

INTERVIEWER: Did you decide to work on the cutting edge of genetics?

HOPKINS: Yes.

INTERVIEWER: What gave you the idea that, as a young woman, you could make that decision on your own?

HOPKINS: I was an undergraduate in college, and I was casting about, trying to find the meaning of life. I wandered into a classroom at Harvard, and the lecture was given by Jim Watson, the man who discovered the structure of DNA. It was 1963, so he discovered that 10 years earlier.

At the end of the hour, I was a convert to this science. I just knew that was it. You know, I just wanted to be one of those people doing that kind of science. So I didn't think about being -- what it means exactly to be a girl who wanted to do that. I just knew I had to do that. So I went to Jim's lab as an undergraduate and worked in his lab. He kind of took over from there. You know, he said you should be a scientist and encouraged me to be one.

INTERVIEWER: What about your upbringing and background as a young woman encouraged you to have the confidence that when casting about for the meaning of life, you could actually determine your own destiny and convince someone with the stature of Jim Watson to make you a part of his team in his laboratory?

HOPKINS: If I could trace it to two things, I think that family was absolutely critical, particularly my mother, who many people in her family had in scientists, apparently. Her family came over from England, but she had had relatives who had been scientists. It was spoken of as a fabulous thing. So there was this image of science as a wonderful thing. My father had some relatives who were engineers, but really my mother. She just encouraged it.

Then, I think, I went to a wonderful, small private girls school called Spence in New York City, and I loved that school. I think they made girls feel that they could do anything they wanted to do. I don't think it ever crossed my mind that you couldn't, hardly ever. I didn't really give it a lot of thought. If I had thought about it deeply, I realize looking back, I should have realized there might be limitations. But at that point, I just never thought of it.

By the time I got to college, of course I realized there was a pattern of life that had been set out for women of my generation. That was, you went to college. Presumably, you would meet your husband in college, which I did. And you would marry right after college. You would work for a couple of years, and then you would give up working to take care of the family. That was really, I think, a sort of feeling I had that this was likely to happen to me. It wasn't necessarily something I wanted, but it was something that was just going to happen. So I did have to get off that track.

INTERVIEWER: You had to decide to get off that track?

HOPKINS: Yes, and I think that was a very long, complicated process. Because after I saw this molecular biology and fell in love with it, I think almost I knew I couldn't live without it, really. I saw, right away, that there was an incompatibility between this type of science that I had fallen in love with, and this life that was meant to be for women of my generation. What I saw was that the men who did the kind of science I wanted to do were working, you know, 60, 70 hours a week. In that generation, women certainly were thought to be the primary caretakers of children. So I didn't think it was compatible that you could be a mother and to be a scientist of the kind I wanted to be. So I knew it was a problem, but I just kept pushing it aside, and saying I'm not worrying so much about a career anyway. I just have to be near this science. I have to be doing these experiments. I have to be with people who are doing it. I have to be here. I didn't really think too much about what was going to happen further down the line.

INTERVIEWER: What was the first experience you had where you designed an experiment and got a result that gave you a sense of, I want to do this again and again? Was it something that happened at Spence or later?

HOPKINS: Much later. It happened, intellectually, in that classroom that first hour, I think, that I heard Jim Watson. I saw where molecular biology was going to go. I could see how it worked and how the thinking went. I could see the kinds of questions you could ask and so forth. But to actually be able to do an experiment yourself; to think it up, design it go in the lab and do it, and get a result, took another three years for me. I actually started in graduate school at Yale. It didn't work out. I wasn't happy. I said maybe this is not the thing I should do. I'm going to go back to Harvard, because there's only one scientific problem I want to work on. People are working on that problem at Harvard. so I have to go back and work on that problem. Because I didn't care if I was a graduate student or tech -- I didn't care what my title was, because I wasn't so interested in the career. I was interested in the experiment and the science and the question.

