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## ORAL HISTORY OF JOHN KANWISHER

Interview by Frank Taylor February 11 and August 11, 2004

Tape 1 of 3 transcribed by Arel Lucas in January 2005

TAYLOR: We're going to start off with a little personal information like where and when you were born, your . . .

KANWISHER: OK.

TAYLOR: . . . parents' names and their . . .

KANWISHER: OK, OK, OK, OK . . .

TAYLOR: . . . occupations, things like that, and . . .

KANWISHER: Yeah, well, . . .

TAYLOR: Don't worry. I'll keep you on track.

KANWISHER: Yeah, now, because I just wrote some of this for my grandchildren.

TAYLOR: OK, well, that's . . .

KANWISHER: Yeah. No, I . . .

TAYLOR: . . . well, one of the things . . .

KANWISHER: Do you want me to start talking, or do you want to ask me?

TAYLOR: No, no, not yet. One thing I wanted to add for you is you probably, when we finish all this, and it's going to . . . I only do about two hours at a stretch, because you start to get fuzzy after that, and we can do some more later, hopefully, is to have a set made for you to pass on to your grandchildren. That's kind of neat, I think, listening to grandpa actually speak, see the sparkle in his eye. This is why I like to do it with film, because you see body language. You see how someone really gets into something.

KANWISHER: This is why writing is hard, because I worked hard at lecturing, and I must have been good, because I kept getting asked back. And, I'm telling you, the easier it looks the harder it is to do. You immerse yourself in a subject so you can stand up and talk about it. And you've got to get their attention, and so forth, and I've suffered under more bad teaching. I've had two or three outstanding teachers in a whole lifetime, and one thing I've cautioned my daughter is that, "What you do is your own business, but if you give any rotten lectures I'll haunt you."

[They laugh.]

TAYLOR: You know what my feeling always was? That besides imparting the information I was also giving a performance.

KANWISHER: Sure, that's . . . Yeah, yeah.

TAYLOR: I mean, I really, saying to myself, "This stuff is neat, and I want these people to feel it was neat."

KANWISHER: Yeah, mine and Suzanne's[?] was genuine.

TAYLOR: But some of them, I mean, [laughs] they could take the most interesting subjects in the world and kill you with it.

KANWISHER: [Sighs.]

TAYLOR: OK. We're all set. Just give me a high sign.

VOICE: Yep. All set.

TAYLOR: All set?

VOICE: Yep.

TAYLOR: OK, we are at the house of Dr. John Kanwisher, formerly with the Woods Hole Oceanographic Institution, to do his oral history. His time at the Institution spans a lot of years, and we've just been talking, before we got started here, about current projects he's working on, and I think you're going to find this very interesting as we go through the whole process. First of all, John, just let me ask you when and where you were born.

KANWISHER: I was born in a small town in upstate New York called Oneida, in 1924.

TAYLOR: OK, how about your mom and dad, what were they?

KANWISHER: My father was a German immigrant. There were 13 kids, and he wasn't the oldest boy. In primogeniture, you don't get the farm, so at 17 he came to America.

TAYLOR: And what was his name?

KANWISHER: Herman[SP?].

TAYLOR: Herman[SP?]?

KANWISHER: Yeah, and he had two brothers named Adolph[SP?] and Rudolph[SP?], I remember [They laugh.], 1909. In the Vietnam-War era I was telling my kids a little bit. They asked about him, and I said, he was 17 and they were going to put him in the Kaiser's army. So he got on a boat and came to America. And they said, "Oh, goodie, he was a military deserter!" [They laugh.] They thought that he was a hero in their mind.

TAYLOR: Times do change.

KANWISHER: Yeah.

TAYLOR: Did he become a farmer up in . . . ?

KANWISHER: No, he repaired automobiles, but his brothers were farmers, so I essentially grew up a farm boy.

TAYLOR: OK, and how about mom?

KANWISHER: She was a local girl, and Irish-English background, and I mean her father was an Irish alcoholic, and her mother was head of the local WCTU, "whiskey can't touch us," and it's a mixed background. It's just a . . . . It's somehow in a class of a small town. My father gave me absolute freedom, and education had a high value to immigrants. And out of a class of 100 I was the only one who got an advanced degree and so forth. I went back recently, and they still remember me as that strange kid who liked physics. But the marvelous part is they left me alone. Kids can be brutal, and they weren't to me. They were good to me, and so I have a deep sentimental feeling for where I grew up.

TAYLOR: But you're bringing up a really interesting point about early immigration into this country. They didn't go into banks and see "exit" signs in their language. They were expected to know English, and they were expected to become part of this kind of system. And that's the way you grew up. They really kind of pushed you in this area?

KANWISHER: Well, there was just no . . . . I don't know. I mean, we had a Bible and a few copies of *Reader's Digest* in the house, but there was a Carnegie library. Here's that nasty robber baron, saved my life. [They laugh.] And uh I have a deep sentimental feeling about libraries. Librarians are the salt of the earth. [Laughs.]

TAYLOR: That's what my wife is.

KANWISHER: Is she? Well, it's a . . . .

TAYLOR: Someone once asked me, what's one of my most valuable possessions, and I said, "My library card." And you kind of feel that way?

KANWISHER: Oh, sure, sure, sure. We're voracious readers. I tell people that the trouble is I'm cursed with a good memory, and I said, "I hope I start getting a little dementia." "Because," I said, "I'm 2/3 of the way through the library and I'm going to run out of good books to read if I don't start forgetting." [Laughs.] It's not true, but I mean it's a . . . .

TAYLOR: So when you were a kid you spent a lot of time going to the local library.

KANWISHER: Well, I spent a lot of time hunting and trapping, and I spent a lot of time with machines. I love machines--hay balers and record changers. [Laughs.] I suppose technically we were below the poverty line, but in terms of environment it was the richest environment I can imagine. Something about small towns creates a certain kind of people. When the *Challenger* flew up in space, they were all small-town people, and we're an 80-percent urban country. There's something about small towns gives people essentially to see a broad spectrum of the world, and find interests. I ground a telescope mirror in high school. No one was interested but me, and I got a full scholarship to study optics at Rochester. [Laughingly] that was pretty nice, you know, because there was no money there. [Laughs.] So I mean, when I see Kodak now I love that yellow color. It paid for my education. They're going to sink now with electronic cameras, but . . . .

TAYLOR: Was that when you went to Rochester, was that the Bausch & Lomb scholarship that they . . .

KANWISHER: Yeah, yeah.

TAYLOR: . . . give on that . . .

KANWISHER: Yeah, yeah, yeah.

TAYLOR: . . . for kids that are interested in optics?

KANWISHER: Yeah, how'd you know about that?

TAYLOR: [Laughs.] Well, it's an interesting story. There was one period of time when I was a high-school teacher, and . . . .

KANWISHER: What'd you teach?

TAYLOR: Physics and chemistry.

KANWISHER: OK, ah!

TAYLOR: And one of my students turned out was . . . a young lady, was very interested in optics and wanted to go to the University of Rochester. So I started to do some looking through the materials I had and found out there was a Bausch & Lomb scholarship for kids in this, and she qualified . . .

KANWISHER: You're sitting in front of a guy who got it.

TAYLOR: . . . and so she spent her four years there as an undergraduate. I lost contact with her after that. But that's how I was familiar with it. Plus, I'm a film enthusiast, so Kodak, . . . .

KANWISHER: Oh, we used to see D. W. Griffiths movies and stuff. Movies were the only art form in a small town: Saturday afternoon, 25 cents for a double bill. I suppose my whole sense of the world was shaped by it. And in the '30s of course there was no television, but there was a couple named Martin and Osa Johnson, and they were a friend of Sikorsky, the amateur[?] plane builder, and they got a couple of his airplanes, [clears throat] and they went to Africa, and they flew over the Serengeti, and Ngorongoro Crater, and Lake Manyara, and the whole damn thing, the sides of Mt. Kilimanjaro and the Mt. Kenya, and they shot movies from the air. And then of course they paid for it by going around and giving lectures, and I saw their movies, and it essentially blew my mind. I mean, Jesus, what a world!

TAYLOR: *Osa's Ark* was the name of her plane.

KANWISHER: Yeah, do you know? OK, well anyway, almost no one knows of them, but . . . .

TAYLOR: I just reread the book, *I Married Adventure*.

KANWISHER: Yeah, yeah, yeah. He was killed in a plane crash, I think, in the late 30s and so forth. I don't know what happened to her.

TAYLOR: Actually, I did a lot of research to try and find out what happened to Osa after he passed away. She got remarried again and then went into a different kind of lifestyle. But what you're talking about is that during that particular period, the kinds of things that formed kids who were curious and wanted to see what the larger world was about were things like Martin and Osa Johnson and their *I Married Adventure* books, and . . . . The very thought of being able to go to a place like Africa and see those animals and fly over it and film it. It's exciting stuff! And that was part . . . .

KANWISHER: Yeah.

TAYLOR: You were into the hunting . . . .

KANWISHER: And then you read Isak Dinesen, and *West with the Night*, the solo trip across the Atlantic, with the people who lived in Nairobi and stuff, and I went to Nairobi after working on ostriches in South Africa. I wanted to see the animals. I made it. I made it! It took 40 years to get there, but I made it! [They laugh.] I had a month with a Land Rover. I swapped all my telemetry equipment for the use of a Land Rover and had a student with me, and we went all over, slept in grass huts and, anyway, stayed across the street from where Isak Dinesen had lived. It's now a girls' cooking school. [They laugh.] Yeah, and uh . . .

TAYLOR: Well, see, what I'm finding interesting here is the kinds of things that developed a young man like yourself.

KANWISHER: Who knows?

TAYLOR: You're talking about things that I have a similar background in. You went off to Africa to look at animals. I went off to South America . . .

KANWISHER: No, I went to do research. I had to get . . . Education was important. Education is fundamental in life. The trouble is it was this goddamn Lutheran or Judeo-Christian morality that medicine ought to taste bad and work ought to be . . . If it's unpleasant, there's greater virtue in it. And so forth.

TAYLOR: [Laughs.]

KANWISHER: No, seriously.

TAYLOR: No, I hear you. I hear you.

KANWISHER: And I've been trying to put some of this down for my grandchildren. And what really happened is that uh I was swept up in the War. I went off to college, and I had 18 months in which I got credit for three years. And I left about on my 18th birthday. And a year later I was doing Millikan's oil-drop experiments, and I was so excited. Essentially I ran my life on that education. I went back and I went to . . . I took another 10 years of education, but it doesn't count, really. I mean, but I work everyday knowledge. [Laughs.] If it hadn't been for the War I wouldn't have had time to breathe and think what to do. My idea is that I could be a reputable engineer and sit at a drafting table in an acre full of drafting tables and do something and get enough money on a vacation so I could go off to Africa. [Laughs.] I never thought you could do what you wanted to do, and I lost enough friends in the War, and I said, "It's up to me to make up for what they didn't do, and I'm going to do what I want to do."

TAYLOR: OK, now, how about your prior-to-college schooling, up in New York State?

KANWISHER: Local public schools.

TAYLOR: Local public schools?

KANWISHER: Oh, yeah.

TAYLOR: What were your favorite subjects?

KANWISHER: Math and physics. I can't remember anything else, except I . . . . I didn't have a crush on her, but I had a deeply warm feeling about the Latin teacher. I took four years of [laughingly] Latin, which hasn't mattered much. I still know the dative, genitive, accusative and ablative and so forth. I know all the things. And there was a high-school math teacher. She was a gem. And we treated teachers so awful then. They couldn't be married. If they were married, they were thrown out of their jobs. They couldn't drink or smoke. Can you imagine? [Laughs.] My children are aghast at these things. You know what the great sadness is? I never had a chance to tell my father or her what they did for me. So I try and do it for other people when I can, because that's what makes the world go around. Whenever I fly over New York and look down at all the silent . . . . He's the one who did the hard thing. I did the easy thing. You think of getting off a boat at 17 and not speaking the language! And he would never talk. I know nothing about it. The standard immigrant story is that you lose the contact. A few years ago, well, thirty years ago I was working in Hawaii, working on divers and stuff, and the head of the local diving club also worked at the medical school, a young Japanese guy. I said, "What do you do in your spare time?" He said, "Well, I'm learning Japanese." He says, "You know," he says, "it's a difficult language." And of course, the immigrants erased their background, like the Japanese did in Hawaii, and stuff. And it's one of the great sadnesses, but I think it's the homogenization that made America work. So I don't believe in bilingual schooling and a lot of other things. [Laughs.]

TAYLOR: Well, this is a fundamental difference in the way you grew up. The idea was to come here and become part of what was already here, not change it to kind of replicate where you came from.

KANWISHER: Yeah, yeah.

TAYLOR: And that was a great immigrant story there, and it had an effect on me. My mother came over from Poland.

KANWISHER: Yeah.

TAYLOR: I hear what you're saying.

KANWISHER: [Blows nose.] My father came from an area which . . . . Went back to Poland and wound up in Germany. I went three times. Now it's Poland and so forth, German Silesia, near Breslau, I think it's Poznan, I don't know what the modern name, but I was out on a Polish ship. The Poles had to donate a research ship if they were going to fish in American waters. That's before we did the 200-mile limit. And when I was out on it, a Pole was elected Pope. And then I told them where my father's hometown was. And I was one of the boys. I couldn't speak a word of the language, but they treated me with tremendous warmth and respect after that. [They laugh.] And I'm a farmer at heart. I love starchy food, and I know how to butcher a pig, and all these things which my kids are aghast at.

TAYLOR: It's a totally different kind of upbringing.

KANWISHER: Um-hum.

TAYLOR: I can relate to my kids, who pay \$80 to go see a Boston Bruins game, and say, "I used to sit in the second balcony for 50 cents."

KANWISHER: Yeah, yeah.

TAYLOR: And they said, "Wow!"

KANWISHER: The surprising thing is the schooling in Oneida was good. It was first rate. Not many kids took advantage of it, but the teachers were dedicated. Now in 1938 I took a year of German. I can remember the man's name--Otto Hahn. And I was a serious student. I wanted to get out of that town. [Laughs.] I really wanted to get out. And I learned the German. And for the rest of my life, it's been a barrier to learning other languages, particularly Norwegian. It's enough similar so it's always in the way. I keep putting the verb at the end or something like this. And a few years ago we had a boat for six years on the European canals, great place to read and see and get away from America and stuff, and I came up to the Kaocanot[SP?] alone. I left the boat for the winter in Copenhagen and I came out to Kaocanot[SP?]. The gates were open. I went in and so forth. I had probably 500 words of German. I could speak it! [Laughs.] I mean, my genders were awful, and they laughed, but they understood me. So it was a good school. I go back now and the buildings are primitive, and so forth. But they had the teachers that would make a school. And they had normal schools then. People were dedicated teachers. Now they sort of get in and sort of half . . . . If I had control of things, I'd burn the schools of education the first day. I mean, teachers . . . .



TAYLOR: You'll be happy to know that they have done that. You can only get your teacher's certificate as a graduate degree now. Now you've got to be a biologist if you're going to teach biology, or a geologist if you're going to teach geology, and interestingly enough, if you want to teach in this state, you have to pass a competency test . . .

KANWISHER: Um-hum.

TAYLOR: . . . to show that you do know your subject.

KANWISHER: Hm, you have to do that in surgery too.

TAYLOR: There's a guy that determines whether you're competent in chemistry, physics, in the earth sciences. That's me. I . . .

KANWISHER: Um-hum.

TAYLOR: . . . do that for the . . . . That's my other job. I do that for the State. And I will look at the problems these people have to solve and see, have they shown a complete understanding of what's been asked, and do they show a logical sequence, that kind of thing. So it has changed, but those early days, those teachers--they were fairly respected in the community, weren't they?

KANWISHER: Oh, sure, sure. But I still think it's pretty ill treatment when you can't be married. Think what the Catholic church is into now for that. Because it was all there was then, people accepted it and so forth, and it was ideal for me, on the consumer end.

TAYLOR: Um-hum, um-hum, and actually, in the town the size of Oneida, there was no place you could hide. The teachers knew exactly where you lived, and they knew what your parents expected.

KANWISHER: There wasn't any . . . . Yeah, but I had complete freedom, and you didn't misbehave, somehow. I probably was beaten twice by my father, both of which I [laughingly] thoroughly deserved, and I didn't dislike my parents. At 17 you go off in the world. I went off in the world, and . . . .

TAYLOR: How did you decide what you were going to study for at the college level?

KANWISHER: Scholarship. I had no money. New York State Regents made my life. I'm a great test taker, and I have a good memory, and I'm modest brightness, but I work hard, and I got terrific scores [laughs], out the roof. [Laughs.] And I'd done some things. I'd won a science fair, and I did electronics. I was a ham radio operator, and I ground mirrors and so forth. And no one was applying in those days. I mean, now, what? 40 percent of the kids go to school or something? I don't know, anyway, it's a big industry and so forth. It wasn't then.

TAYLOR: Well, see, you and I both came from a generation where, like our uncles maybe got through the 8th grade.

KANWISHER: Sure.

TAYLOR: My dad got through high school. I was the first one to go to college.

KANWISHER: Yeah, sure.

TAYLOR: This was the development.

KANWISHER: I was too, yeah.

TAYLOR: So you went to the University of Rochester.

KANWISHER: Yeah.

TAYLOR: OK, tell me about your four years there. What was that like?

KANWISHER: Well, I mean I was a shy person, had no social life whatsoever, and in those days of course they didn't mix the sexes. They had a separate women's and men's campus. And they taught, well you can't have socially aloof kids, so they had what they called a "freshman mixer," or what my daughter calls a "cattle market." [They laugh.] And I went in, and I walked in the door, and there was a girl in a green dress, and I married her. [They laugh.]

TAYLOR: I hope there was a little interim in there.

KANWISHER: Well, yeah, sure, we went off in the War and so forth, but I mean, I fell in love and here I am. [Laughs.] There were, I don't know. Teaching was serious business then. I had a couple of terrific teachers, one of whom later became chancellor of the University of California, a guy named Herb York, and so forth. I loved gadgetry and I had a lot of skills, and most of the kids didn't have those things, and so forth. I could run a lathe and drill press [laughs] and do glassblowing and stuff, and they just had this new thing called a cyclotron. Essentially it's a radiotransmitter which dissipates this energy, making things spin around in a circle. And this Herb York was a graduate student, and everyone had gone off to start making an atom bomb and stuff, and he was having trouble with it, and I looked in one day. When you have radio-frequency energy, it wants to get out in the world, and I think probably the best thing that happened to me was I was on a ham band called 40 meters, 40 meters CW, and I remember talking to a British Army officer in the Himalayas. He had 4 watts of power, and the fact that 4 watts of power would go halfway around the earth and I could pick it out of the air: to me, that's what I call Jesus walking on the water, I mean things that you just can't believe, and so forth. And so I told him, I said, "You know, that's radiofrequency stuff, and that's a transmitter you got

there.” And so, essentially, because it was so high powered you had to use water to cool the tubes. So you’d just take the hose and wrap an RF choke out of it. It’s a way of stopping the RF energy. He says, “You don’t want to take lab. Come down and work with me.” [They laugh.] I weighed 112 lb. I was a shy young kid, but . . . .

TAYLOR: One of the things that’s really interesting is more of the scientists that I’ve talked to in this institution, whether they be biologists or chemists or what have you, all had--a lot of them had--interest in gadgetry. You talk about running a lathe. Did you know Willem Malkus?

KANWISHER: Of course I knew him. He’s still alive.

TAYLOR: Oh, yeah, well Willem told me that his mentor was Enrico Fermi at the . . .

KANWISHER: Ahhhh!

TAYLOR: . . . University of Chicago. I said, “Well, how did he mentor you?” He said, “Well, we each had a lathe, and we would stand there working on things, and he would grunt occasionally.” There’s a lot of interest in putting things together, taking them apart. There’s a certain kind of curiosity.

KANWISHER: It’s a generational thing, because during the War everybody knew cars, and you can’t park a Jeep any place, because someone’ll get in and drive it away. So you always carry an extra distributor cap or a rotor or something like that in your pocket. [Laughs.] Of course, my kids have had to learn enough to drive a car, but it’s not common knowledge any more.

TAYLOR: No, no. [Laughs.] You’re absolutely right. I remember after the Second World War they were selling all those old Jeeps at 50 bucks apiece, wrapped in cosmolene, and you had to put them together. A lot of people were able to put them together . . .

KANWISHER: Yeah.

TAYLOR: . . . and make them work.

KANWISHER: I can remember gadgetry. I took the clock apart. I had an erector set, a great imaginative tool, much better than Lego blocks. You can make all kinds of devices with it. And essentially that’s what “Evolution” is doing. It’s got a set of rules and it makes these animals and so forth, but the hay baler. You used to have to tie the bales, and they had this marvelous mechanical device to tie a knot. How can you . . . ? They can’t make thing go under . . .

Anyway, it had stopped one time. And here I’m 16 years old, and I told the farmer, I said, “I can fix that for you.” And he said, “Go ahead,” and I fixed it, and he gave me a couple bucks. Well, that was a fortune! And it turned out you can use your head to make a living. [Laughs.] And

that's the important . . . . I've never had to do common labor. I did a lot. I build houses for a hobby, and so forth. If I hadn't done that touch I would be running a gas station in Oneida or something. And the thing that shocked my kids is I'd probably belong to the National Rifle Association.

TAYLOR: Were you able to finish the four years at Rochester?

KANWISHER: No, no, I was pulled off into the War after 18 months. I had a commercial radio license. I was going to go in the Merchant Marine, and they needed some radio operators for the run to Murmansk, up around Norway, and I almost certainly wouldn't have survived, with the deadly passage. I later . . . . The Germans had their submarines all on the Norwegian coast, and their main base was in Trondheim. And they built this marvelous structure for the submarines. It's 3 meters of reinforced concrete. I left my boat inside that one day. It's right in the middle of town. They can't get rid of it. [Laughingly] so it's a sort of a . . . . But I didn't go on that. I was drafted and went off in the War and ran electronics, and I learned a lot.

TAYLOR: Where'd you serve your time?

