A conversation with Dr. Denton A. Cooley

Interviewer: William H. Kellar, PhD, from the Center for Public History at the University of Houston

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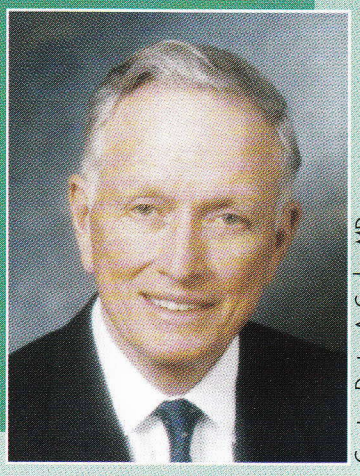


Courtesy Denton A. Cooley, MD

WHK: First, tell us about your days in medical school.

DAC: As a young man growing up in Houston, I had the greatest respect for the physicians in town. My father was a dentist and I can recall very well being at home and hearing him talk about the physicians in town. Even though he was a prominent and successful and skillful dentist, he respected the physicians more than he did his own branch of the medical profession. So, my goal was to someday become a doctor of medicine rather than following my father's request that I take over his practice as a dentist.

I entered medical school in Galveston at the Medical Branch at the University of Texas. I had only applied just right at the beginning, just before World War II began, but I was prompted to apply to three medical schools. One was Tulane, the other was Baylor in Dallas, and the third was the Medical Branch in Galveston. And when I was accepted at the Medical Branch, I had no hesitation at all in accepting because I thought it was the most prestigious school of those three.

From the first year, it was a very trying and strenuous program. We studied awfully hard. It was very competitive. It was all based on the point system, not by good, fair, and bad. It was all a point system. The man who had an average of 93 was considered smarter than the man who had an average of 91. And we competed very strenuously—most of us did.

It was an interesting and fascinating time to learn about the human body. Anatomy courses and things like that appealed to me the most. There were so many other subjects that were also fascinating to me, including physiology. And then, we got into pathology and the diseases that affect the body. And it was a most enlightening period of a young man's life. It was just a new world to all of us.

At that time, most of the surgeries that were being done were for removal of diseased organs. Excisional treatment, we called it. If a person had bad kidney failure or an abscessed kidney, they would take the kidney out. The same for any other organ. The uterus was a victim, as of course, were the appendix and things like that, and even the bones of the body that had osteomyelitis. They did not have antibiotics and the thing to do was either take out the diseased part of the bone or scrape it all out...that sort of thing. So, it was mostly removal.

Reconstructive surgery was present but not nearly as much as it is today. We did not even think about surgery of the heart. In fact, we learned a lot about the physiology of the heart and its function. But it was beyond thought at the time that surgery or manipulation of the heart could be successful. In fact, we were even taught that if you suddenly stopped the heart's action for anything, for any purpose, you would never get it started again. So, it was something that was really not even considered part of our surgical training. Some of the admonitions from surgeons from the 19th century were still there, including the notion that anyone who dared to operate on the human heart would lose the respect of his colleagues. Another at about the turn of the 20th century said that we have gone about as far as we can ever go with the treatment of heart disease. So, we had no experience with heart surgery.

I spent my first and second years, my freshman and sophomore years, in Galveston. While I was in my fourth or fifth month of medical school, the Japanese bombed Pearl Harbor on December 7, 1941. Then, the whole national effort to uncover any possible activities that were un-American began. Galveston had a political problem there in its faculty. The dean of the medical school became really estranged from the faculty. Word got back to Austin, and it was considered an un-American activity to have this sort of conflict in the medical school and the medical branch of the university.

So, the legislature decided they should do something about it and investigate it, that this was an un-American, a German Bund created down in Galveston. They organized a committee to go down and investigate the medical branch, and they brought with them about four Texas Rangers. They had Kangaroo Courts in Galveston, invited the medical students to come to Kangaroo Court and listen to the proceedings there, and you could see the faculty making accusations against other

ABOUT THE INTERVIEWER: William H. Kellar is the executive director of the University of Houston's Scholars' Community program. He is also affiliated with the Center for Public History at UH and has written several books on Houston institutions.

Photograph by Jacquline Sarver

members of the faculty and then against the dean and so forth. It was demoralizing to most of us. We were worried that as hard as we were working as students to become physicians, our diplomas might not be recognized, since our school might be placed on scholastic probation. Sure enough, it was ultimately put on probation because of this.

I decided that it was time for me to transfer to another school. I very quietly applied to Johns Hopkins University in Baltimore. I went to ask the advice of my mentor, Dr. E.W. Bertner, who I think was really the brains behind the creation of the Texas Medical Center. He advised that I transfer up to Johns Hopkins. And so, I applied there and because my grades were good, I was accepted. I left Galveston in February of 1943 and transferred up to Johns Hopkins for the last two years of my medical school.

