OREGON HEALTH SCIENCES UNIVERSITY HISTORY PROGRAM

ORAL HISTORY PROJECT

INTERVIEW

WITH

Albert Starr, M.D.

Interview conducted February 17, 2006

by

Richard Mullins, M.D.

SUMMARY

Internationally renowned cardiac surgeon Dr. Albert Starr talks about his training, discusses the development of the Starr-Edwards heart valves, and looks back on a long and highly successful career in this interview, conducted by trauma surgeon Dr. Richard Mullins.

Starr begins with a detailed description of his early surgical training in Boston and New York with Alfred Blalock and Max Chamberlain, among others. Drafted into the armed forces during the Korean War, Starr served first as a battalion surgeon and then as chief of the abdominal unit at a mobile army surgical hospital. He talks about some of his war experiences and his return to complete his residency in New York.

In 1958, Starr came to the University of Oregon Medical School, where he soon met engineer Lowell Edwards. Together, the two men went on to develop the first prosthetic heart valves successfully implanted in human patients. Starr discusses the development of the valves from concept to implantation; talks about the complications seen in the first patients; and reflects on both the contemporary response to the valves and the long-term significance of the discovery. His commitment to outcomes-based research and his insistence on follow-up studies have produced a wealth of information about the long-term health of patients receiving artificial heart valves.

Within a few years of the first successful implant in 1960, heart valve patients began to overflow the wards at the Medical School Hospital. Starr responds to questions about the impetus for his move to St. Vincent Hospital and briefly discusses his present relationship with OHSU.

Looking back on his career, Starr reminisces about many of the pioneering surgeons whom he has met and gives a brief outline of the history of American surgery in the twentieth century. He finishes with a few comments on the delicate matter of informed consent.

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MULLINS: Good afternoon. Today is February 17, 2006. We're at the Oregon Medical Association with professor and doctor Albert Starr. This is part of the oral history program at Oregon Health & Science University Library. The interviewer is Richard Mullins.

Good afternoon, Dr. Starr.

STARR: Hi. Glad to be here.

MULLINS: Shall we begin with where you were born, and what was your early education?

STARR: Well, I was born in New York City in 1926, and my early education was through the New York public high schools.

MULLINS: I've read that you were a piano student as a young man.

STARR: Yes, to some extent. I played the piano in a jazz band to work my way through college.

MULLINS: Have you enjoyed music all your life?

STARR: Only as a passing—as I passed into medicine. Then medicine became my music, so to speak.

MULLINS: What were your interests when you attended Columbia College?

STARR: Well, that was a great experience, because I was introduced to the world of liberal arts and had some really great professors; for example, Jacques Barzun and Lionel Trilling. I mean, these were well-known figures in the literary world, and they were teaching classes to Columbia students. So it was a real revelation. I felt that I had finally found an environment that I really felt comfortable in. It had a dramatic effect on my life and outlook.

MULLINS: You've written a lot of papers through the years. You have a particularly clear style of writing. Is that where you learned that?

STARR: Yes. Trilling, especially, was a—he was a literary critic, and we would write papers and he would really criticize them, and so he was excellent.

MULLINS: You graduated from college at the age of twenty.

STARR: Yes.

MULLINS: Were there many in your generation there in the Second World War that felt things had to be accelerated?

STARR: They were accelerated. It wasn't anything that we did. When I got out of high school I was too young to go into the army, and so I went to Columbia. By the time I was old enough to be drafted, I was in medical school, and so I had a deferment from armed services until I finished medical school. And by the time I finished medical school, the war was over, and that took care of my military career for that period of time.

MULLINS: At one point you were interested in physics in college, I understand.

STARR: Yes.

MULLINS: Can you tell us about that?

STARR: Yes. Columbia College at that time was teeming with Ph.D. physicists who were working on the Manhattan Project, and it was the early days of molecular physics, and so it was very exciting. I took some physics courses and I enjoyed them very much, and I considered physics as a career. And also, the courses were very strong in economics and I considered economics as another possibility, but, then, biology was just too fascinating to leave behind.

MULLINS: So how did you get interested in medicine?

STARR: Well, that goes back to high school, when I had a teacher in the biology class who ran weekend trips to various museums and botanical gardens, and so on, and took a special interest in the students. It just shows the effect of a high school teacher, you know, on a kid, and I became fascinated with biology at that time. That was in high school, and then in—as an undergraduate, then, I was exposed to the world of literature and the arts and liberal arts, and so that had a great influence as well.

MULLINS: You went to Columbia College of Physicians and Surgeons. Who were some of the professors in surgery who influenced you during your medical school career?

STARR: Well, medical school was a blur of tremendous energy, studying. We went to school all year around. It was during the war, and so we had three semesters a year instead of four. I finished medical school in three calendar years, and it's hard in four calendar years to do it; in three calendar years it's even more rough. But there were some great professors there that impressed me. The chief of medicine was a well-known internist, a fellow by the

name of Professor [Robert] Loeb, and the—I wasn't well enough acquainted with the surgical service at that time. I mean, I was immersed in the basics of medicine.

MULLINS: So how did you end up with an internship in surgery?

STARR: Well that was—I decided as a third-year medical student that I wanted to go into surgery. The reason is that I liked—I'm a definitive person, as I like to get an answer soon. In surgery there was important decision-making, and it was either yes, you operate; no, you don't operate. I mean, it was a simple choice, and medicine was more complex and much more sophisticated than surgery, and so I liked the decision-making aspects of surgery that I found appealing.

MULLINS: Do you remember your surgical rotations as a student?

STARR: Yes, I do.

MULLINS: Where did you go?

STARR: Well, I went to Roosevelt Hospital as a student and to Bellevue Hospital as a student.

MULLINS: What are your recollections of Bellevue?

STARR: Bellevue was a garbage pit. I mean, it was—you know, coming from Presbyterian Hospital to Bellevue Hospital was a real culture shock. But, it was rough-and-tumble medicine, gross, active, furious; it was dirty. A completely different kind of entity. It was a county hospital.

[tape stopped briefly]

MULLINS: So, repeating the question, was it such an exceptional experience that you thought maybe you wouldn't want to be a surgeon at Bellevue Hospital?

STARR: No. Bellevue was exciting. It was rough and tumble, but it was a very exciting place.

MULLINS: How did that compare with Hopkins?

STARR: Well, it was entirely different. Hopkins was basically a Southern hospital and Southern mannerisms and an entirely different culture.

MULLINS: How did you get the job at Hopkins?

STARR: That was an interesting issue. As a medical student, I really—I was a good student and I was at the top of my class, and everything, and so I really had a choice of where

I wanted to go. I wanted to go to the MGH really badly. I interviewed there and I interviewed at Hopkins, and I was accepted at Hopkins but not yet at the MGH.

I had a phone call from Hopkins saying, "You are accepted for this surgical internship." And I said, "I cannot accept it now, I need some more time." I was waiting for an acceptance from MGH, which is my first choice. Then, later that day, Dr. Alfred Blalock got on the phone himself, and in his Southern accent he said, "Starr, nobody refuses an internship at Hopkins. What's wrong with you?" And I said, "Well, Dr. Blalock, I was hoping to go to MGH." And he said, "Well, we can't wait. You're going to have to tell me now whether you want this internship or not." So I did. I said, "Sure, I do," because I couldn't be sure of MGH. So that's how I got to Hopkins.

MULLINS: Did you have an interview with Dr. Churchill at MGH?

STARR: No. It was—I forget who it was, but he subsequently became quite well known in fluid balance, but his name escapes me for the moment.

MULLINS: So you interviewed at both places. Did you interview with Dr. Blalock?

STARR: No, with Dr. Mark Ravitch, who was his second in command.

MULLINS: Well, can you tell us about the internship at Hopkins?

STARR: Yes. The internship was really a great internship. When I met Blalock, at first he wouldn't believe I was a doctor, because I wasn't even shaving. I think I was twenty years old, something like that. The war was going on, it was—I was too young, in his view, to have gone through medical school. He was a very friendly guy, a very nice man, a real Southern gentleman, and very devoted to the house staff and to his work.

MULLINS: He was doing the shunts by that time.

STARR: Yes, he was.

MULLINS: Did you see him do some of those?

STARR: Oh, yes. We spent a lot of time on his service, and every day we would do a shunt and a coarctation and a ductus. And, actually, the intern would do the ductuses, because heart surgery was—that was what they did there. And so, instead of learning how to do surgery on hernias and things like that, I learned how to do surgery by tying off these ductuses in these little toddlers.

MULLINS: You did your residency at Presbyterian Hospital and Bellevue.

STARR: Yes.

MULLINS: How long was your residency?

STARR: It was not very long at all. I had three years of general surgery and two years of thoracic.

What happened was that when I got back to New York—when I was finishing my internship, Den Cooley was my senior resident, and he said, "Al, what are you doing next year?" And I said, "Well, I'd like to stay here at Hopkins." And he said, "Well, you know, we've got thirteen interns, we take only two as assistant residents, and we've already selected two who have been medical students at Hopkins and already had started research projects while they were students, so you'd better talk to Dr. Blalock."

So he made an appointment for me to see him, and Blalock discussed the postgraduate educational programs and picked up the phone and called the chief at Presbyterian—he said, "Starr, where do you want to go?" And I said, "Well, I can go back to New York. I thought Presbyterian was pretty good." So he picked up the phone and called the chief of surgery at Presbyterian and said he had this young guy that was looking for a residency, would he take him? The transaction took about three minutes, and that was that. That's how I got back to New York.

MULLINS: And how was that residency for you?

STARR: That was also a very exciting residency, and I came across people who were making major inroads into medicine and surgery.

MULLINS: Do you want to talk about some of them?

STARR: Well, yes. Some of them were Nobel Prize winners. In my thoracic residency I rotated through chest medicine and they were doing cardiac catheterization. The guys who developed cardiac catheterization were based at Bellevue, André Cournand and some of his colleagues; they were Nobel Prize winners for doing cardiac catheterization.