KANWISHER: Mostly in the Pacific, but I was always a year behind the real action. Here I was fearing essentially action in Japan when they shot off the bomb, but I got a good . . . . Well, I started out knowing a fair amount of electronics. I got a good education in electronics. I was an accomplished electronic engineer, more or less, running fire-control systems and stuff. And that was one of the gambits when I came to Woods Hole, is that there were all these things with dials on the front, and no one knows what's in them. And I knew what was in them and could make a run, and I could always go any place I wanted to ship, because I could run the gear and fix it and stuff. And I enjoyed doing it. It wasn't hard work.

TAYLOR: Um-hum. Now, whereabouts in the Pacific were you?

KANWISHER: Oh, I had just started towards Hawaii when they shot off the bomb. They developed this new device called LORAN, and they had proximity fuses, which were deadly devices. The bombs all went off 50 meters above the ground. And here's the [noise of search] one of the 5-inch shells, one of the first ones. I spent all night sawing it off with a hand hacksaw to have a souvenir from the war. [They laugh.]

TAYLOR: When you stop and think of the scientific or technological development during that period. I remember seeing some of the original Navy planes that were biwing, open cockpit, and whatnot, we ended off with jets, at least the Germans.

KANWISHER: The Germans did, and the English, yeah.

TAYLOR: So, there was a huge, huge growth in terms of technological advancement during that six or seven years, pretty fascinating.

KANWISHER: Yeah, I know it because I later taught for a dozen years at MIT, and it's what they call Building 20, which is where all the radar work was done, and I met the people. And one of them was a guy named Zacharias, famous physicist there. Oppenheimer wanted him to come to Los Alamos. He said, "I want to help win the war." He didn't think the bomb would work, you see. [They laugh.] Well, because of that, though, they developed 3-centimeter radar, and the Germans didn't know about it, couldn't detect it. They'd been 10-centimeter, and so forth. Later he retired and lived down near the bridge. And I met him at a cocktail party once. I bent down and kissed his shoes. I said, "That's for 3-centimeter radar." His wife, who was a pediatrician, was so touched that we became close friends. When he died, she gave me the bell for the boat he never built, and so forth, which I'm going to give to the next generation. I never got the boat built either. [They laugh.] But they did fantastic things. They were still around. I could talk to them at MIT, and somehow the war was a collection of genius small world. I mean, at first the antisemitism of the Nazis of course allowed us to win the war, because, except for Oppenheimer, practically everybody else on the Manhattan project was a refugee--well not all, but a lot of them.

TAYLOR: Well, of course, you remember, right after that War, everyone was rushing around trying to grab off a lot of the German scientists and things like that.

KANWISHER: Yeah, yeah, well . . .

TAYLOR: A lot of Russia's advance . . . .

KANWISHER: . . . I spent 10 years on something called the Space Science Board, and I had drinks with Werner von Braun. [Laughs.] Tom Lehrer had this marvelous record: "In Chinese I'm learning to count down." [Laughs.]

TAYLOR: I always remember Bob Hope telling that joke one time, he'd like to congratulate the Russians on their scientific advance, "but I can't speak German." [They laugh.] And it was true. I mean, there was a huge collection. Von Braun was what? 19, 20 years old when he was deputy commander at Peenemunde? Literally a kid. So you finished up your time in the Service. What happened then?

KANWISHER: Came back to school and was married. They shot off the bomb, and another thing my kids can't understand is if you weren't 21 you needed your parents' written permission. [Laughs.] They look, "You're kidding!" But the bomb went off on the 8th or 9th of August, and I was 21 on the 20th, and my wife was in the Navy teaching instrument flying, and they said, all married WAVES with a year's service will be released. She wanted to go back to school. So she phoned me up and said, "Let's get married." We got married. So I had a wife and I had the remainder of the scholarship, but I had the GI Bill. And the GI Bill was one of the great social things of this country. It has this shaded history, because the people in the South particularly were scared of the fact that we had 15 million people who knew how to use a gun. They were going to come back and they were going to get angry. And so, they said, "We'd better make sure that they make the transition to civilian life." So they had what they called the 5220 Club, and as an afterthought, someone said, "What about education?" Harvard tried to block it. James Conant, who is a hero of mine. They didn't want this riffraff in school. But they passed the GI Bill, so I was able to get an education without paying money, and it bankrupted us to educate our kids. The Europeans can't understand, but education is one of the big wrongs in the country. It shouldn't be money between you and an education. But educating your kids is like buying another house. And unfortunately the deal with ours is, we'll put them through any school they get in, and they got into Harvard and MIT. I'm proud of it. It's not that. It's just that . . . . I was able to go on with an education without having to think about feeding myself.

TAYLOR: Well, there were two big things that happened then. It make college believable for a lot of guys that never would have had the chance to . . .

KANWISHER: Uh-huh, sure.

TAYLOR: . . . do that. And it made owning a small house possible.

KANWISHER: Yeah, and you can't do that now in Central Europe. You can't afford a house. [Laughs.] I just can't get over that. Houses have been a lot of my life, and so I think encouraging home ownership and the GI Bill. There are a lot of things that were done perfectly right in this country.

TAYLOR: And that was a couple of them.

KANWISHER: Yeah, and I didn't want to design lenses. I hated optics. [They laugh.] I was good at it, but I didn't want to do it. They shot off the bomb, and it turns out that radiation was one of these mysteries we didn't know much about, except that it kills you if you get enough of

it. It's what they call a mean lethal dose of 50 percent of the people is called LD50, and it's in units called Roentgens after the guy that invented the x-ray, discovered the x-ray, didn't invent it. [Laughs.] That is such a small amount of energy. It touches one in 50 million bonds, but the animal dies. And I thought, what a sophisticated way to understand how animals work. I could foresee there was going to be something like Maxwell's equations for animals. [Laughs.] We're going to really understand animals, and so forth. I couldn't have been more wrong. But I didn't know it at the time, so I took a degree at the medical school, which essentially mostly was quantum chemistry. And after four years it turns out that the effect of radiation is sort of like hitting a watch with a hammer and trying to understand why it doesn't tick. And I'm a member of the Norwegian Academy of Sciences, and 50 years later they were very upset over Chernobyl, and they were having a meeting. And so I went over and put in . . . . I spent a year catching up on the field. My next-door neighbor was the head of the Radiology Department at Harvard Med School, and he gave me books to read, two years of this journal, and here's a couple of books, and so forth. And they still don't understand it. It's one of these things like turbulence. The Willie Malkuses talk a good game, but they don't understand it. [Laughs.] They don't predict the weather. So that was poor judgment. So I've been interested in high-speed navigation and I'd impressed some people with some of my early teaching, and I was hired by the Air Force to do operations research. And so for 18 months, or two years out in California, I flew all over the world and had a great time because they were starting to fly planes at 600 miles an hour. You don't have time to sit there and do your astronomical calculations, going through tables and so forth. They were flying mainly . . . . The big trouble was the Russians over the Arctic, and the Arctic atmosphere is such there's a lot of refract corrections to the star sites and so forth. I worked out ways for precomputing a lot of these things so you could do the calculations in a hurry. And of course now we have, for \$100 you buy a cigarette-package-size thing that tells you latitude and longitude within 100 meters.

TAYLOR: I have one in my car. [Laughs.]

KANWISHER: Do you really? Yeah, yeah.

TAYLOR: Plug it right into the cigarette lighter. And now, actually, it will get me down to anywhere from 5-10 meters.

KANWISHER: I know that, I know. I'm just talking . . . . I just want to know what continent I'm in. [They laugh.] Yeah, and uh so at what do you do, and clearly the military really wasn't

interested in what I was doing. Sort of broke my heart, because I sort of liked it. I liked technical things, and I liked machines, and numbers, and equations and stuff, and so I read a book called *Cannery Row* (Steinbeck), and we were in Sacramento at the time, at Mather Air Base. And the following weekend we went down and slept on the beach at Carmel, which you could do in those days, [laughs] and saw the whole thing, where Ed Ricketts had his collecting place, and the old Chinese grocery store. It's all there. It was real. [Laughs.] And I thought, "Jesus, that would be great to do." But you have a Ph.D. in biophysics, no one's going to hire you in the zoology department. And I thought, "Well, we'd better give it a try." So we sold our house and we went all of both coasts, and we'd passed through Woods Hole, and in the winter it's a pretty dead-looking place. I thought, "What a miserable town! The summer people are all gone. This is the end of the earth!" [Laughs.] And went on down to the Bahamas. And I was starting to try to do some research in electrophysiology, how nerves carry signals, which they didn't know then, and a man named Scholander from Woods Hole showed up. I spent one day with him, and my life was changed. I mean, he knew where the problems were, and I knew how to make the measurements. And it was a marriage made in heaven, and he was the most marvelous, funny, intense man. And a couple weeks later I'm sitting up in a tree over here, where the other campus is now, and measuring sap and grapevines, spending all night and stuff. [Laughs.] And a few months later we went out on the Arctic ice to look at supercool fish. There was no snow scooters then. We used dogs teams and Eskimos, and . . . .

TAYLOR: So had you actually moved? I mean, you were now . . . .

KANWISHER: I came here and I walked in off the street and they hired me. I'd never understood the administration. No one ever told me what to do. They hired me. I mean, I couldn't believe it. I thought, "Well, they're going to tell me what to do." A few weeks later I went off on the *Atlantis*. And talk about . . . . I mean, I showed you the picture of me some place around here. It's under sail! In those days they actually had to sail to save money. Labor was so cheap it was easier to use labor to sail the boat than it was to pay for the petroleum. [They laugh.] And we sailed and stuff. And it just sort of blew my mind. Here I had . . . . I took Joseph Conrad and *Admiral of the Ocean Sea*, the Story of Columbus, and so forth, and I climbed the mast and there were flying fish and dolphins and so on. I thought, "This has got to work. I got to make this work." And I made it work. And as I said, I don't know they differentiated me from anybody else, but there I was. I was hired, and I was free. And those are



combinations which I am deeply sentimental about. I mean, most people spend their life trying to get a little freedom. The trouble is, if you're free, you can also make mistakes, and I made a lot of mistakes. And I could decide what I wanted to do. And I knew you got to publish, "publish or perish," and so forth, and also Scholander forced me to give lectures. He said, "If you can't present your work to the general public you're going to get no place." And the first couple of times is awful. It got to be I could sit in the back of the room almost and hear myself talking up there. [Laughs.] Once you really know the subject and stuff, and the subject interested people. I did the first electrocardiogram on a whale. I just found the old [shuffling papers] release from back in 1959, and that's my heartbeat, and that's the whale. It doesn't matter. At the time Eisenhower had had a heart attack. And his doctor was a guy named Paul Dudley White. And he'd spent his life trying to do that. But I did it. [They laugh.] My next-door neighbor was a doctor named Al Sempte[SP?], and I always felt at home around fishermen in boats, and so I established friends there, and most of them didn't know I was a scientist, so they treated me as one of them. And I told them one time, I said, "I did some research there, and I'd really love to get a chance at a live whale and make some measurements. I want to see the temperature and the tongue," and various things that were a real problems we didn't understand. And I got a call one winter's evening, just before Christmas, and there was a live whale on the beach in Provincetown. So I had my instruments ready, and off I went, alone. [Laughs.] It was cold, and snow blowing, but I got the measurements I wanted. I wanted samples of breath to tell how the respiration works. I wanted to measure the heartbeats, and so forth, which I could do by just feeling the pressure and stuff. My next-door neighbor, we'd joked about it. I said, "Let's do an electrocardiogram." Because you've got a heart the size of a small Volkswagen, or not quite that, maybe. It was 1,000 lb., and the physics and time of a big device are much different than a small one. So I phoned my neighbor, and he stole some welding rods from the MBL shop for electrodes to go through the blubber, and I came down, and it didn't work. And I went to the fire station, and they brought their portable generator down. That was too noisy too, but it was Christmas, and I tore some Christmas tree lights down from somebody's house and broke into another house and got 110 volts out to the whale, and we got marvelous EKG records and stuff. Directors love publicity. Of course, I came home with essentially the world looking for me. I was in *Time* Magazine, and the BBC, and that was my 15 minutes of fame. [They laugh.] But it was also a decent piece of science. I suspected that a lot of people thought I was doing stunts,

and some of them are stunts, but I mean mainly there was science behind it. I wanted to know how an animal 1,000 times larger than myself worked. And Ed Smith was the director, and he's another one of those saints in Heaven some place, because he backed me on anything I wanted to do. And I told him, I said, "You know, I could probably make some measurements on whales if I went to a whaling station." So I'm off in Norway on a whaling ship, which was an honorable profession, though. It was before Greenpeace and Brigitte Bardot and all the other people said, "We've got to pet the animals rather than eat them." [Laughs.] And the Norwegians were absolutely cooperative. I'm sure they thought, "What's this young kid want doing over here?" And I had a pair of hip boots, wading around in the great offal of guts and so forth, and I said, "I really would like to get a set of lungs out and measure their volume. It's very important we know their volume." And so they had these huge steam saws and winches, and they carefully dissected out the lungs, and I blew them up with the gas meter, and I got the volume, 2,200 liters and so forth, and out of those I could put together enough stuff to estimate the metabolism of a whale. After all, mammals go from a bat to a whale. It's 100,000,000 times. And a whale's roughly the size of a big 18-wheel truck with a tail on the end to drive through the water. And the tiniest bats or shrews can make a home in a teaspoon. And I used to say it's the size of an olive, and it takes 100,000,000 olives to fill the truck. [They laugh.] And the physics of small and big animals is a fascinating thing. Because it's 200 times the linear dimensions. It turns out it's 200 times faster metabolism. Everything else goes as linear dimensions, and so forth, and they live in a world where a whale lives on a yearly life cycle and the tiny shrew lives on a one-hour life cycle. And over my life I was able to fill in enough of that to make it a teaching subject.

TAYLOR: But this really was part of your devel . . . . As I listen to you talk, I'm starting to see a real development here. You liked trapping. You liked hunting when you were a kid. You're in Upstate New York. I had a daughter . . . .

KANWISHER: Don't make too romantic a thing, but it's true. The thing is, people think I'm spready[?] lily, but I could gut a deer, and when they butchered the pig in the fall, it was a festive occasion, because after all this ham for the Christmas dinner. [Laughs.] And once they cut its throat, I caught the blood in a bucket. I knew that blood keeps you alive. I knew about oxygen. I knew instinctively, and stuff. And we could blow up the lungs. They could massage the heart and try to get an extra heartbeat and so forth, and the bladder was always important, because

we'd blow it up and dry it for tetherball and stuff. And so I mean the physical reality of animals is a circulating system of organs, a relatively small number of organs, all doing their thing to make the operating animal was instinctive to me, which most people learn as an intellectual subject, and they don't really grasp it. It's like they learn about the cold. The way you learn about the cold is you go out and live in an igloo on the Arctic Ocean. [They laugh.] And you come out in the morning, and I've got . . . . I just had some [rustling] pictures of it here someplace or other, that I was looking at for my book. But anyway, so my first field station was an igloo. Yeah, [laughs] and we were spinning wheel blood on the hand sentries on the side of the dog sled and so forth. So oceanography was a ticket to the world. And instead of telling your departmental colleagues when you were a young assistant professor or something, you got to up in the Arctic Ocean, they expected you to do it here. [Laughs.]

TAYLOR: There is a certain sense of adventure to all this. One of the things . . .

KANWISHER: Oh, it was! It was exciting, too!

TAYLOR: One of the things that you just clued me in on here when you were on Cannery Row, and you read about Doc Ricketts, . . .

KANWISHER: Oh, boy.

TAYLOR: Doc Ricketts was leading the kind of life every biology person wa . . . .

KANWISHER: Yeah.

TAYLOR: Go out on the coastal tide pools, collect samples, the *Sea of Cortez* book. Did you read that?

KANWISHER: I know, I know, the "handsome sea cow." I know it by heart.

TAYLOR: That's great stuff.

KANWISHER: Well, I'll tell you what. I was sitting by the Officer's Club pool and reading this, and my wife came and said, "We've got an invitation. The base commander's having a reception," and since I was a civil servant equivalent to a major. He had 26 different . . . . I wasn't worth it. But anyway, there I was, and it said, "Officers and their ladies, and enlisted men and their wives." And the class structure of that was so appalling to me that that's when I decided, "I'm going to leave the military." But it was the kind of egalitarian thing of shipboard life and so forth which appealed to me, because I liked being on ships even in the Navy. I didn't particularly care for discipline. I was always getting in trouble, but not serious.

TAYLOR: But, as I say, there's this whole idea of . . . . Doc Ricketts was the scientific equivalent of what the surfing life was like in Southern California.

KANWISHER: Yeah, that's a good way to put it, because unfortunately he drank too much. He wasn't paying attention. A train hit him and killed him, right there at the Cannery Row.

TAYLOR: Right. Actually, I had to buy my copy of *Cannery Row* at the Chinese fellow's shop right across the street from there, because that still exists.

KANWISHER: They still don't sell whiskey called "Old Tennis Shoes," though. [They laugh.] Somehow my mind [??] for that book, and I can almost quote it. I only read it once. I know the whole damn thing. Backing that Model T up over the Carmel Hill, because Model Ts use bands rather than gears, for the transmission. And I knew, because I had had a Model T, but it's a great story, and I suppose there was some of that Ed Ricketts stuff in, but through him, I mean, he loved Gregorian chants. And I love Gregorian chants now, and stuff. So you pick up your cues from people you admire somehow.

TAYLOR: OK, well, you're showing a real development here, what made you you.

KANWISHER: Well, look, look, look, I'm doing a book now, OK. It's a tidying up of a messy past. It's not that way at all. I mean, recollecting it and so on. I remember the things I want to remember, and so forth. But I'm not trying to be an outright liar. I mean, I really did have a small-town life. I really did know animals, and they didn't interest me like machines, but you had to know them. And all of a sudden I get in graduate school, and someone's got a donkey, and they've got to get a blood sample. Well, I'm not afraid of animals. [Laughs.] And I know how to draw blood, and do a wide variety of things which are you might say are sort of the alphabet you need before you can be a writer. And that you can't get any more. Now essentially, the raw materials for a Big Mac are done on a ranch in Mexico or Brazil or at least away from public view. And as a physiologist, death is an ugly thing. I'm interested in live animals. But if you're hungry, it's a nice thing, and stuff.

TAYLOR: Back when you first started into all this, a lot of the people here at this institution I would think of almost more as what we now classify as naturalists, rather than pure scientists.

KANWISHER: Well, naturalist, come on. I don't like that at all. Because you see, . . .

TAYLOR: OK, fight back.

KANWISHER: Well no, the British, you see. I consider myself a naturalist. I think that's a good word, and one of the most important things I ever read was by a small-mammal man in the

Midwest named Arrington. He published an article in about 1960 in the *American Scientist*, which is the journal of the Sigma Xi, scientific society, and it was his observation over a lifetime, about how mallards have these small shallow ponds, and they're always out there, predators are foxes and minks and stuff, trying to grab them and so forth. So it's a prey-predator. It's an . . . [END OF SIDE 1. Material since "away from public view" is repeated]

KANWISHER: . . . arms race kind of behavioral thing, and he went through what he'd seen.

And uh his conclusion was, "Nature's way is any way that works." Which is why I could never accept Stephen Jay Gould and stuff. I mean, who knows what ingenuity you can find? Who knows? [Laughs.] I'm writing a book now on whales and stuff, and it is so bizarre. It is so beyond any imagination. Can you imagine: the male sperm whale has a nose that weighs 10 tons, nothing more than to attract the girls. Or this one here [rustling], I mean here's . . . This is the bowhead whale. That mouth is big enough for a herd of elephants, just the mouth.

"Nature's way is any way that works." So I don't like theory or model building or anything.

Those are inventions of the devil. They're like booze to an alcoholic. Imagination is cheap.

Real hard information is hard to come by. And I know the volume of a whale because I cut them out and measured them, and so forth. And what's the term? I guess when I was a kid they called it, "I'm from Missouri. You got to show me" sort of thing and stuff. And students show doubt on some things. They said, "How do you know?" I said, "I asked the animal." And essentially, when you're doing an experiment with animals it's the conversation. But you got to have some language to speak. And I had a terrific falling out, including Scholander, my [??], because animals are so subtle in their behavior, that unless you've been around them a long time you don't really understand them, and so forth. Now, I wanted to know what these marine mammals do. I mean, how can a whale go down a mile and stay an hour, because after 60 seconds I'm being forced to breathe and so forth. And you can't take an animal out of the water and measure it. People did it. There's probably a thousand papers on it. And as far as I'm concerned it's a great way to keep warm in the winter is burn them up, because they aren't asking the animal.

They're doing an experiment, and they don't know what question they're asking. When you tie a seal or a duck to a board, and you hold him underwater, you're scaring him in addition, and fear has a tremendous input on animals. They'll stop their heart, do all kinds of crazy things. And I can explain this in terms of their behavior out in the natural ecosystem where they're part of, and so forth. But one of my most valuable colleagues . . . If you're going to work with animals,

you'd better understand them. And the people who understand them are veterinarians and curators at marinelands and people like that, and those are my colleagues, and so forth.

[Laughs.] And stay away from medical school, because you'll always get the wrong answer.

