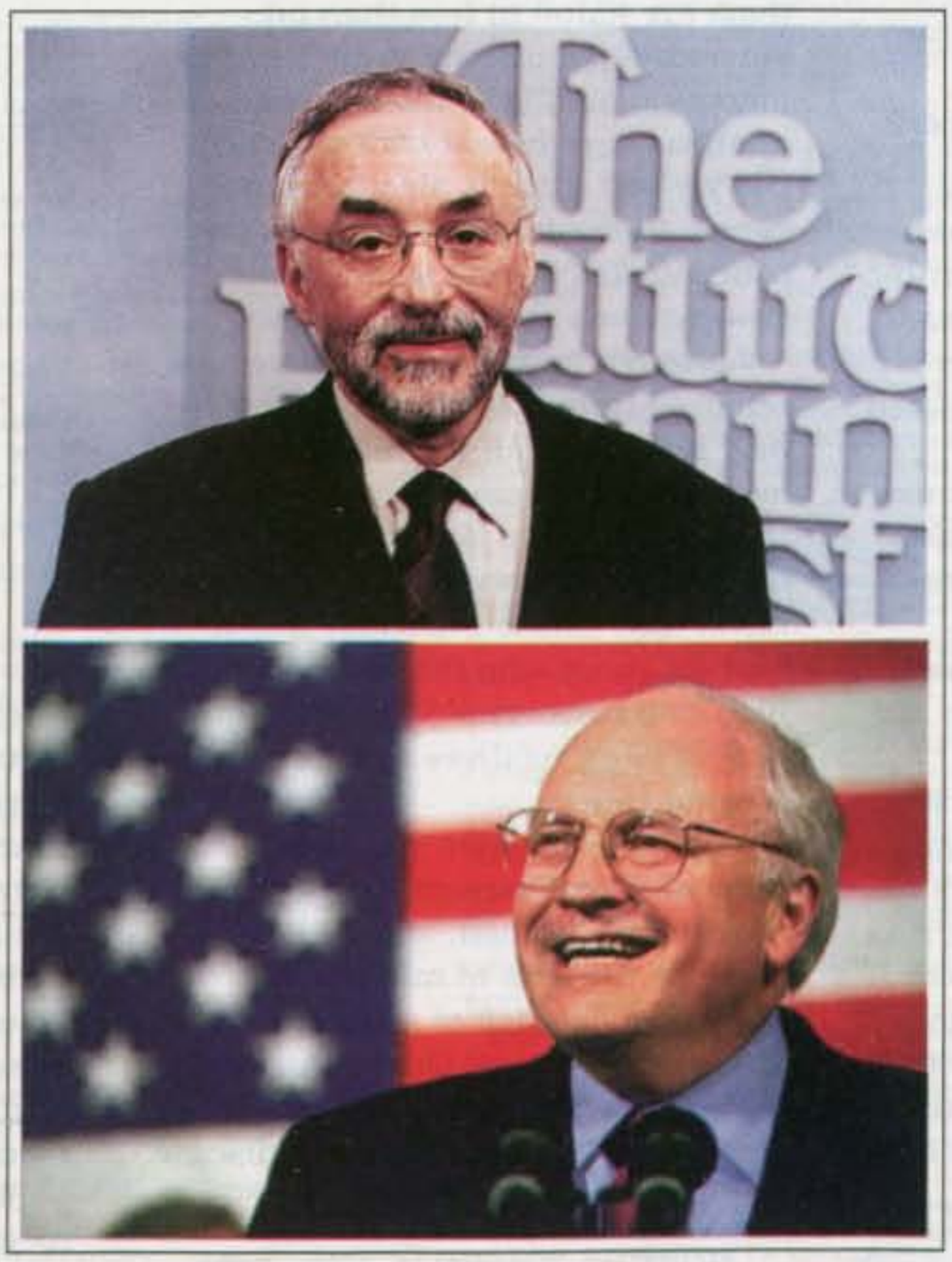
An interview with

Douglas Zipes, M.D.

by Cory SerVaas, M.D., and Patrick Perry

Implantable cardioverter defibrillators (ICDs) have been available for a number of years, but these amazing life-saving devices only became widely known last year when one was implanted in the chest of Vice President Dick Cheney. The vice president's history of heart problems led his doctors to recommend giving him an ICD in case he developed a life-threatening heart arrhythmia. Now, with his own implanted defibrillator, he won't need to rely on the Secret Service carrying a portable defibrillator wherever he goes.

Dr. Douglas Zipes, president of the American College of Cardiology and director of the Krannert Institute of Cardiology and Division of Cardiology in Indianapolis, played an important role in the invention of the ICD and was a consultant in the vice president's case. *Post* editors interviewed Dr. Zipes at our offices in Indianapolis.



"We are electricians and not plumbers," says Dr. Douglas Zipes, who specializes in the electrical manifestations of the heartbeat. Dr. Zipes was consulted last year when Vice President Dick Cheney received an implanted cardioverter defibrillator. Because Cheney's previous heart attacks left scars on his heart muscles, his chances of suffering a life-threatening arrhythmia are greatly increased.