At Johns Hopkins, I found a new sort of element going on, an interest in heart surgery. My chief, my mentor, the professor of surgery, a man named Alfred Blalock, was working on several things to do with circulation. He was not necessarily involved with heart disease originally, but he was interested in things like surgical shock or traumatic shock and was interested in circulation of the lungs and what made some patients develop high vascular pressure in the lungs. Dr. Blalock was working with a man named Vivien Thomas who was a black man who had a high school diploma. Thomas had joined Dr. Blalock when he transferred from Vanderbilt up to Hopkins, and was working with Dr. Blalock as a lab technician, working on shock and pulmonary circulation. They had worked on the technique connecting one of the arteries, arterial system, with the artery to the lung, attempting to create a model for pulmonary hypertension.

At the same time, a woman who was a cardiologist for congenital heart disease over at the pediatric service area of Hopkins was looking for a way to correct the problem with the blue babies, which were born with a condition where the blood returning to the heart and to the lung was diverted back out into the circulation. It never went through the lungs to become oxygenated. Oddly enough, Dr. Blalock had been working on another aspect of the pulmonary circulation where he was trying to overfill the lung with blood to see if he could create hypertension. Oh yes, he could easily connect the artery to the artery of the lung. So, they decided that they would try this in a patient.

Sure enough, the procedure worked very well. I was in the operating room myself. I was an intern on the case and just happened to be there. When they took the clamps off the vessels and the blood began to go through the lungs, the cardiologist standing at the head of the table howled, "The baby's lips are a brilliant, rosy color." The lips were the color of your blue shirt there beforehand. They opened this artery and things just changed immediately. I have always thought that that was the dawn of modern heart surgery and I was privileged to be present to witness it. I did not fully realize the importance of it at the time, but it occurred to all of us as time progressed that it was really the beginning of modern heart surgery. That was in November 1944. Now, it is July 2004, 60 years later, and I have been privileged to be not just a witness, but a participant in a whole new field of endeavor.

Heart disease today is one of the real challenges for surgeons, and it has gone on and progressed by leaps and bounds since that time, from the days that we were able to first stop the heart and substitute for the heart and the lung functions—something we call cardiopulmonary bypass.

I had the opportunity to go up and witness two of the early pioneers in open heart surgery, both of them in Minnesota. One of them was Dr. Walton Lillehei at the University of Minnesota. They were doing heart surgery by cross-circulating blood between the mother or sometimes the father, and the child. And the real purpose was that the best oxygenator that has ever been devised and ever will be devised is the human lung. And they could therefore use the parent to oxygenate blood for the infant or child while this open heart repair was being done.

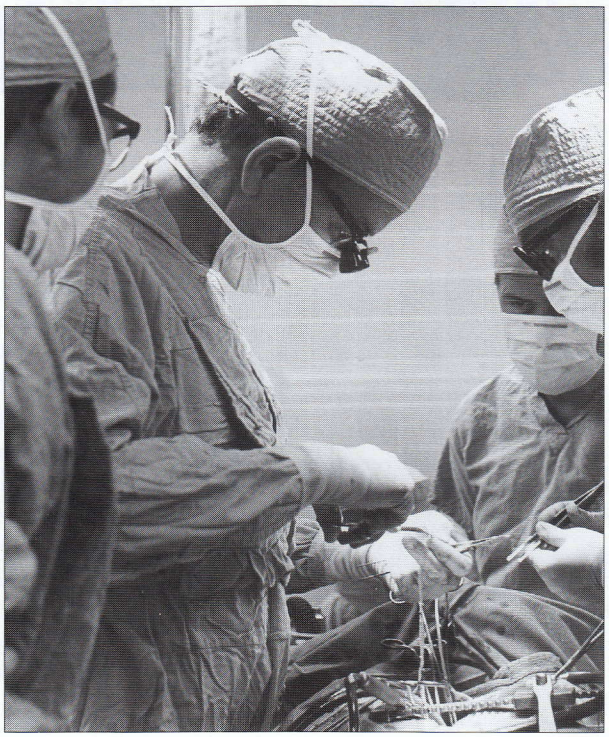
Over at the Mayo Clinic, (it is only about 45 miles from Minneapolis and I traveled over there) a doctor named John Kirkland had taken a machine that had first been used at Jefferson College in Philadelphia by a man named John Gibbon. He worked on this device for about 30 years before he ever was able to try it in the human patient. He had a different kind of a mechanical oxygenator where they just spread the blood over a screen with the exposure to oxygen in the screen. It was not very efficient, but it would oxygenate blood. While I was on that same trip, I was in their laboratory there at the University of Minnesota and saw the use of a bubble oxygenator, which just bubbled oxygen through a column of blood to oxygenate it.