[They laugh.] I know because I did my graduate work in a medical school. And there's a man named Sam Ridgeway, who's the chief veterinarian for the Navy, who takes care of all these animals now that they've been using in the Gulf War to find mines and stuff. And we met at a meeting long ago. I said, "What do you do?" He said, "Well, I take care of these animals. You know, we're training them to do things," and so forth. He said dolphins and sea lions and stuff. And he said, "You know, we could do some research." And he said, "Why don't you think up some experiment we can do." And [laughs] so I went home and thought, "What do I really want to know?" I want to know: you have a certain amount of oxygen. You've got to meter it over time. And if our brain loses oxygen here, you faint in 3 seconds. In 3 minutes you're a vegetable. We run on a very close-in thing. [Laughs.] And I thought, "I want to know what they do with their oxygen." So I said, "Can you make him hold his breath, or can you make them dive down deep, because when they go down deep their lungs collapse," and so forth. And he said, "Well, I guess so." And I thought, "Hah." And so, he went back to Point One Amy, which is where they . . . was at the time . . . . It's now down in Point Loma in San Diego, but it's north of LA about 50 miles. And he phoned me up one day, and he said, "Well, it's all trained now. I got this dolphin trained to dive down." So put up or shut up. So I went out, and there are things that utterly surprised me that I never would predict. And one of the things is that you can take a dolphin or a sea lion, and you can train it, and work within the open ocean. It doesn't run away. Now, I can give a very unpleasant explanation of it as, "Oh, they're lazy bastards and they want free food." May be it, and so forth, but I don't like to say it, because I love my freedom, and I don't know why they don't love it too. But we lowered a buzzer 400 feet down in the ocean, and it had a button on it, and the animals had very good hearing. They live in a world of sound rather than sight, because a whale can hardly see the end of its tail in the rich waters where they live most of the time. And so we'd turn on the buzzer, and it'd hear it in the ocean, and he'd dive down and turn the buzzer off with his nose. So we'd know he's been there. He can't cheat, OK. Then he also knows he's got to come up, and there's another buzzer, and he's got to put his nose against that buzzer and breathe out. And we have a funnel and collect his breath. And it's sort of a Rube Goldberg device, but it works. And the animal is motivated because it

gets three fish. It's sort of a cheap trick, [laughingly] to make them do this terrible thing. And at 400 feet it turns out that he breathes out, and then he wants his fish. He didn't even bother to inhale. We hadn't even begun to push him yet. So eventually we found they can go as deep as 900 feet, which is three football fields. Just think of three football fields. And so we learned to speak to the dolphin, you might say. And all I am is . . . . I tell people, "I'm just a mouthpiece for the dolphin, and this is what he told me." And we got terrific data, one of the best experiments I've ever done and so forth. As I said, you've got to understand the animal or know people who do, and my best experiments have all been done with people who have animal insight and stuff. That was the core of my physiological theories on marine mammals and stuff, because what they do is they shut off all their body but what they need, and of course we live in a surrounding, oh we need more air we just inhale. They can't do that. They're away from the surface. And so they shut off everything but their brain. And they beat their heart a few times to supply the brain. Now if they're swimming they're using muscles, and that's the only cost they have, but they have a lot of myoglobin in the muscles. It's almost black in color, which is why people don't like to eat it. But it means it increases by 50 percent the amounts. And out of that you get theories of diving animals and stuff. You know the questions in the beginning, and they're simple questions, but how the hell do you get the answer? And it's the operational challenge I enjoyed, and so forth. For seals I went out on the Arctic ice. It's a hunter-gatherer culture, the Eskimos. And I thought, "I'm going to be one of the boys. I'm an anthropologist out there, living with the New Guinea natives," or something or other. [Laughs.] And of course our gasoline for the dogs was half a seal a day. We were getting 30 miles per seal, you might say. [Laughs.]

TAYLOR: Now, this is a really interesting aspect of what you were doing. Take me through the whole thing. How do you get out to the ice out there? How you going to live?

KANWISHER: Oh, you take a bush pilot, and you find some Eskimos, and you take some groceries, and the Eskimos had never seen skis. And you want to establish credibility with them right off, and when I could go twice as far as they could with the snowshoes, they said, "This guy knows something." And so that was a very productive combination, but you also had to get used to the fact that there's no vegetables. They live on meat. They're true carnivores. A friend of mine in Norway was in Greenland last month, and he described the market in Godthåb. He said, "Four species of whales, three kinds of seals, 20 kinds of seabirds." He said, "And not a damn

vegetable in the whole place.” [They laugh.] And so the Eskimos always kept a gun on the ready to shoot a seal, and they shot a seal one day right about noon, so we stopped, and the seal was for us and the dogs. And I had worked with seals here. I’d cut them [??], we have a local harbor seal from here up to the Maine Coast. And I measured how they could withstand the cold. We built a cold room and put them in it, -30 and so forth. I’d look at the animals from the outside, but eventually you want to know what’s inside the animal. Well, these are pets. I’m not about to cut . . . . I mean, they’re hand-fed pets. I’m not going to cut into them, even if I could, and so forth. But the Eskimos, of course, it’s nothing to them, and it turns out that fur doesn’t work under water, so they have blubber. And what they do is they cut a slit down the back of the seal, and they spread it out, and it’s essentially a thick layer of blubber. It turns out it’s a little tiny animal inside a huge blob of fat. And in there is a huge pool of blood. So you got 50 percent blubber, 20 percent blood, 50 percent bone. Eighty percent of the animal is gone before you got any animal. So what it really is, is a small animal in a huge blob of fat. One of my friends said . . . . We used to have a little outboard called *Seagull*, British-made *Seagull*, air-cooled, you know. You’d start it in the house on a winter day and carry it out running and clamp it on your boat. He said a seal is a seagull on a big barge. So that sense of animals is very important to me, but it’s shaped all my eventual research on these animals, like going to a whaling station done for whales, and these were things which no one at the Oceanographic knew I was doing it, but they didn’t say “no.” My feeling is if it doesn’t say “no” you can do it, probably. And the freedom to do them was everything. As I said, I mean, “Iceberg” Smith was, I mean, God bless him. [Laughs.]

TAYLOR: But you know . . . .

VOICE: Got to change tapes soon. Well, can I change it now?

TAYLOR: OK, sure. He’s going to change the . . . . I got to u . . . . Got a bathroom in here somewhere?

KANWISHER: Yeah, yeah, sure. You can cut . . . . [Tape stops and starts again.]

TAYLOR: Before we changed tapes, we started to talk about being up on Arctic ice and things like that. We’re going to go back to that, but one of the things that I let myself get off track on here: we haven’t talked about your wife and what her name is, and your children. I’d like you to tell me . . . .



KANWISHER: Well, you said you liked bicycling, and my wife's responsible for the path to Falmouth. I tell people I'm responsible, because I told her, "You can't do it." [They laugh.] But she and a friend phoned up the vice president of the New York, New Haven, and Hartford. He came down and saw them, and they started the process that made the bicycle path. And the friend was Barbara Burwell[SP?]. Her husband was my doctor, and we were personal friends and stuff, and her son was so moved that he went and started something called Rails-to-Trails. He was a lawyer by training, and he did it for 20 years. He just left it now to do something else, and so out of that came the bicycle trails all over the country. This was the first one here.

TAYLOR: My wife and I send them \$500 every year, Rails-to-Trails, and we're members.

KANWISHER: We just got the yearly calendar, and it starts with a picture from the Trunk River looking towards Nobska.

TAYLOR: OK, great, I'm glad to hear that. When we got our tax refund that the president was so good to give us, we immediately signed it over and sent it to Rails-to-Trails. Build more, we love them.

KANWISHER: I wish they could go to North Falmouth and on. There's too many little petty issues locally and stuff. It's such a shame, because it's such an ideal thing, particularly in a geriatric like me. [Laughs.] Railroads can't go on steep grades, and I can't go on steep grades. Go ahead, let's get back to something else.

TAYLOR: OK, so she was involved with that. How about your children? Could you give me a rundown on your children?

KANWISHER: Oh, yeah, I got two daughters and three granddaughters. And . . . .

TAYLOR: What are your daughters' names?

KANWISHER: [Laughs.] Susie[SP?] and Nancy. And they're very different, and neither of them . . . . Both of them wanted to get out in the world. My younger daughter refused to be a senior in high school here. She went off to college. She went off to MIT. She's now a professor. I don't know what motivates people. She had it in spades. Of course I'm so proud I can [laughingly] barely stand it. But you don't want to embarrass her, but . . . .

TAYLOR: What's her discipline? What . . . ?

KANWISHER: She studies brain research, and she's got a couple of cubic millimeters of the brain that's nothing but facial recognition. You turn the face this way and they can't do it. The brain was the ideal thing that was going to be what I call a "black box." It's an engineering term.

If all you have is a black box, and you got inputs and outputs, and what must be going on in there, and they'll never know, I figured. Then, of course, I'm dead wrong, because now with this nuclear magnetic resonance scanning they can reach in and look at tiny details in there, and so forth. It's an exciting business. When she comes down there's a new adventure story every week in it. But it's true. It's a soap opera of truth.

TAYLOR: Well, did you discuss animals and things like that a lot . . .

KANWISHER: No, no.

TAYLOR: . . . at home? Where did her interest come from, do you suppose?

KANWISHER: Who knows? I don't know. I don't know. I simply don't know. I wish I do. She taught at UCLA at one point, and she's in what's called neuroscience, and they have a big meeting. I never went to scientific meetings. There wasn't anyone doing blood-and-guts work on marine mammals. I was it for 15 years, in the world, practically--one or two others, but not much. She goes to a meeting now, there's 25,000 people. And the meeting was in San Diego. So she flew to Los Angeles, and a couple of her old buddies, they chartered a boat for a week to use as a floating hotel, and sailed down. Well, on the way down, of course, there's a dolphin surfing on the bow wave. And she reached over and she said, "Dad, you can't imagine. I could reach over and touch him." And I said, "What do you think my life was about?" Kids don't know. They don't follow what their parents are doing. The only thing that ever got their attention: I had to learn to ride horseback to round up ostriches, because we wanted to know about heat in the biggest bird. [They laugh.] They thought riding a horse was pretty neat. I mean it's clear there was no cultural transmission that way. And when you leave at 16 . . . . People give us credit, but we didn't spoil her. I wish I knew, because people say, "How'd you do it?" Well, it's just a roll of the dice somehow.

TAYLOR: But there must have been something about the environment that she was living in, or something.

KANWISHER: Look at what we had. I mean I had Szent-Györgyi next door who got the Nobel prize for Vitamin C. Across the street was Selman Waxman with streptomycin. Next to him was where Thomas Hunt Morgan had lived, the fruit-fly guy. [Laughs.] And our closest friend sailing and stuff was the president of the National Academy and stuff, and so it was clearly a culture where learning is a respected thing. But there was more than that to it, because it didn't happen to any of the other kids. It's like winning the lottery, and I won the lot. If there was a

course in it, we'd do it in education. We'd make all Nobel prizewinners, but someone's got to collect garbage and make Ford cars, and run the town offices, and I was lucky. I could do what I wanted to do, but the world can't do that. There used to be something called the Boston Sea Rovers, and I developed a . . . . When you go underwater with scuba gear, unfortunately a lot of noise and bubbles, and animals don't like it, so I developed a closed-circuit diving device. I already had a patent on an oxygen electrode, and a guy named Walter Stark, who was the son of a fisherman on the Florida Keys, and so forth, but a terrific diver. He studied fishes commercially.

TAYLOR: Is he the one that went to Brown?

KANWISHER: No, no, he was down at the University of Miami. And we uh I had got the idea for this diving device. I went down and the Navy wouldn't even look at it. I was furious. [Laughs.] I'm sure what drives me and what drives people like my daughter is pride. [Laughs.] It's part of our heritage. We can't do much about it. But I mean, I said, "Look, you're the only navy I got. I got my wife out of the Navy." [They laugh.] But they wouldn't do it. So I said, "The hell with you," and I meet Walter Stark. We did it privately. We started a company and then sold the company. Because I didn't want to give up living in Woods Hole. And we could go underwater for eight hours--no noise, no bubbles. And that was a great way to study animals. Unfortunately, it's dangerous. I mean . . . .

TAYLOR: You were limited in depth on that.

KANWISHER: No, no, no. I went to 400 feet with it. We were using helium and oxygen. We were controlling . . . .

TAYLOR: Oh, oh, you were using a heliox rig way back then?

KANWISHER: Huh?

TAYLOR: A heliox rig way back then?

KANWISHER: Oh, it was my rig. There's nothing like it. There's a thing up there on the wall if you want to look at it. They advertised it.

TAYLOR: Because I know the Navy then was using oxygen when breathing.

KANWISHER: The Navy was using things that killed people all the time. Whether they're still doing it, I don't know. I don't want to go where I'm not wanted, and I'm not wanted there. I don't whether it's . . . . It's what I call the "NIH factor," "Not Invented Here." But uh ours worked, and as a measure of it working, is the head of the Israeli navy came to my home one day

alone, and I gave him my last model of it. [Laughs.] Now I don't want anything to do with . . . . I'm a pacifist, having fought in the War, and I don't want anything to do with warfare if I can help it, and so forth, but there was someone who knew about my thing, and you can do terrible things with it. If you can keep warm. I don't want to get into technology, because it was essentially part of what I did essentially to do the research I wanted to do, which was to be under water and live with the animals and study them in a way that didn't upset them. And since I was an engineer also essentially I could do my own engineering. And I liked it as much as the biology, practically.

TAYLOR: OK, now what I'm trying to put together here, in my own mind, because this is really fascinating, uh you did a lot of studies in the Arctic. You did studies in South Africa. You invented a device that allowed you to stay under water for long periods of time, and I'm trying to develop a whole picture of how all of this flowed. The old Boston Sea Rovers--when did you get involved with them?

KANWISHER: Oh, I know what I wanted to say is the Boston Sea Rovers: because I had done this, I made the cover of Popular Mechanics magazine. Now that's probably the proudest moment of my life, because it was my Bible as a kid--my Bible. And to make the cover! It's the only thing I've ever done that got back to my home town that people sent me letters on.

[Laughs.] But we could do this, and so forth. So the Boston Sea Rovers used to have a meeting every spring on careers and oceanography or something or other, and I was one of their trained circus ponies. [Laughs.] And there'd be these 1,500 kids there, all clean and well scrubbed who wanted to go off and be Cousteaus and do oceanography. Cousteau never did a piece of research in his life, and it's just publicity and so forth, but I wanted to tell them. I said, "You know, I probably didn't do anything really worthwhile until I was 30 years old and had a Ph.D. And it's a long row to hoe. And if you want to do something quick, get into something like real estate or . . ." [They laugh.] To do truly original research, you've got to have education, but you've got to have an idea. And the hard part is to get them in the same person. There's too many people with ideas that don't have the background to judge them right off the bat, and so forth. And uh you need time, and oceanography gave me time. They didn't say "six months now," I mean we got to see whether we'll appoint you again. And uh except for Admiral Smith, I don't remember ever having a conversation with any administrator. [Laughingly] I was left absolutely alone. And I say it as a semi-joke, but it's true, and it was the most valuable thing I had. Because it had

publicity to it occasionally, they were happy. But it had science to it, to me, and then Harvard asked me to come give a course, because I'd done some showy stuff. And I got up there and of course, here's a classroom full of people, all brighter than me. And it's what I call "The Great Awakening." I mean, it's sort of like Rip van Winkle waking up, and so forth. And I sweat blood that year. I kept a chapter ahead of the kids, and I really learned physiology as an intellectual discipline, and that was probably again the second most important thing I did after coming to Woods Hole, because you've got to see a field in a perspective. You got to take 30 feet of a bookshelf of journals, and you've got to put it in 30 lectures and try to show the overall structure of what's important about it and where you might go on to get more, and so forth. Because essentially it's a guide to someone who really wants to go on in the field and to learn more and stuff, and it turns out I got great satisfaction out of it. So that was further proof I was a bit of a strange person. I liked to teach, and so I've always taught after that. And it was a kind of an alternate reality from going out in the field. Because I don't know, I just liked to teach. I guess it's [laughingly] what I call a "petty dictator." When I come in there and I close that door, it's my world, and I . . . . [Laughs.] Everyone wants to be in control.

TAYLOR: Yeah, but there's more to it than that. It's when you really love something, you want to have other people enjoy [??]

KANWISHER: Well, that's what I call the evangelistic spirit, and of course that's why I think essentially the evangelism of religion is a sort of [Laughs.] an international curse at times. Everybody's got the truth. And we know that only one can be right, and maybe none of them are. [They laugh.] But here's a field in which I know these things, because I went out there and asked them. It's a magic subject to teach. Everyone's curious about their own body. And there are a lot of things you can't talk about. I'd tell the students the first day: "I don't talk about sex or money." I know more about both of them than any of you. But I mean there are certain things which are socially difficult and so forth. The rest of them are animals as machines guided by a brain, and it's a great subject. That's one of the reasons I'm writing a book now [laughingly] is that I worked hard on my notes. And the last time I taught, my kids were undergraduates, and they came to see what their old man was teaching. And I worked hard on them, and I really decided I didn't want to throw them away. I didn't trust any of the textbooks, and I wrote my own notes, and I'm trying to put them in book form now.

TAYLOR: I'm going to try and put this whole thing in context, because you come from an era that I think of as the "Golden Age of Oceanography." OK?

KANWISHER: Yeah.

TAYLOR: For a whole bunch of reasons.

KANWISHER: I just used that expression. It was the golden age of field biology. I was first out there with the high technology, and everything was interesting. The first fish I towed up from the Pacific had 25 atmospheres of pure oxygen in his swim bladder, little tiny fish like this. Everything was like that. Some fish were supercool. Other fish had antifreeze in them. Nature was a kind of giant Easter-egg hunt. And you always know there are going to be more eggs. You never run out of eggs.

TAYLOR: Yeah, and also during that period we're talking a really small field.

KANWISHER: Yeah, yeah.

TAYLOR: Let me make a couple of statements, and you can react to them.

KANWISHER: [Laughs.]

TAYLOR: I had gone to several Boston Sea Rover meetings.

KANWISHER: Have you really?

TAYLOR: I was one of the first. I was in the days when we had to build our own wetsuits, because no one made them . . .

KANWISHER: Yeah, yeah, yeah, yeah.

TAYLOR: . . . and dragging on the old *Calypso* regulator almost turned you inside out to try to get some air through it, and . . .

KANWISHER: Yeah.

TAYLOR: . . . so on. Now I think it was 1961, the Boston Sea Rovers had their first kind of symposium, if you will.

KANWISHER: Um-hum.

TAYLOR: And the field was so small then. I remember I was dating my wife at that time, and we went, and sitting at my table was Luis Marden from National Geographic, who found the bones of the *Bounty*, Doc Edgerton, who was "Papa Flashback" in those days.

KANWISHER: I know. Close personal friend of mine. What a charmer!

TAYLOR: We'll get to it in a second.

KANWISHER: [Laughs.]

TAYLOR: Georgie Bass, who became the father of the Institute of Nautical Archeology at Texas A & M.

KANWISHER: Um-hum.

TAYLOR: It was a small field. Everybody knew everybody else. All the equipment was experimental. As I say, we'd go down to Atlantic Avenue, and for \$10 you could buy enough 1/8th-inch Neoprene with glue . . .

KANWISHER: Yeah, yeah.

TAYLOR: . . . to glue a suit together.

KANWISHER: Yeah, contact cement. I know.

TAYLOR: And that's the kind of period you came through.

KANWISHER: Well, I didn't get killed. I did awful things. [Laughs.] Someone's looking after me, because I lost some friends. Essentially, something happens when you're underwater, you got 30 seconds to do the right thing. And most of the fatalities come in the first year, because people don't have the right reflexes, and so forth. And I'm scared now of the things I did. I wouldn't tell my kids . . .

TAYLOR: Doc Edgerton lost a son.

KANWISHER: I know it. He lost a son with a rebreather. And he never told me. I never knew it. He would ask me, "What are you doing?" I said, "Well, I'm making a rebreather." I had no idea. His son was killed in Nantucket Harbor. By a professor of the University of Pennsylvania I knew personally, and it had been kept quiet. Later on one of my closest friends was Henry Kendall, physics professor, got the Nobel prize. He was killed with a rebreather, because I wouldn't let him use mine. It's a subtle thing. If you're going to be a good diver you got to be a good physiologist. You got to understand what's happening to you. I was 6 feet high, and there's two pounds per square inch more pressure on the bottom, and our veins, and stretch out all these things and so forth. But it's a delicate, delicate system. I've seen a person burst their lungs in a college swimming pool, because they were doing scuba training and didn't open their mouth when they were coming up from the bottom and stuff. You got to have a bit of the fear of God and know these basic things so you have the right reflexes and so forth.

TAYLOR: What I think I'm trying to point out and wanting you to comment on is that that was a period of great experimentation. We didn't know a hell of a lot about what would happen if you went down deep and came up. We had the Navy rate of ascension tables and all that, . . .

KANWISHER: Yeah.

TAYLOR: . . . but a lot of this other mixed gases and things like this, didn't even exist really in those days.

KANWISHER: Um-hum.

TAYLOR: But there was a great sense of adventure, and we were also finding new kinds of species. We used to talk about deep scattering layers and things like that. This was all new kinds of stuff back then.

KANWISHER: Um-hum.

TAYLOR: So it was really kind of a perfect time for someone like yourself that had a spirit of adventure, to go out and do what you call the "blood-and-guts" kind of work that was there.

KANWISHER: Um-hum.

TAYLOR: The times were really kind of right for that, don't you think?

KANWISHER: Yeah, yeah. As it said, it was the right time, in the right place, with the right skills. And the right opportunity--which the Oceanographic gave me, and stuff. I would have gone to a university, except they aren't going to let a guy in the Zoology Department who has never had a course. [They laugh.] But the important thing to know is physical chemistry--how gases behave, how they move around in the body, these kinds of things, and so forth. It was never really part of scuba training. It was deadly. The rebreather: we started a company, Walter Stark and I. We made 30 devices, I guess, or something or other, and sold the company, because I didn't want to leave Woods Hole, and Beckman Instruments bought it. And they maybe killed three people with it. The system is now being done over again by a guy in Munich, Germany, who is less than half my age, but a very bright guy. He's going to do a great job, and I told him all this history, and he picked up . . . . He said, "It's sort of like selling airplanes without pilot training." If you don't do the right thing. [Laughs.] Give me a car anytime. You can always pull over to the side of the road and think, "Where the hell am I now? What do I do next?" [They laugh.]

TAYLOR: But again, the period you're talking . . . . I remember when I got to first use what they kind of generically call the aqualung now. You jump off the end of a dock, . . .

KANWISHER: Yeah.

TAYLOR: . . . and then you go rocketing back up on the dock to learn how to turn the thing on. We didn't know anything.



KANWISHER: Yeah. I was there at least 10 years before that, and when I went in there was still the 300-lb. grouper right by the dock in the Bahamas. They're gone now. [Laughs.] And, as I said, since there was no instruction, I'm just lucky to be here, because it's a deadly instrument, and it's a great instrument. Let's get on to something else here. I can reminisce for a long time, but it's not the science I did.

TAYLOR: I understand that, but everyone that listens to one of these oral histories is not going to be a scientist. They're going to be kids in school that are writing reports and things like that. So I want them . . . . You talk about your own kids saying, "Come on, you didn't really do that kind of thing back then!" And I want them to understand what the situation was like. Now they see these scuba divers with color-coded suits, these exotic resorts. Thirty-forty years ago was a whole different ball game.