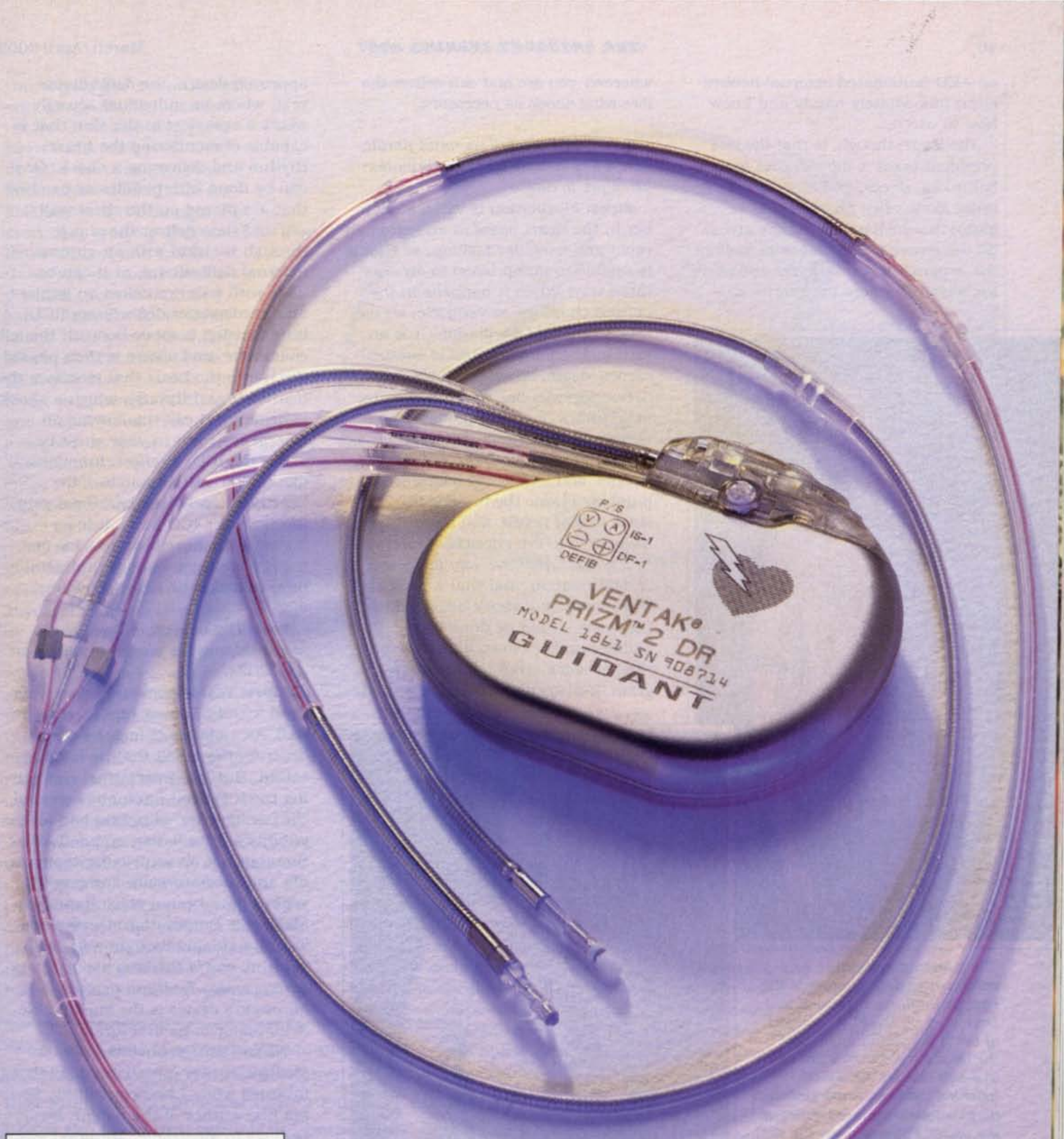
Post: *You were consulted on the vice president's case. Could you tell us how this came about?*

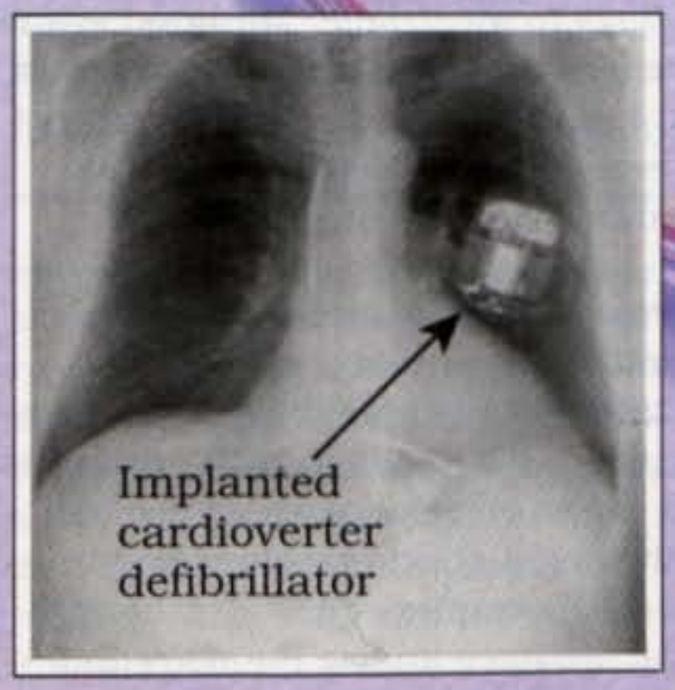
Zipes: I received a phone call from Cheney's cardiologist, Dr. Jonathan Reiner, ten days prior to the ultimate implantation of the defibrillator device in the vice president. My secretary put the call through and said, "A Dr. Reiner from Washington wants to talk with you." I didn't know who he was, but when he said, "I would like to ask your advice about an unnamed hypothetical patient," I thought, *Oh, my goodness, he is talking about the vice president.* Then, and a couple of times after that, we discussed what should be done with the vice president.

Prior to this, I actually was rather critical in the press that no one was paying attention to potential heartbeat problems in the vice president. At some point around that time, he had gotten what we call Holter recordings. These are like portable electrocardiograph machines that an individual wears for 24 hours. It records each heartbeat and was able to demonstrate that the vice president had short episodes of a rapid heartbeat coming from the bottom chamber of the heart. This heart rhythm is what we call ventricular tachycardia, which is much slower than ventricular fibrillation, though potentially serious. It certainly was a red flag that the vice president—given his previous heart attacks—was at risk for having a life-threatening event. I recommended that he undergo an electrophysiology study, which is kind of a heart catheterization. It differs from the usual heart cath that looks at blood vessels because we are electricians and not plumbers—we are interested in the electrical manifestations of the heartbeat. They indeed did that, and it demonstrated he was at risk, and they subsequently implanted the ICD.

Post: *We sent an external defibrillator to the vice president long before he got his internal one, and he thanked us. We thought it was important for all the security people around him to learn how to use a defibrillator.*

Zipes: Yes, and I actually had suggested that. I had a lengthy interview with *Newsweek* magazine, and at the end of the interview, I said something offhand like, "I would sure as hell have a defibrillator handy and somebody who knows how to use it close by." Of the whole hour interview, that is the quote they put in *Newsweek*. I was subsequently assured that all the Secret Service people, indeed, had





Implantable Cardioverter Defibrillators (ICDs) are available in a range of models and sizes. Guidant makes the world's smallest dual chamber ICD—about the size of a small pager. It can perform a number of different functions, including detecting rapid heart rhythms and delivering one or more treatments to restore a normal heartbeat. It stores data about each arrhythmia episode, enabling a cardiologist to monitor the heart's performance.