Another great superstar was Max Chamberlain, the thoracic surgeon who developed segmental resection for tuberculosis, and he was a great surgeon.

MULLINS: You did a thoracic fellowship. Can you tell us what that was like then, compared to what training for a…

STARR: Yes. The thoracic program involved a rotation—what the difference is, it was one year of basic science and one year of clinical work, and the basic science included rotation on chest medicine. So we became specialists in chest medicine in order to do what was then primarily pulmonary surgery. And the second year was at Presbyterian—the first year was at Bellevue and the second year was at Presbyterian in thoracic surgery.

MULLINS: So pulmonary resections for tuberculosis and infection, that sort of thing?

STARR: That was the common operation. That's how we trained. We trained doing segmental resection.

MULLINS: And how about heart surgery?

STARR: There was no heart surgery. There was an occasional mitral commissurotomy. I've had many adventures along those lines. And then the early—towards the end of my residency, closing atrial septal defects using very rudimentary methodologies.

MULLINS: On pump?

STARR: The first ASD that we did was using a well technique, in which a rubber dam is attached to the right atrium and the clamp is removed from the atrium and blood comes into the dam, and then you could put your finger in and feel the atrial septal defect and then, by feel, suture a patch in the defect. That was a very crude method developed by [Robert E.] Gross in Boston and then adopted in New York.

Only later in my residency did cardiopulmonary bypass become available, and then we were doing them under those circumstances.

MULLINS: Was that at Presbyterian?

STARR: Yes.

MULLINS: You finished your residency and you went into the army.

STARR: Yes. It was during my residency. I interrupted the residency to go into the armed forces.

MULLINS: You served in Korea.

STARR: Yes.

MULLINS: How long were you there?

STARR: I was in Korea for a year.

MULLINS: The summer and the winter?

STARR: Yes.

MULLINS: Do you have any recollection of your service in Korea?

STARR: Yes, I have a lot of recollections of Korea. I did about a thousand laparotomies in one year. I had calluses on my hands from operating. It was an unbelievable

experience. I had had only one year of surgical internship and about six months of residency in general surgery.

Dr. Frank Berry, who was the deputy secretary of defense, was chief of surgery at Bellevue, and my first year of residency I had to go and tell him that, "I'm sorry that I have to leave your program, Dr. Berry, but I'm going into the army." He was very excited about that, thought it was a great opportunity, and said, "Well, Starr, you should go to Korea. There's a war on there." And I said, "Well, Dr. Berry, I'd rather go to Europe." The cultural aspects of being in the armed forces in Europe were overwhelmingly interesting to me. And he said, "No, no. During a war, the place to be is in the combat zone." So he saw to it that I was assigned to Korea. Many of my friends went to the European theater.

Then, I started out in Korea as a battalion surgeon, out on the front lines, sometimes behind the front lines or ahead of the front lines. Then I wrote to him and I said, "Dr. Berry, I'm not doing any surgery in Korea. I'm basically a battalion surgeon, and I don't think this is what you had intended for me." And, sure enough, about a couple of weeks later I was transferred to a mobile army surgical hospital, and that's where I had the bulk of my experience in surgery.

But the time as a battalion surgeon was really important to me, and I learned a lot about warfare, about people, about—I lived with these army officers who were really tough and brave. And I knew it was a worthwhile war that we were in, and it was—I admired the discipline of these mature men who were putting their lives on the line. I wouldn't—I mean, it was good for me to see the war as it actually was.

MULLINS: Was there a lot of uncertainty in that experience? Were you never quite sure what was going to happen?

STARR: Well, there was—yes, because in my first assignment, the regiment that I was assigned to was completely surrounded by enemy forces, and I couldn't get to my assignment for a few days, until the roads were reopened. And I had all kinds of adventures going on task forces into North Korea with a tank battalion as their surgeon. It was a real experience.

MULLINS: And when you did the thousand laparotomies in the MASH, what was that experience like?

STARR: That also was a very positive experience. The chief of the surgery was an old-time general surgeon from somewhere in the Midwest. He knew I came from an Ivy League background, so he was a little bit in awe.

I only had three months, or so, of general surgical residency, so he said that he would—I would scrub with him on a few cases and he would help me with a case, and then, if I did okay, he would put me in charge of an abdominal unit, and that was the best job in the MASH, because there we were doing laparotomies. All puncture wounds of the abdomen were operated on in the MASH.

So the first case that came through was an appendectomy on a Korean national. Of course, that was the one operation I knew how to do, so I did a brilliant appendectomy, and he said, "Okay, Starr, you're now head of an abdominal team," and that's what we did. So we had an anesthesiologist, a corpsman or nurse anesthesiologist, and one technician, and we were opening abdomens and closing holes in bowels and taking out ruptured spleens.

The only thing we didn't do was vascular surgery, because there were no vascular grafts at that time, during the Korean War. But we did a lot of emergency major surgery.

MULLINS: So the year must have been arduous at times, physically demanding.

STARR: It was, it was physically very demanding, but I was young. I was about twenty-two or twenty-three years old, and I thought it was really important. Actually, I felt, having gone through medical school, that if anything happened to me while I was in Korea, I would have achieved my goals. So life after Korea was a bonus, as far as I was concerned.

MULLINS: Just parenthetically, so when the movie *M*A*S*H* came out in the late sixties, what did you think?

STARR: [laughs] It was a teen version of what it really was like. I mean, it was very well done, but it was even more raunchy than it appeared on television, and even more off-the-wall, but it was a very good depiction, an actual depiction of what was going on.

MULLINS: So you returned from your service and you finished your residency at Columbia.

STARR: Yes. I went to Dr. [George] Humphreys, who was the chief of surgery at Presbyterian, and showed him my list of operations and said I'd like to be promoted into the next level, I had done all this. And he said, "Starr, you're lucky to have a job. You're going right back into the plan, where you left it." And so I did.

MULLINS: Was he unreasonable in that regard?

STARR: No, no, but he didn't find it amusing that I was anxious to finish my training.

MULLINS: What was your first published manuscript?

STARR: Well, when I was at Bellevue, we had a patient that had an electrolyte problem from potassium loss, and the potassium loss was related to an adenoma of the rectum that was secreting all this mucus containing potassium. So I wrote that up as a—it was called a villous adenoma. And we were encouraged to write case reports, if we could.

MULLINS: That kind of became a classic manuscript.

STARR: Yes, it did.

MULLINS: Commonly referenced, sometimes by interns.

STARR: Yes. It was noting that the potassium loss was related to the tumor. And at that time, electrolyte imbalance was a hot topic in medicine.

MULLINS: Can you tell us about your early experiences with cardiopulmonary bypass?

STARR: Yes. Cardiopulmonary bypass, my experience was first in the animal lab and then clinically. In the animal lab, we were—and this was during my residency—we would work with some of the research faculty in assisting them at doing surgery on animals, open-heart surgery on animals. At the same time, we were doing closed-heart surgery clinically. After a few months, the machinery that we used in the lab was then taken to the operating room.

MULLINS: Did you ever meet Dr. [John H.] Gibbon?

STARR: No, I never had.

MULLINS: One of his biographers said that after Dr. Gibbon developed the cardiopulmonary bypass and he used it on a few patients and some of them died, he gave up.

STARR: Yes, that's true. He never became a heart surgeon.

MULLINS: Do you want to comment about that?

STARR: Well, it just shows that everybody's a little different. They have their skills, different kinds of skills, and it takes a variety of people to make gains. Some people can start a company and they can't run it; other people can run a company but can't start it. So you have to have enough motion to find your own spot where you really can make something happen.

MULLINS: Did you then have your first interest in valve surgery when you were in New York, on the faculty?

STARR: No. At that time, the focus was on congenital heart disease, and we thought the mitral valve commissurotomy, finger fracture, that was what we were doing, and no one was really interested in looking at the valves at that time. Later on, within a couple of years, we began doing open-valve repairs and looking at the valves, and then realized that some of these valves cannot be repaired.

MULLINS: So that brings us to the later fifties, I think 1958, when you moved to Oregon.

STARR: Yes.

MULLINS: Can you tell us the circumstances that led to your coming to Oregon?

STARR: Yes. I was in the operating room at Presbyterian. It was May or earlier spring—I'm not sure quite when—but there was a visitor in the operating room who was chief of thoracic surgery at the Oregon Health Sciences University. It was then the University of Oregon Medical School. That was Dr.—I'll think of his name in a moment. Dr. Conklin, Bill Conklin. He was in the audience. We had a balcony.

He came down after the operation—it was an atrial septal closure. I was putting the dressing on the patient—the attending who did the operation already left—and he asked me if I could do that kind of surgery. And I said, "Sure. This is what I've been trained for," although I had not done any of it except assist. He said that they needed to start open-heart surgery in Oregon and would I be interested in coming out. They were sending their patients from the Crippled Children's Division to the Mayo Clinic at that time, and they'd like to have the surgery done in-house if possible.

So I came to visit Portland at his invitation. It was a beautiful, clear, sunny day, which I didn't realize was really unusual. It was just such a beautiful place that I thought it was a great idea, I would come here.

MULLINS: Who were some of the others that sort of convinced you to come? Who was the chair of surgery?

STARR: Well, the chair of surgery at that time was [William] Livingston, but he was not here, he was on leave, and Clare Peterson was taking his place. I met Clare Peterson, and that was an interesting meeting.

MULLINS: We'd be happy to hear about that.

STARR: So, here I am, from New York City, and dressed up in a three-button suit and shirt and tie, and I have an appointment to meet Clare Peterson, who's acting chairman of the Department of Surgery, at about nine o'clock in the morning, and he breezes in about nine thirty. He's dressed in his fishing outfit, and he's got a basket filled with trout attached to it, and this was my interview. He had just gotten in a little early-morning fishing before coming to the office. So it was astonishing. But it turned out he was a very bright and literate and articulate person, and I got to know him and like him and realized that this was—the surface was not what—I mean, there was more underneath the surface than a guy, you know, fishing in the middle of the week before coming to the hospital.