KANWISHER: Um-hum.

TAYLOR: We were making camera cases out of the old pressure cookers, and things like that. So there's been a huge development. You got into that and got into a field that might not be so easy to get into today as it was for you then.

KANWISHER: You couldn't get anybody to live in Woods Hole. They hired me off the street with nothing to recommend me except I'd been in the Navy! [Laughs.] No one asked any questions. I did know a lot of electronics. That made me a welcome shipmate. It's like it's nice to have a cook along too. [They laugh.] When we'd do expeditions, the first thing is who's going to cook! [Laughs.] And then, can he tie a bowlin? And then, does he know any science? [Laughs.] It's not quite that, but it's . . . . Now, of course, the world wants to live in Woods Hole. The action was in the cities then, and now essentially they're all urban refugees and stuff. I remember the Mormons. They were chased out of Missouri and Iowa, and they went across the Plains. They came over the mountains; they looked down at the Great Salt Lake; they said, "This is the place." [Laughs.] We drove all of both coasts. We came to Woods Hole and said, "This is the place." And I had employable skills. As I said, it was a whole new . . . . People hadn't left the lab much. Taxonomists had been around. What's there? Now they knew what's there. Now how does it work? And Scholander was just a magic person to do that.

TAYLOR: Give me a thumbnail sketch of him, what he was like.

KANWISHER: [Laughs.] That's like a sex-starved teenager who just had a date with Marilyn Monroe. [They laugh.] That's part of what made my life difficult, because essentially he's come

back from Marilyn Monroe and now he's got to find a date for the junior prom. [Laughs.] To me he was magic, because he's a great musician. He's just a great personality. He saw the problems. The first morning with him. We took a green coconut. And I said, "Be careful now. There's probably pressure in there." I had broken one up and it had squirted. We put a needle into it. It had 5 atmospheres of pressure. Well, it turned into an interesting story about the coconut develops and what it does with the milk in it. I had to open them, because I always wanted a drink. We had a little winch, the kind they used to tow targets behind a big plane for fighter pilots to train on, and we lowered a huge shark hook down in the Gulf Stream a half a mile. The first fish we caught was a new species called the Golden Grouper. [Laughs.] And that night we filleted off half of it to eat. He said, "They can count the scales on the other side." That was such a hideous crime to a museum person. There was a museum guy at our hall who worked with me for 30 years and never spoke to me. He heard those stories. I don't want to get into the personalities and so forth; it's too personal. He had you might say a kind of childish wonder with a deep understanding of animals and plants to back it up. I wouldn't have known what to do.

TAYLOR: So this was a real mentor, professional mentor.

KANWISHER: Real mentor, yeah. And he left after two years. That's equally important, because I'm a loner by instinct. [Laughs.] And it wouldn't have worked out. Later on I was offered a professorship at Scripps, because he was out there. And I knew it wouldn't work, and I didn't go. And he never quite forgave me for that, which broke my heart. You got to have someone to get you started. My daughter has that. And this woman in our world she can walk on water. She did such a valuable service. And to think that you can actually go out there and pull that fish up, and it's got 25 atmospheres of oxygen, and no one's ever seen it. [Laughs.] There was a moment when we were working on Arctic birds. We were using transmitters on the birds, because we were interested in how they avoid predation. This was up beyond the Arctic Circle up in northern Norway. And these are little ground nesting birds--ptarmigan, which is a quail. They sit on these eggs, these little jelly-bean-size eggs. They brood 13 young. They all hatch within an hour. There are a lot of marvelous things going on there that we only partly understand. So you have to go off and eat every so often, and of course it's 3 degrees Celsius. That's what? 38 Fahrenheit. [Laughs.] And there's sleet falling as snow further up the mountain. We're wet and cold there. The hen has been gone for some hours. And we think,

“Oh, God, it’s a short summer. We only get three chances a summer. We’ve lost a third of our chances.” Pretty soon the bird is coming back. We can hear him as he’d run from bush to bush. And everyone he’d run the heart would speed up. He got the eggs, and birds lose the feathers on their belly. It’s called a brood patch. They got to keep the eggs warm. So he hit these cold eggs, and the heartbeat went up to 600 a minute--bebebebebebe. [Laughs.] Fortunately with the recorder running, and the conversation was half in Norwegian. And my daughter says . . . . She’s 17, had two years at MIT, but she had never been out in the world of nature. She said, “Well, what do people think about this?” I said, “No one’s seen this.” She says, “Shit, you mean we’re first!” And it was that sense of excitement. I finally was able to convey to her what my life was about. It’s hard, and most people never manage that. I don’t know whether her interest in research got planted there or not. But the fact that no one had seen this before.

TAYLOR: You treat all of this, to this day, with such wonder.

KANWISHER: Well, it’s a game. It’s a child’s . . . . [Laughs.] I feel like a little boy wandering through the museum and looking at these marvelous things. The interesting thing is that there was a science-friendly society, particularly after Sputnik. And oceanography was a magic word. Whenever you’d do a grant application, put “oceanography” in every other sentence. [Laughs.] Once you learn how the system works--for instance we had to ride on military planes, but there wasn’t that much money for travel. But I mean they fly just as fast, and you can ride on fishing boats and scientific vessels and oil tankers and I’ve used dog sleds and dugout canoes and stuff, and you could do all these things. It doesn’t say you can’t. As long as you got some science guiding you. And the hard part is asking a question that can be answered. I mean, anybody can ask questions. The Hubble telescope [laughs] is one of these absolutely magic things. [Laughs.] I thought astronomy was a dead field. [Laughs.] But I couldn’t ask questions in astronomy, but I could ask questions on animals and plants.

TAYLOR: Well, that to me has always been the greatest education: when you have learned to ask the good question, . . .

KANWISHER: Yeah.

TAYLOR: . . . then you’re really educated, as far as I’m concerned.

KANWISHER: It’s that initial filtering. Some people spend their life on futile things that don’t work. I’ve spent enough years I don’t like to even [laughs] remember some of them. I think that’s what Scholander gave to me. I learned an arrogance from him which has irritated an awful

lot of people, but too bad. [Laughs.] It's not arrogance, it's a sense that it's a hell of a lot of fun. And a lot of people are wrong. Almost no adult can say very easily with grace that I was wrong. And I think of poor Stephen Jay Gould, who was such a magnificent writer. It turns out that it was a meteorite that did the "punctuated" evolution. It wasn't some internal mechanics of evolution. And this still goes on in all kinds of fields. It's hard. People live . . . Fifty years. My uncle was plowing with a horse. I can remember the poles coming across the fields--this electricity. They got rid of this marvelous kerosene lamp I loved the smell of. And now you can fly any place in the world for \$1,000 in a day. And I've done it. I haven't been to the Antarctic. The people in the NSF in the Antarctic Group and me didn't get along. But I've been every place else, almost. I haven't been to central Asia very much, because the Russians were not very hospitable. And there were problems there, and once you have skills, and once you like to talk about it, the combination is sort of what I call "scientific freeloading." I'll give lectures.

[Laughs.] I went to Barcelona last spring. It was one of my old MIT students has married the boss there. The boss is a lady there, you see. [Laughs.] And I gave some lectures and stuff. And people love to hear stories. And a lot of them are exciting, because now DNA stuff is just mind-blowing, because it's absolute fact. A lot of the stuff that I do is intelligent guesswork. And a lot of it, like ecological theorizing, is pure guesswork, and imagination is cheap.

TAYLOR: Yeah, but it forms the groundwork. It forms the direction things are moving.

KANWISHER: Yeah, it doesn't . . . . No, no, I . . . .

TAYLOR: You won't buy that.

KANWISHER: We're going to get rid of the schools of education, also the schools of ecology, because the British in the 1920s did an awful thing. You see, I consider a naturalist as a noble profession, and they said that ecology was scientific natural history. That's the class structure--intellectual class structure. And you've got to know the animals before you start talking about them. You can't make models on things you don't understand. I can go through my whole life is that. The sperm whale, [laughs] the animal that made the whole economy here, because it made light at night. The sperm whale has a 10-ton nose, it has no upper teeth. It has a blowhole only on the left-hand side. It's an absurdity of design, and yet with that it can dive down a mile for an hour and live off deep-sea squid, and there are more of these deep-sea squid, which we can't catch any other way. The million sperm whales, each weighing 30 tons, takes two times out of the ocean what man takes. Just because of that physiology. It's the course of that

physiology and how it got there is the story that's been essentially the center of my life, which I want to write about now. People don't under . . . . You can pick up the *New York Times*. They have a thing on the oceanography, and of course fisheries is appalling. It's been badly mismanaged. The cod are gone, and all these things. But we're a minor character in the oceans. The oceans don't count: we get half a percent of our food from the oceans. If we lost the oceans tomorrow it wouldn't hurt much. Iowa is equal to the oceans--or maybe it's Iowa and Kansas--anyway, something like that. But the oceans as a biological puzzle are entirely different. It's two-thirds of the earth, and here's this damn whale out there. There's still a million of them. There used to be two times as many, and it's got that special ability to dive down and stay there, and it does it by a whole number of strategies. One is a small heart in a big body, and things of this sort. It's what I call sort of bioengineering. There is not another set of oceans to go to. [Laughs.] I got there when it started. People wonder about life on Mars. God, we got the oceans, and they're so different than land, bears no resemblance. There's no plants at all. There are no herds of buffalo or wildebeest, or caribou or any of these other things. They can't see any of the herbivores. They're little tiny flea-like animals, what do you call them? Plankton or something like that. Everything you see are animals eating animals. Most people never adjust to it. They take some group of fish; they spend their life with them. They do some nice, useful, what I call taxonomic or phylogenetic studies. But to understand it as an overall living system, it's . . . . I don't want to lecture too much here. [Laughs.] But I wish I could write. It's a great story, and I can't write well enough. [Laughs.] There are a few people who can, but as I said, they don't know the story. It's just worth knowing. It's what I call absolutely marvelous trivia. [Laughs.] One of the great British writers recently wrote a book on (what do you call?) charming trivia, and it turns out that the size of a NASA rocket is determined by the width of the behind of a horse, because it turns out when the Romans came in the first century A.D. they used two-horse chariots. And when they got around to building a railroad the ruts were there, so that's how they put the separation of the tracks for the train. And of course, the train has to go through a tunnel, so it's as wide as the two horses. And the rocket has to go through the tunnel, so that's how big the rocket is. [They laugh.] But you can do these kinds of things biologically. And they're absolutely charming.

TAYLOR: It must be something from the era of science that both you and I grew up in, because my wife always said that me, her husband was an expert on little-known facts by little-known people of little-known use, but they're interesting.

KANWISHER: Well, it's not true.

[END OF TAPE]

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#### JOHN KANWISHER ORAL HISTORY

Interview by Frank Taylor, February 11 and August 11, 2004

Tape 2 of 3 transcribed by Arel Lucas, January 2005

KANWISHER: . . . ation of the things, of the tracks for the train. And of course the train has to go through a tunnel, so it's as wide as the two horses. [Laughs.] And the rocket has to go through the tunnel. So that's how big the rocket is. [They laugh.] But you can do these kinds of things biologically, and they're absolutely charming.

TAYLOR: It must be something from the era of science that both you and I grew up in, because my wife always said that me, her husband, was an expert on little known facts by little known people of little known use, but they're interesting.

KANWISHER: Well, it's not true, it's not true. Continental drift and stuff is the big story. I'm furiously jealous of the geologists. There's a guy named J. Tuzo Wilson. And he was . . . . I guess he became chancellor of the University of Toronto. And I once . . . . We were talking at a symposium together. And I flew across the country with him beside me, [Laughs.] and it was the best six hours of my life, because he had a couple of pieces of Masonite and a window shade, and he'd been talking about how continents slide over each other, and here was pure intellect. It's one of the things that I thought that oceanography was missing. It was missing intellect,

because there . . . . People who did these things were university people who had time to think what we had collected. And Maurice Ewing down at Lamont, at Columbia, had the old Lamont mansion. I taught a semester down there. And he had it full of cores and so forth. What the hell do the cores mean? And J. Tuzo Wilson saw it. [Laughs.] He's the guy who deserved the Nobel prize. They don't give one in geology. A few people like him, and so forth. I think that's missing in most fields.

TAYLOR: The visionaries.

KANWISHER: Well, yeah. The visionary disciplined by what we know. It's important you know what you don't know. I know the lung of a whale and a few other trivial things. As I said, imagination is cheap.

TAYLOR: Yeah, but that imagination, that ability to think, to use the trite term, to "think outside the box," how something might be?

KANWISHER: Yeah.

TAYLOR: That's great stuff.

KANWISHER: Well, that's the important part of not having had zoology. I probably think one of the few valuable things I had is--in addition to my mechanical skills and stuff--is that I didn't know anything. Well, it turns out a lot of things were wrong, particularly in zoology and diving, and so forth. They were wrong because they were done by people who had a job to do, which, like the military, to go underwater and do certain things, and so forth. And it was a high-stress, dangerous situation, and they didn't have time to sit back and think, and MDs, by their general nature don't think because they got a problem in hand. They got a sick patient or something or other, and the chance to be a pure intellectual is a rare one. The British is the only other country that I think does it to the extent that we do. They do it even better, probably. And I rail at the class system, but I can remember I worked with the British Antarctic Survey people in Cambridge. You start in the middle of town, and you go up what's called "The Backs," and you pass the physics lab. My friend said, "There are more Nobel prizes in that building than in all of France." And they somehow have, within their system, they have the tolerance for eccentricity and creativity, and they put up with Watson and Crick, who were two sons of bitches. And I mean they were really rather overgrown children, acting like spoiled, but they were right. [Laughs.] And of course the head of the lab was a guy who got the Nobel prize at 25 for the bubble chambers. So it pays to . . . [Laughs.] But he somehow realized that we'd better give

these guys a stairwell to work in. A stairwell to build their models and so forth. [Laughs.] And they were thrown out once, and they sort of snuck back. [Laughs.] And it's having those locations, and also I think you're part of a structure. I feel I'm part of scientific society of the world. And I would like to put a couple stones in place in the building. It's that sense of discipline. Because there are 10 or 20 people who I care intimately what they think of what I do. I wouldn't lie to them any more than I'd lie to my wife. [Laughs.] And it's . . . that's why you got to have this discipline with the creativity.

TAYLOR: OK, good. How are we doing on time?

VOICE: Ah, got 20 minutes on this tape.

TAYLOR: OK, let's hold it there, because we're going to run, . . .

KANWISHER: Yeah.

TAYLOR: . . . because we started a little early there. Uh . . . [Tape stops, then starts again.]

KANWISHER: Well, I guess, to put a bit of folk wisdom in it, when I left home, my father gave me one piece of advice. He says, "Find a job you like in a place you want to live." "Because," he says, "you'll be there for a half a century."

TAYLOR: [Laughs.] That is good.

KANWISHER: Yeah, and I managed both by walking in off the street and being hired at the Oceanographic. Now why they should have hired me, God only knows. I mean I was trained as a physicist. I'd worked in operations research in the Air Force, and I didn't like it at all. And I loved animals, but I knew nothing about animals, never had a course in biology. I never mentioned that, of course, to them, and they hired me. I'm not sure it reflects well on the trustees at the time to have such a policy. [They laugh.] But if it was oversight or intention, it was unbelievable opportunity, because just after World War II, all of a sudden there's this explosive growth of interest in science. We'd had the Bomb and the radar and all these other things. It was a science-friendly society, so instead of something being locked up in universities and museums, it was something that became essentially a part of the general public civilization. And here I was, and they said, "Do what you want to do." [They laugh.]

TAYLOR: OK, that's a good start, but just so that whoever listens to this will know, I am with Dr. John Kanwisher. We're in his house, and we're going to our second session on his oral history. And he has had an amazing career. And he sits here at this point and says, "Boy, essentially, I could do this all over again. This was really exceptional."



KANWISHER: Well . . . .

TAYLOR: Now, you were trained as basically a physicist. That's a "things" kind of person, and yet you had this tremendous interest in animals and things like that.

KANWISHER: But it was an aesthetic interest.

TAYLOR: Now explain that.

KANWISHER: To me, I was a nature watcher, and in the 1930s there was no television. Movies were the only culture. And there was a couple named Martin and Osa Johnson, and they got a Sikorsky amphibian and they flew over Africa. They flew over Amboseli and Ngorongoro Crater, and they showed these million wildebeests in their tracks, and so forth. And I was a farm kid, and it literally blew my mind.

TAYLOR: That plane was *Osa's Arc*.

KANWISHER: I mean, I'm sure there was a girl climbing out of the Empire State in the movies, but this was real world, with real animals.

TAYLOR: But you're bringing up an interesting point here, because that's how it was at a period. Now I'm pretty contemporary with you. The Johnsons, in Africa, with those two old aircraft, the kind you would never see around today, one painted like a giraffe, one painted like a zebra, *Osa's Arc*, and I forget what the name of the other one was. It was a much simpler time. That just caused people to get really into "Look at that!" [Whistles.] "Oh, do I wish I could do something like that!" That represented real adventure in those days. Did you read their book, also.

KANWISHER: Oh, sure. Sure. [Laughs.] Probably the first wide awakening was reading the story of Lewis and Clark. It's two hundred years ago, but it was like it was yesterday. In my fantasy mind I was starting up the wide Missouri, [laughs] and there's an Osage orange tree out on Penzance Point here. And the first thing that they sent back from the cuttings a month after they'd been on the trail was some cuttings from a tree that the Osage Indians made their bows out of, called the orange tree. Jefferson planted that on Monticello, and various cuttings have been planted in Central Park, and a cutting of that came up here, so that there's a kind of a . . . . All of a sudden here's 50 million buffalo. What a fantastic thing! [Laughs.] If you could be anything you wanted, I would have wanted to have been with them. [They laugh.] But what I did was a pretty good second place.

TAYLOR: This is very true.

KANWISHER: Yeah.

TAYLOR: But with that kind of love, I mean, boy . . . .

KANWISHER: But I never knew it at the time. I was just storing away memories. I was part of what I guess you would call a small-town, conservative, religious upbringing. I had a pin for three years' perfect attendance at the Methodist Sunday School, and it was sort of this, what I called this Judeo-Christian morality. Medicine ought to taste bad and work ought to be hard. You got to triumph over adversity and so forth. And I went off to college, and I got in a couple of years, and then all of a sudden I'm in the War. And from a shy boy I emerged with an amount of arrogance that upsets a lot of people. I realized that that you could do anything you wanted to if you put your mind to it.

TAYLOR: So this was kind of a getting out of what, for you, was a very limiting environment. There's a big world out there.

KANWISHER: Oh, yeah, yeah, yeah. And before I got to Woods Hole we drove all of both coasts, and I can remember we got into Seattle and I went to the Boeing plant. There was a room there that must have been an acre of drafting tables. And I would have been someone at one of those tables. [Laughs.] I'd wake up occasionally. I don't dream much, but if I ever do dream that's the only nightmare I have, is being at one of those drafting tables, someone not liking my drawings: "Go back and do it again!" [Laughs.] But it's uh . . . .

TAYLOR: Now, how did you happen to pick physics for college?

KANWISHER: Because it was hard and . . .

TAYLOR: Really?!

KANWISHER: . . . I loved it. And I loved it. I lived in a real world of rollers and winches and hydraulic systems and so forth, and I lived in a real world of real things and stuff. And I went back to my 16th high-school reunion last year, and they still remember me as the kid who liked physics. [They laugh.] And I did, and classical, quasi-, what I called "Newtonian" physics was a snap. That was how things work. And my whole life was tied up in how things work. Now I'd been around animals, but I wasn't particularly interested in them except as aesthetic things, and so forth, and so I went on in physics, and of course in the War, and essentially I figured the Bomb saved my life. People didn't understand how radiation affected animals, people. And we have what we call a mean lethal dose; 50 percent of people will die; and it's 500 Roentgens. And what it is touching one in 50 million bonds within an animal, and it upsets the whole apple

cart. And I thought, “Oh, what a sophisticated way to study animals.” And after four years I got a Ph.D., and what it really is, it’s hitting a watch with a hammer and trying to understand why it doesn’t tick any more. [They laugh.] And 50 years later I had retired, and I was a member of the Norwegian Academy of Science, and they were upset over Chernobyl, and they were having a meeting. And so I spent a year catching up on the field, and it’s still the same way. Some things, like predicting the weather, understanding that is happening with radiation, are essentially insoluble problems. Fortunately, I picked a problem that was soluble. But I watched these people, these fluid dynamicists and so forth. [Laughs.] They’ve had tenfold larger computers, at least three or four times. They elect each other to the National Academy, but the weather in a week is noise. And some things aren’t amenable to a rational understanding. Einstein said “the turbulent flow of fluids is the most difficult of the classical problems,” and boy he was certainly right. It’s nice to have a field where you get results. And sometimes the results come from [??]. For instance, there are all these evolutionists, paleontologists, sitting in museums, looking at bones, and so forth. And they talk about “punctuated” evolution. All of a sudden, somehow, within the living system of interacting animals and plants something happens, and all of a sudden there’s a big change, like the Cambrian “explosion.” Well, there was a big change, but it turns out that it was a meteorite hitting the Yucatan Peninsula. And it was found by classical physicists who contributed to the atom bomb, and his son who was a geologist. And they put their two skills together, and it’s one of the neat things. You never know where the answers are coming from. I may be arrogant on the outside, but on the inside I’m humble, because I’ve seen unbelievable things, like Dolly. You can’t really use a cell from an animal and make a whole other animal. But it turns out we’re wrong.

TAYLOR: But you see, the beauty of . . . . You ultimately ended up in a field where all of those different kinds of science is mixed in. The two gentlemen you were talking about, who wrote that book, the something *of Doom* [*T. Rex and the Crater of Doom*], I remember reading it. And they found this layer from that meteor.

KANWISHER: Alvarez, their name was.

TAYLOR: Alvarez, right, and they found this layer somewhere up in Italy in one of the road cuts, and son, the geologist, got dad, the physicist, interested, and they worked out this whole thing, which gave us a whole new theory on perhaps how the big--at the KT boundary--how the big . . .