So I went back to Harvard, and I worked very closely with a brilliant young scientist named Mark Ptashne. He was trying to isolate the repressor, which was an incredibly important problem at that moment. We got it to work, and then one day, this one day came where I said, oh yeah, I see how all this works, and from there on, I was free. I was independent. I could do science.

INTERVIEWER: What did you see of how it all worked? In other words, was it a scientific insight? Was it a mechanism of how the molecules played? Or was it more a question of how you can design an experiment to get a clear result without a lot of noise and distractions in the background?

HOPKINS: Yes, I think it's like that. What I was able to grasp very quickly early on was the big issue; the big question. How you want to go from here to the next answer. What I didn't realize was how you create the small steps that take you there. Of course, how you technically work in the lab to produce really reproducible results; which is a hard craft you have to learn. But it was connecting the posing of the small question on the way to the big question; the posing of the daily experiment to get to that big answer, and it was by working side-by-side with Mark in the lab that I really learned it. I already had the intellectual part of it under control, but I didn't have the connection between the lab work and how to get to where you wanted to go.

INTERVIEWER: Often scientists are an assortment of configurations, where some are, perhaps, more result-oriented, very much into the reproducible result; the granular level of science. Whereas others are, maybe, very much more in the big picture and the computational stuff; the specific results. People will do that or will get there eventually, but I know that I'm right theoretically. What kind of a balance do you have as a scientists, between those two?

HOPKINS: I hadn't thought of it that way, honestly. I think part of it comes from the era in which I became so excited about science. In that era of molecular biology, molecular biology was a small field, a new field. You have to remember, 1963 was the year the genetic code was still being cracked, the year I discovered molecular biology. The questions were focused onto a few questions, and it was very intellectually driven. How do you, you know, get the information out of DNA into proteins to make living things? That was where we were. So everybody knew what those questions were, and it was really a question of getting to those answers. They were huge, I think, questions. They really were the meaning of life. So, I think we were all focused on the questions, and that was the thing. I was so focused on them, I had to go back and learn the nitty gritty. So to me, the big question has always been the driving thing. Where is this going?

What I didn't understand, when I started, because I was so driven by the big question, was how much I would fall in love with the process of getting there. That came later for me. It's a mystery. I think it remains a mystery. I could go into lab and work, and you have no sense of time. You could work until you fell onto the floor, you're so tired, and you just lose track, because it's so much fun. I don't quite understand it, actually. It's some combination of thinking about the problem and the doing of it. It's running through your head. It reminds me a little bit of riding on a train. When you're riding on a train, I find ideas just flow through your brain. That happens to me when I work in the lab. So that connection to the science, when you're at the bench, was for me -- I just loved that. I think not all scientists do. I think some only love the intellectual part. Those people can't wait to get out of the lab and get other people do it for them. Whereas for me, it was very hard to leave the lab, because I loved doing experiments while thinking about them.

INTERVIEWER: I like the train metaphor. There's a joy in keeping the train going and there's a joy in looking out the window as you're moving.

HOPKINS: Yes, and it's something. It's the connection -- I don't know if everyone has it -- I think they do. That sense of your brain being freed by the movement of the train. Somehow in the lab, as you're doing it, you're putting things into the tube, you're thinking about the molecules that are in there, and what they must look like, and what they're doing, and trying to make sure you're treating them right so it's going to work out right. So the whole experiment is constantly in your brain in a very intense way. It's just a fantastic thing.

INTERVIEWER: I love how you described 1963, the year you discovered molecular biology. It feels like a red letter day to me, all of a sudden. What in your interests and backgrounds and thinking of what you might do, went by the wayside at the moment you became so clear about what direction you were going to go in?