MULLINS: So did you have a boss or were you the chief of—?

STARR: Yes, I had a boss. I was assigned to the Crippled Children's Division; I was not directly in the Department of Surgery. Dick Sleeter, who ran the Crippled Children's Division, was my boss. I had an office, not in the surgical area, but in the Crippled

Children's building, which was a separate building from the hospital, and right down the hall from Sleeter.

MULLINS: So what was your first pediatric heart surgery case in Oregon?

STARR: I arrived in August of '57, and the first case was in April of '58. During that early period, we were working in the—the first thing we did was set up an animal lab, and then we found a supply of experimental animals. There was no organized way of getting them, as a matter of fact. They came in in the middle of the night from various parts of Oregon. So we did a lot of animal surgery using various heart-lung machines and tooling up to do the clinical work.

MULLINS: And that first case, do you remember what it was?

STARR: Oh, yes. The first case was a ventricular septal defect in a beautiful five-year-old girl, and she did very well. Her name was Van Cleave, and her picture was on the front page of the *Oregonian* the next day.

MULLINS: Who else was on your team? Who was the anesthesiologist?

STARR: I forget who the anesthesiologist was on that first case.

MULLINS: But you had put together a team?

STARR: We put together—because I had to train a pump tech, someone to run the heart-lung machine. There were no organized training programs, so I found someone who worked in central supply, who had never been in an operating room, and trained him to run the heart-lung machine in the animal lab, and he became a very accomplished pump tech, now called perfusionist.

MULLINS: Did you have an assistant?

STARR: Yes. The surgical assistants were the residents in the thoracic program.

MULLINS: And did you do the case in the South Hospital?

STARR: We did it in the new University Hospital. The University Hospital opened in 1956, and I arrived in '57, and then in '58 was when we did our first case.

MULLINS: Somewhere in there Dr. Dunphy arrives. Can you tell us about the role that he played in terms of the department of surgery?

STARR: He played a pivotal role in the Department of Surgery, because he had all of the sophistication of the Eastern establishment. He had enormous social skills; he became the buddy of every important surgeon in town. There was no town-gown rift in any way. I mean, he circulated in all circles. He also was very powerful politically in…

[End of Tape 1, Side 1/Begin Tape 1, Side 2]

STARR: …the national surgical scene, and so he brought that with him to the University of Oregon. And also, he was a very definitive person. He would decide something and he would do it. I mean, he was not—it was a real surgical mentality that he had. So he added an enormous new dimension to the Department of Surgery at University of Oregon Medical School.

MULLINS: One thing he did was train an enormous number of academic surgeons who went on to great success. Do you have a theory as to why he was so successful, compared to other surgeons?

STARR: Well, he liked developing other people's careers, which he did, and he would push them. For example, when we did the first valve replacement, he—I was much more cautious than he. I wasn't ready to do the first case; I thought we should do more animal work. And he said, "Come on, Starr. I mean, look at what you've got here. I mean, all these dogs bouncing around in great shape. We have people over here that need this." And so he was very supportive in going from the laboratory to the bedside just as fast as possible. And there were others who felt the same way.

MULLINS: Obviously, at some point here you meet Lowell Edwards.

STARR: Yes.

MULLINS: Can you tell us about that?

STARR: Yes. I had an office at the Crippled Children's Division building in the parking lot out there, and Lowell Edwards was a retired engineer, and he was living in Portland and had a cabin out on the Sandy River and had worked for Weyerhaeuser for a long time and had a son who was in medicine, and he became interested in the circulation. He was trained as an electrical engineer, but, in fact, he worked mainly in hydraulics, and he developed the hydraulic debarking system that's used in most lumber mills. Of course, that's a big industry in the Northwest.

He was interested in the circulation as a hydraulic problem and developed mock circulation and thought that, since open-heart surgery was starting, that if the heart was truly damaged, why not replace it. So he was interested in developing an artificial heart, and he asked around town to see who at the Medical School he should work with, and I was the only guy up there in heart surgery, and so he came to visit me. It was at that visit that we had our seminal discussion as to what to do.

MULLINS: Was he truly visionary, thinking about mechanical hearts in the 1950s?

STARR: Yes, he was visionary, because he was also—he had an engineering mentality; in other words, what is it that makes it work, and what does the heart really do? It just pumps. Well, how does the pump work? Well, it has these valves and it has muscle. Well, why can't we build that? I mean, why not?

MULLINS: Was that the way he talked to you?

STARR: No, that's the way he thought.

MULLINS: So how did the conversation go, that first conversation?

STARR: The conversation was that—you know, we went through the niceties, social niceties, and then he came to the point and said he wanted to develop an artificial heart. I told him I thought it was too early, that, yes, we would need one, and it's a great idea, but let's do one valve at a time; because by then I had done enough exploration of valves to realize that we really needed to have a valve replacement.

So it was only a question of which one to attack first. We picked the mitral, because at that time there were some leaflet valves that could be used for aortic valve replacement, but there was no method of replacing the mitral valve, so—and that looked like a more difficult project, so that's the one we selected.

MULLINS: And he would make the valves, literally himself?

STARR: Yes. He had a shop, a little engineering shop, in Multnomah, which was called Edwards Development Company. He was quite a wealthy person, but fully retired and living off royalties from his previous inventions. These were very important inventions, not only in the lumber industry, but also he developed a fuel injection system for rapidly climbing aircraft so that they would handle—it would inject a liquid- and gas-phase fuel into an engine with rapid climbing aircraft.

One of the problems with fuel injection was a bubbling over of the liquid turning into vapor as the atmospheric pressure dropped. So he developed a method of taking care of this issue, which was used in many of our war planes during World War II. He received royalties on those inventions, so he had a financial base to operate from.

He had this development company, a small shop. It was just a machine shop, with one engineer working there alongside of him. That's where he would putter around.

MULLINS: Would he pay for the dogs, and all that?

STARR: No. He paid for all of the work done in his shop, but the animal lab was supported in part from the surgical budget of the Medical School and from the Oregon Heart Association. The first grant that we had was from the Oregon Heart Association.

MULLINS: Dr. Griswold, in one of these interviews, talked about how in that time he and you and others wrote a big program project grant.

STARR: Right. That was later.

MULLINS: Do you recall that?

STARR: Oh, yes. Once we had done the valve work, then we had lots of opportunities to work with the NIH on various projects; program projects and training projects.

MULLINS: But the point is that the money that got this started was more independent financing here in Oregon.

STARR: Yes. Some of it was Lowell's private money and the other was the Oregon Heart Association. I think our first grant was about ten thousand dollars, which at that time was still a sizeable—it was a sizeable sum, and that's all we needed.

MULLINS: Were you spending a lot of your time on this project?

STARR: All of it.

MULLINS: How about operating on the babies?

STARR: I didn't do any clinical work until our first case in April of '58. We were working entirely in the animal lab.

MULLINS: I want to make sure I understand. You met Dr. Edwards shortly after you arrived?

STARR: No. I met him in the spring of '58, and I arrived in the summer of '57.

MULLINS: We'll jump forward. You do your first valve in a human in the summer, I think, of 1960.

STARR: Yes, August 1960.

MULLINS: So between then and when you started work on this, can you estimate how many valves you put into dogs?

STARR: Oh, yes. We did about maybe forty, forty or fifty dogs; valves of different types. We had a very fast turnaround, so dogs would clot a valve in two or three days or we'd know it was not successful and we'd go back to the drawing board, and maybe five or six days later Edwards has got a new model, and then, five or six days after that, another one. We were able to go through, very rapidly scan the different possibilities. There was no

bureaucracy to deal with. I mean, it was just the two of us. He was obsessed with this problem; worked on it constantly.

MULLINS: Would he come to the operating room and watch you put in the valves?

STARR: No. No, he never saw an operation.

MULLINS: I know that at one point you were using the tilted disk.

STARR: Right, right.

MULLINS: Was that the first valve you tried?

STARR: Yes. The first one was very similar to current tilting-disk valves, bileaflet valve. But the dogs have a very vigorous clotting mechanism, and they would clot almost anything that you put in the mitral area within a matter of days. They looked good initially; then they'd go into pulmonary edema from obstruction of the mitral valve.

MULLINS: Dr. Starr, you must have been learning technical issues, details as to how to do this. Would you want to comment on that?

STARR: Yes. The technical details were evolving, but I had the background from my training with Max Chamberlain, who was one of the world's greatest surgical technicians. He was the one who developed segmental resection. But he had a style of surgery that could be adopted to cardiac, and this style was an absolute focus on the technical aspects of the procedure to make it flow smoothly and accurately and reproducibly. Any new method would be added, but not helter-skelter, so that the operations were almost the same every time. He looked at the operation like a construction site, and it has to run smoothly.

Now, after—you know, medical school attracts intellectuals, and intellectuals don't always think along—in that particular way, but Chamberlain did. So the same methodical methods that he used for segmental resection, we adopted in cardiac surgery, and that's why, I think, that we have been able to train so many really good heart surgeons, because of this emphasis on technical aspects of the surgery, performance issues.

MULLINS: Dr. Griswold describes the first patient as having spent six months in the hospital.

STARR: Yes.

MULLINS: End stage heart disease, and had had previous surgery on her mitral valves.

STARR: Yes.

MULLINS: Had you done the previous surgery?

STARR: I don't think so, but I'm not sure.

MULLINS: Can you just tell us about how it came about that you decided to do that first patient in August of 1960?

STARR: What happened was that Dr. Griswold came to the animal lab and saw what we were doing, mainly a kennel full of really active dogs. At that time we were doing these black labs, and they were marvelous animals, and they all seemed so healthy and friendly, and they all had valve replacements. He said, "You know, we have patients in the hospital. I have one right now, a young woman, who's in an oxygen tent. She's been here for months. We can't do anything with her. I think you should consider operating on her." At that time, I thought we would be another year or two in the lab. So that was my recollection of that first case.