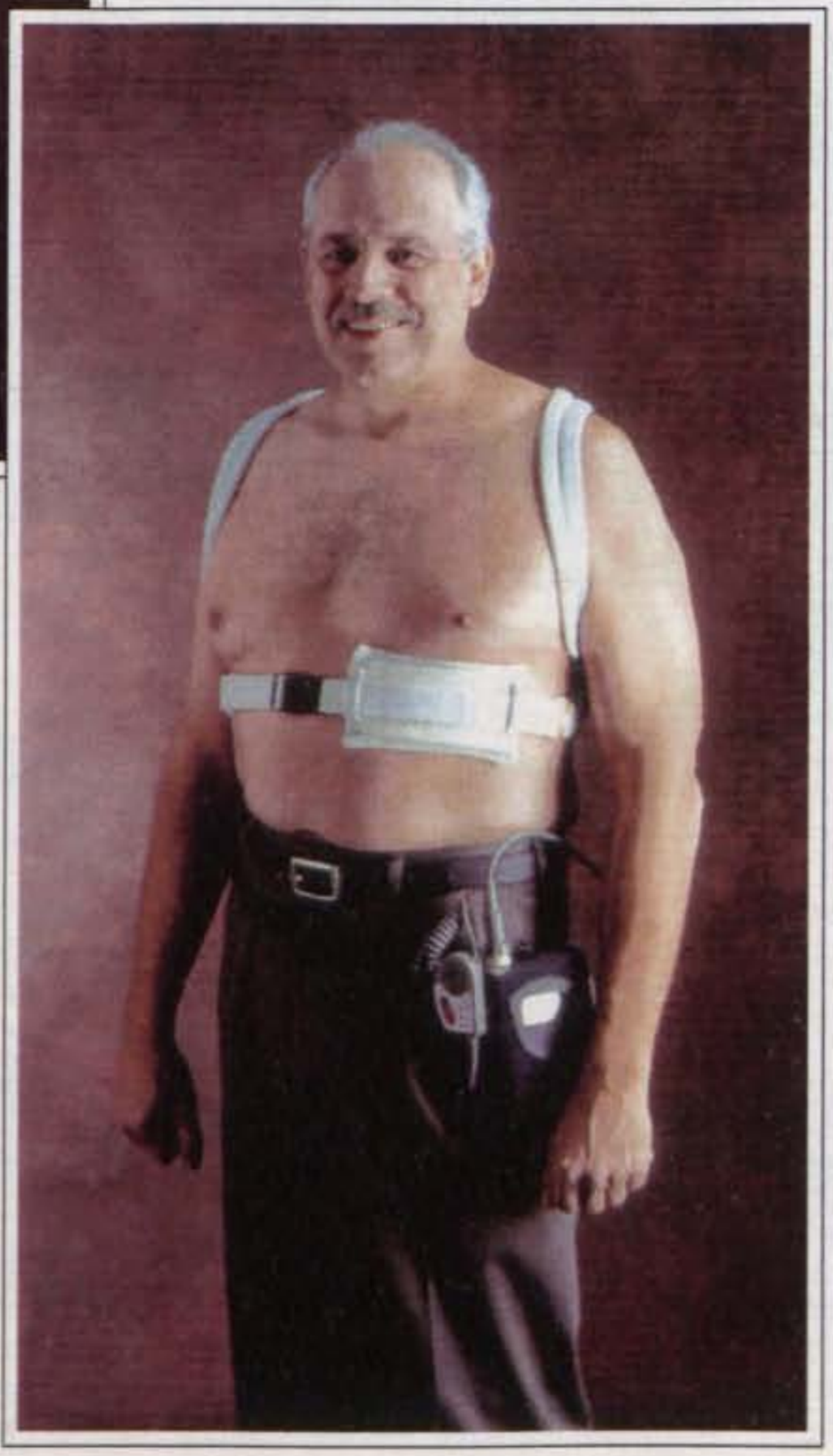
an AED (automated external defibrillator) immediately handy and knew how to use it.

The issue, though, is that the vice president takes a shower, goes to the bathroom, sleeps, and has private times alone when no one might be aware that he has had cardiac arrest. So there were clear reasons to implant the implantable cardioverter defibrillator, which monitors the heartbeat wherever you are and can deliver the lifesaving shock as necessary.

Post: *Can you tell us what fibrillation refers to and what defibrillation attempts to do?*

Zipes: Fibrillation is when a chamber in the heart beats in an extremely rapid and irregular fashion, so that it is unable to pump blood in an organized way. When it happens in the bottom chamber, or ventricle, we call this ventricular fibrillation. It is an extremely common cause of sudden cardiac death. When you hear about the person who has died of a massive heart attack, it is very probably from ventricular fibrillation. The ventricle is beating at rates of 400 to 600 times a minute, and it is totally ineffective for pumping blood. The brain is very sensitive to that result, and basically you have three to five minutes to reverse it.

The most effective way to reverse it is defibrillation, and that almost always involves a shock delivered to the heart. It can be done with paddles on the chest, as we see on "ER" or some other television program. It also can be done by a newly approved device, the defibrillator vest, where an individual actually wears a vest next to the skin that is capable of monitoring the heart rhythm and delivering a shock. Or it can be done with paddles or patches that are placed on the chest wall itself and then deliver the shock through the skin with an automated external defibrillator, or it can be done with a device called an implantable cardioverter defibrillator (ICD). A little incision is made beneath the left collarbone, and a wire is then passed down into the heart that monitors the heartbeat and through which a shock is delivered. I call this having an emergency room in your chest because the ICD, in effect, functions like that. The ICD monitors the heartbeat, and if the heartbeat gets too slow, the ICD paces it to go faster. If the heartbeat gets too fast, the ICD delivers a shock, a defibrillation, to make the heart go slower.



The latest advance in cardioverter defibrillators is the vest defibrillator, approved last December by the FDA. Instead of being surgically implanted, the device's electrodes are worn in a belt around the chest, touching the skin. A monitor with an alarm is worn in a holster at the waist. Patients wear the vest 24 hours a day except when bathing or showering. The device continuously monitors the patient's heart for life-threatening abnormal rhythms. If a life-threatening rhythm is detected and the person loses consciousness, the device delivers an elecrical shock. In studies, the wearable defibrillator was 71 percent successful in treating sudden cardiac-arrest episodes, compared to a 25 percent success rate for patients calling 911.

Post: *Did you know Dr. Michel Mirowski and his pioneering work on the ICD?*

Zipes: Yes, Michel and I were very good friends. I knew him extremely well. As a matter of fact, he clearly deserves the credit that he has received. But it is interesting, concerning the ICD, that I actually invented the cardioverter. Mirowski had all the patents on fibrillation and defibrillation, but not on ventricular tachycardia and cardioversion. For over 25 years I have been a consultant for Medtronic Corporation. During one visit, I suddenly thought, *My goodness, no one is thinking about cardioversion for these devices.* Mirowski's device is the implantable defibrillator in its first form.