HOPKINS: That's an interesting thought. I had gone to Harvard wanting to major in Math. My mother had told me that everybody, even including women, had to be able to earn a living, because you never knew what was going to happen in the world and you had to be able to earn a living. She said computer programming seems to be an up and coming field. You should do that. But I didn't know what that was even. But I loved math, and I wanted to major in math. So I get to Harvard, and the first week, they tell me I couldn't major in math, because they said, having gone to an all girls school, they didn't teach you enough math. You can't major in Math at Harvard. You're so far behind, you'll never catch up.

So I was heartbroken. I couldn't imagine living without math. I loved math. So I thought to myself, well, I will just secretly take math. You know, I won't tell them I'm majoring in Math. I'll take math courses. I'll try to find something else to major in. But as time went by and the math became -- I liked it at first. It was fine, but I didn't love it. It was not what I thought it might be. So I had that sense I think young people have of confusion, of looking for the meaning of life, of trying to understand the world, their place in it. I thought, maybe I should go to medical school, help cure people.

My mother had had a very mild form of cancer when I was young. In that era, you didn't say the word cancer. You did not say cancer in public. It was so terrifying that people didn't even use the word. So I was very scared by that when I was a kid. I thought, maybe I should go and try to cure these people who are sick or something. You know, that kind of youthful idealism, I think.

I thought, maybe I'll go to medical school. So I'll take biology. Then, as I went and took this class and sat there, I realized, wait a minute, if you were in medical school, if you were going to cure people and a disease came along and you couldn't understand it, you'd be sitting there watching them die and you wouldn't be able to do anything about it. That might not be so great. Then in came Jim Watson. I said, oh, that's going to cure all those diseases. That's for me. So it was a funny combination of fitting some emotional need at that age, I guess, with the obvious, unbelievable fascination of this field, and the sense that this was the meaning of life. I mean it really, for me, was the meaning of life that I'd been looking for. I somehow sensed that was going to supply that need, and it did. However, there was this realization that as time went on, this was a very long period of doubt and confusion really. What was going to happen when you had to give it up and have children? Because then you'd have to quit. So I knew it was a limited time I had to be with this science I loved.

INTERVIEWER: So even those beginnings, exciting days with James Watson, Cold Spring Harbor, all those early, sort of, research experiences that you had, there was this sort of Sword of Damocles hanging over your head, that the Grim Maternal Reaper was going to come and drag you off to the maternity ward.

HOPKINS: I love it. The Grim Maternal Reaper. Can we use this? That's great. That's good.

INTERVIEWER: Open source. Yes.

HOPKINS: Absolutely. I had a limited time to experience this incredible science and satisfy this need. Then I would have to give it up and resign myself to my fate, which is a terrible way to look at motherhood, which I'm sure is a wonderful thing. But that's how it felt.

INTERVIEWER: When did that stop? HOPKINS: Well, in those days, and this is, I think, an interesting thing, we tend not to notice these changes. But for me, the sword was going to fall at the age of 30. 30 was the last cutoff, and about 28, you had to start preparing. In that era, we had, of course, no, reproductive technologies did not exist. There was no amniocentesis, and women were highly encouraged to have children by the age of 30.

So I figured, I graduated when I was 20. So I had a maximum 10 years before I would quit science. So I had to get going. But what happened to change it was several things. But I was married at the time. I wasn't exactly sure when my husband was going to need to move away from Boston. So there was a little ambiguity in the timing. Then, what happened was that all of a sudden, Civil Rights and Affirmative Action kicked in. I was suddenly offered jobs at Harvard and MIT. At first, I thought, well, what's the point of interviewing for these jobs, since I'm going to quit science in a year or so.

But I went to Jim and said what should I do. He said, you've gotta go and talk to them. So I went and talked to them, and I was offered these jobs. There I was, not knowing it was a very complicated thing. When to quit. What to tell them. What to do. Then, all of a sudden, my husband decided he didn't want to be married anymore. And that solved everything.

INTERVIEWER: What a guy.