We checked it out with Dr. Dunphy, and he said, "Oh, yeah, I would do it." So with both of their support, we were able to—we got it done. I told Edwards; he was surprised at the speed. So he went to his attorney to see, you know, what are the liabilities involved in me developing a valve and then implanting it in the person. There was no such thing as informed consent at that time.

His lawyer designed the first informed-consent form that I'd ever seen, and it listed the potential problems of having a valve replacement and informed the patient of these risks, and the patient had to sign, releasing us from liability related to these issues. So those were the steps that we took before the first operation.

MULLINS: I've seen pictures of the second patient, who survived for years and fell off a ladder.

STARR: Yes.

MULLINS: I've never seen a picture or the name of the first patient. Do you want to—she must have been courageous.

STARR: She was very courageous. My recollection is that she was a young black woman who had terrible rheumatic fever and was confined to a hospital-type of life for years, and then an oxygen tent for many months.

She consented to the operation with informed consent. We did a great valve replacement. It was the first one, and it was much easier than the animals. The structures were bigger, the left atrium was dilated, the tissues were stronger, and it was very easy to do her valve replacement, which we did. She came out of the operating room in good shape, and she went to—we had no intensive care unit at that time, so we used a wake-up area, anesthesia wake-up area, as an intensive care unit. That was the first intensive care unit at the Oregon Health Sciences University.

She went back to that area, and it was still early afternoon, and the blood pressure is fine, pulse is good, looks great waking up from anesthesia, and then she became fully awake. Dr. Hod Lewis, who was chief of medicine at the time, came in to see her, knowing that we were doing this first operation, and listened to the valve with a stethoscope. So that was the first artificial valve that he had ever heard in a living patient. I could still see him doing that, and his concentration on it.

Then, I left her to have some dinner and came back to the makeshift intensive care unit, and we needed to get a postoperative chest film. In those days, in order to get the film, we would sit the patient up and someone would hold the film behind them. We sat her up, put the film plate behind her, and I was there, helping to hold her. The film was done. While she was sitting up, she lost consciousness, and we laid her back on the cot and waited to see the film. The film showed an air fluid level in the left atrium, and by sitting her up, this air escaped from the heart, went to the brain, and she died almost instantly of severe cerebral ischemia, and so that was the first episode of air embolism that we ever experienced, and was different from the dogs that were done in a somewhat different position and had relatively a small left atrium and could not possibly accumulate that much air.

MULLINS: That must have been a crushing blow.

STARR: It was. I remember the sleepless night after that. But, I also remembered Dr. [Charles P.] Bailey's experience at doing mitral commissurotomy. He had five patients lined up; the first four died. He just went from one hospital to another, doing them, until finally one of them survived. So, to avoid a problem of continuing the project, we had other patients lined up for surgery than this first one, and so we had one already scheduled. We knew exactly what the cause of death was in this case. We learned about surgical techniques and approaches, and so on, and so the next patient was the first survivor, the second patient.

MULLINS: Dr. Blalock reported that when he did his first Blalock shunt, the chief of anesthesia refused to put the child to sleep. Too high-risk. And one of the junior anesthesiologists—my question is, were there supporters and were there critics at that moment?

STARR: No, there were—I never encountered a critic. Now, Dr. Griswold, when we started doing aortics, after we had a successful mitral series, we had again a—he was used to the patients surviving from mitral valve replacement. We started doing aortics, and we did lose—of the first five aortics I think we lost two or three. And he did say, "Why don't we just cool it for a couple of months and figure out what's going on and then restart the program?" which we did.

What it did was it gave us a chance to figure out how to protect the heart muscle from lack of its own blood supply. When we were doing the mitrals, the coronary blood flow was unimpeded; when we were doing the aortics, there was no coronary blood flow, and it took just long enough to injure the myocardium. So we figured out how to overcome that problem and then restarted the aortics.

MULLINS: So in September, within a month of this first valve, you went to a meeting, and you have there next to you a book.

STARR: Yes.

MULLINS: I'll set the stage. In September 1960, there was a conference on prosthetic valves for cardiac surgery. It was at the Edgewater Beach Hotel in Chicago, and you attended.

STARR: Yes.

MULLINS: Sponsored by the NIH.

STARR: NIH, yes.

MULLINS: Could I ask you to look at the book? I've got the things marked there. I know you might want to wear your glasses.

The first thing is, Dr. Starr, the list of participants is like a who's who of subsequent cardiac surgery in the United States. This was a high-powered meeting. Sir, how did you get invited to go to it?

STARR: I don't know exactly. It could have been Dunphy. It wouldn't surprise me if it was Dunphy.

MULLINS: Do you remember attending the meeting?

STARR: Oh, yes, very well. Lowell Edwards came with me.

MULLINS: I was going to ask that.

STARR: Oh, yes.

MULLINS: And you gave a presentation of your work, which I'd like to get to in a second, but number two, there, is a report from a woman, Dr. Nina Braunwald…

STARR: Oh, Nina Braunwald, yes.

MULLINS: …who was at the NIH. She reported on her first five valve replacements in human beings, with one several-months' survivor. Her valve—can you describe what kind of a valve she was using?

STARR: Yes. She was using a flexible cloth valve that contained cords from the free margins that would be sutured to the papillary muscles of the patient's own—inside the patient's own ventricle. So it was basically duplicating the structure of the normal mitral

valve, but in a flexible cloth material rather than in tissue. It was an imitation of a natural valve.

MULLINS: And, in fact, many of the reports in there are fabrics trying to reconstruct…

STARR: Yes.

MULLINS: And so the ball valve—the ball-in-a-cage valve was not very common, although Hufnagel had used it for years.

STARR: Right.

MULLINS: Can you tell us about—did you have a conversation with Dr. Braunwald? Do you remember what…

STARR: No. I remember the presentation, and I knew what she was doing, but I didn't think it would work over the long term, because the—it looked good to begin with, but then deposits of tissue occur on the cloth surfaces and they get stiffened; and, then, implanting them in so many different dimensions, you have to sew it into the orifice of the valve, then you have to adjust the cords just right to the papillary muscles. It looked like too complex a method of implantation, and also that the long-term durability and function of the leaflets would be in question.

MULLINS: In fact, I think two or three of the first five died in the operating room.

STARR: Yes.

MULLINS: It was a very technically…

STARR: Technically a very demanding operation.

MULLINS: She has some pictures in there, and I've marked them, of how she approached the atrium. They're elegant.

STARR: Very elegant.

MULLINS: In your own paper a year or so later, you—you know, you had a very similar approach.

STARR: Yes.

MULLINS: So, I wonder, did you discuss how to do this operation?

STARR: Not with her, no.

MULLINS: You figured out how to do it.

STARR: We figured it out, yes, but we were doing it in dogs for a long time—a relatively long time. Not a long time for now, but a relatively long time.

MULLINS: Sir, your discussion starts on page 319. As I understand it, you were basically invited to discuss your work.

STARR: Yes. Not to present, but to discuss.

MULLINS: You give a summary of your work in dogs, and then you report on the one case which you had done.

At that time, there seems to have been a lot of candor, Dr. Starr, regarding people saying to everyone exactly what they were doing and how it worked, versus this trying to hide our design from other people. Was that the feeling at the time, that people were trying to share information with one another to make it better?

STARR: Yes. There was a lot of information sharing, free sharing. The concept of intellectual property was not as developed then as it is now.

MULLINS: There seem to have been some young surgeons there and some old surgeons there. Was the cutting edge of heart surgery at that time young people like yourself?

STARR: It was a combination, it was a combination. The older guys, they were interested in doing this, too; very interested.

MULLINS: At the end of your talk, your last sentence is, "This valve holds much promise."

STARR: Yes.

MULLINS: That was a very confident and, it turns out, extremely accurate statement.

STARR: Yes.

MULLINS: How did you feel at the end of this conference, in terms of your own work?

STARR: Oh, I thought that we were going to go back and do it. In other words, the conference really didn't come up with a solution to the problem. It was a great conference, there was a lot of information exchanged, but the problem was not solved. But I knew that when we went back to Oregon that we would solve the problem, because we already had the animal work and we had this one human in which the prosthesis was well adapted to a

diseased human heart. That's all we needed to know, that there was room in the ventricle for that ball valve type of prosthesis, and that from then on we would be able to do it. So, yes, I left knowing that we would be able to do it.

MULLINS: The other presentation there at the end is Dr. Hufnagel presenting his ball valve. He was interested in the aortic position.

STARR: Yes.

MULLINS: Did you have a conversation with Dr. Hufnagel?

STARR: Not about this particular presentation, but on the next page are these leaflet valves that he was doing, and that's why we did the mitral first, because I thought the leaflet valves would really work out. And interestingly, new models of valves that are coming out now, but made of different materials, are very similar to Hufnagel's valves from back in 1957.

MULLINS: Do you consider him the real pioneer in the valve?

STARR: Yes, I do. And the reason is that he figured out that the valve would be actuated by the motion of the blood itself, that you didn't need something that opens and closes the valve, like you do in many engineering—many devices outside of the body. But in the body, you could open and close a valve according to systole and diastole of the patient's own circulation. That was a great leap, and it was that knowledge that we didn't need to have a forcible opening and closing mechanism that was synchronized to the heart in some way; the heart would open and close it for us. All we had to do was put it in. That was a great discovery on his part, even though it wasn't in the heart itself, it was in the descending aorta. But that demonstration was really important. Hufnagel was a brilliant mind. He developed these valves when he was working on a method of treating coarctation of the aorta. And so he was working for Gross in Boston and was making coarctations and fixing them and realized, "I could fix a coarctation if I put a Lucite tube between the two ends, I could do it real fast." Then he figured, "I could put a valve in the Lucite." And so that's how he came up with it.

[tape stopped]

[End of Tape 1, Side 2/Begin Tape 2, Side 1]

MULLINS: This is the second tape of the interview with Dr. Al Starr.

Dr. Starr, we were talking about Dr. Hufnagel. What was his relationship to Dr. [Dwight E.] Harken?