When I was a consultant for Medtronic, they owned anything that I invented while I was consulting. So I am first author of the patent, but it belongs to Medtronic. Mirowski again deserves all of the credit that he gets, but I am actually the inventor of half of every implant that goes in—the cardioverter portion.

Post: *Could you tell us about the cardioverter portion?*

Zipes: The cardioverter concept, externally with paddles on the chest, is not a new concept at all. It involves delivering a shock synchronized to the QRS complex—that is, a heartbeat. We have known for years that

you can deliver a very low energy shock through paddles on the chest and stop rapid heartbeats. Mirowski came up with the concept of the implantable defibrillator for fibrillation. But I thought, *Not everybody is dying of ventricular fibrillation*, and indeed, of those who do, many have a preceding ventricular tachycardia. Why not try to terminate it with a very low energy shock, synchronized to the QRS complex? That was the idea I suggested to Medtronic, and they obviously thought it was good. In about 1979 or '80, Medtronic rapidly patented it, then supplied me with external hardware to replicate my idea.

We did a series of animal studies in dogs. We made episodes of ventricular tachycardia, then tested the device. It worked flawlessly. This was the first time in the world that a shock was delivered through a catheter in the heart, synchronized to the ventricular tachycardia beat, at a much lower energy rate than Mirowski was using to terminate fibrillation. It worked beautifully.

I remember vividly the first time we presented this research at a national meeting. Mirowski and his entire troupe were hanging on every word and every concept because they had previously done all the research in this area. He was there first. But he had not thought about ventricular tachycardia and cardioversion. Then Medtronic made the same kind of hardware to try it in a patient. We didn't have the complex Independent Review Board issues, paperwork, and so on that we have to go through today, so we very rapidly applied it to a patient. I can't tell you the thrill of knowing that in the very first patient, the very first shock through a catheter in his heart terminated the ventricular tachycardia instantly. It was comparable to an intellectual orgasm. There is nothing intellectually, as far as I am concerned, that beats that high of knowing that you have created a little bit of new knowledge and, for that brief moment, you are the only one in the world who has that piece of information. It was a wonderful experience.

Medtronic's GEM III DR ICD was placed in the chest of Vice President Cheney on June 30, 2001. ICD insertion takes about an hour, and patients often are discharged from the hospital either that day or the next.

"The thing that is so troubling to me, as an electrophysiologist, or heart-rhythm expert, is that I understand how fibrillation happens, and I have the tools to terminate it immediately. It is not something that we don't understand how to stop, like AIDS or cancer."

Subsequently, Medtronic made an implantable device that was just a cardioverter device, and we implanted that in two patients. It worked well, and obviously, as the developments went on, it became part of the defibrillator as well. Now all these devices have cardioversion, as well as defibrillation capability, built into the same device. This was a very exciting period.

Post: *Did the patent process delay getting ICDs to the public?*

Zipes: No, not really. Patents created incredible litigation issues, but I don't think it really prevented or delayed the application to the public.

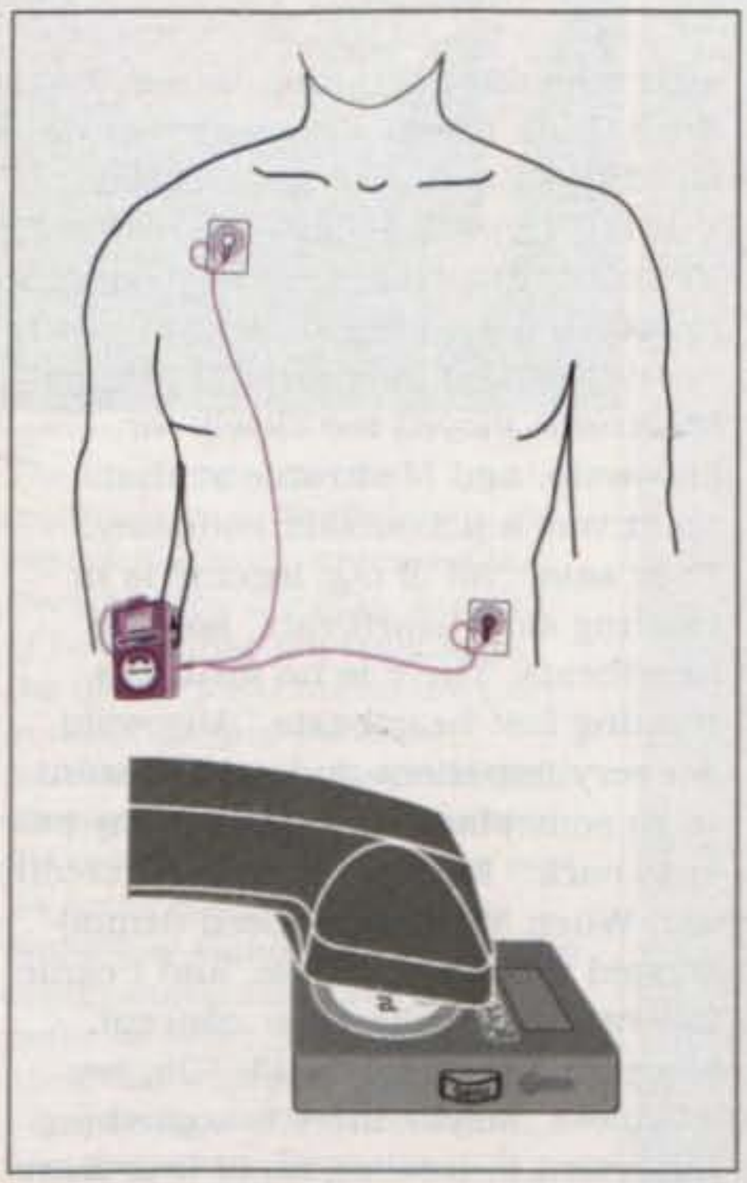
It is interesting—Mirowski, after he invented this, took the whole concept to Medtronic and said, "I want you to develop it, and here are my patents." Medtronic moved too slowly for Mirowski, and Medtronic at that point was a pacemaker company. They said, "All of our income is in treating slow heartbeats, not fast heartbeats. There is no future in treating fast heartbeats." Mirowski got very impatient and said, "I want to go someplace else; give me my patents back." Medtronic, to their credit, did. When Mirowski indeed demonstrated this was feasible, and I came up with the cardioverter concept, Medtronic suddenly said, "Oh, my goodness, maybe there is something important in treating rapid heartbeats rather than just slow heartbeats." My cardioverter concept moved them into the rapid heartbeat area.

Subsequently, there were patent issues between Medtronic and CPI (now Guidant) that went to the courts, but none of those delayed the

actual application of these devices to the public. They just created a great deal of problems between the companies.