When I returned to Houston in 1955, I created my own bubble oxygenator and artificial lung. And so, this bubbler was so much more efficient. It was not probably effective for more than about 30-45 minutes of surgery, but it permitted us to operate on children. In 1956, I did my first open heart operation with a bubble oxygenator. And that really opened up the way for surgery throughout the world, although they were limited in how long the operation could be conducted and so forth, and what size patient was a good candidate for such surgery. We were able to show that you could stop the heart, you could work inside of the heart, and if you did it efficiently and precisely, you could expect survival. Those early operations in Minnesota carried a rather high mortality. By showing that patients could survive the short periods of open heart condition, I was sort of credited with showing that open heart surgery was practical and that it could be done with low risk. And from that time on, many developments have occurred.

We experimented with various substances like potassium ion that could really be injected into the heart. Once you stopped the flow of blood, you injected this into the coronary circulation and actually stopped the heart so that the surgeon could operate in a completely quiet and bloodless field for the first time, without having the heart beating and being obscured by blood. Then, in the early 1960s, I was able to show that we did not need to have a lot of blood to prime the system that was used. I showed that we could use what we called an electrolyte solution, a glucose solution, so you were not as dependent upon the blood bank to collect all of this blood. It used to be that we had to collect 8-10 units of blood on the day of surgery and then do the surgery that day. But after we showed that you could do it with this glucose solution, we would be able to operate on Jehovah's Witnesses that would not even permit any kind of blood transfusion. So, that was really, I think, a major contribution that I made with my team here, that surgery could be done in a very practical and reproducible way with disposable equipment and so forth. That was our major contribution to heart surgery. And it really established our hospital here, particularly, St. Luke's and Texas Children's Hospital, as centers for heart surgery.

We became the most prolific heart center in the country at the time. Whereas, the other major institutions would be reporting 40-50 heart surgeries per year, we were up into the thousands. We had a wonderful opportunity and I worked 24-hour days because I knew that we were into a wonderful new era and I wanted to establish the Texas Medical Center as a major center for heart surgery.

For example, when the first heart transplant was done in Capetown, South Africa, by Christiaan Barnard in 1967, I was determined to establish our position in this new field of cardiac transplantation. I had the opportunity in 1968 to perform the first successful heart transplant in the United States. And then, in 1969, we implanted the first total artificial heart, which we did as a step—we called it a staged transplantation. For example, we had a patient who would have died in the operating room, but we had a backup from a total artificial heart, and we used that heart as a stage to transplantation. In other words, we preserved this man's life by putting in this artificial heart, and put out a plea for a donor, which we obtained about three days later. We maintained his life for that period of time. We had to go all the way up to Massachusetts to get the donor and we did the implant. Unfortunately, the patient rejected the implant for a number of reasons, but nonetheless it was, again, a first.



Dr. Cooley performing surgery. Courtesy McGovern Historical Collections, Houston Academy of Medicine-Texas Medical Center Library

Since then, we have been working with all sorts of mechanical devices to accomplish the same purpose. And some of these mechanical devices that we call assist devices are now being used as a bridge to transplantation or, more recently, may even become a destination therapy. I think that is an interesting term. We call it destination. People may be using this assist device to maintain their life permanently. Much like the concept of pacemakers, which have become so commonplace, they are put in now and people may look forward to 10–20 years of life on the support of that pacemaker. So, these assist devices are in that sort of concept. So, that is pretty much where it is going.

Of course, the real breakthrough in producing increased life expectancy has come with the coronary bypass operation, which came into vogue in the late 1960s and 1970s. And today, of course, coronary bypass is the most common heart operation that is done, and maybe 750,000 of them will be done throughout the world. In our own hospital here, we have done about 75,000 coronary bypass procedures already.

In our operating rooms today, we replace all the components of the heart available and we replace the valves in the heart. We replace the partitions in the heart. We use the pacemakers to support the conducting mechanism of the heart. And then, in our hospital, we do about 50 heart transplants a year. We have done close to 1,000 heart transplants in the Texas Heart Institute up to this time, one of the largest programs in the cardiac transplantation in the country or in the world, for that matter. So, all of these things have taken place during my 50 years here as chief of surgery at the Texas Heart Institute.

WHK: That is absolutely marvelous!

DAC: Well, it has been a wonderful time. In 1962, I conceived the idea of creating a new institution called the Texas Heart Institute. I thought, at the time, we were the leaders in heart surgery in the world, and I thought we ought to identify not just as St. Luke's Episcopal Hospital or the Texas Children's Hospital—we ought to identify ourselves as a specialty institution. That is when I had the name Texas Heart Institute and the concept chartered with the two purposes of research and education. Of course, our interest was also on heart surgery and cardiology, but the Texas Heart Institute has those two objectives—research and education.