STARR: Well, they were both working in Boston. That's about the relationship. Hufnagel worked with Bob Gross, and Harken was a separate entity in his own life; I mean,

he was a real piece of work himself. Both very complicated men, and I don't think they were colleagues: they were not working together, they just happened to be in the same location. And, of course, Boston was a very vibrant, intellectual medical community, and so you'd expect to find many giant-type people working there.

MULLINS: So for the early part of the fifties, up until 1960, they had been trying to find a solution to the prosthetic valve but had not really been successful; am I correct?

STARR: Right, yes.

MULLINS: You returned to Oregon, and, then, how did the second operation go?

STARR: The second operation went really well. And then other problems that developed were the problem of infection, and that was a really serious issue, and for a brief period we stopped implanting valves and had a consultant, actually from Boston, come out and examine our total operation to see what the problem was. We had a staph infection, staphylococcus infection, that was devastating to one of our patients. At that time, it was not known how vulnerable the artificial device would be in the circulation to get infected, how easy it was to infect it.

MULLINS: Were the patients anticoagulated?

STARR: Yes. The decision was made beforehand to—two big decisions were made. One was not to use the valve that was successful in the dogs, and the other was to use anticoagulation, which we did not use in the dogs. In the dogs, to achieve long-term survival, we had to use a shielded valve; that is, a valve that had a silastic shield, like a diaphragm, and it would cover the zone of implantation, and any clots that formed at the zone of implantation would be covered by the shield and not break off and go to the brain.

The question was, should we use that valve in humans or not, and I felt the humans could—we would be able to use the unshielded valve because they don't clot as readily, but, to hedge our bets, that we should use long-term anticoagulation, at least for the first few years, and then maybe try without later. So that was our protocol.

MULLINS: As you were doing these operations, were you encountering other unexpected findings and difficulties?

STARR: Well, the major problems were air embolism, which we encountered; infection, which we encountered; another one was perivalval leak, producing hemolytic anemia. That was a completely unknown disease. Nobody had described—no hematologist had described hemolytic anemia related to an artificial device inside the circulation, because there were no artificial devices in the circulation. So that was an important aspect.

The other was mitigating the sound of the valve to see what we could do to make it less audible.

MULLINS: I'd like to discuss what it was like as the surgeon doing operations that you can't read about in a book and finding something that is unexpected. You must have had that happen. Was that stressful?

STARR: Yes. In a word, yes, it was quite stressful. But it was a kind of stress that's exciting stress. I mean, we—your own life is not on the line, so it's a different kind of stress than the stress I experienced in Korea, for example. It's more of an intellectual stress, trying to figure out—you know, nature's out to get you, so how can I get around it. It's that kind of feeling. It's more like a game stress than it is a war stress or a personal issue in your own personal life.

MULLINS: Is this where your training with Dr.—was it Chambers?

STARR: Chamberlain.

MULLINS: Chamberlain, was helpful?

STARR: Yes, it was. Chamberlain was a very cerebral, very physical engineering-type mind. There's a project, and let's do it fast, but also elegant. It had a flow, it was like a ballet. One thing had to lead logically into another; no horsing around, just very methodical, logical, and elegant.

MULLINS: So did you just have to teach yourself how to put the sutures in the ring, the annulus?

STARR: Yes.

MULLINS: Not too deep and not too…

STARR: Yes, all those things. The animal experience was very valuable. The humans were easy compared to the animals.

MULLINS: Well, you went ahead and I think did eight in '60-'61.

STARR: Yes.

MULLINS: Can you tell us about the circumstances that led to your presentation at the American Surgical in the spring?

STARR: Yes. We had these eight cases with, I think, six survivors. Dunphy was keeping track of what we were doing, and so he said, "I think you ought to present this stuff now." I said, "We only have eight cases, Dr. Dunphy, and we have no long follow-up." I was a more intellectual type, but he said, "Look, Al, the American Surgical is coming up in the spring. I'd like to have a nice paper from our medical school here, and I'll make sure that you get on the program. Send the abstract in," which I did. And he did make sure I got on

the program. And not only that, he got Dr. Michael DeBakey as the first discussant of the paper. He was really a powerful fellow.

MULLINS: Why is Dr. Dunphy's name not on the paper?

STARR: Oh. Well, he was not—on the first paper?

MULLINS: Yes, sir.

STARR: That's a very good question, because in those days authorship was meaningful; that is, you had to really have done the work and written the paper to have your name on the paper. Now you see papers with five or six names, and the department head is there as the last name, or, if he wrote the paper himself, is the first name, but a lot of people in between who contributed something to the paper but not the authorship, true authorship. It was a different time.

The issue that came up, though, was [Herbert] Griswold, and should Griswold's name be on the paper or not. That I made a conscious decision on, and that was that this was a surgical paper. It did involve the physiology or the diseases of the mitral valve. He would have been on the paper if we were writing this paper now. The other thing was that I wanted Edwards to be undiluted, and I wanted my own authorship to be undiluted, and so I did it.

I think Dr. Griswold was peeved to some extent, but not a lot. And we did many, many papers after that first paper together, with numerous coauthors from—including him and members of the Department of Medicine. But I just wanted that first paper to be clean and neat as far as authorship was concerned; unambiguous, in other words.

MULLINS: Dr. DeBakey is the first discussant, and he—what I've read is he says, well, he'll have to reconsider the ball valve as an option. And then the second discussant was Dr. George Clowes, who was very complimentary. It must have been a real thrill to present at this meeting.

STARR: Oh, it was. I mean, there I was, a young guy, with all these well-known surgeons. What I was surprised at was the collegiality. I mean, they really took me under their wing, so to speak, and I didn't feel estranged in any way. Emotionally, it was a great experience. It was like a young ballet dancer, you know, with all the superstars. So it was really a great time.

What DeBakey said, essentially, was that if he—he didn't say it in the discussion, but he told me afterwards that if this application for research came in to his committee in the NIH, he would have turned it down. So I learned something from that statement, too. He was surprised it was successful. He would not have anticipated that this would be the answer to mitral valve replacement, at least for the time being. His discussion was quite short.

George Clowes was a more fatherly, kinder person, and it doesn't surprise me that he was complimentary, because in person he was very supportive and made sure I came to some of the dinners, and whatnot, and was more of a father figure.

MULLINS: It seems like maybe some senior surgeons missed the opportunity to get up and say this is probably the most important paper…

STARR: Those are the only two, right. I don't think they had figured it out completely. Also, remember that the American Surgical is not primarily a cardiac organization, it's a general surgical organization.

MULLINS: Following your initial experience, you and Dr. Edwards modified the valve. Can you tell us about how those modifications—in general, what the process was?

STARR: The modifications were very important. The first valves were very crude, and they were made by hand out of acrylic; carved. And the silastic for the ball, we got crude silastic from Dow Corning, and he made molds for it and practiced how to make them. And also, we had arrived only at tentative dimensions. We needed more valve sizes and we needed to address various issues of durability and corrosion. So within the first five years we had a lot of tuning-up to do, fine-tuning of the device.

MULLINS: How would that go? You would say, "Dr. Edwards, I need this;" and he would say, "Dr. Starr, I need that," or, "I can do this?" Was it an iterative process?

STARR: Yes, it was back and forth constantly. We were collaborating—three or four times a week we'd have discussions. One time, I was out camping on the coast of Oregon, and the forest ranger knocks on my tent at eleven o'clock at night on a Saturday night. It's Edwards. He has some ideas he wants to run past me. It was that kind of collaboration.

MULLINS: Now, clinically, you must have been very busy.

STARR: Yes.

MULLINS: Can you tell us what that was like?

STARR: Well, we started the open heart program. It already had matured as far as pediatrics were concerned, but there were still new operations to do in pediatric cardiac surgery, as well as this huge task of defining the indications for operation, developing outpatient services, the anticoagulating clinics, referral lines to Corvallis and other cities, in Portland, bringing internists into Portland to see what we were doing, and establishing the program.

MULLINS: Dr. Griswold talks about people coming from all over the world.

STARR: Yes.

MULLINS: You were the only opportunity they had, if they had…

STARR: Yes. We had quite a few overseas patients.

MULLINS: So was this physically demanding for you? Were you working all the time?

STARR: Well, I had two children during the period, so I wasn't working all the time, but a lot of the time.

MULLINS: I'm just trying to get a feel for what—were you immersed in your work?

STARR: Yes, it was immersion. Yes, it was.

MULLINS: And, again, it was stressful but challenging.

STARR: Yes. It was game stress, it was not personalized stress. They're a little different.

MULLINS: And at the same time, you were increasing the number of pediatric cases you were working on.

STARR: Yes.

MULLINS: The changes that occurred in the valve design were quite publicly reported in the medical literature. Did you ever have a problem with someone suing you because you had a faulty valve and you changed it?

STARR: There were early suits; there were liability issues. The informed consent did not make us immune from suit. The suits were primarily against the manufacturer. They were from various causes. I remember testifying at trials against Edwards Laboratories, which was the company that Edwards had founded, as an expert witness in various suits.

MULLINS: My point is that weren't—in some ways, it would have been easier just to keep quiet about it.

STARR: You mean about complications?

MULLINS: About complications and valve…

STARR: No, no. See, there I thought you were alluding to something else. With regard to reporting—so, we made some very important decisions at the very beginning, and that is that we would be absolutely open about everything that happened and, secondly, that we would establish a long-term follow-up system so that we would know what happened over the long term. So we started a unit called Medical Data Research Center, and all of our

patients, from the first patient on, have been followed. And we have, for example, recently written a paper on the forty-year follow-up following valve replacement. So, those were two very important deals: complete openness and long-term follow-up.

MULLINS: And you and Dr. [Edward] Lefrak wrote a book about valves, and in there you discuss, for instance, the DeBakey valve, and you say you can't reach a conclusion because there's no reported follow-up.

STARR: Right.

MULLINS: Were others trying to duplicate your valve?