Post: *Do most cardiologists today have access to the implantable device?*

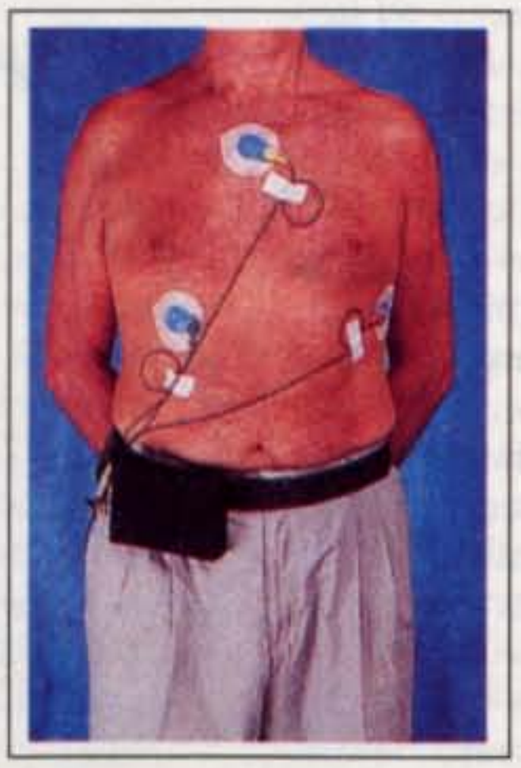
Zipes: Yes, certainly in the affluent countries in Western Europe, in the United States, and many places in South America. However, the actual utilization is much less than what the guidelines would indicate. We have a paper, just accepted for publication, in which we analyzed the discharge diagnoses of 4½ million Americans for diagnosis of ventricular fibrillation, ventricular tachycardia, and sudden death—all of which would be indications for receiving an ICD. The raw number is about 1,200 of these diagnoses per million population. So you would think 1,200 people per million in the United States would be candidates for an ICD. We then searched for things that might disqualify the individual, such as comorbidities like cancer or age greater than 79, because maybe you wouldn't want to put it in a very elderly individual.



An electronic device called the King of Hearts, which can record and transmit data to cardiologists miles away, helps identify the cause of occasional chest pain, dizziness, and fainting. When symptoms begin, the patient presses the RECORD button and sends the stored data over the telephone for analysis.

Post: *Why not put them in elderly persons?*

Zipes: We just erred on the conservative side. I clearly *would* implant it in an elderly individual, but we wanted to be very conservative. I didn't want anybody claiming that we are trying to recommend the device inappropriately. So we subtracted out all those who might not be candidates and came down to 700 or 800 individuals per million who would be considered candidates. The actual implant rate is about 190, so we are implanting the device in less than one third of the individuals who qualify according to established guidelines. The United States is the biggest implanter in the world. When you get to European countries, you get down to 12, 5, and 2 percent of the indicated implant rates in many of them.



The commonly used Holter monitor, a portable ECG and recording system, is particularly useful in detecting intermittent arrhythmias. Patients wear the device on a belt around the waist for 24 hours while continuing their normal activities. They can also record when any symptoms, such as dizziness or pain, occur.

One of the problems is cost. The devices are, indeed, very expensive. I suggested to Medtronic and several of the other companies that they make a Volkswagen ICD rather than the Rolls Royce—a $10,000, rather than a $25,000, device. We call it a shock box. It monitors the heart rhythm. When you get something abnormal, it delivers a shock. If you use up to ten of them, then you get a new implant or something like that. There is no impetus for the companies to want to do that, so nobody is doing it. But if the rate of implant increases and it starts to really tax the healthcare budget, somebody is going to have to do something like that. It is feasible. They could do that if they wanted to.

Post: *Do insurance companies pay for this device?*

Zipes: They do. It clearly is reimbursable, though some of the insurance companies balk. As a matter of fact, I met with President Bush about the patient's bill of rights prior to September 11. I and several other doctors actually spent 45 minutes with him. I pointed out to him that some patients, who had medical symptoms identical to his vice president, were denied reimbursement for an ICD. He responded very vociferously, "That is one of the reasons why we need to pass a patient's bill of rights." But September 11 came along, and he now has other things on his plate. The patient's bill of rights is languishing, but we do need that to guarantee that patients who qualify could receive an ICD, and some are denied that.

Post: *Before we leave this discussion, can the device called the "King of Hearts," which monitors the heart at home and uses the telephone to transmit arrhythmias, be used to screen people to predict that this person might have a problem?*

Zipes: It sure could. There are a number of ways that we could and should be screening people. The problem is that we don't have any foolproof method that is inexpensive and could be widely applied. I have said in print, based on what the American Heart Association has told us, that 220,000 to 250,000 sudden deaths occur annually in the United States. A recent publication from Dr. George Mensah at the CDC indicated that there are probably 400,000-plus sudden cardiac deaths annually. But we don't have a screening methodology with sufficient sensitivity, specificity, and predictive accuracy for the vast majority of individuals that we could use to screen accurately.

That is one reason why I feel so strongly, as do you, that education and making AEDs available are absolutely critical, because our screening methodology is not that good. When an individual declares him or herself as a sudden-death candidate by having ventricular fibrillation, we need to be responsive within a very short time. We need to be able to deliver that defibrillating shock within minutes, because the survival decreases by 10 percent per minute.

Post: *Could you tell us about your idea of the Neighborhood Heart Watch*

initiative?

Zipes: At least 75 percent of sudden deaths happen in the home. In an article that I had published a month or two ago, I started out with three patient scenarios. There is a little of the novelist in me, so I took advantage to write little vignettes that you might read in a novel. In the first, an obese individual gets out of his car, walks across the hot macadam parking lot, and grinds out his cigarette in the ashtray as he enters a Las Vegas casino. He buys $500 in chips, which he promptly loses at the blackjack table, then has cardiac arrest.

The next scenario occurs when an individual in a VIP waiting lounge at an airport hears the announcement that his plane is going to take off. He boards the plane, flies off, is over the Atlantic—sipping his brandy after dinner—and has a cardiac arrest.