KANWISHER: Sure, sure, sure.

TAYLOR: . . . extinguishing sort of thing went on. But what they were doing was something that led to a biological thing, also.

KANWISHER: Sure, sure, sure.

TAYLOR: Because I know when Chuck Norris here at the Institution was working with the--I think it was--Chicxulub, the crater that was formed from the impact, or that's what they called it. And he initially found ejecta from that out on the Blake Plateau.

KANWISHER: Did he really? Yeah.

TAYLOR: Because I asked him one time . . .

KANWISHER: That shows how violent it was. In other words, literally a molten splash, erased everything in North America. Boom! Everything larger than a mouse, practically.

TAYLOR: Well, see that's what I asked him. I said, "what was the angle of impact on that, to the best of your knowledge?" And he told me, and he said, "What we now call North America, this area must have been absolutely, totally devastated." But here are some geologists and physicists whose knowledge is going to make big inroads in the biological field, and that's why I don't find it so strange that you started off as a physicist, because I don't think you can go wrong with a physics background. I don't care what science you go into.

KANWISHER: Look, you got to learn to think. And the way to think is to do something that's difficult. Now the British have done it in the past by learning Latin and Greek. [They laugh.] And one of the best bird people in Britain is an M.D. now, and he said, "When I went to medical school, a doctor said, 'What are you doing?'" He said, "Well, I learned Latin and Greek." He said, "You'll have no trouble with medicine." [They laugh.] If you could predict the future, you could plan a career. But I've had trouble with administrators at times, because they want to know what results you're going to get. If you know what you're doing, it's not research. [They laugh.] They're sort of simple syllogisms, but . . .

TAYLOR: But you're correct.

KANWISHER: Yeah, as I said, I've been thinking a lot about [??], and I think one of the valuable things about an institution like the Oceanographic, in spite of my not getting along with some of the people, and so forth, is that it forced you to mix with other people. And going to sea, essentially I judge people by whether they got anything interesting to talk about at the breakfast table. And there've been some real stars. [Laughs.] Fritz Fuglister. [Laughs.]

TAYLOR: Yep. He could not only talk science, but he could talk art.

KANWISHER: Yeah, I know, I know, I know. But this cross-fertilization: It sounds like a put-up thing, but it's real.

TAYLOR: Now, what had you known about the Woods Hole Oceanographic Institution before you came here?

KANWISHER: Almost nothing. Almost nothing. Nothing. I'd been in the Navy. I loved boats. I didn't particularly much care for discipline, but eh it's the war, and . . . . I had skills people needed. I could run fire-control systems and fix radars and they needed it badly, and we bargained at each other, and I can't tell you how exciting it was. It's like a kid who's been playing with an erector set, and all of a sudden he's in an automobile factory making real things. As I said, you can't have wars for little boys to grow up, but I was lucky as hell that I wasn't killed. And I lost a lot of friends, and my attitude has been, I've got to do a lot to make up for those who didn't have a chance. [Sighs.] I saw this Norwegian physiologist named Per Scholander on the island of Bimini, and I watched him for a couple hours, and I said, "That's for me!"

TAYLOR: What was he doing?

KANWISHER: He was just putting . . . . We went out . . . . [Laughs.] They used to tow a sleeve behind an airplane that fighter pilots could practice on, and they had a winch for that, and he'd gotten ahold of one of these winches, surplus. And we went out fishing in the Gulf Stream. The first fish we caught was a new species, weighed 40 lb. [Laughs.] Called the Golden Grouper. [Laughs.] And if the museum people had known it they would have killed us, because we ate half of the fish that night. He said, "They can count the scales on the other side." [They laugh.] And then the next thing we did is there were green coconuts, and put a needle one and it squirted across the room. It turns out there's 5-6 atmospheres of pressure in a green coconut. And we looked a whole series of things. He was curious. Up to that time I had been looking at Nature as a grand show, as what and how many. But he asked "How?" and "Why?" And he turned that on in me, and it's been a restless life ever since. There are times when I could curse him, [laughs] in the cold, in the Arctic some place, waiting to see what this bird's going to do next. If you don't have that curiosity, then essentially research is a job.

TAYLOR: Well, let me ask you this. First of all, what were you doing on Bimini, and how did you happen . . . ? Because that was a pretty deserted place back then, and . . .

KANWISHER: Yeah, I know.

TAYLOR: . . . how did you run across this guy?

KANWISHER: Well, there was a lab there for the American Museum of Natural History, and the Ichthyology Department had a little lab there, and I had been working for the Air Force, and I picked up [laughs] John Steinbeck's *Cannery Row*, and I sat by Officers' Club pool, and I read it at a sitting, and the next weekend we went down to Carmel. In those days you could sleep on the beach, so we slept on the beach, and a guy came along with a collie dog at 8 o'clock and said, "OK, rise and shine, you got to get up now. You shouldn't sleep all day on the beach." And I saw where Ed Ricketts had his place in Cannery Row, and so forth. It was a real world, and I thought, "Jesus, it would be great to work on marine animals." And I read everything I could get ahold of--Rachel Carson, who lived in [??], lived a few doors down the street.

TAYLOR: Oh, really?!

KANWISHER: Yeah, back in the '30s. She worked for the fisheries here. And Herb Graham was still alive, in his late 90s. His son is a friend of mine, and his son showed me some pictures the other day where they're going on a picnic down to the Weepeekets together.

TAYLOR: So just through things like books--Steinbeck's *Cannery Row* . . . ?

KANWISHER: Look, I knew a lot of medicine, a lot of physics, and I knew I didn't want to be in a large, institutionalized research lab. And I had valuable skills. I could do machine work and electronics, glass blowing, and I was full of a lot of bright remarks about things like thermodynamics, which is really sort of glitter, but not much substance. And Scholander was at Woods Hole, and I came and walked in off the street, and Alfred Redfield hired me. As I said, I'm not sure it reflects well on his intelligence. [They laugh.] If it was an oversight, it was my reward.

TAYLOR: OK, but now I'm missing something here, and this is too interesting to let me get away with you jumping over it. You were out in Bimini with this gentleman, and they had a lab there.

KANWISHER: I was seeing what I might do in marine science.

TAYLOR: OK, so you went out . . . and essentially . . . .

KANWISHER: We had no kids. We had some money from a house we sold, and my wife was free to try anything, and we drove all of both coasts, and we ended up in Miami and went over to Bimini.

TAYLOR: So you were in an area that was essentially vegetation, a beach, a little coral reef and things like that. You said, “This is terrific.”

KANWISHER: Well, this is true. It’s essentially a sandbar with coral reefs and so forth. And of course coral reefs are one of the spectacles of nature. There’s essentially nothing equivalent to it. Later I became good friends with a guy from the Florida Keys, who did a thesis on the fishes of Alligator Reef, and he found 537 fishes in one place--species. And they’re twice as many in the Indo-Pacific.

TAYLOR: So you really liked the environment when you were there. You said, “This is kind of me--gut level.”

KANWISHER: Who could not?! [Laughs.] I mean, it’s not . . . . Who could not!?

TAYLOR: That’s true, “who could not?” But then, a lot of people wouldn’t say, “This is what I want to do with the rest of my life.” They’d say maybe . . . .

KANWISHER: I wanted to do what he was doing. I came here a week later. I’m up in a tree all night, down where the MBL built the houses now, measuring the sap rising up in trees, and he was just a magic person, the right person at the right time.

TAYLOR: OK, now, where did you first see about this opening, getting into Woods Hole? Did you just show up here? Did you see an ad in the paper?

KANWISHER: I just showed up here. No, no, I just showed up here. He encouraged me. He says, “Go up and see if they’ll hire you.” [Laughs.] I mean, as simple as that. As I said, I’d seen pictures in the *National Geographic*, and I came here. Within a month I’m off on the *Atlantis*, under sail in those days. Under sail! Labor was so cheap that it was cheaper to use sail than to use diesel oil. [Laughs.] Some of these guys were making \$20, \$25 a month or something. It was just a different world.

TAYLOR: I know. Dean Bumpus told me his salary in those days finally got up to \$75 a month. [Laughs.] And he said when he made 100 a month he was in second heaven.

KANWISHER: Yeah, and he went to Oberlin. He had a good education.

TAYLOR: OK, now who was it you saw when you came here? You’re knocking on doors. Who did you first see?

KANWISHER: Alfred Redfield. That’s all I saw.

TAYLOR: That’s all you saw?

KANWISHER: Yeah.

TAYLOR: OK, now that's a big name in biology.

KANWISHER: Yeah, but I didn't know that at the time.

TAYLOR: Well, tell me about that meeting.

KANWISHER: Well, I can't remember the details of it. But I do remember something recently after that, that Bigelow was still alive. And I guess it's called the Bigelow Building, isn't it? Yeah, and I overheard him one time talking to "young Alfred," he called him. "How are you, young Alfred?" he called him. [Laughs.] Alfred at that time was in his early 50s or something or other. [Laughs.] And uh they were describing what life had been like in the '30s. I told you about the Martin and Osa Johnson, but it turns out that Sikorsky landed over in Hadley's Harbor and picked up [laughs] one of the Forbes, Alexander Forbes, and flew the Labrador Coast and did aerial pictures and made the first charts made from aerial photographs, which I later used when I spent a year in Labrador. I got to know Alexander Forbes pretty well. People were doing unusual things then. I later stopped . . . . There's a remote village called Hebron. They're all Biblical names because of Moravian missions who built the towns. And we flew in there with a bush plane in the winter. And so, with nothing to do, I was looking through the guest book. In 1933 the only name was "Colonel and Mrs. Lindbergh." They had been flying for PanAm, looking for new routes. You had a feeling that the past was full of spectacular people doing unusual things.

TAYLOR: Oh, truly an age of adventure and exploration.

KANWISHER: Yeah, yeah.

TAYLOR: I mean of the old type.

KANWISHER: Yeah, there's Washburn, looking at the glaciers in Alaska, all these kinds of things.

TAYLOR: Even comic books--Frank Buck and his "Bring 'Em Back Alive," . . .

KANWISHER: [Laughs.]

TAYLOR: . . . which . . . . He really existed. I saw him at the old '40-'41 World's Fair in New York. He had his little crew of animals and all that . . .

KANWISHER: Yeah, yeah.

TAYLOR: . . . sort of thing. But they actually comic-book characters.

KANWISHER: The Trilon and Perisphere. Yeah, yeah.



TAYLOR: And they actually made comic books of these kinds of people at that particular time. So it really was a very, very exciting age, and for a young guy it really opened horizons. I mean, heavens, you wanted to be out in that tropical rain forest, or you wanted to fly that plane along this deserted coast. I mean, do I ever hear you, because that's how I grew up too.

KANWISHER: Yeah, now I wouldn't have known what the ocean was like, except I was in the Navy. I was on boats and airplanes. First you go out there, and there's nothing--just gray water. [Laughs.] All of a sudden there's a dolphin running beside the boat, or surfing on the bow wave and so forth, and you can lean over, and you look down his blow hole, and you think, "That's a damn mammal! What the hell is a mammal doing out here? This shouldn't be that way!" And it's that sort of curiosity and a chance to look into it that I enjoyed.

TAYLOR: Now, when they hired you, what did they hire you as?

KANWISHER: They didn't say. I don't remember anything. They put me in a place with Al Vine. And, as I said, I could run a lathe and make electronics work, and so forth. And during the War, for the first time they started running around in boats with echosounders. And the echosounders keep finding these so-called "scattering layers." And, of course, when you're looking for enemy submarines, you want to know what the hell these targets are here. And so essentially the scattering layer was this great cloud. Well, it turns out the echosounder is essentially a very crude finger. It's a 30-degree cone and it tells you there's something in that cone. And it's sort of like sampling birds. Are there any birds [??] thing. And so you get this thing that looks continuous. And I thought, well, it can't be continuous. You got to see it up close. So there happened to be a thousand feet of coax cable on the *Atlantis*, and I put the echosounder transducer down low, and it turns out they were little individual fishes passing under it. And you have to grasp essentially the geometry of space and time and so forth. What are you looking at? We sit in a place in the ocean and we see a few miles around us. It's a spot on the floor. It's like dropping a pea on a tennis court. That's all you see, and can you put together picture from that? It's rather audacious to think you can go out with a few hydrographic stations, with a reversing thermometer and everything, and get something. Well, the chemistry you can do, but you can't do biology, because you take a sample with a net here and you go on a few miles, and you take another sample. It may be tenfold different. And so essentially it's a very complex tapestry. It's one of these things that's inherently insoluble because it's so complex, changing all the time. By the time you've spent two weeks crossing the Atlantic you

know where you were before it's not like it was any more. And uh you never know where some insight's going to come. The insight came from satellites, because satellites up in the air can look down and they can look at the color of pigments in the water. They can see where the rich areas are, which we more or less knew, but we never knew the detail and the complexity. We didn't know, for instance, that the Gulf Stream was throwing out these big eddies now, which live for a couple of years, with a life of their own, circulating around the Atlantic. And so, essentially, what seemed like a gray, monotonous thing has all kinds of internal structure, both physically, chemically, and also biologically. I wish I had another decade or two, because I mean we're going to understand some of these things I pawed at for a life, and I still don't know. [Laughs.]

TAYLOR: Let me mention a couple of things I can get your reaction to it. First of all, it seems the age you're talking about was an age of initial great discovery in the ocean. You guys didn't have a huge background behind you to rely on, that had built this whole data pile, and things like that. Dick Backus told me that he came here as a newly-minted Ph.D., and for the first year he essentially threw hydrophones over the side for Brackett Hersey and brought them back on, but he said that gave him a way of investigating deep scattering layer and things like this, and said, "Gee, what could cause that kind of reaction?" So it was a whole new way of looking at things, and that's essentially why your physical and mechanical background could fit so well, I think, into the biological end of things.

KANWISHER: I think it's even more, probably, my small-town, rural background. I had to deal with real things--running a trap line. I was a great Eagle Scout, and all these things, and so forth. You look at it, you think, "Well, if I don't do the right thing I'm going to be awfully cold tonight." And eventually, when I'm really out in nature, I mean I might die, and so forth, so you'd better be pretty shrewd about what you're getting into. It's a way of thinking which came natural to me.

TAYLOR: Well, the old term for that used to be . . . .

KANWISHER: It wasn't like I sat down with determination and had a good teacher and so forth. But I had terrifically sympathetic surroundings--parents who gave me utter freedom, and a remarkably good educational system in a small town, when they wouldn't let the teacher get married or have a drink or smoke. Can you imagine?

TAYLOR: Oh, I know.

KANWISHER: I mean, appalling.

TAYLOR: That's how it was when I was a kid.

KANWISHER: [Laughs.] If there's a real heaven, there's a place for that math teacher of mine, Miss Burns.

TAYLOR: Well, see what you're talking about is an old term. It's called being "canny." There's a certain caninness about you.

KANWISHER: Yeah, yeah, yeah.

TAYLOR: Now, so, you're going to put that caninness . . . . You're going to put an obvious talent for mechanical things, physics, how things worked, the force and energy of all things, and then you came here and saw Redfield, got a job. They didn't give you a title. What were you going to do here?

KANWISHER: I was part of the group that set up the tenure system. We needed titles. You couldn't get people to come here from the University unless we had a title. So we did "assistant scientist," "associate scientist" and "scientist." We didn't want the word "professor" in it. And I appreciated that. At times I'm a bit anti-academic. I don't like the structure of universities and departments. I think that they separate things into little balkanization of intellectual concepts, which I'm still unhappy with.

TAYLOR: Little city-states, [Laughs.] so to speak.

KANWISHER: Yeah, yeah, yeah, with their own journals, their own organizations.

TAYLOR: And their own protection of their own turf, and things like that.

KANWISHER: Yeah, but Scholander was here, and as a nicety he asked me over to his house. We had no kids. It was Christmas Eve. And he had been in Point Barrow, Alaska, for a year to study frozen animals. And unfortunately there aren't any frozen animals, because the ice scrapes everything off the shore. There's no shore life. Well, he was ingenious. He found some little insects back on the tundra, but that day I had literally been over by Quissett Harbor. My wife's a painter, and she was painting, and it was a cold day, and I was looking around. At low tide, it turns out, there are oysters there they park to go The Knob. And there was some *Mytilus* (mussels), and I opened them up, and they're full of ice. And I said, "Aw, come on, there are frozen animals all over here." He looked at me and said, "No, it can't be." So I went home that night, and again, it's where the physics comes in, essentially the conversion of a liquid to a solid requires a lot of energy. It's 80 calories per gram. [Laughs.] It's easy to measure. So, using

essentially a mercury thermometer read with an eye loupe and a freezer in my refrigerator, I showed that 90 percent of the water was turned to ice in these animals, and it's part of living intertidally in the winter at this latitude. So suddenly I'm a biologist. I never went back.

[Laughs.] He asked me off to a trip in the Arctic, and . . . .

TAYLOR: OK, suddenly you're a biologist. You're going to go to the Arctic, and you just told us how that came about. Now, that must have been pretty exciting.

KANWISHER: Oh, Christ, [laughs] I was speechless. I mean, the first two years with him! Thank God I had an understanding wife! I was responsible for hiring three different people. Each time the wife was a disaster. One was a nymphomaniac and picked up men in bars. The other thought she was an opera singer. The third was plain crazy. And having a secure married life, essentially I never was very realistic about what [laughs] the problems that some people have to face, which I never had to. I had a wife who did everything. Everything you see is because she ran the show. She's responsible for my kids getting into Harvard and MIT, and things like that. So I was free to do anything, and I did, and Scholander was a magic man. He was the pied piper that led me down the [laughs] path.

TAYLOR: OK, so he said, "We're going off to the Arctic." Now, in those days the Arctic might as well have been the Moon as far as exploration and discovery and all that kind of thing was concerned.

KANWISHER: Yeah, yeah. But there was a geographer named Beany[SP?] Nutt, who's still alive up in Hanover, New Hampshire, as of a few months ago, anyway. And he had this 100-foot schooner that had once belonged to one of the presidents or something. I can't remember what. And so we went up on a sailing schooner to the Arctic, and they dropped us off on shore, and we set up a lab, and we studied supercooled fishes, and frozen intertidal life, and a whole series of things, and they came back at the end of the summer and picked us up. Well, it turns out that there was a strict rule against having women around the boats. So my wife and Scholander's wife found their way up there on their own, through the Royal Canadian Mounted Police and the Eskimos, and so forth, and they happened to be in the same fjord, and so we had a great summer. We had fresh bread every day, and [laughs] we set up a purse seine and had all the char we wanted, which is a salmon-type fish. And when the *Blue Dolphin*, the schooner came back, you couldn't leave these women alone on the shore. [Laughs.] And Dave Nutt's never forgiven us for that, but [laughs] . . . . As I said, you've got to have a curiosity. On the

way back, of course, the Labrador Coast is full of icebergs, the kind that sunk the *Titanic*, and we're under sail. We're under sail on a schooner. I mean, talk about fun! [Laughs.] And every day, at the end of the afternoon, we'd stop by an iceberg and we'd use a rifle and knock off a piece and roll over and get it to have for our liquor drinks. Well, the ice is white. It's white because there's a lot of bubbles in it. And when you're sitting there contemplating the sunset through the glass of booze, as the ice melts, as each bubble is released it pops out, because the gas is under pressure. And Scholander and I sit there, and within seconds: the Greenland ice caps, 10,000 feet thick, that accumulates a foot a year--"We have fossil air here. We have a chance to tell what the atmosphere was like." So we set up lab on the deck of the schooner, with my wife taking data. And we did something glaciologists had never thought of, [laughs] and if Scholander hadn't freed up my thinking, nothing would have happened. I mean, I would have done something, and I would have had a respectable time, but people hadn't gone out in the field with measuring devices. One thing I was good at was physical measurement. And he showed me where the problems are. Out of that came, essentially, the ice and permafrost lab, and they've now drilled two mile cores in the Antarctic, looking at past air temperatures, but no one had ever thought about looking at the gas in the ice before. It's nice to come along when the whole stage is clean, because anything you do is probably worthwhile. It was certainly that way with marine mammals. The people in the museums had given them names and hung the bones up from the ceiling, and so forth, but what's a warm-blooded, air-breathing animal doing living in the ocean? I'm in trouble in a minute when I dive. I go in the water all the time, but I'm always somewhat scared, and know the danger. Here's a whale that goes down a mile and stays an hour. What a grand problem! I spent my life on it, and it's what I'm writing a book about now. And it turns out that you got to know what you don't know. And a lot of things in medicine and biology were utterly wrong. We didn't have any basis of thinking of it. And it turns out that mammals are mammals. They have very strict rules. They've got to be warm inside. They've got to have a certain amount of air supply, and so forth. And you can push the things around so you can go down in the ocean, but you got to be big. You got to have a small brain, and all these other things which we couldn't conceive of at the time. And that's essentially what research is, is finding out those things. I'm still excited. I've worked with trained dolphins, and so forth.

TAYLOR: But the way you describe it, it's still something that's very alive to you. [Laughs.] In many ways, that experience was almost like an Indiana Jones movie.

KANWISHER: Yeah, except it was for real.

TAYLOR: Yeah, except it was for real.

KANWISHER: Yeah. I was like a little boy in a toy shop. What do I play with first?

TAYLOR: Can you kind of remember kind of a generic, what a day onboard was like, as you were sailing up there?

KANWISHER: Oh, sure. [Laughs.] I'm addicted to boats. [Laughs.] It's almost cost me my marriage, my wi . . . . [Laughs.] And a real schooner under sail. This is like a blue-nose. [Laughs.] And I'm standing watch. I stood watch with a physical oceanographer named Larry Coachman, who was one of the nicest, bravest people I've ever known. It's the middle of the night, and a storm comes up, and here we are, running the boat. And you don't want to wake the captain up if you don't have to. Your self-respect is suspect if you really have to be a weakling and go get the captain. Well, the gaff on the boom of the forecandle jammed. Coachman went up the mast and got that free. Not only was a nice guy, but by God he was brave and strong. It's not an ordinary life, in any way, shape or manner. I spent a lot of my life here in the summer with people who were essentially urban scientists. And they did all the biochemistry and cellular details. Now they're doing all the DNA stuff. And their acquaintance with nature is Central Park and the Woods Hole beach. What I did is looked at somewhat quixotically by them. At a cocktail party, some person says, "What do you do?" "Well, I worked on whales?" "How do you work on whales? How do you do research on whales?" [Laughs.] What they're really saying is "Why the hell would you want to do that?" [They laugh.] Which there's no real answer. And so I say, "Well, you work them any way you can." And I try and put them off on it. But . . . .