WHK: Could you talk for a couple of minutes about the role of the development of new drugs in concert with this developing technology and surgical skills related to the heart?

DAC: Drugs have been an important part of all of our advances. Just for example—we could not do open heart surgery today if the drug known as heparin had not been introduced, and that was introduced around 1920. But nobody knew at the time that it would be that essential to the development of heart surgery. You could not do all of this manipulation of the circulation if the blood would clot, and this heparin would prevent clotting. So, we could put this in the patient and therefore, their blood would not clot and we could manipulate the circulation around through these extracorporeal units. So, without heparin, our predecessors could not have had that opportunity to do open heart surgery. But then, if you prevent clotting, you cannot survive unless you have some clotting tendency, so they had to invent another drug which we call Protamine. It is interesting where these drugs come from. They are both biological. They are not synthesized. Heparin comes now primarily from beef lung, sometimes they use pork lung, but mostly beef. And then, Protamine, the antidote to restore the ability of the blood to clot, comes from fish sperm. Can you imagine?

Of course, there are many other drugs available that made heart surgery what it is. The potassium ion, which physiologists or pharmacologists have shown you can stop the heart with, has been very basic to heart surgery. Other drugs such as adrenaline or epinephrine are major stimulants for the heart. Other drugs that played an important part, of course, are digitalis which goes back 200 years. It comes from the foxglove leaf, but it has a very important role in cardiac function. And doctors have used that for treating heart failure for centuries. It is being gradually replaced by other drugs and the pharmaceutical industry has been busy providing all sorts of new drugs to help the treatment of heart failure and cardiac arrhythmias and things like that. So, a big industry has been developed in pharmacology and every day, we see new drugs introduced for various purposes.

WHK: What about the drugs that help prevent the body from rejecting transplants? That has been kind of an evolution, too, hasn't it?

DAC: Well, in those early years of transplantation, say, in the late 1960s and the 1970s, rejection was a real problem. We tried a number of drugs at that time, some of which were biological drugs. I remember drugs almost like vaccines that we would give to patients to prevent rejection. Some of the other drugs that were used were not very effective, but they could slow down the rejection process with the introduction of a drug called cyclosporine, which came in during the early 1980s. With cyclosporine, it was first possible to do transplantation of almost all the organs with much better control of the rejection process. So, that reinstated interest in organ transplantations—the cyclosporine, and a number of other drugs today which are used in transplantation, but the big problem still in transplantation is the problem of tissue rejection. I have always said from the beginning that the only time you do not have to worry about tissue rejection is if the donor is an identical twin.

WHK: Is there something really significant that you envision coming in the next 20 years or so that will have a huge impact again on medicine, especially in terms of the heart?

DAC: Well, I think that if we can get better antirejection drugs, if they discover them, they will certainly revolutionize transplantation. There are so many other drugs that are present today that have helped so much in medicine. Nothing can compare with the antibiotics, that cut down so importantly the infectious diseases that plagued previous generations of patients. Patients used to die of diseases such as streptococcal diseases and so forth that were so devastating—diphtheria and some of those infectious diseases. These once devastating diseases today can be corrected very quickly with appropriate antibiotics. And there are many other things that have come along. Right now, our scourge that is part of aging is arteriosclerosis, which is mostly a disease of long life. There are certain elements that lead up to it. Now, we are beginning to show that infection or inflammation, we will say, is a forerunner to arteriosclerosis. And I have a belief myself that so much of arteriosclerosis begins in childhood. All of the diseases that we thought were normal childhood diseases such as measles, mumps, and whooping cough, now children do not have to be subjected to those illnesses. But I think that things like measles and so-called sore throat or streptococcal disease actually scarred our circulatory system and that has led to some of the atherosclerosis that occurred in later life. And I think the reason we are living longer actually than our previous generation is because we are spared some of those illnesses of youth. And if we can ever get a means of preventing or curtailing the onset of arteriosclerosis, we can extend life even longer.

WHK: Could you talk about one last thing for just a minute, and that is changes in the way doctors approach patient care over time?

DAC: Well, today, doctors can converse with their patients. Their patients are much better educated than they have been in the past. They have access to the internet and all this information that so much of our television and radio informs patients about illnesses. And I do not think that my parents or my grandparents had that kind of information at their disposal. But nowadays, doctors are encouraged or almost forced to tell patients in a very honest way what threats are to their life, what they can do to improve their lifestyle, and so forth. And when tragedy hits and that patient develops cancer, now, the doctor is compelled to tell the patient what his life expectancy is, what his outlook is and so forth, and what he probably ought to do about it to prolong his life. It is a different world now, with a lot of communication between the doctor and his patient. ■