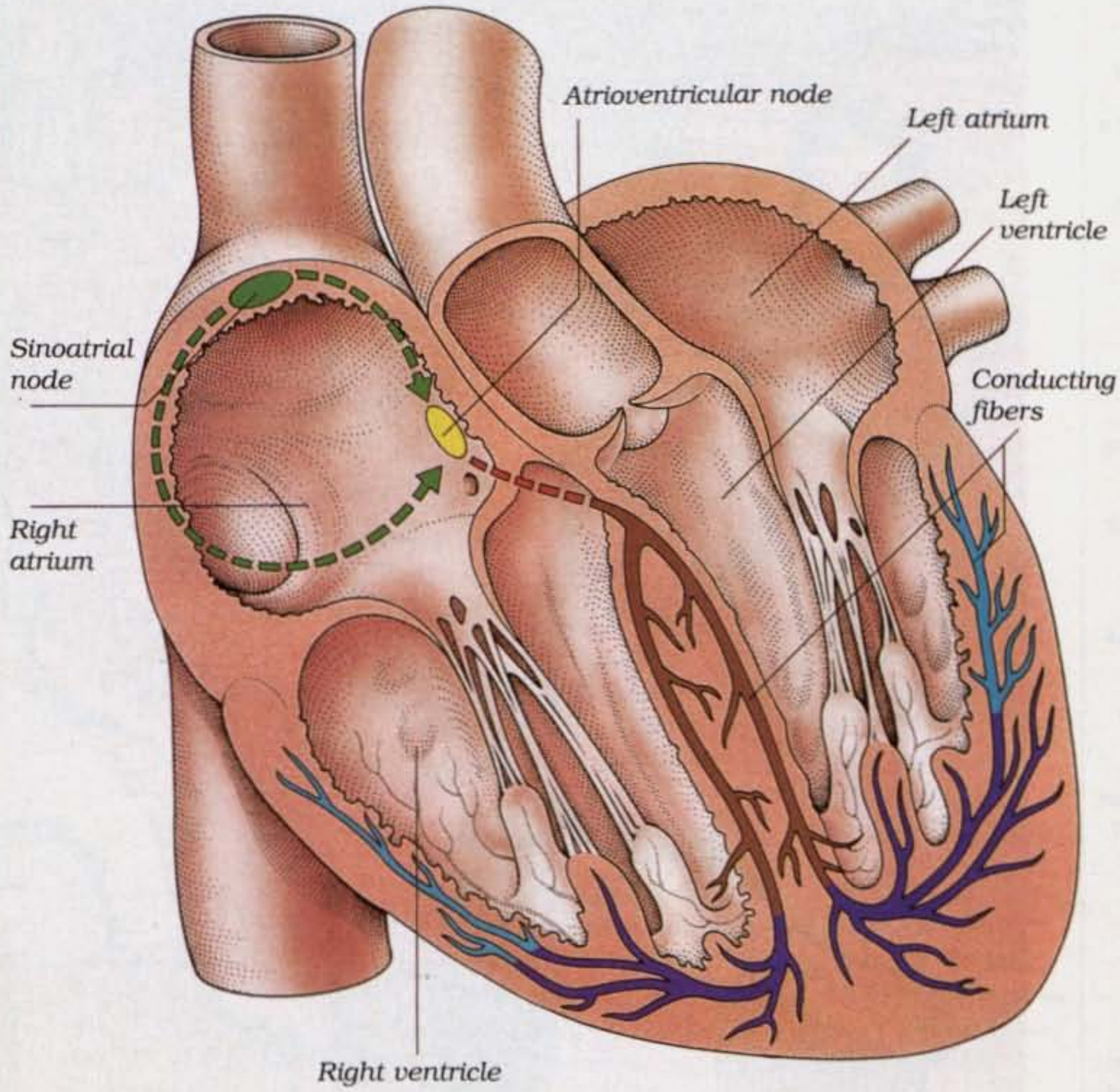
The third occurs when a farmer in rural Indiana, who is just a young man, has an inherited heart rhythm problem that we call Wolff-Parkinson-White syndrome—it simply predisposes an individual who is otherwise healthy to having rapid heartbeats—and he has cardiac arrest. His wife sees him go down.

Of those three individuals, the one in the Vegas casino and the one in the airplane have a better than 50 percent chance of surviving their cardiac arrests. It is witnessed. There is a defibrillator immediately available; both receive a shock, and they come out of it. The poor farmer's wife sees

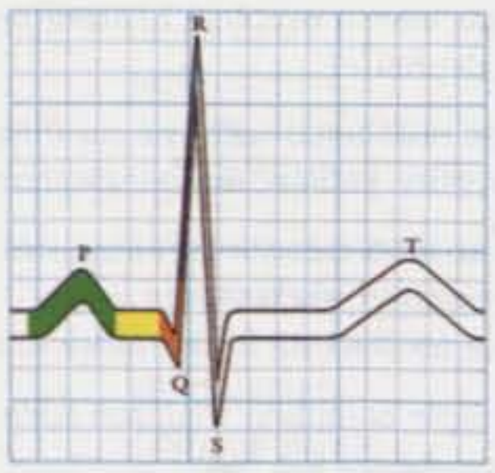
see An Emergency Room on page 70

The Electrical Pathways of the Heart

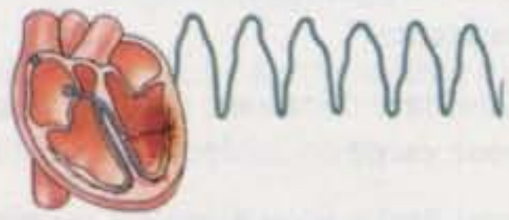
With each beat, our hearts force blood through an intricate network of blood vessels that would circle the Earth 2½ times. A regular and rhythmic heartbeat is maintained by electrical impulses that originate in the sinoatrial node—the body's natural pacemaker. The impulses then travel through the upper heart chambers, or atria, and along special conducting muscle fibers through the lower pumping chambers, or ventricles. When the heartbeat becomes erratic, unusually slow, or too fast, the condition is known as an arrhythmia. These abnormal patterns are commonly caused by coronary heart disease, stress, caffeine, and some medications.



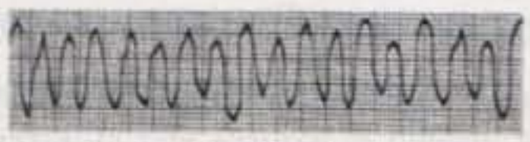
Sinus bradycardia:
An arrhythmia called sinus bradycardia occurs when the heart rate drops dangerously. A surgically implanted pacemaker can "pace" the heart and restore it to a normal rate.



ECG tracing:
An electrocardiogram records the flow of electrical impulses throughout the heart. This color-coded tracing represents an impulse as it follows the electrical pathways shown at left.



Ventricular tachycardia:
Damaged heart muscle may result in ventricular tachycardia—an abnormal rhythm characterized by rapid contractions of the ventricles. The King of Hearts can detect a heart rate of more than 140 beats per minute, for example, and raise a red flag for life-threatening arrhythmias.