TAYLOR: Now, you go up, you have this day at sea. This must have been like your own version of Martin and Osa Johnson, only you're on a different continent, and you're on a different method of transportation, and you were going to get put off on shore for a whole summer?

KANWISHER: Yeah, yeah, we did. We had a prefab lab which the carpenter shop had built beforehand. We put it together in a bit military tent, and spent the summer. The things I tend to mention--the things that get noticed--are what I call the "Eureka moments." But we had a hard

problem, because here were fish. Like us, all vertebrates have a third the saltiness of sea water. And the salt in the water depresses the freezing point a little bit. So our blood will freeze at -1 degree Celsius. (That's what? 31-1/2 Fahrenheit, OK?) And seawater freezes at -2 Celsius. So essentially there's a full degree difference between seawater with ice in it and the fish. And it took three trips to the Arctic to understand. And the answer is the fish never gets near the ice, and he's supercooled. Now supercooling was something which intellectually you learn is you do with triply distilled water and ultra clean glassware, which is utterly wrong. You take any tap water sample and supercool it to -2 or -3 degrees and keep it for weeks that way. I used to do a stunt. [Laughs.] Lecturing is showing off stunts and so forth. And I could bring in fish that were supercooled in water at -2-1/2, -3 degrees Celsius, and I could touch them with an ice cube and kill them, because the ice would propagate through them, and they [claps] freeze and die. And it's this inability to conceive of something as unusual that we thought was a holy of holies in clean lab situations, which is an everyday phenomenon, the supercooling. Now there are also fish on the surface, and they come near the ice, and they don't freeze either, and they have an antifreeze. And what they **do** is, they have--well, there's two samples. There's one answer in the Arctic and another in the Antarctic. Evolution has engineered it, but essentially, one of these you have a structure that looks like the structure of ice. In this case it was a funny protein, and it prevents ice from forming. So evolution shows you there's lot of ways to skin a cat, [laughs] the term I grew up with in a country town.

TAYLOR: But the era that you were doing this. I mean, for the animal kingdom there were still all kinds of stories. We still always look for the elephant graveyard and things like that back then. The great source of ivory somewhere over in Africa and whatnot. And you're in kind of the same boat, only we're talking marine mammals in this case. You're sitting on basically what most people would consider to be a very inhospitable shore with this laboratory you built. What would a day like . . . ? Day was very long at that . . . .

KANWISHER: Almost 24 hours at that . . . . Since the lab was so small and so crowded I used to work in the middle of the night, and there was a snow field up behind the side of the mountain, and I had to have cold baths occasionally, and I'd go up there. And one night there were a couple of husky dogs there. So the husky dogs are treated poorly there. They used to put them on an island all summer, and those who lived they used. Dogs aren't pets to the Eskimos. They're a convenience. And these dogs cornered me. It's one of the few times I've been truly

scared, [laughingly] because I know that they could make a mess out of me. I also know psychologically you can't show any fear, and so I took my belt off and went at them. My heart wasn't in it. [Laughs.] But it worked! [Laughs.] Repeatedly, we just couldn't imagine the idea of supercooling. We'd do these experiments over and over again. We recalibrated thermometers, and it's one of the reasons that I think most people do some of their best work when they're young because they aren't too polluted by the past. [Laughs.] They haven't made a lot of wrong decisions yet. And as I said, everything was interesting. I can go through a whole series of things we did on plants that summer. No one had ever been with instruments in the Arctic making measurements before.

TAYLOR: OK, now, besides the marine mammals, what were some of the other things you looked at there, because I know when you go into an area you're going to look at everything totally, because it's just interesting to you.

KANWISHER: Sure, sure, well, I told you. I told you that the shellfish on Quissett Harbor freeze in the winter. When the tide goes out and it's -10, they freeze. And they have to have a body that can stand freezing. And that was a whole line of research that I spent several years on and did some papers on. A lot of our view of life comes from our self-centeredness with ourselves as mammals, that shows an object[?] of God or something or other. Animals can do things we can't do, and we can't even conceive of them doing, which is having internal ice formation. I knew, for instance, I loved to ski when I was young. You'd go up on a mountain like Cannon Mountain in the winter. It's -20 up there, and you can see there's frostbite on the nose and ears. That's ice crystals in there, and you're telling me, "Warm that up and get the hell out of the cold!" You're avoiding injury. Well, there couldn't have been life. The earth is tilted 23-1/2 degrees, and there're seasons, and there couldn't have been life in lots of places unless they could stand the winter as well as the summer. And of course, once you're mobile, which incidentally has been one of the interesting parts of the study of whales is the whales feed at high latitude, and then they go half a world away. And they can do . . . .

[END OF SIDE 1]

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## JOHN KANWISHER ORAL HISTORY

Interview by Frank Taylor February 11 and August 11, 2004

Tape 3 of 3 transcribed by Arel Lucas, January 2005

1 TAYLOR: . . . the other things you looked at there, because I know when you go into an area,  
2 you're going to look at everything . . .

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16 places unless they could stand the winter as well as the summer. And of course, once you're  
17 mobile, which, incidentally, has been one of the interesting parts of the study of whales, is the  
18 whales feed at high latitude, and then they go half a world away, and they can do that because  
19 they're large. They're 25 times larger than an elephant. After all, a bowhead whale has room in  
20 its mouth for a herd of elephants. We're talking about big animals. I mean, we're talking about  
21 animals that are 100 million times bigger than a little mouse. And so it's that physics of it, the  
22 numbers. It pays to have done particle physics, to know powers of 10, to grasp the simple  
23 mathematics of logarithms and stuff to deal with this broad range of things you're dealing with in  
24 mammals.

25 TAYLOR: OK, now, I'm . . . . Where all this originates from, I'm trying to get kind of a mental  
26 image of what this whole camp looked like. You had a laboratory that you worked in. What  
27 were your living quarters like?

28 KANWISHER: They were a tent.

29 TAYLOR: What was the temperature around there?

30 KANWISHER: Oh, it was warm enough in the summer. Midsummer. I was warm enough. I  
31 mean, we wore a sweater some, but the insects are impossible. Our fish chowder was more  
32 mosquitoes than it was fish, probably, at times, and if that bothers you, don't go to the Arctic.  
33 [Laughs.] I can remember coming into a British port one time and looking on at this troop ship  
34 down at the docks and the guy next to me . . . . Here's the land of Shakespeare, the source of our  
35 language and culture, and I was excited. The guy says, "Look at all the bird droppings on the  
36 dock." I think it's the point of view. [Laughs.] I mean, the Arctic, with its insects, is still an  
37 exciting place biologically.

38 TAYLOR: Now, had you made arrangements with your wife before you went up there . . .

39 KANWISHER: She was with me.

40 TAYLOR: . . . that she was going to . . .

41 KANWISHER: Oh, sure.

42 TAYLOR: . . . come up . . .

43 KANWISHER: Oh, sure, sure, sure.

44 TAYLOR: . . . there? Now how did her whole trip come about? How did she do that? What  
45 did . . . ?

46 KANWISHER: Well, we didn't have kids yet. She and Susan[SP?] Scholander got together on  
47 their own. They flew to Goose Bay. This was the age of propeller aircraft, when you had to stop  
48 in either Gander or Goose Bay when you came across the Atlantic. And from there they got a  
49 Royal Canadian Mounted Police boat up to Nain, and then an Eskimo's boat up to Hebron, and  
50 so forth. And we met them up there.

51 TAYLOR: OK, and how long were you there total, that year?

52 KANWISHER: Oh, three months, I think.

53 TAYLOR: Yeah, give or take a little, sure.

54 KANWISHER: Yeah, yeah, sure. I mean, after all, a lot of the young guys crewing on the ship  
55 were college kids, and they had to go back to school.

56 TAYLOR: Now, were you ready to go back then, or could you have stayed longer?

57 KANWISHER: Well, I came back the next winter and went out on the ice on a dogsled, and  
58 worked out of an igloo. [Laughs.] I really did these things, you know. [Laughs.] And I'm sure,  
59 at this point, if I'm at a cocktail party and get talking about it, they'll say, "Boy, what a drunken  
60 imagination he's got!" [They laugh.]

61 TAYLOR: OK, so you did that for a summer, and then you said you came back.

62 KANWISHER: Because we didn't understand the supercooling yet.

63 TAYLOR: OK, so when you get back here, and this is for people that are going to listen to this  
64 that might require more of an explanation, you get back. You've collected a lot of data and  
65 things like that, what you do with all that in the interim?

66 KANWISHER: Well, [laughs] we try and find a story that we can write a scientific paper on.  
67 The Oceanographic exists for published scientific research, primarily, OK? It also does public  
68 service in times of war, all kinds of other things, but I mean that's what it's there for. And that's  
69 their payoff. And so anybody who uses its liberties has this obligation of writing. And of course  
70 I realized that I could not exist in science if I didn't publish. I wrote probably five or six  
71 scientific papers the first year, and I told you about the scattering layer being individual fish, and  
72 to give gas in icebergs, and I had a whole series of frozen intertidal life, and the writing isn't  
73 hard, it's what happens. You just have to learn to express yourself clearly. What I'm doing now  
74 is the hardest thing I've ever done in the world, is making it palatable to the general public. And  
75 there are truly great writers writing science, not many of them from inside science. I mean, you  
76 read Darwin, and it's dull as dishwater, absolutely accurate, but dull. And if you want to hold a  
77 reader now, with all the distractions of cable and TV and so forth, if you don't make it interesting  
78 they won't read it. What I want them to know is I want them to know how mammals live, and  
79 how mammals can live in the oceans, but I've got to spoon feed them. So essentially what I'd do  
80 is I'd make it the story of whales, seals, and dolphins, because everybody's fascinated by these  
81 animals, and so hidden in that is what my real purpose is. [Laughs.] I'm essentially a  
82 propagandist, in a way, because I think, for instance, mammalian life as we enjoy it, our lung is  
83 the area of a tennis court, and it's essentially a hundredth the thickness of a sheet of paper, and  
84 only that way can you get oxygen into the blood. The capillaries are long enough to go around  
85 the world twice, in our body. And that little four-chamber heart, pumping the stuff around a  
86 closed circuit, letting the oxygen into one place, dumping it off in the tissues, and it turns out you

87 go to carry it in the blood, and we use something called hemoglobin. Well, to keep it from  
88 having bad effects, we put it inside red cells, but they aren't real cells. They don't have any  
89 nucleus. They're throwaway devices. After 100 days, we throw away our red cells. We make  
90 more. We're absolutely limited by the choice of the hemoglobin molecule, which came long  
91 before oxygen even existed in living systems. Because of it, we can't get much oxygen.  
92 Therefore, we can't make the fire burn very bright. Now, what we're doing here is not much in  
93 the world of 100-horsepower outboards and 300-horsepower cars. We're 0.15 horsepower.  
94 That's a small number. So essentially, the whole strategy of nature has been to be efficient--to  
95 do the most with the least. And this gets really difficult when you go in the water, because water  
96 is 1,000 times denser than air, and it takes a lot of work to get through it, but they've been  
97 remarkable. In 50 million years, they've worked out a dolphin that can go 20 miles an hour on  
98 half a horsepower. I mean, that's essentially my engineer's instinct. That's why I think people  
99 might be interested in what I want to write about, and what I'm trying to put in words now.  
100 There's only one ocean. There's only one time the mammals came in it, and it was mine, in  
101 terms of functional biology. I mean, there are other people who are worried about who was  
102 related to who, and so forth, but to me the glory of mammals is the sameness. All you do is  
103 change the bones and muscles, and you go from us to a dolphin or a whale. I put a lot of my life  
104 into teaching that to pre-meds, at Harvard, MIT, and Brown. I at times sound like a missionary,  
105 and I am a propagandist, because not only is it a good story in itself, which I hope people will  
106 enjoy, but also within it is the basic biology which makes a doctor a good doctor. One of my  
107 close friends, who is head of the department in Columbia, who has had cancer, and who was in  
108 the Sloan-Kettering Institute: he damn near died because some resident went by, and he didn't  
109 say, "Look, that guy's gray in color. He's not getting oxygen." I don't want that to happen,  
110 because one of these students I have might be someone who has me as a patient sometime.  
111 [Laughs.] As I said, it's the scientific story itself that was my excitement, but there's also  
112 essentially a need to propagandize . . . uh propagate, not propaganda--well it's really propaganda in a  
113 way, but it's essentially scientific fact--to people who are going to do applied things in our  
114 society like medicine.

115 TAYLOR: You know it's interesting, when you bring this up and your approach, when I was  
116 teaching, and when I was teaching in a middle-school setting, one of the very most popular  
117 books in the library was *How Things Work* by David Macauley.

118 KANWISHER: I know it. I know it like a Bible. I can't remember the page numbers, but I  
119 remember almost everything else.

120 TAYLOR: That's right, and that's essentially what you're kind of looking at in the animal  
121 world.

122 KANWISHER: Well, I'm essentially writing a book which is "How Mammals Work." Now I  
123 don't want to call it that. I want to make use of the fact I worked on marine mammals, and so I  
124 call it "Warm Blood in Cold Water." [They laugh.] It's a Hollywood-type name, and then:  
125 "The Biology of Whales, Seals and Dolphins." And it's how we take our biology and put it into  
126 that package. And I said, I feel sorry for the people who come on, because a lot of the good  
127 things are done. Essentially a lot of biology now is going to be highly evolved, limited area of  
128 things like some gene that might be responsible for us having some kind of sickness, like  
129 diabetes or multiple palsy or something or other. For instance, there's something called autism  
130 which is a poor development of the nervous system early in life. And I have a daughter who's  
131 prominent in such fields. She's an MIT professor, and she pointed out. She said, "If you're  
132 autistic, your identical twin has an 80-percent chance." She said, "But remember, it's 80  
133 percent; it's not 100." So there are other factors involved. It's this kind of you might say  
134 "murder-mystery" type thinking that makes the whole thing so damn much fun.

135 TAYLOR: But you bring up something that's very, very important, I think. You may disagree  
136 with this. Let me throw it at you. You've got through your summer up in the Arctic, and then I  
137 asked you a little more about your winter, and you said, "Gee, it's a shame, because all the good  
138 things have been done, and these people now are going to work on some very . . . ." Maybe it's  
139 not the same kind of scientist any more.

140 KANWISHER: No, no, no. But you know, I missed on some of them. I missed on the blood  
141 pressure in the neck of the giraffe. [Laughs.] Makes me mad as hell I didn't get there, but  
142 someone else did. So there are a lot of these big, visible problems that face you.

143 TAYLOR: But you had to be willing to be an explorer.

144 KANWISHER: Oh, sure.

145 TAYLOR: And I don't mean an intellectual explorer, I mean someone that's out in the field  
146 with a sleeping bag and a tent.

147 KANWISHER: But oceanography is a ticket to the world. If you work around a university--I'm  
148 not positive of these things, but I've been around them, and I've taught a lot, but only as a

149 visiting professor. I've always been a visitor. I've never been part of the local scene.  
150 Essentially, you wait for a sabbatical to do something. At the Oceanographic, if you didn't go  
151 off on an expedition once a year, there's someone who: "What are you doing hanging around  
152 here for?" As I said, oceanography was a ticket to the world, and there were things to get you  
153 there. If a ship wasn't going there, then some MATS plane there, or you could hook a ride with  
154 a fisherman, or I've even used a dugout canoe in the Amazon, or a dogsled in the Arctic. There's  
155 got to be some science behind it.

156 TAYLOR: But today up here, I know people that haven't been to sea two, three, four, five years.

157 KANWISHER: Yeah, well, there are intellectual aspects of it, but . . . What do you want?

158 TAYLOR: He's just giving me time on this.

159 KANWISHER: [Laughs.] If it doesn't turn you on, it doesn't turn you on. I don't know. As I  
160 said, it's highly suspect by some of my close social friends, who spend their life working on a  
161 single gene. It's this kind of class structure in science. For instance, there used to be when you  
162 studied nature that you were called a "naturalist," and then of course it turns out the British, who  
163 love class structures and so forth. They started saying "ecology." Well, that's "scientific natural  
164 history," "scientific" meaning that natural history isn't scientific, which is nonsense. And then  
165 there was people who didn't think "ecology" was elaborate enough, so they became what they  
166 called "ethologists," which is really animal behavior. And I'm leery of all these divisions,  
167 because [laughingly] you never know where the answer's coming from. Because, if you knew, it  
168 wouldn't be research.

169 TAYLOR: OK, let me hold it . . . [Tape stops, then starts again.] As we were changing films,  
170 we were talking about various issues dealing with your Arctic experience. And we had kind of  
171 ended off with this whole idea of maybe people today who seem to be concentrating on this  
172 really small area of something, very different from this big picture that you used to look at.  
173 Seems to be--for lack of a better term--the "new scientist." I'm wondering. I have had this  
174 hypothesis that essentially there's a point in our lives where we all become redundant, in that . . .

175 KANWISHER: [Laughs.]

176 TAYLOR: . . . we either can't keep up with the new technology, or we're not willing to keep up  
177 with the new technology, or what we went into this for in the first place no longer exists like that.  
178 And I'm wondering if the kind of work you're talking about--going in a schooner up to the

179 Arctic, on a beach, on your own for a three-month period--that's not real big nowadays. Most  
180 people are in the laboratory.

181 KANWISHER: Yeah.

182 TAYLOR: The scientist today is going to spend most of their day with their face glued to a  
183 computer, crunching numbers and things like that.

184 KANWISHER: I feel a little sorry for them. [Laughs.] It's the next stage. As I said, I was there  
185 when all of a sudden it opened up, and a science-friendly society was willing to back this,  
186 particularly after Sputnik, and, as I said, I was just lucky in space and time. I was lucky I had the  
187 nerve to walk in off the street. If I didn't have this brash self-confidence from the military, I  
188 wouldn't have had the nerve to do that. I would have been uncertain of myself.

189 TAYLOR: And maybe that world that you came into doesn't really exist any more.

190 KANWISHER: It probably doesn't, but it's one of the reasons I want to write now, because it  
191 was what I call a "golden age." It's only going to happen once, you know. And I guess as you  
192 get older you develop this sense of history. And as I said, there was only one ocean, and one  
193 time the mammals came in it, and it's been 50 million years making these things like this here. I  
194 was just reading before you came, this sperm whale. It's got a 10-ton nose. What's an animal  
195 doing with a 10-ton nose? Well, only because it's a huge body and a small brain that can dive  
196 down, and it can get these deep-sea squid, and it's one of the great, exciting stories of my life.  
197 Because here's an animal that eats twice as much as the fishing fleets of the world, about animals  
198 we didn't know are there, because our nets can't catch them. So it's uh . . . . [Laughs.] It's  
199 worth a whole chapter in my book.

200 TAYLOR: Yeah, and for some young person that's listening to this, or maybe someday reads a  
201 book that you write, essentially what you were doing--and correct me if I'm wrong--was looking  
202 at the world, the marine world, with the mammals in it, and trying to place them somehow. How  
203 does all this work? How does all this happen? How come they're here? Why aren't they over  
204 there? How can they do this?

205 KANWISHER: Yeah, yeah, yeah, yeah.

206 TAYLOR: That kind of thing.

207 KANWISHER: Well, ecologists organize complex groups of animals and plants in what they  
208 call food chains, who eats what and how much, and so forth. And it's sort of like an agricultural

209 situation--how much does it take to fatten the calf, [laughs] to make a useful animal in terms of  
210 meat.

211 TAYLOR: Which is a highly controversial subject right now.

212 KANWISHER: Well, I know that. I know that, but I mean I'm talking about the biology behind  
213 it, and so forth. And a calf that you bring the food to now, because you don't want him wasting  
214 energy walking around. Essentially you can get a pound of meat for three pounds of food. And  
215 the food frequently is things like fish that we don't want to eat, all kinds of strange stuff.  
216 Anyway, the real trouble is, at the lower levels in the oceans, you can't measure these quantities  
217 of animals very accurately. You have things you really know. The fishing fleets of the world, it  
218 turns out, are one of our great sampling things. But they sample with a bias. They want  
219 something that's good to eat and that they can catch. But they tell us a lot of things that we  
220 would never know otherwise. They tell us, for instance, the great numbers of cod which aren't  
221 any more there on Georges Bank and the Grand Banks, but I mean they tell us these quantities of  
222 fish that are there, and then it's up to us to imagine a food chain that results in them. Because  
223 they're a hard reality. We don't know the lower levels. Well, I was interested in mammals for  
224 their own right. Now I have to intellectually justify it. And I justify it by saying, since we can't  
225 measure most of these steps in the food chain, let's work down from the top, and so I essentially,  
226 I used to give a lecture called "Back Down the Food Chain." There's 100,000 mammals, and  
227 there's 25 million of one kind of seal, crabeater seal. People think they're endangered. They  
228 aren't. There are a lot of them there. I'm not very popular with [laughs] the Sierra Club and so  
229 forth, but I've spent my life out there. We kill a lot of the whales, but there's still a lot there.  
230 And so this puts an upper limit on how much biology there must be to keep them well fed. There  
231 are 300 million people in America. We know at least a minimum of how much food must be  
232 produced to keep them well fed. And so you come into numbers which you could put more faith  
233 in than you can going through three or four wild guesses from the bottom. That's what I'm  
234 doing intellectually right now. I should have left it alone, because a lot of things aren't very  
235 popular that you come up with. We get less than one percent of our food from the oceans--70  
236 percent of the earth. If you're a fisherman, it's very important, but on a world scale, it doesn't  
237 count for a darn. Iowa is equal to the oceans, and it's this sense of scale that I got from having to  
238 teach and put things into quantitative order, that I'm trying to put on paper now in a way that  
239 hopefully won't make people too [laughingly] mad at me.



240 TAYLOR: But isn't that what we're supposed to base all our policies on?

241 KANWISHER: Oh, yeah, I know, but you get a group of retired admirals and retired  
242 congressmen and maybe a couple of CEOs, and you have a committee to look at the state of the  
243 oceans, and oh, they're very sick indeed. We must do more research. I mean, you know what  
244 you're going to get ahead of time. [They laugh.]