STARR: There were a few, mostly out of Texas. But the major next step was a different type of valve, and that was one in—instead of having a ball in a cage, there was a disk that tilted open. At first there was a disk that just glided open, and then there was a disk that tilted open. The tilting disk was a Bjork-Shiley, [Donald] Shiley having been one of Edwards's engineers. Shiley was the guy who worked with Edwards here in Multnomah, in his little machine shop. He learned enough about valve design to design one himself and then started his own company called Shiley Laboratories, which then was bought by Pfizer and then sent—manufactured these valves for all over the world.

MULLINS: Many of the valves that were developed in the sixties seem to have lasted only a brief time.

STARR: Right. They mostly disappeared.

MULLINS: And the Starr-Edwards valve was used—I don't know, is it still used today?

STARR: It's used today in patients in whom anticoagulation cannot be maintained perfectly. It's a very safe valve for patients that are not well anticoagulated.

The other, more sophisticated devices that we currently use in our practice in this country, they do require very precise anticoagulation, which is easy to do in a developed country, but not in all parts of the world.

MULLINS: Did you feel you were competing with these other valve developers in the sixties? Was there a sense that…

STARR: No. I guess I should have thought we were, but I was so pleased with our engineering team that I felt that we were always on the cutting edge. I mean, the engineers that Edwards was able to collect in the company that he formed were guys from our space program, and they had been working on the Atlas missile. And this was the first company that was a bio-industrial company, the first one. And so it attracted engineers who had been working on weapons systems to a field where they're working on humans and life-extending systems. So their enthusiasm and their devotion to the projects were unbelievable. And so I

always felt that we had our pick of intellectual talent and devotion to maintain a presence in the valve field.

MULLINS: We have here one of your aortic valves, so I was wondering if you could tell us about—and perhaps show the camera and tell them about the development of the aortic valve.

STARR: Well, we started developing the aortic valve in 1961. We had a brief period where we stopped, and then we continued, and by 1965 we had the final form. This valve looks very simple, but it's a very sophisticated device. The sewing ring, especially, is very compressible, allows fibrous in-growth into it, handles sutures very well. It's basically the only sewing ring designed by a surgeon; all other valves, the sewing rings had been designed by engineers who had never sewed a valve in place under the circumstances of open-heart surgery, and so they don't have a good feel for what it takes in a sewing ring.

The silastic ball is also quite sophisticated. It has barium in it, so it shows up on the x-ray. The lubricity of blood has been studied by Edwards. As an engineer, he was the first one in the world to look at blood as a lubricant and get an SAE number for blood. And what he found was that he could design the valve so that the blood film between the poppet and where it touches is never broken, and that's why the valve is so durable. I mean, you look at a valve that's been in for thirty years, it looks exactly the same as this. How come? Well, it doesn't corrode because it doesn't have any iron and it doesn't wear out because it's constantly lubricated with blood, and the blood is constantly being replenished, so it's a very neat device. The excursion is carefully measured so that the flow pathway around the ball is optimal. The struts are as thin as they possibly could be without disrupting the film of blood on it. It's a very sophisticated device.

MULLINS: The development of the aortic valve replacement operation, was that technically more challenging for you as the surgeon than the mitral valve replacement?

STARR: Yes, it was more challenging. We had no animal model, and we had to interrupt the blood supply to the heart muscle. We had to figure out a way to preserve muscle function, and our first method was to use ice-cold blood. By cooling the heart muscle down to about ten degrees we were able to operate on the aortic valve for an hour or more and have a viable heart muscle at the end of the operation.

MULLINS: How good was the pre-op workup with these patients?

STARR: The pre-op workup of patients was gradually changed in sophistication as the field of cardiology developed. There was no echocardiography when we started, so we had no way of looking at these valves before surgery, except if we saw calcium on the regular x-ray. There was cardiac catheterization, which was very helpful in defining the degree of obstruction or regurgitation, but there was no coronary arteriography, so we had no idea whether the patient had concomitant coronary disease or not.

The postoperative measurements, we had no way of measuring cardiac output, no Swan-Ganz catheters, and so it was pretty crude. But we became very excellent clinicians, using stethoscopes and feeling pulses and looking at chest x-rays and listening to sounds. That was the way it was.

But then, as these new elements developed, we incorporated them rapidly.

MULLINS: So you put the patient on bypass and you opened the aortic—and find the unexpected. How often did that happen?

STARR: Well, there were always surprises. We had no angiography at that time, so we would have to recognize what the pathology was.

MULLINS: As a master surgeon who has trained surgeons, do you find that some of them can tolerate that and some of them can't, the unexpected?

STARR: Yes. The most important attribute that a surgeon has to have is the ability to deal with the unexpected without losing it, so to speak. So you have to be sure that the—when the going gets rough you actually are more calm and analytical than at other times, instead of becoming flustered. That's a very important surgical characteristic. And most of the surgeons—I'd say 99 percent of the surgeons that have trained here with us have that mentality. They will not get flustered if they encounter an unexpected event. Some will, and if they do, they're really—they could be great performers, but they're essentially dangerous. The more accurate the diagnosis is, the less they endanger the patient. But it's a very important surgical characteristic, to be graceful under fire, and that takes a certain mentality.

MULLINS: I'd like to ask you about Charles Dotter. Can you tell us about when you met Dr. Dotter?

STARR: Charles Dotter was head of the Department of Radiology shortly after I came, or maybe when I had come to Oregon. He was a slim, athletic fellow, in great shape, mountain climber, restless, hypomanic constantly. I never saw him depressed, I never saw him normal; he was always in a hypomanic state. He ran a great Department of Radiology.

His major driving force was to do something with the image. He did not want to only provide the image, he wanted to do something with the image. In his office he had a hammer in a frame as a symbol that he wants to do something, he just doesn't want to see something. So that was his unique characteristic.

MULLINS: So we had two young faculty members from New York who were being tremendously innovative in Oregon. Were you collegial or friends?

STARR: Oh, yes, we were great friends.

MULLINS: Did he encourage you and did you encourage him?

STARR: It was a two-way street. When he did the first coronary arteriogram, it was so meaningful to us, because for the first time we could see the coronary arteries. And he did that—I mean, the guy was really brave. He did the arteriogram by putting a catheter in the ascending aorta, stopping the heart with acetylcholine and injecting the contrast into the ascending aorta, producing cardiac arrest on a live patient. Of course, the acetylcholine would be worn off within seconds, and the heart would start again. But he had no assurance upfront that that would be the case.

So that was the kind of courage that he had, to be able to do something so dramatic and knowing that he was not going to jeopardize the patient, although it was astonishing to see this heart stop, the patient still talking, and then start again before the patient loses consciousness.

So that was a great addition to aortic valve surgery because now we could see if there was any coronary artery disease along with valve disease.

MULLINS: He was doing somewhat controversial procedures with dilating strictures and arteries. Did you—and you were doing some controversial things.

STARR: He was more controversial than I was.

MULLINS: Dr. Judkins, I think, is the name of the fellow who worked with him and developed the catheters. Do you remember Dr. [Melvin] Judkins?

STARR: Oh, yes, very well.

But I have to get back to Dotter first, if you don't mind, because the coronary arteriography was just the beginning. The development of coronary artery dilatation, that was really Charlie Dotter's idea. And the interesting part of that was that he went to the cardiologists to get their support for this program of coronary artery intervention. The cardiologists thought it was a crazy idea. He went to the Department of Surgery, myself and my colleagues; we thought it was a great idea and told him, "Yeah, any patient that we see, we will be happy to send to you."

So there we had the anomalous situation of having surgeons support an interventional cardiologist who was eventually going to put them out of business, or could, whereas the cardiologists, who now use this tool as a mainstay of their practice, who were not really conducive to this new technology at the time he developed it.

[End of Tape 2, Side 1/Begin Tape 2, Side 2]

MULLINS: We were going to talk about Dr. Judkins and his development of the coronary artery catheter here at Oregon. Do you think that was really innovative?

STARR: Judkins's work was tremendously innovative, because at the time, the idea of finding the coronary ostia to make an injection, that was a real problem. People were trying to develop steerable catheters that you could turn in every direction. Edwards himself was working on a steerable catheter.

But Judkins was the first to figure out, if I had a few formed catheters, I could put them on a mandrel and they could straighten out, and I can get them up into the—I don't have to go through the brachial artery, like current methods, I could go through the groin, and the catheter will remain straight; then I pull the guy-wire out and it assumes its curve, and I have a curve for the right coronary and a curve for the left coronary, and they work.

And his method of coronary arteriography revolutionized the field of coronary artery visualization, and to this day, you know, is a very important adjunct.

MULLINS: When did you start doing coronary artery bypass surgery?

STARR: We did our first bypass surgery in 1969. Actually, before then we did what was called the Weinberg operation, where we take the internal mammary artery and put it in a tunnel underneath the anterior descending coronary artery, but it was not as effective as a direct coronary anastomosis. So we were one of the first providers of coronary bypass surgery when it became available in '69.

MULLINS: I would like to talk about a critical decision that others have described, made in mid-sixties by Dean [David] Baird, and the decision is whether the University of Oregon Medical School is going to make a major commitment to developing itself as a heart center or not. He decided not to do that. Can you tell us about that decision and who was involved and your recollections about it?

STARR: Yes. That was not the decision that Dr. Baird made. Dr. Baird did not decide that the Oregon Health Sciences University should not have a major heart program. What actually happened was that we were filling the University Hospital up with patients from all over—not just Oregon, overseas as well—and he had to run a medical school, and you needed all kinds of patients. You could not have a heart hospital. You'd have to have a hospital that had multiple disciplines represented.

So he called me in to the office—at that time he was the dean—and he said that, "We can't accommodate your practice of your group, Al. Either you're going to end up leaving Oregon or we have to make some other accommodation." And he said, "I don't want to lose our program, so I don't want you to leave. So I think we have to start an ancillary service at another hospital. I know the Portland Clinic group very well, and they work primarily at St. Vincent Hospital, and I think you're going to have to do some cases over there."