Ventricular fibrillation:
Ventricular fibrillation—in which the lower heart chambers quiver at rates of 400 to 600 times per minute—requires immediate treatment with an electrical shock. This stops the heart for a split second so that the sinoatrial node can restart a normal heart rate.

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him go down, but before the EMS, police, or whoever drives 10, 12, or 15 miles, this man is going to die. His chances of surviving with an otherwise normal heart are less than 5 percent.

So my idea is to create a Neighborhood Heart Watch program, based on initiatives such as the Crime Watch and volunteer firefighter programs that we already have in place.

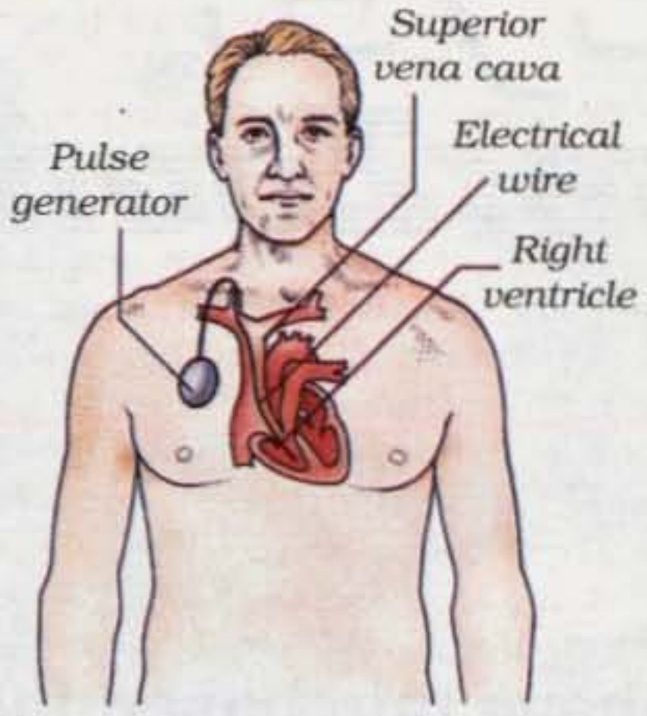
Why couldn't we identify houses within a complex of homes where there were individuals who could be trained to do CPR, have an AED in the home, and be trained how to use the AED? Now your neighbor could respond within a minute or two, run across the street or three floors up in an apartment building to respond to the sudden death. The 911 call would immediately be shunted to this Neighborhood Heart Watch family or however we construct this, and they would be able to respond to the individuals in the home. I floated that idea out as a trial balloon in an editorial in the journal *Circulation* several weeks ago.

Post: *Have communities responded to your idea?*

Zipes: Yes, as a matter of fact, there has been an extremely positive response. I have been getting e-mails from people all over the country saying, "What a great idea. Why don't we try that?" I would like to see the American Heart Association, the NIH, or some organization fund a study to show that, indeed, the idea is feasible and to show exactly how to go about it.

I was in New York last week. It was a very emotional event for the American College of Cardiology, of which I am president. The ACC contributed $100,000 to the relief fund after the September 11 tragedy. We are giving half of the money to educate physicians in bioterrorism, and the other half goes to establish medical-school scholarships for children of families affected by 9/11. Mayor Rudy Giuliani was there to accept the contribution, so it was a nice thing.

But driving across town in New York, one of the things that struck me was that if I had a cardiac arrest and was going to wait for an EMS vehicle to get to me, forget it; I would die. But if you had someone in a high-rise, for example, who had an AED and CPR training, they could be there on the scene virtually immediately. That is the whole concept.



What is the difference between a pacemaker and an ICD?

A pacemaker speeds up a heart rate that is too slow. A defibrillator delivers an electrical shock to terminate a very fast heart rate. The two devices are implanted in much the same way; however, there are some differences in the lead designs and placement. A lead is an insulated wire that carries the heart signal from inside the heart to the ICD or pacemaker. The most advanced ICDs actually include both pacemaker and defibrillator functions in one device for patients requiring both.

Post: *Our Indianapolis mayor's father, Howard Peterson, had a heart attack outside the RCA Dome after a Colts game. If you wanted to get the Heart Watch program going in Indy, you could probably get our popular mayor's attention. His father has a defibrillator on his yacht in the Caribbean now. He might be a candidate for your ICD.*

Zipes: I didn't know that.

Post: *How many lives could possibly be saved with greater access to AEDs through programs like Heart Watch?*

Zipes: Presently, we are talking about 400,000 sudden deaths annually. Your chances of leaving a hospital alive, depending on the city you are in, average around 5 percent in the United States.

Some cities, like Seattle, have a very vigorous program. A physician there named Len Cobb has made this his life's work, and consequently, Seattle has a very robust response to sudden cardiac arrest. Their survival rate is probably in the range of 15 or 20 percent. But interestingly, it has stayed relatively flat over the years because they still have the problems of getting to homes and rural areas.

No one has capitalized on this Neighborhood Heart Watch concept. So if you simply take that 5 percent, I would bet we would double it initially—and possibly quadruple it or more eventually—when this initiative becomes organized. The thing that is so troubling to me, as an electrophysiologist, or heart-rhythm expert, is that I understand how fibrillation happens, and I have the tools to terminate it immediately. It is not something that we don't understand how to stop, like AIDS or cancer. I can do this immediately. The question is, how can you get that equipment and that response to that individual? That is what we are talking about. If we can get it there quickly, we can save easily 50 percent or more of these individuals, as the Las Vegas casino response and the airplane experience demonstrated. Conservatively, I am saying we could double the 5 percent, but it really could be ten-fold—to 50 percent or more.

Post: *We have read about individuals and communities raising money to put these into their rural emergency vehicles. Is there federal legislation promoting this, and could you tell us about it?*

Zipes: There is some help. First of all, the Senate passed a bill which earmarked some $35 million for education. Schools can apply for these dollars to set up their own CPR/AED training programs. This was something that I called for in a 1992 article, almost ten years ago—so that money is available. In addition, there has been legislation to supply all the federal buildings with AEDs. Finally, there has been legislation of a Good Samaritan-type so that individuals using these devices and trying to save a life would not be held liable for malpractice or misuse. But there really has not been any legislation of which I am aware that says you must have a specified number of AEDs and people trained in CPR per million population.

Post: *What is your view of training children in CPR?*

Zipes: I think that all youngsters should be trained in delivery of CPR

and the use of AEDs, which are pretty easy to use today. That then increases the cadre of individuals who might happen to be where you are when you have your cardiac arrest and be able to administer the necessary response.