245 TAYLOR: You're opening up whole cans of worms . . .

246 KANWISHER: Yeah, I know that.

247 TAYLOR: . . . here. But that's OK.

248 KANWISHER: No, no, no, let's talk about my scientific career. Because I did two important  
249 things: I did research, and I also did teaching.

250 TAYLOR: Yeah, right, right.

251 KANWISHER: Also, on the side, did some inventing. So if I have a tombstone, I want  
252 "naturalist, teacher," and down below, "inventor."

253 TAYLOR: OK, but remember again the philosophy behind these oral histories is to look at you  
254 and what made you like you were, and what kind of outlooks you had on things, so there's a  
255 couple questions that I wanted to ask before we get into that part of it. You just mentioned that  
256 in your writing now you're trying to do things that maybe won't upset people too much, but in  
257 the past, historically, just to give you an example. Walter Munk wanted to do . . . .

258 KANWISHER: Oh, boy! There's a bright guy, and an utter charmer. [Laughs.]

259 TAYLOR: Well, he had the ATOC.

260 KANWISHER: I know. I know all about it.

261 TAYLOR: OK, well, now there's a case where people that were of the "Save the Whale" type  
262 got a really good project cancelled because they didn't have the right factual material . . .

263 KANWISHER: I know, I know, I know.

264 TAYLOR: . . . and they relied on emotion, things like that.

265 KANWISHER: Look, look, look: I ran around dropping depth charges. I'm talking about real  
266 noise. This is nonsense about the kind of things they're doing. And it might have been pretty  
267 hard on the local dolphins and whales during the battle of Midway, or the landings in  
268 Guadalcanal, or D-Day. And certainly, when they shot off a bomb at Eniwitok, that was the shot  
269 heard round the world! These sperm whales I'm dealing with now make the loudest sound in  
270 nature, 140 decibels or something or other. That's what that 10-ton nose is for. It's so it can tell

271 a girl friend anyplace within a hundred miles what a nice father he would made for their babies.  
272 I don't think the world's going to collapse out of these. And I didn't follow too closely except in  
273 the public press about this ATOC thing, and so forth. But you know, one of the things they did  
274 off La Jolla: they put one of these transmitters offshore, I suppose 25 or 50 miles. I don't know  
275 far, but anyway, and then on some days they turned it on, and some days they didn't turn it on,  
276 and they looked and censused the animals there. The first day they flew out there were 50 sperm  
277 whales. Airplanes are fantastic tools. So I almost wrote Walter Munk a letter thanking him for  
278 starting that whole thing, because we found out things we'd never find out otherwise by flying  
279 those airplanes. And so [laughingly] I mean, there's good comes out of everything sometimes. I  
280 felt sorry for Walter, because I think a lot of the animal lovers are irrational.

281 TAYLOR: Well, this to me was a perfect case of irrationality, if you will, getting what should  
282 have been a very topical and very worthwhile project underway, and when you mentioned you  
283 try to write so that you don't upset too many people, but on the other hand, aren't we supposed to  
284 be taking data that folks like you collect and basing policy on it?

285 KANWISHER: We don't, really, much, I don't think. Well, that's in the best of all possible  
286 worlds, but I [sighs] I've followed fisheries research. I work at fisheries labs in Norway and in  
287 Spain, and in England. And I'm not sure they've had much effect on fisheries. Fishing has been  
288 ill-managed, largely by our congressmen on the Ocean Affairs Committee, or something or  
289 other, and they essentially put the hen house in charge of the fox. And these fisheries  
290 committees have a predominance of fishermen on them, and they think more of tomorrow than  
291 next year or next century. And the fish are gone. It's our fault, and I don't know what you do  
292 about it. [Laughs.] But, who would ever think that fish farming would be so successful? I was  
293 utterly wrong on it! And shrimp! We have salmon and shrimp once a week now. Ninety  
294 percent of our shrimp, and about 60 percent of our salmon is from farming now, and it's changed  
295 our diet. Now salmon is almost half the price of a cod.

296 TAYLOR: And that used to be a luxury fish 20 years ago.

297 KANWISHER: I know it, I know, I know. I can't remake the oceans of the world the way the  
298 world treats them, but it's been a great place for intellectual mysteries.

299 TAYLOR: Yeah, and you're really giving kind of a wide spectrum of the kind of research you  
300 did, and where it's kind of evolved to, what's happened with all this sort of thing. You spent that  
301 first summer in the Arctic, and then you said you went back again the next winter?

302 KANWISHER: Yeah, yeah.

303 TAYLOR: How did you get back up there?

304 KANWISHER: You fly in by bush plane, and land, and I have a lot of respect for those pilots.

305 TAYLOR: I was going to say. I . . . .

306 KANWISHER: I mean, there are old pilots and bold pilots, but there are no old, bold pilots.

307 [Laughs.]

308 TAYLOR: This is very true, particularly in that area of the world, and when you come into land

309 . . . . Were skis on the plane?

310 KANWISHER: Skis, yeah, and the snow is in what they call struva[SP?], it's like washboard on

311 a gravel road.

312 TAYLOR: And you don't have much perception in terms of height and whatnot, and you're

313 bringing a plane . . . .

314 KANWISHER: Yeah, but I said, he knew what he didn't know, and he got us in there. And the

315 Eskimos had never seen . . . . For instance, they'd never seen an orange. We had skis. They had

316 never skis. We had some hickory skis that the military had given us at Goose Bay. And I made

317 tremendous leeway with the Eskimos in terms of self-respect, because I could go two times as far

318 on my skis as they could go on their snowshoes. And so pretty soon we built a ski jump in town.

319 [Laughs.] I think the missionary didn't think we should be having so much fun. [They laugh.]

320 TAYLOR: So when you were living there, you had a regular community.

321 KANWISHER: We wanted to go back to where we had been in the summer, and the only way

322 to get there was by dogsled, and once you're out on the ice the only real way to keep warm is an

323 igloo. And although the Dew Line--there are radar stations across the Arctic--has pretty much

324 ruined Eskimo culture, with booze and religion and stuff, but there were still some people that

325 had dog teams and could make an igloo. And we went out, and I had a new lab every thing.

326 [They laugh.]

327 TAYLOR: Now how in the world did you ever get yourself . . . . Did you actually drive a dog

328 team yourself?

329 KANWISHER: Oh, sure, but I'm not good at it. There are skills to these people that you need.

330 Now out on the ice it's different than a forest. Out on the ice you use a fan hitch. In the forest

331 you have to use essentially inline things.

332 TAYLOR: How did you get yourself . . . ? Did you just say, “Hook them up and I’m going to  
333 go?” I mean, how do you know what dog to put first, and what dog comes second?

334 KANWISHER: There’s an alpha male or female, and the Eskimos have them all trained and  
335 know what they’re doing. The real trouble is, is in the fall, before the sea is frozen, and before  
336 there’s enough snow on the ground, the dogs are fed again, and they’re then reasonably  
337 dangerous because they’re so ill treated, and so they usually get a kid a year on the Labrador  
338 Coast at that time. Now they use snow scooters. Tough on them, is all I can say. [Laughs.]  
339 There’s some credit for being old and having had to use a dog team.

340 TAYLOR: OK, so you used a dog team, and you say you lived in an igloo?

341 KANWISHER: Yeah, yeah, it’s a continual spiral of blocks, and then you charge out the side.  
342 You build it from the inside, and the floor inside . . . . You take the blocks that you can make in  
343 that circle that the igloo is going to be on, and so the floor is essentially one course below the  
344 outside snow, and the guy does it from the inside, and then the last block he lets in like this, and  
345 then we pock it together on the outside, and he charges through for the hole, for the door, and  
346 you get inside, and you put a polar-bear fur on the floor, and you light a primus stove, and pretty  
347 soon you’re stripped to the waist. You’re warm above and cold below.

348 TAYLOR: Really?!

349 KANWISHER: Yeah, yeah. I don’t want to get into this. This is story telling.

350 TAYLOR: No, but this is great stuff. This is what the science was about in your day, the kind of  
351 work you did. These are the conditions you lived in.

352 KANWISHER: Yeah.

353 TAYLOR: It’s not like being in an MIT lab that’s nice and steady. It doesn’t yaw, pitch, and  
354 roll. The temperature’s constant. You know you can go down the hall and get yourself a pack of  
355 Oreos out of a machine. This is a different kind of life.

356 KANWISHER: But I had this magic mentor, Scholander, who during the War had worked on  
357 Arctic survival, living in a tent on the side of Mt. Washington, with Sir Hubert Wilkins, the  
358 famous Arctic explorer. And they showed when you put a cold aluminum dish into a hot primus  
359 stove carbon monoxide pours out. It’ll kill you. Every mountaineer ought to know it, but when I  
360 was in Alaska a few years ago, two Frenchmen on McKinley . . . . I can’t think of the

361 TAYLOR: Denali.

362 KANWISHER: Denali. Died of that. So you don't wander into the wide open without a lot of  
363 skills. Some of the people I worked with went the following year, and one of them stumbled  
364 crossing a stream and drowned.

365 TAYLOR: Hum, hum. Now you're up there during a time of year when you didn't have an  
366 awful lot of sunlight.

367 KANWISHER: There's a fair amount of sunlight. Remember, it's well below the Arctic Circle.  
368 The eastern side of the continent, the isotherms come way down, essentially, so that essentially  
369 we were at the latitude of Oslo.

370 TAYLOR: Oh, OK. Well that can be . . . .

371 KANWISHER: No, no, we were south of Reykjavik. The only station we could get was  
372 Icelandic. And Icelandic, it turns out, is equivalent to Old Norse, sort of like Chaucerian  
373 English is. And Scholander, having had some classical Norwegian schooling, could understand  
374 the Icelanders giving the news.

375 TAYLOR: Now, how do you work out there? You're working on animals. Give me how you  
376 work with these animals. I mean, it's not like opening a cage and the monkey's right there, or  
377 the mouse is right there, or something. I mean, you're in very harsh conditions. You've got an  
378 unpredic . . . . Well, maybe I'm wrong. I was going to say, "an unpredictable critter as to where  
379 they're going to be." But maybe they're more . . . . You may know . . . .

380 KANWISHER: Well, the first place is I didn't do any good live physiology that winter. I'd  
381 already had seals at the Oceanographic dock the summer before and found out that they indeed  
382 can keep cold without having to increase their heat output. In other words, they've got enough  
383 insulation. But I didn't know anything that was going on inside the animal. Well, when you  
384 travel by dogsled, essentially seals are your gasoline. It takes a half a seal a day to keep the dogs  
385 fed. So we were getting 40 miles per seal, if you want. [They laugh.] And there are 10 million  
386 of these harp seals all across the Arctic. They have to be spaced out so they don't take too much  
387 of each other's food, and the Eskimo always kept a gun on the ready, because they were living  
388 on seals too, so they shot a seal one day, and we stopped, and it was lunchtime, and the seal fed  
389 us and the dogs. Well, I finally had the chance. You see, the seals I had in Woods Hole were  
390 hand-fed pets. There's no way I'm going to cut into them. I've cut into dead seals, but you  
391 don't really understand too much from dead animals. So here they take this freshly-killed  
392 animal, and they slit him down the back, and the blubber plus the fur is called the scalp, and they

393 spread it apart. Well, it turns out the animal is 50 percent fat. There's a huge amount of blood  
394 inside. Inside is a little tiny animal. So essentially you got 50 percent fat, 20 percent blubber.  
395 You haven't got any animal yet! Ten percent bone, and inside is a little tiny animal. And I  
396 finally understood that to live in the cold you need a huge amount of insulation. You need a big  
397 flame inside keeping it warm. And once you get an answer, essentially the DNA is just like  
398 Gutenberg's printing press. It just duplicates them up against the food supply. I hadn't gone to  
399 study seals, but I finally understood seals, and out of that essentially it's the same physical  
400 problem for the other group of marine mammals--the cetaceans--the whales, dolphins and  
401 porpoises. So there must be the same answer with small porpoises, so I couldn't catch them  
402 here, and no one was interested in helping, so I went to Norway and caught and maintained a  
403 small porpoise, and found out that he's got a lot of fat and a huge metabolism, and only then  
404 barely makes do. But what looks "barely makes do" is good enough. Nature's only concerned  
405 with things that work. And nature's way is any way that's good enough.

406 TAYLOR: And it's not luxurious. It's good enough.

407 KANWISHER: That's right. That's why we have trouble for our bodies, because Nature's  
408 selected us on the African savannah for things that were just good enough. If Nature has losses,  
409 it makes it up with reproduction, and when you're dealing with a person, with real life . . . . And  
410 someday there's going to be something, what the medical people call a "vascular incident." It'll  
411 turn me off. I hope it's a ways ahead. It's a fragile system. It's this kind of I guess almost holy  
412 attitude toward living systems which has sort of been the philosophical background in my life,  
413 which is why I love to work on them and teaching about them. Some people, like my daughters,  
414 are turned off by the things I did, living with the Eskimos, but if you don't do that, you don't  
415 survive there. [Laughs.] The Eskimos would take this freshly-killed seal, and they'd take the  
416 handle of a hunting knife and smash the skull. They mixed the brains in with the blood and then  
417 take pieces of raw blubber and use it like a dip at a cocktail party. Now I thought I'm going to  
418 be tough. I'm going to be the anthropologist who can really go out there and live like the local  
419 boys, but I couldn't quite do that one. [They laugh.]

420 TAYLOR: But one of the things I discovered when I was off living with these primitive tribes,  
421 that what made it successful for me was a realized very, very quickly, in this particular  
422 circumstance and environment I was an inferior pink race.

423 KANWISHER: Yeah, yeah.

424 TAYLOR: And I needed their help to get me through this.

425 KANWISHER: I was out on that ice only because the Eskimos had the skills. If they had  
426 vacated me, I wouldn't have made it home probably.

427 TAYLOR: Now how long were you out there?

428 KANWISHER: Only for a couple weeks, but it's sort of like [laughs] . . . . It's like your first  
429 ride on a roller coaster. [Laughs.] It isn't the time, it's the quality.

430 TAYLOR: Now, I'm curious. When you do these kind of studies, things like lung structure,  
431 thickness of lungs, heart rate, blood pressure, all those kind of things, did you do that kind o  
432 work too, with these . . . ?

433 KANWISHER: Most of it had already been done in human physiology, and one of the things  
434 people didn't recognize when I started is that all mammals are basically the same except for the  
435 bones and muscles, so a dolphin or a seal is me in a different package. So, as I said, the fantastic  
436 mass of fragile structures, because diffusion is such a slow process, and oxygen had all these  
437 contrary properties, and so forth. There's a physiologist who once said how marvelously nature  
438 was contrived. I think how awful those situations have been and how they overcame it with  
439 trickery. So that once you realize that all mammals are the same, you start with a tremendous  
440 body of knowledge, which is why it's fun to teach about, because essentially I'm teaching about  
441 your own body. And everyone's curious about their body, some of them morbidly so. Some of  
442 them are hypochondriacs, but you really ought to have the basic rudiments of what's going on in  
443 your lungs and your capillaries and so forth, just so you aren't a hypochondriac. If you know  
444 about humans, then you know a good deal about seals and dolphins, and if you know more about  
445 seals and dolphins, you're also learning about yourself. So there's been this juxtaposition, the  
446 two fields breeding off each other, which has made it pleasure to work in, because the people  
447 who do medical-school physiology have almost no interest in what I do, but they have a lot of  
448 results which are pertinent. And of course this is the best town in the world for medical research.  
449 I've had these fantastic summers. When I'm home it's a three-month intellectual cocktail party,  
450 of chatter all summer long. And in fact when I was here in the early days, I would go over to the  
451 MBL. They still had the wooden buildings. I'd go in one building, and here's Julian Huxley,  
452 talking about evolution. In the next one is Albert Szent-Györgyi, telling about muscles. There's  
453 two things, actin and myosin, he says. "Now you need some of that," he says. "So you take a  
454 horse." [Laughs.] I'm telling you, these are showmen par excellence. They're also good

455 scientists. But finally, at the end of the summer, I'd say, "Look, I got to get some work done or I  
456 can't stay here." [Laughs.] And so you really have to shut off a lot of it. And for instance, it  
457 still goes on. I mean, there was a couple of Friday-night lectures this summer which were truly  
458 spectacular. And occasionally now, there are people who do something. For instance, I told you  
459 about actin and myosin. They're two molecules that glide over other, and a guy managed to put  
460 a fluorescent molecule on one of them, and he made these movies you could them moving. Up  
461 to then we'd taken it on faith. I'd never heard the MBL audience break into clapping. It was so  
462 neat and so great. So there is this tremendous body of basic biology which is just pouring out,  
463 which I could put my work the frame of, and I wish they thought as much of my work as I  
464 thought of theirs, but [laughs] . . . .

465 TAYLOR: Did you ever work in concert with people from MBL?

466 KANWISHER: Oh, sure, sure. I gave a Friday-night lecture. That's part of manhood.  
467 [Laughs.] There's been nothing in my life quite like when my daughter gave a Friday-night  
468 lecture, the only kid from town who ever made it. I told my wife that night, "I'm ready to die."  
469 Let's get into something else. So that to me the MBL and the mixture, and the lack of . . . . The  
470 departmental structure at the early Oceanographic didn't mean much, because you went to see  
471 with these people. Someone's got to do hydro stations, so you spend up the night doing hydro  
472 stations. None of it was onerous at all. It was usually quite exciting. One time at three in the  
473 morning I'm doing a hydro station with Fritz Fuglister--not Fritz, oh uh . . . . I can't remember  
474 who it was. Anyway, I was at the hydro winch, taking the bottles off, and going in and sampling  
475 the water and reading the thermometers. This bottle came up from 2,000 meters, and here's the  
476 arm of an octopus wrapped around it, still wiggling, and obviously, when we started the hydro  
477 winch it had torn the arm off the octopus. So I donated a bottle of cheap Bermuda booze to bring  
478 it home preserved. It was a great life. I mean none of these things are trivial. They're all  
479 contributing in some way. Now, sometimes you find out after the fact, "I shouldn't have done  
480 that. That was stupid to do, because I didn't really size up what the important nature of this  
481 problem is." But hindsight's some marvelous stuff.

482 TAYLOR: Oh, yeah.

483 KANWISHER: Yeah, so what is it Yogi Berra said? He says, "Prediction is very difficult,  
484 particularly about the future." [They laugh.]



485 TAYLOR: Very true. You bring up the point of doing hydro stations and things like that.  
486 That's one of the things that's unique to the Woods Hole Oceanographic Institution. I mean, I  
487 don't care how famous a scientist you are, if the ship needs ice knocked off it, everybody goes  
488 out and helps knock ice off the ship. If someone needs some help, everybody kind of . . . .

489 KANWISHER: Yeah, they'd better knock the ice off. Two sister ships of the Crawford turned  
490 over the War were total losses, and Admiral Smith, our director at the time. He says, "I know  
491 one of them was under my command." So I mean you have a touch with history when you've  
492 had people like Admiral Smith around, who I thought the world of. He wasn't particularly  
493 popular, but he just encouraged me to do what I wanted to do. He said, "What do you want to  
494 do, John?" I said, "Well, I think if we're a little lucky we can probably measure the . . .  
495 essentially what amounts to the horsepower of a whale." And to do that you need to know how  
496 much air goes through their lungs, and how much oxygen they take out of it. And the critical  
497 things was the volume of the lungs. Well, I'd already done that. I'd counted breaths, and I have  
498 a picture of a whale on the beach there. I did the first EKG on a whale, and so I knew a lot of the  
499 details, but I didn't know the volume of the lungs. So I went to a Norwegian whaling station.  
500 They were still whaling in those days, and they pulled the whale up on what they call a flenching  
501 plane, and they had these big stream-driven saws. You're dealing with 40 tons of animal now.  
502 And I'm sure the Norwegians probably thought, "This crazy kid from America!" And there I  
503 was in hip boots out in among the viscera and the slop. I had made them a challenge, that I  
504 would give them two bottles of booze if they could get the lungs out without scarring them  
505 much. And they operated--having spent their life at it--they operated with the deftness of a  
506 neurosurgeon. They got the lungs out. I blew them out. I emptied them through a gas meter,  
507 and I got the value. Now you got to be willing to take a chance. I mean, that could have failed  
508 for a number of reasons. And I'm had some failures, but . . . .

509 TAYLOR: John, I can't imagine a new scientist coming out of MIT, Cal Tech, or what have you  
510 today, standing in hip boots amid that totally smelly mass there and blowing up a set of whale's  
511 lungs.

512 KANWISHER: Yeah, but they're nice people. I find that people who are fishermen, people  
513 doing real things like that, particularly under dangerous things, are almost always nice people.

514 TAYLOR: Well, I just, pulling this whole thing together, this picture of you, someone who's  
515 willing to use a dogsled out on the ice caps, to live in an igloo, to essentially do a whale

516 dissection almost from the inside, so to speak It takes a certain kind of individual to do that.  
517 Were there others like you during that period?

518 KANWISHER: Scholander showed me the way. There's a whole group of them he got started  
519 in Norway. They're sometimes known as the "Scholander mafia." And they're my closest  
520 friends. And we can talk shop with each other. My beloved Norway has been the source of my  
521 sanity. As I said, it doesn't turn some people on. It turned me on. But, remember you got to  
522 make scientific sense of it. It's research we're doing. We're not making adventure stories. I'm  
523 not Cousteau making movies for the *National Geographic* or something or other.

524 TAYLOR: I hear what you're saying.

525 KANWISHER: I'm not finding shipwrecks like the *Titanic*. I mean, this is real science. I mean,  
526 how do the damn oceans work? Why are things the way they are? You can't see it. It's all  
527 beneath the surface. I mean, you wish you had magic glasses, you could look down there and  
528 see them. But I'm on a Navy destroyer escort, I guess it was, one of these little tin cans which is  
529 in violent motion, which I thought was exciting as hell. [Laughs.] A whale jumped, probably a  
530 humpback, with the long flippers, and I thought, "Jesus Christ! There's something there besides  
531 Japanese subs!" [Laughs.] And of course you grow up on Captain Nemo and *20,000 Leagues*  
532 *Under the Sea*. What's he called his ship? *The Nautilus*.