And so I spoke to Dr. Griswold about it, because he was based entirely at the University Hospital, as I was, and he said, "Yeah, that's what we have to do." And actually, the first operation we did at Providence St. Vincent was a patient of his with pulmonary stenosis, and he came to St. Vincent to see the patient postoperatively.

So the decision was not to have a first-class major cardiac service at the medical school, it was simply too big for the physical plant to manage. And the alternative, as Dr. Baird saw it, was that he'd lose the program in its entirety, whereas if we had an affiliated program at another hospital, that he would be able to retain it here, in his own institution, and also for the sake of the medical care in the state.

MULLINS: The interesting thing that I'd like you to comment on is why you never took one of those offers to go somewhere else, Dr. Starr. I mean it must have—what I'm sort of interested in is your recollection of what Oregon was like. It was this regional medical center that wasn't that big a deal, and you and others, Dr. Edwards and Dotter, were turning it into an international—were you ever tempted to go back in triumph to the Mass General?

STARR: Well, I was asked a lot, but it was basically easy to turn it down. For one thing, I had a great base of operation here. We had an animal lab that was—it would be hard to duplicate. It could be, but it would be hard to duplicate. It had all the people that had been trained and working with me. I didn't want to start all over again.

And secondly, and probably more importantly, I loved Oregon and the surrounding areas and the natural beauty of the place and the lifestyle of the place. I had been to the big city, I had been to the Ivy League, and I knew what they were like. They were much more constrained, formal societies. Here, we had a lot of mobility, a lot of opportunity, and so I was attracted to that. And as far as the intellectual climate was concerned, I believe we carry the intellectual climate in our own minds, in that once it's formed you don't have to be plugged in to intellectual society in some other location, you bring it with you and you use it for the rest of your life; it doesn't matter where you are. Those were the reasons why I did what I did in terms of staying here.

MULLINS: Dr. Starr, it does sort of beg the question, do you think if you had been at Columbia or Dr. Dotter had stayed in New York that the environment would have supported your ability to be innovative?

STARR: Not as much, no, no. This was real pioneering country, and it has remained that way. I think it's no accident, for example, that open heart surgery started at the University of Minnesota, not in Boston or Philadelphia, and that the Mayo Clinic, in a little town in the Midwest, became the largest provider of cardiac services at the very beginning of thoracic surgery in this country. And it's where you don't have an ingrained aristocracy, so to speak—not precisely that, but that kind of a hierarchical situation. It allows things to develop much more rapidly.

MULLINS: I'd like to talk a little bit about Edwards's laboratory as the company, if that's okay.

After the valves began to be successful in the sixties, is that when Dr. Edwards founded the lab?

STARR: Yes. It was shortly after the first case.

MULLINS: And so this company began to make the valves.

STARR: Yes. He felt an obligation. Edwards was a very interesting guy from the ethical point of view. He was a man who felt we had something, it was lifesaving, now I have an obligation. He didn't look at it as a business opportunity, he looked it as an obligation. He was a Quaker, a very moral man, and so he felt this need, and so it was only a question of where he would do it. Would he develop a company here in Oregon or would he go to some other location? He ended up going to California, mainly because of tax considerations in Oregon.

MULLINS: The company was remarkable in that it made Swan-Ganz catheters and it made Fogarty catheters.

STARR: Right.

MULLINS: Can you tell us about Tom Fogarty, another Oregon…

STARR: Yes. Well, Fogarty was a resident in general surgery under Dr. Dunphy. He was developing an embolectomy catheter for removing clot from the bifurcation of the aorta that had come down, usually from the heart, and was working in his little apartment, trying to assemble these balloon catheters. At that time, Edwards Laboratories was already established, and I told him, "I think you should go to Edwards and have them make them." They had a lot of smart engineers, and, besides, Edwards was already into catheters at that time, trying to develop a steerable catheter for coronary arteriograms. So that's how he got started with them.

MULLINS: What was kind of the eventual trajectory of Edwards Laboratories? Did he own it till he died?

STARR: Edwards?

MULLINS: Yes.

STARR: No. What happened to Edwards was that they were a privately-held company; they then were sold to American Hospital Supply, and then American Hospital Supply was purchased by Baxter International, and then Baxter International spun it off as a privately-held company, and then the company went public and now is a public-owned company, with shares listed on the New York Stock Exchange.

MULLINS: I think you've given at least one talk along the lines of beware the medical-industrial complex. Have I got that wrong, or do you want to comment on that?

STARR: Well, no, not beware. My presidential address for the Society of Thoracic Surgeons was on the biomedical-industrial complex, because, you know, I participated with

Edwards in—I wasn't a part of the company, but I knew this was the first of a breed, and I felt that it was a prototype and that this industrial base for surgery was absolutely essential to the further development of surgery, that we could not rely on the National Heart Institute in Washington to come up with all of the ideas and all of the funding for new products, and that we needed an industrial base, and Edwards was the prototype of that. And by the time I gave my talk, there were other companies similar, like Medtronic and Cordis and others, and I described the individuals who had started them and what they had contributed to medicine.

So I'm very much in favor of building this industrial complex and enhancing the interface between the physician and this complex. That interface is absolutely essential for advances in medicine, both in the pharmaceutical industry and the device industry.

MULLINS: The NIH, thirty years ago, made a major commitment to molecular biology. Do you think that's paid off?

STARR: Yes, I think the basic research has paid off, and it's led to a much better understanding of fundamental aspects of biology, and they left it to the private sector in the pharmaceutical industry and device industry, using risk capital, to develop the bedside—the bench-to-bedside type of research that is so important in clinical medicine.

Now, the NIH is now refocusing on bench-to-bedside medicine, and they would like to grant—they're inviting invitations from medical institutions to submit grants for this purpose, not for basic science, but particularly from laboratory bench to the patient right off the bat.

MULLINS: Dr. Starr, you're the paradigm, in many respects, of the practical surgeon who solved a very important problem. In your lifetime I think there have been many examples of that and not so many examples of where surgeons have used basic science to come up with a solution. Are there other practical surgeons that you admire in the twentieth century?

STARR: Yes.

MULLINS: Do you want to just comment on a few of them? Who are your heroes? Who do you remember and admire?

STARR: Den Cooley is my hero, because he's brilliant, he's affable, great personality, he runs something really big, he's got big ideas. He was very kind to me as a young intern coming in from New York, from a different culture entirely, and took me under his wing. And he was also very young, himself, for his station in life at that time, and even now. And he was very innovative. I mean, the operations devised by him are a long list. Just what comes to mind immediately is removing left ventricular aneurisms. That's his operation. And then many others that he pioneered. So he's one—a living surgeon that I truly admire.

MULLINS: Would you want to comment on Dr. [Norman E.] Shumway, who recently died?

STARR: Yes. Another close associate who I knew very well, and very different from Den Cooley. Shumway was a quiet, more self-effacing individual, a real intellectual, a little shy, careful, methodical, yet you couldn't stop him; if he wants to go forward, he's going to do it. The way he attacked transplantation in a very methodical way, the animal models, the care developing immunosuppressive agents that would work in animals first, and his caution; and then his equanimity with Chris Barnard having done the first transplant and not getting unnerved, just proceeding in a logical way to really laying out the field.

So if you look at both, I admire them both. They have different characteristics, but Shumway was one of the great surgeons at one end of the spectrum and Barnard was another one at the other end of the spectrum, a real shoot-from-the-hip, but he hits the target, too. So you have two very different guys working in the same field.

MULLINS: One difference is how they handle the public relations parts of things.

STARR: Yes.

MULLINS: Could you comment on the role of surgeons and being notable and personalities, please?

STARR: Yes. The public relation issue is—so much depends upon your personal attributes rather than your professional attributes, and so you see the whole spectrum. Shumway at one end, a quiet and retiring and modest individual, and then others that are very self-promoting, and yet they can all make major contributions. It's more a matter of personality, I think, than anything else.

MULLINS: You've trained a lot of surgeons through the years. Can you comment on your role as a mentor and as a teacher?

STARR: Yes. We've trained a lot of surgeons, both Americans and overseas, and it's very enjoyable to do that, especially if they have talent. And most of them, by the time I see them, they're talented. And the other thing is that we've got a real good way of showing them how to do things, so we're very successful in taking someone who really doesn't know the ropes and turning them into really good heart surgeons by using Max Chamberlain's choreographed approach.

For example, today we had a visitor from Italy who's now the head of a department in Torino and is here to escape the Olympics. And when he got back to Italy—that was in 1982, he got back to Italy, he was one of the few surgeons who had this methodical approach, and older surgeons came to watch him operate to learn how he did it. And so that's been—the fun of the training has been to have such results, which confirms the way you have choreographed the surgery yourself, that it's recognized from others that your trainees—that these guys really know how to do the surgery.

It's a different style. And all of our trainees have this style, and they're in China, India, all over Europe, and I'm really proud that this Portland style is a part of cardiac surgery in so many different parts of the world.

MULLINS: It was sometimes said that Dr. Dunphy, himself, was not a terribly talented surgeon, but getting back, he trained many people. What does it take to sort of turn out professors or people who are innovative? Would you want to comment on that?

STARR: Yes. I think what it takes is to create an environment where they could do their thing. So everybody is different, and if you're running a service, you don't want everyone in exactly the same mode. You don't have a prototype: "You have to fit the prototype otherwise I'm not going to hire you." You need heterogeneity in the service. Some guys are going to be intellectual, they're going to write a lot of papers; other surgeons are going to be great performers in the operating room, they're going to want to operate all day long. Let them do what they like to do. I think that's the way to produce a really good service. Give as much elbow room to young people that you have on the service as you possibly can.

MULLINS: Another one of your contemporaries is Dr. Viking Bjork. He was at that first meeting and developed an elegant valve. Did you want to talk about Dr. Bjork?