Post: *We taught CPR to third-graders at one of our local elementary schools, and they were strong enough to administer CPR.*

Zipes: It has actually been demonstrated that very young kids had no problems in mastering CPR, use of the AED, and remembering this months later, possibly better than some of the older people. I would advocate teaching these concepts each year in a health class. Just as kids learn how to use a computer, a typewriter, or how to drive a car, this ought to be part of their education.

Post: *Is there any way that children could make a mistake using an AED?*

Zipes: Not if you follow the very simple directions. It is pretty fail-safe today. What is the alternative? The patient is going to die, or you are going to make some kind of attempt. You clearly need to make the attempt.

One thing we can't lose sight of, Cory, is the emotional relationship of whomever is administering this to the individual who is down. My wife just had a ruptured appendix, and we had some scary moments. At one point, I was a husband and literally sobbing; another moment, the cardiologist broke through as I took control over what was happening. If this is your spouse or your child, I can tell you from personal experience that there is an incredible emotional overlay when you are doing this on your loved one. Another reason for the Neighborhood Heart Watch concept: because it is a neighbor, it is not your husband or your wife who can respond, and having lived through my events of the past couple of weeks, I feel even more strongly and more committed to the concept.

Sometimes a patient will ask me if it's OK to have an AED in the home so that they will be prepared to defibrillate their spouse. That is great, and we do do that, but it takes a very steely nerved individual to be able to put paddles on your husband or your wife who is down and handle that, versus a neighbor coming in and doing it.

Pioneering cardiologist Michel Mirowski invented the first implantable defibrillator. Dr. Mirowski and Dr. Zipes were friends and shared the development of the implantable cardioverter defibrillator.

Post: *But if death is the alternative . . . ?*

Zipes: No question, and it is doable, but we can't lose sight of the emotional impact.

Post: *As a cardiologist, do you often prescribe an AED when someone calls you and says, "I would like to have this protection?"*

Zipes: We have. I think there is growing interest and momentum for that. Interestingly, Medtronic has AEDs scattered throughout the company headquarters. To my knowledge, they have never used them or needed to. Again, it underscores what I am saying—these deaths occur in the home, not when you are at work. For unknown reasons—maybe because you spend most of the time in the home—they occur in the home, and that is what we need to be responsive to. It is great in a Las Vegas casino, but that is not where most of these are happening.

Post: *Our mutual friend Jeff Isner was at home when he had his fatal heart attack.*

Zipes: Jeff Isner could have been saved.

Cory, I am giving the Ronnie Campbell Memorial Lecture for the British Cardiac Society in England in May. Ronnie was a dear friend of mine, an electrophysiologist who made wonderful contributions to our knowledge base. A year and a half ago, he was at a symposium, had delivered his lecture, went for an afternoon ride on his bicycle, and never came back. He was found on the side

Using a child-sized mannequin, third-graders at Crooked Creek Elementary School in Indianapolis practiced CPR under the supervision of nurse Chris Kutruff and Dr. SerVaas. The children quickly learned where to place their hands and how much pressure to exert. Eight-year-olds have the strength to keep circulating blood to the brain of an adult. (Post Archives, September 1989.)

of the road, and he had had sudden death, just as Jeff did. It tears your heart out. And this is happening 400,000 times a year in the United States today, and we have the cure—we can do something about it. We just have to get the cure to the person who needs it as quickly as possible. And that is what we are talking about—a transportation and communication issue.

Post: *Jeff Isner didn't have a history of a heart condition.*

Zipes: Twenty-five to 50 percent of sudden deaths that occur are the first manifestation of heart disease. That is a sobering statistic. You didn't have angina. You didn't have a heart attack. You didn't have heart failure. You didn't have palpitations. You didn't have anything. It is sudden death as the first manifestation of having had heart disease.

Post: *Now for your wife's protection, do you have a defibrillator in your bedroom?*

Zipes: Guilty. No.

Post: *Do you have one in your car?*

Zipes: No. We have talked about it and haven't done it. You nailed me on that one. It is something that we certainly should do. You are right.

Post: *Would the Red Cross help you set up Neighborhood Heart Watch teams?*

Zipes: I think they would love to help. I think the American College of Cardiology, 28,000 cardiologists worldwide, certainly would take part. The American Heart Association would certainly participate. They are conducting what they call the Patient Access Defibrillation (PAD) trial. They are trying to find out where the devices should be, how we can have ready access, and so on. We [Indiana University] are participating in that particular trial. So there is growing momentum. It is moving rather slowly, and you nailed me on the fact that I don't have an AED in my own home or car. It is something that we need to do sooner rather than later.

Bill Groh, M.D., who has done a major job with a number of the AED trials that Krannert has participated in, had a wonderful anecdote from his study. An off-duty police officer was watching a high-school football game when the father of one of the players had cardiac arrest. He went to his car, got his AED, and defibrillated the father in under two minutes. The father woke up and protested about being taken to the hospital because he felt so good. He wanted to watch the son finish the game. That is how dramatic saving lives can be and how inexpensive it can be. This was a $1,500 defibrillator, used in a period of less than two minutes by an off-duty patrolman. There was no need to worry about Medicare, paying doctor bills, hospital bills, whatever, with the saving of that life. I think it is money well invested.

Post: *Do people often have brain damage when then don't get revived soon enough?*

Zipes: Absolutely, because you resuscitate the heart and not the brain. People have been without oxygen for such a long time that they have permanent brain damage from that episode. It is a terrible tragedy and an expensive one.

Post: *Are defibrillators being adapted to address the pediatric and youth populations?*

Zipes: Fortunately these events occur far less commonly in young people, though they absolutely do happen. They can happen because of congenital heart problems. We implant defibrillators in young people, and there are a variety of adaptations that have been used for infants and young children. Rarely, ventricular fibrillation can happen due to what we call commotio cordis, when a youngster is struck in the left chest by some sort of hard object—a baseball or a hockey puck. The timing has to be absolutely accurate for a bad thing to happen. It has to occur precisely between one heartbeat and the next for this to do any damage. We are talking about an interval of 30 thousandths of a second. That is why it doesn't happen more frequently. But it does on occasion happen and, if an AED were present, that youngster could be defibrillated and a sudden death prevented.

Post: *At what age would you not use a standard defibrillator on a child?*

Zipes: The defibrillator could be used at virtually any age, but the amount of energy delivered would have to be toned way down. Indeed, in very small infants or children, the ICD, instead of being implanted in the chest, is implanted in the abdomen, where there is plenty of room and then the wires are connected to the heart. We can, and do, implant these in very young children, if necessary. Fortunately, it is a very infrequent need in that age group. ▲

"Family? No, they're pictures of me at various stages of my life."