533 TAYLOR: [Simultaneously.] *The Nautilus*, sure.

534 KANWISHER: Yeah, yeah, battling with the giant octopus and so forth. But there are really  
535 animals down there which are damn near as strange. And the trouble is, we say "strange."  
536 Strange means it's different than us, different than we expect. But I've done a lot. Some of the  
537 best work has been done with the Navy, with their trained dolphins, because they will work in  
538 the open sea, and they'll do things for us. And we can hang a buzzer on the end of a long cable,  
539 and we'd turn that buzzer on, they'll hear it, and they're trained to go down and turn off the  
540 buzzer with their nose, and then come up and breathe out under a funnel, and then we'll give  
541 them some fish. All of a sudden we can make real measurements in the real oceans on real  
542 animals. Now, the first time we did that I didn't have proper respect for marine mammals. So  
543 we only had 400 feet of cable. And of course the dolphin came up. We called him Toughie.  
544 The species name is *Tursiops*. [Laughs.] And I put Toughie *Tursiops* as one of the authors on  
545 the paper, but the editor caught it and took it off. [They laugh.] But anyway, he came up, and he  
546 breathed out. He wanted all three fish before he inhaled. So clearly he wasn't even pushing his

547 breath-holding skills. So eventually he went to 900 feet, which was three football fields.  
548 Imagine three footballs fields. Then he'd go down and back. And later we used a white whale,  
549 beluga, which has twice as much blood, therefore twice as much oxygen, and it went . . . .

550 [END OF SIDE 1--last 4 lines repeated on Side 2]

551 . . . to 2,100 feet. 2,100 feet down and back is almost a mile underwater. Now, they probably  
552 don't do that in their normal life. We don't know. But we wanted to know what the physiology  
553 was first, and then . . . . There's the physiology, then what do they do with that physiology. If  
554 the Navy hadn't had the foresight to be working with these animals--they were using them to  
555 find mines and all kinds of things now; they've been using them over in Iraq recently--there  
556 wouldn't be this valuable skill.

557 TAYLOR: Mmm, mmm, well, weren't the . . . . Seems to me years ago I read about a couple  
558 called the Lillys down on the Florida Keys?

559 KANWISHER: Yeah, yeah, but they were there with the . . . . They were sort of the BSP[?]  
560 artists, and so forth. We don't know what's going on in their brain. And they're fascinating  
561 animals, but they aren't awfully bright. Animals have what they need to have. They don't have  
562 decorative appendages. I mean, that 10-ton nose on the sperm whale is there for a purpose. Now  
563 you may not understand why it's there. I spent 30 years wondering why it's there, but some  
564 bright young guy in California finally got the idea and was able to take the head of a sperm  
565 whale and, up at China Lake, which is a Navy research place in the desert, they have the biggest  
566 CAT scan machine in the world. It's used for checking the packing of the fuel inside the rockets  
567 that NASA uses to get into space. And he got the . . . . I don't know how he talked them into it,  
568 but he got the whale's head in there and did a scan on it, and found out that it's a sound-making  
569 device, and it's a way of communicating. So there's still some people doing fascinating things.  
570 Now the dolphin, for instance: it's so incredibly sensitive. There's real physics behind it, but a  
571 dolphin can get a return--an echo--from his click, outgoing click, the distance of a football field  
572 of the size of a tennis ball. Not only that, he can tell whether it's edible. He can tell whether it's  
573 triangular or it's flesh, or it's steel or so forth. And this guy who did this sperm whale. He's  
574 found out that there're two sides of the breathing passages, and they each have sound-making  
575 sources, and one is from 40-70 kHz, and the other is from 60-140 kHz, and so it's a wide band  
576 system, and wide band systems give you lots of detail. So they have a brain nearly as big as  
577 ours, but it's doing acoustics rather than vision.

578 TAYLOR: Um-hum, um-hum, and interestingly enough we've finally replicated that with things  
579 like side-scan sonar, where we can come up with a very excellent picture of what's out there by  
580 using sound.

581 KANWISHER: Yeah, I remember when John Swallow first came with that. What an eye-  
582 opener that was! He was such a smart guy and so modest, unlike me. [Laughs.] Like several of  
583 the outstanding British scientists I know, he hadn't gone to Oxford or Cambridge. He was  
584 always a bit self-conscious about his credentials. To me he was a bright guy. I'd have had him  
585 with me at any time. And that side-scan sonar: it was sort of like looking at your face with a  
586 shining light. Everything stands out.

587 TAYLOR: But as you go through all this, and you talk about the early adventure and the people  
588 you run into, it was a very small community, but the names you keep throwing out here, most of  
589 them are considered to be the fathers of something or other here, as we go along.

590 KANWISHER: Yeah, well, Walter Munk was the father of original ideas, really. Bright as hell,  
591 great speaker, great raconteur and so forth. [Laughs.]

592 TAYLOR: And still working strong out there!

593 KANWISHER: I know, I know. I just looked at a Spanish fisheries journal, and he had a paper  
594 in there.

595 TAYLOR: Yeah, it's just amazing. Now, you've worked not just in the cold climates. I mean,  
596 you came out, you got your original inspiration from Scholander in Bimini, and that would be  
597 considered a tropical paradise by most people. At least, that's what the travel agents tell us. And  
598 then you went up to the Arctic. But you worked in other areas of the world, right?

599 KANWISHER: Yeah, yeah.

600 TAYLOR: OK. Talk about some of those.

601 KANWISHER: Well, mammals have a hard time in the water, because water carries heat away  
602 so fast, and fur is not efficient, so you got to use blubber. Blubber's not very good, but it's all  
603 they got. So they have to use a lot of it. And I mentioned, for instance, this seal we killed, and it  
604 was half blubber. That's for cold animals. But when you get down to the tropics you can relax  
605 that requirement, and so you can have a much thinner layer of blubber, therefore more muscle,  
606 and therefore swim faster. And so that's the other side of the coin. Then you add things like  
607 acoustic skills, which are so important that once you have them, nothing else is even vaguely  
608 competitive. So, for instance, in the eastern tropical Pacific, which is an area once or twice the

609 area of the US, off Central and South America, where all the tuna fishing is done, and where all  
610 the tuna deaths were back in the '60s. There are 20 species of dolphins there. They're all  
611 exactly the same, because they need that acoustic gear. They need that swelling forehead, and so  
612 forth. And you can only tell them apart when you see them up close. Now, how they keep from  
613 mixing, because they don't interbreed, is something to do with behavior and whatever they're  
614 eating, and so forth, but it shows how strict some requirements are: to keep warm, to swim fast,  
615 and to find food, the three things. And there's only one good set of answers for them, and  
616 they've found it, and once they do they keep duplicating it. But they can't go into cold water.  
617 For instance, I've been up and down the coast a lot in my own boat, and in the late summer,  
618 you'll see the bottlenose dolphin. It's the trained one from the marinelands, and so forth. You  
619 see them as far north as, say, Norfolk, and they get quite common along the Carolinas, but they  
620 recede back down in the winter to warmer water, and since the first place I had hands-on  
621 experience with these animals was the original Marineland, south of St. Augustine. And in the  
622 winter northern Florida has water that, now, I can only think of it in Celsius. I can't think  
623 Fahrenheit. Our body temperature is 37 Celsius; it's 98.6. And seawater is -1. Let's say it's 0,  
624 and so forth, and half of that is 18, and that's the temperature of the water in Northern Florida.  
625 So when you're in St. Augustine in the winter you're halfway to the Arctic in terms of thermal  
626 stress. And those animals are riding just on the edge. They have as much blubber as they dare,  
627 but they can't go into cold water. And so essentially there's a complete separation in terms of  
628 animals that live in the tropics, where most of them do. And those few that can go into the  
629 Arctic. Now big animals, it's a different problem--surface to volume, and so forth. And so this  
630 little harbor porpoise we have here, which goes to a terrible amount of bother just to be small,  
631 and I can't really give you a good answer, but it seems to be the only answer that works up here.  
632 And they find them halfway up the coast of Greenland. But remember, if you're half fat, you  
633 can't have much muscle. And so they're 10 percent muscle. We're 40 percent. A horse is 55  
634 percent; and muscle is horsepower; and all muscle is the same. It's percentage of muscle that  
635 tells you how powerful you are, as essentially an instrument of doing things--running,  
636 swimming, or flying. So I wish I really understood what's going on there. [Laughs.] Now that  
637 I'm trying to write it without equations, without a lot of technical jargon--I'm writing it for my  
638 granddaughters--I'm not sure. We needed these animals. For instance, what do you do? We  
639 need a small porpoise in cold water. Well, they look rather rare around here, but some of the

640 people here, particularly the fisheries and the Oceanographic, have done an extensive survey of  
641 Gulf of Maine or Bay of Fundy, I guess you know. Essentially, it's between Nova Scotia and  
642 Maine. There're 40,000 in there. Now, 500 are killed every year in fishing nets, killed  
643 accidentally, not intentionally, but that's not that serious a drain on them. They're keeping up  
644 with it. The North Sea, where there's a lot more fishing, but it's a much bigger area, there're  
645 400,000 of them. So the animals are not uncommon. It's just that they're hard to see. They're  
646 beneath the surface. Ninety percent of the time they're beneath the surface, and they come up to  
647 breathe, and if you aren't there looking you don't see it. Now as far as rarity, on the Pribilof  
648 Islands in the Bering Sea. I've just been up on the Berent Sea in Northern Norway. This is the  
649 Bering Sea, Vitus Baring, and so forth. There are something over a million fur seals that come  
650 there in the summer to have their young and to breed, and they have this harem breeding  
651 structure. One big male has a bunch of 20 ladies, and there's a bunch of frustrated young males  
652 sneaking around on the outside trying to make out, and it's raucous and noisy, and it's funny as  
653 hell. [Laughs.] Anyway, so it's hard to think of them as common. In a couple of weeks, they're  
654 going to be scattered along 3,000 km of coast, all the way down to San Francisco, and you can't  
655 see them. I mean, if you go out and really look for a long time, you see one or two, but because  
656 they get together, and because they have to crawl out of the water to have their young, we have a  
657 much better fix on their numbers than we do with the cetaceans. Now, the dolphins in the  
658 tropics, the eastern tropical Pacific, because of the tuna fishing, that's the most intensely  
659 observed large area of open ocean--not only the research, but the fishermen themselves. And  
660 because they use purse seines, they've found out accidentally if they set a purse seine around a  
661 school of dolphins, there'll be tuna fish underneath, and I could probably give you some strange  
662 answer to that. We don't really know why. We can make some guesses, but the point is,  
663 unfortunately it kills a lot of dolphins. It killed 8 million dolphins in the '60s, which is awful,  
664 because they throw them away. They don't use them. I mean, I can understand killing animals  
665 to eat if you're hungry, but I can't stand that. But because of that we know how many there are  
666 there. Now, it's an awful way . . . . It's like Audubon. You didn't collect a bird until you'd shot  
667 it and mounted it. [Laughs.] So since then they've done a lot of going out and just trying to  
668 count them, and there are probably 10 million dolphins in that area. Now, that's 8 percent of the  
669 oceans, and so when I say there's a 100 million mammals, essentially it's not a wild guess.  
670 There's some hard numbers of 25 million crabeater seals, 10 million harp seals in the Arctic--this

671 kind of thing. As I said, fishing has been a great sampling device, which science can use the data  
672 from, if they realize how it's been biased for things they want.

673 TAYLOR: Um-hum, um-hum, but it's interesting. I wonder if there will be a day where people  
674 will start reappraising all of the work you did originally, and things like this. When you talk  
675 about certain kinds of marine critters only go so far because of the mass of fat versus the  
676 musculature--they're limited in range. Wouldn't that be a wonderful indicator of ocean  
677 warming, and things like that, if those critters change where they're going?

678 KANWISHER: It would take too massive an effort. Walter Munk's device was sort of a self-  
679 tending thing. It's the way a lot of the devices they can do now with satellite transmission of  
680 data. I had this guy who was one of my teaching assistants at Harvard one time, who is now in  
681 St. Andrews in Scotland, and he puts satellite tags on elephant seals in South Georgia, right next  
682 to the Arctic ice, and they spend a year out there, traveling all over the Antarctic. He sits there in  
683 the lab, and he knows each dive and how deep it is. And there's a group at Santa Cruz in  
684 California are doing the same thing with the northern elephant seal, the guy at Oregon who's  
685 doing this with blue whales, blue whales off the coast of California! There are 2,000 blue whales  
686 off the coast of California that aerial surveys showed. So fly those airplanes. I don't care if  
687 you're checking whether they're going to be upset by the noise or not, but I mean an airplane is  
688 100 or 1,000 times more powerful in counting and observing than is sitting on the sea surface.  
689 And I love to fly. [They laugh.]

690 TAYLOR: Well, there's nothing wrong with saying you like the adventure part of the work you  
691 do.

692 KANWISHER: Yeah.

693 TAYLOR: And when you find answers because of what you did, you have the best of both  
694 worlds. You had the adventure, and you find the answers.

695 KANWISHER: Well, look, I've had some failures too. I mean, [Laughs.] I have a way of  
696 forgetting those!

697 TAYLOR: Well, don't we all.

698 KANWISHER: Yeah, but if you don't take a chance: nothing risked, nothing gained. As I said,  
699 oceanography was an open science, and they expect you to go out in the world. I couldn't  
700 believe it when I got here. [Laughs.]

701 TAYLOR: Just, yeah, go and do.

702 KANWISHER: Yeah, and Scholander did me the second most important favor is he left. After  
703 two years he went back to Norway to open a new department, and I'm not a follower. I'm a lone  
704 wolf, and I love working alone. And it would not have worked out over the long term. But you  
705 go to learn to fly, and you need an instructor to learn to fly. And the same way with physiology.

706 TAYLOR: Now, was the reason you were over in Norway so much because you maintained a  
707 contact with him, or . . . ?

708 KANWISHER: Well, the whole group of students he started, yeah, for sure, yeah. And when I  
709 wanted to work on the little harbor porpoise, turns out my friend over there . . . . He's a sharp  
710 guy. He's the son of a fisherman, and he knows how people work, so he puts an ad in the  
711 fishermen's newspaper: "1,000 kroner reward for a live . . . ." Let's see, now, they call it  
712 "nisa[?]." "Live nisa[?]." And the calls started coming in. He talks the Air Force into flying  
713 out to this remote place and bringing this back, and the police lent us a casket to use as an  
714 aquarium. And he knows how to essentially make things work. And then of course when we get  
715 into the fishery lab in Bergen we had this 60-foot-diameter pool, which is ideal for it, because  
716 animals in the open ocean don't like corners. They like to keep moving, and a round tank was  
717 the answer, which we didn't know at the time. But people have tried retainer tanks; it doesn't  
718 work. Because of his--what I call--entrepreneurial skills, what I call a green thumb. You've got  
719 to really assess the animal, its personality, what its life is like. Does it resent you being there?  
720 Now, when we used the trained dolphins for diving, they just can't wait to go. They're crowding  
721 each other to be first in line. And incidentally, I went out last year to pay a social visit with him,  
722 and an animal I worked on 30 years ago is still there, very happy. It must be 45 now.  
723 Unfortunately, he didn't remember me, but . . . .

724 TAYLOR: You talk with such great enthusiasm about your life's work.

725 KANWISHER: How else could I talk?

726 TAYLOR: Well, why did you retire?

727 KANWISHER: Because it got more bureaucratically structured. I mean, you have to put in  
728 proposals, and the proposals . . . . The kind of people who go to Washington want to know the  
729 answers before you have them. I mean, I see it in my daughter's life now. What you do is, you  
730 get some good result, but you don't tell anybody. Then you put in a proposal, because you  
731 already got the data. Then it gives you some money to play around for some new idea. That's



732 essentially it. It's somewhat fraudulent. And also I was an engineer, and I did consulting, and I  
733 needed the money. My kids got into Harvard and MIT. It took a lot of money.

734 TAYLOR: Oh, yeah, big-time money.

735 KANWISHER: Yeah, yeah, yeah, sure. It's like buying another house. Incidentally, since then  
736 I've done things like Jimmy Carter's Habitat for Humanity, helped on houses and old people and  
737 this kind of stuff, but I also worked with people gratis, building instruments, because  
738 instrumentation was my specialty. So I would come along with the transmitters they could put  
739 on animals, and then hang around while they get the data.

740 TAYLOR: So, essentially, you never really did retire. You just kind of moved to a different  
741 way of doing things.

742 KANWISHER: Yeah, yeah.

743 TAYLOR: You got out of the bureaucratic . . . .

744 KANWISHER: But also, after Rachel Carson and this whole thing on the environment, most of  
745 which I don't believe. We've done awful things. The population of the world has tripled in my  
746 lifetime, from 2 to 6 billion, and that's the real crime, and that's the limitation. And some of it's  
747 rubbing off on the oceans, and 90 percent of the big fish, the swordfish and tuna are gone. That's  
748 what you can do with longlines. You put out 10,000 hooks from 1,000 boats all over the ocean,  
749 and eventually the animals never have a chance to grow up. And I don't think it's possible to  
750 practically manage the oceans, even though people have talked about it endlessly.

751 TAYLOR: Well, they have this big thing about sustainable yield, and I don't . . . .

752 KANWISHER: Yeah, I know that. But they're gone! And they may never come back. Fifteen  
753 years ago they stopped fishing the Grand Banks, and they haven't come back yet. They may  
754 never come back. The book *Cannery Row* talks about the--not herring--what's the other fish,  
755 anyway, they catch there?

756 TAYLOR: Anchovies?

757 KANWISHER: Anchovies they catch in large amounts. And they disappeared in the late '30s,  
758 almost certainly not from fishing, because there were so many of them they couldn't have  
759 possibly have done it. We don't really quite know why. Well, if it had happened now: "Oh, it's  
760 DDT or something," and we don't really know for sure. And so there's an object lesson there in  
761 that you shouldn't expect long-term stability in these things. Now, the cod on the Grand Banks,  
762 and now in the Berent Sea, have been reliable for centuries, but if you go back through the

763 records of the Norwegian Coast and the Germans who ran the trading companies there, they have  
764 shown cycles over a hundred years or more. And so . . . .

765 TAYLOR: Is that one of the issues you see, that there just isn't enough empirical data to really  
766 make definitive statements about a lot of these kinds of things?

767 KANWISHER: Yeah, there probably isn't. The thing is, we've done a lot of things wrong, so  
768 we know a lot of things not to do. [Laughs.]

769 TAYLOR: But, I mean, you have what we call intellectual failure. Sure, you're going to fail,  
770 but you're going to learn from what you failed at.

771 KANWISHER: No, we aren't learning from them, the point is. It's people. Because politicians  
772 . . . . You know, politicians essentially stay in office by lying, and how artfully can you lie.

773 [They laugh.] I don't want to get into politics right now. And scientists work by finding out the  
774 truth. The two, by their very nature, are opposed to each other. They can't expect to get along  
775 well.

776 TAYLOR: How do you keep . . . ? You talk about this with such passion. Now, we're talking a  
777 40, 50, half a century passion for something. How do you maintain a passion like that for so  
778 long?

779 ]KANWISHER: Because I've been going over it and trying to write about it. I want my  
780 grandchildren to know. There's a guy named Andy Grove, one of the two guys who started  
781 Intel, and he was a Hungarian refugee. And we adopted a Hungarian refugee, so I always watch  
782 that class of people. And he was on Charlie Rose one night, and he was reviewing . . . . He said,  
783 "All of a sudden, I wanted my grandchildren to know what growing up as a Jew in the '30s in  
784 Budapest was like," hiding in basements, and so forth. And I said, "You know, I want my  
785 grandchildren to know too." As I said, I wish I had the writing skills equal to the story. [They  
786 laugh.]

787 TAYLOR: Could I ask you a semi-loaded question, and you don't have to answer it if you don't  
788 want to? If you woke up tomorrow morning and found yourself the Director of the Institution,  
789 what directions would you take it in?

790 KANWISHER: I don't know. It'd never happen, because I simply don't have people skills. I  
791 know it because I have a daughter who does. I watch her at close hand, running a large lab, with  
792 15 or 20 people in, and answering 50 emails a day, and so forth. And I want to be alone in my  
793 boathouse, thinking about, "What the hell's going on here? What do we really know?" And it

794 turns out that we know the facts from fishing, for instance. We know all kinds of things which  
795 people don't think of. And I was in Europe, in Barcelona, giving some lectures last summer, and  
796 it was very hot. A bunch of people died--15,000 people died in France during the month of  
797 August.

798 TAYLOR: Right.

799 KANWISHER: Yeah, and I said, "How do you know?" Just, "That's how many extra caskets  
800 we sold." Now that's hard data, and there's a lot of that that you can get from the real world, if  
801 you let your mind wander, if you read voraciously, and so forth.

802 TAYLOR: Well, you know what it sounds like you've never lost over the course of your career.  
803 You said that most scientific discoveries, the famous old before 25, after that you don't, because  
804 most people get locked in a box, and you say, well, of course it can't be that way. I mean, I just  
805 understand from all the data I've collected it can't possible be that way. But yet it sounds as  
806 though you still say, "Well, what if it is that way?"

807 KANWISHER: Yeah.

808 TAYLOR: That you can break the old paradigm, so to speak.

809 KANWISHER: Well, I don't think I would have amounted to much if I hadn't taught, because  
810 teaching . . . . I mean, doing research is like writing short stories, and some of them are great.  
811 [Laughs.] But eventually you want to write the Great American Novel. You want to put it  
812 together in a structure. This is the way it is. So, essentially, you're connecting the points,  
813 whatever you want to call it, and you're talking about a lot of things you haven't really done  
814 yourself, and you're dealing with people who were once in your shoes, and you have to  
815 remember what you did or didn't know at that age. And I've found that a completely separate  
816 challenge from doing the research. It's addicting, too--that sea of faithful faces [laughingly]  
817 waiting for the spoken word. I'm sure Arnold Arons felt it. [Laughs.] I didn't get along with  
818 him well enough to ever actually compare notes with him, but . . . .

819 TAYLOR: OK, good, well, he's just got a couple of minutes, so why don't we shut . . . .

820 [END OF TAPE]

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