STARR: Truthfully, I love Bjork. He is a great Nordic guy; let me put it that way. I mean, he's very hospitable, very intelligent, made numerous contributions to all fields of thoracic surgery. He was working on bilateral pulmonary resection for tuberculosis in the 1940s. He was one of the first to use a ventilator on a patient after thoracic surgery. He developed ventilators.

Then he came to the United States and he worked at Johns Hopkins while I was there, and I met him at that time. He was a young research fellow, and he was working on a disc oxygenator, a way to oxygenate blood without blowing bubbles into it; a real advance and one that became a preponderant method of oxygenation for a long time in this country. He became chief of thoracic surgery in Uppsala, which is somewhere outside of Stockholm, and when Clarence Crawford died, he became the chairman of the department of surgery in Stockholm. He hosted numerous international meetings, a very marvelous host.

And he got involved in the heart valve field with his tilting-disk valve. He was one of the early users of ball valves in the aortic position, and these ball valves in the aortic position, if the aorta is very small, the ball actually becomes obstructive and interferes with flow, and so he felt there was a flaw in this valve and he wanted a different type. So when Shiley came to him with the idea of a tilting-disk valve, he thought it was a great idea, because he was looking for just that kind of device. So he made all these advances.

The other thing about him is he's very adaptable. He developed a research lab in this country, working in Palm Desert at Eisenhower Medical Center. He's just a great all-round, innovative fellow. I like him a lot.

MULLINS: I'd like to sort of end up here with just a few straightforward questions. You've received many honors through the years. Obviously, that was a pleasure, but how do you feel about having this national and international recognition? And which one of the honors meant the most to you?

STARR: Well, it's just fun, that's all. I mean, it's not an essential part of my life, but it's a fun part. It's nice to be so acceptable.

MULLINS: And how do you feel when a patient who has a valve you put in twenty years ago comes up to you?

STARR: I feel good about it. I don't go a day without having some evidence of past work brought to bear, and it's really a great feeling.

MULLINS: Do you enjoy surgery?

STARR: Yes, I do.

MULLINS: There was a survey of surgeons, and I was surprised to find that 25 percent of the surgeons over the age of fifty, who are good surgeons, when asked "Would you do it again?," said no. I'm not sure why. But you've always enjoyed surgery.

STARR: Yes.

MULLINS: Never wished, "This is just too hard on me, I wish I'd been a nuclear physicist or an economist or something?"

STARR: No. Now, but, if I can make a deal—not with the devil, but if I could make a deal that I would come back as another individual and start out in economics or start out in physics, yeah, I would do it. But for this life, it was a great ride, and it's still going on, because we still have—to me, I'm basically more interested in the future than I am in the past.

MULLINS: I think that kind of the last topic I'd like to bring up is your last years' relationship with Oregon Health & Science University, and I would appreciate if you could just tell us what you would like to tell us about that.

STARR: Well, I'm a professor of surgery at the Oregon Health & Science University. I've had a great career there, and then I had a second career in the private sector.

MULLINS: In your lifetime you've seen…

[tape stopped]

MULLINS: We're on Tape 3, and I would like to get an answer to my question, is there a favorite award or recognition or event that you remember particularly?

STARR: Well, I've had a lot of awards, but I think what stands out in my mind is one that I got from Princess Anne in London. That was very formal, and it was an honorary doctorate from the University of London. And you get dressed up in this British outfit, a British academic outfit, and come up, and it's like getting a knighthood. You sort of kneel in front of the princess, and she puts this thing on you. There were a few other people getting that honorary degree as well, and some of them—one of them was the head of British Petroleum. So I really knew I was up in the top tier. And she was a lovely lady, too. The first and only princess I have met, and a very nice person, and so it was a memorable award.

I've got a lot of other awards, but the pomp and ceremony of that particular one was orchestrated only the way British royalty could do so.

MULLINS: I was asking about your relationship through the years with the University of Oregon and Oregon Health & Science University, and certainly the university has gained an enormous amount from the relationship. I'm going to make the observation that I think in your era there was the emergence of many powerful academic cardiac surgeons who had an influence in the United States: John Kirklin, DeBakey, Shumway, [Frank C.] Spencer, these men were very powerful. Do you want to comment on the role of cardiac surgery as it emerged? You were at the beginning, and now it's, in some ways, some people say, with interventional radiology, perhaps on the down slope.

STARR: Well, there are basically four generations of cardiac surgeons. It's a bit more complex than your question. The first generation were the really great pioneers, and that was Kirklin and [C. Walton] Lillehei and Blalock. They really started the field. I was just training at the time, so I'm really the second generation. I was the young kid on the block that they adopted, and so I hung out with them, but I really wasn't one of them. I was second-generation heart surgery.

And that second generation did have a lot of influence. The first generation had a tremendous influence; the second generation also had a lot of influence because there weren't that many of them. And then the third generation: that is the people who are, let's say, twenty years younger than I am, there are so many of them that you can't pick a handful out and say, these were the guys that led the field. And right now, we're in the fourth generation of surgeons; that is, fellows who are in their thirties and forties, and there are just a lot of them, and they're doing work themselves which far exceed in benefit to the public than the first generation and second generation did. I mean, they're doing marvelous work, but there are so many of them that it's more generic…

[End of Tape 2, Side 2/Begin Tape 3, Side 1]

MULLINS: I think one of the great things you've done in your career, with your colleague Gary Grunkemeier, is report the long-term outcomes. I mean, we hear a lot of talk in the new millennium about outcomes, but you were doing it right from the start.

STARR: Yes, from the get-go.

MULLINS: Can you comment on your vision of the future in terms of outcomes?

STARR: Yes. I think you put your finger on a very important topic in medicine. The measuring of long-term outcomes is really important, for a variety of reasons; certainly, to know the effectiveness of treatment over the long term. I mean, the medical delivery system is one of the few business enterprises where you don't know what your product is like many years, or even shorter than that, after you provided it. You only know what it was like when you were delivering it. And so we have to upgrade medicine to what is common practice in the business world, to evaluate your product over the long term.

And if there's any problem with the product, you want to know it, and that product is carried by the patient in their health status. You need to know the health status.

But now, even more importantly, in addition to knowing the medical details of the product, you need to know the costs involved. What is the cost-benefit ratio of what we're doing, what is it producing of value? How can we measure that? And let's do it prospectively instead of retrospectively. Like we do the medical information prospectively for cardiac surgery in our own service, why can't we do that with other services as well? And then why can't we add to it the financial aspects, which are important. Pretty soon we're going to have to make some very important choices about selecting different therapies, their efficacy and what their costs are over the long term, and we need to have that information.

So this is where my—my idea is now to expand our knowledge base with long-term prospective studies of the patients that we're currently doing.

MULLINS: Recently, in South Korea there was a scandal about fraud in research. I gather that the investigators were so committed to trying to make it look successful that they couldn't face the truth. As a man who faced the truth through the years, how do you understand what's going on here, that there's fraud in science?

STARR: Well, there are a lot of different types of people around. I mean, we're not a homogeneous species. We all have different DNA, different attitudes, different exposure, different cultural issues. And so we're going to find a lot of diversity, and we'll find all kinds of people. And if one of them is an investigator in medicine, they will—and they're dishonest, they could be dishonest in their research just as they might be dishonest in any other business dealings. We have to pay attention to the fact that there are all kinds of people in this world and you can't take everyone at face value and assume innocently that they're all going to be totally honest.

MULLINS: So through the years if somebody criticized your work, or come up with alternative valves who really were not entirely being honest, have you encountered that?

STARR: No. No, I have not.

MULLINS: Excellent.

Kind of the next to last topic is the issue of informed consent. I'd like to get your thoughts on that. Obviously, through the years you've gotten informed consent in a lot of people in high-risk situations. You talked about the future, needing outcomes. So I think it's even more of a challenge for us to say to the patient, "I can fix it today, but it may not make you better tomorrow." How do you react to patients? What have you learned about talking to patients before surgery?

STARR: Well, there are two elements. One is informed consent, and the other is trust. So you cannot consider one without the other. If you give someone a twenty-five page document that lists all of the possible dangers of what you're doing and they don't trust you, the document is valueless. On the other hand, if you say, "Trust me; I can't tell you any of the details, just trust me," that's not enough. It's a combination of the two.

So, you have to know, when you're talking to a patient, when to stop in describing all the things that could happen and when you have to rely on trust. So this is why I think the encounter between the surgeon and the patient before the operation is absolutely essential. No one should ever be operated on by someone that they have not met and sat across from and talked to and got some idea about, 'Does this surgeon—is he really interested in my problem, does he have the goods to deliver for my problem."

At the same time, as a patient, I want to see what the different outcomes could be, and I want a reasonably honest appraisal. I don't want him to scare me to death; on the other hand, I want to know. So, it's that combination.

And striking that balance varies from one patient to another. With an engineering type, you may sit down and spend a long time going over a long list of things, because he has that mentality. He doesn't rely on trust in his own field; he relies on measurements, and so he needs to have it. Someone else, who has a different mentality, they're going to rely primarily on trust. So it's knowing when to bring the trust situation in and to stop the long list of complications that could happen, and it would vary from one patient to another.

And getting the feel for that is a very important part of the initial contact, sizing up the patient in an instant to figure out how far to go with either of those aspects.

MULLINS: Well, that pretty much brings to an end the questions that I had. We'd love it if you have any final comments or reflections.

STARR: Well, I didn't know you were going to ask that question, otherwise I would have thought about it. But if you'd let me know, then I would have prepared, which might not be valuable to you [laughs]. So, I don't know.

I think that recording this era of the development of heart surgery is a fine thing to do, and I'm glad you're doing it, and we should do it in other fields as well. The history of medicine is remarkable and should be known. And also, somehow the public should have a good understanding of how all these things happen, and there are a lot of good books written by clinicians laying this out for the public. So I think what you're doing is a good advance. You're not wasting your time by asking all these questions, and by the library at the university keeping—documenting what's going on.

MULLINS: Well, as a man who's had a pivotal role in the development of heart surgery, thank you very much.

STARR: My pleasure.

[End of interview]

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