HOPKINS: I'll tell him you said so. It took a while to be friends again. But we are. But thank you. It was a surprise. So that took a real readjustment in the life plan. So I stopped and thought, well, now what? I thought about it for quite a long time, about a year, and then I said, I'm gonna do it. I'm not gonna get remarried. I am not going to have children. I am going to be a scientist. I was going to do that.

INTERVIEWER: We're talking age 28, age 29?

HOPKINS: Yes. Age 29. That's very young.

INTERVIEWER: You were holding, at that point, two offers?

HOPKINS: I could have gone to Harvard Medical School or to MIT.

INTERVIEWER: Why did you choose MIT?

HOPKINS: The water. It was the water. Good quality water. Thanks to David Baltimore, actually. MIT, because of the Nixon War on Cancer was going to build this Cancer Center. It was being built by Salvador Luria, who had been Jim Watson's mentor, and who completely understood the kind of intellectual science we wanted to do. And David Baltimore, who was the leading virologist, probably in the world. David, of course by then had discovered reverse transcriptase. So my dream had been to work on cancer, but you couldn't work on cancer when I was in graduate school. You couldn't do it yet. It wasn't ready. Technically it wasn't possible to do what we felt needed to be done. By the time I graduated, you could. So all of a sudden, it was the right job, the right place, the right people, the right approach, and it was possible to do this science. At Harvard Medical School, they hadn't yet realized how difficult it was going to be technically to grow animal cells in culture. To do it, you needed to have really pure water. I went to Jim and said what should I do? He said, David understands this. Go to MIT. So, because David Baltimore knows how difficult it is to grow cells in culture, he'll make sure they build a building where the water is good enough to grow cells in culture, and Jim was right. So that's why I came. Cells grew beautifully.

David had special pipes put into the Cancer Center that would allow you to take the water straight out of the tap and actually grow cells. It was a miracle really.

INTERVIEWER: That's incredible. So that's where the MIT motto "It's the water" comes from? No, nevermind. That's wrong.

Take me from of your initial research at MIT to the decisions that lead to the incredible work you do on zebra fish, who I gather, as a species, had no idea what was about to hit them, when you arrived at MIT.

HOPKINS: Well, it was quite a few years later. I started out to work on cancer, using viruses that cause cancer. That was what made it possible. We knew how to work on viruses from earlier work. Suddenly, you could imagine doing it in cancer. So I did that for fifteen years, and it was a fabulous field. It was lots of fun. However --

INTERVIEWER: Let's just remind people the mechanism that you were exploring at that point. You were looking at viruses as triggers for tumor activity in cell tissue.

HOPKINS: Yes, in mice and chicken. So the reason that we suddenly had the confidence to think we could work on cancer in a productive way was we had worked on viruses that infect bacteria, which are called bacteriophages. That was used to work out a lot of molecular biology in the early days, because they were so simple.

INTERVIEWER: They reproduce quickly, and you get a lot of results.

HOPKINS: Yes. Basically, they were as close as you could get to having pure genes in your hand. So you could really use them to analyze gene expression, etc. So cancer was a problem. I'd imagine it was a problem of animal cells, which was thousands of times more complicated.

But suddenly, although it had been known for a long time that viruses could cause cancer, a virus could transform a cell into a cancer cell. So that meant something that had a very small number of genes could cause cancer. It was an object that was just like the ones we'd been studying in bacteria. Suddenly, we realized the same techniques, the same intellectual things, are going to be usable on this virus that can cause cancer. All we have to do is go find the genes in this little virus that can turn this huge cell into a cancer cell. We had done it. So you just suddenly realized it was possible, intellectually and technically.

INTERVIEWER: But suddenly in the animal field, you're doing with the complexity of cell specialization, and it was a much bigger genetic domain than just with the bacteria.

HOPKINS: Yes, and the animal cell was hopeless at that point, it seemed to us. But the virus was manageable. This tiny little virus had five or six genes, and somehow it could turn that cell into a cancer cell. So maybe you could try to avoid the cell and just try to figure out what the virus was doing. So that was the entry into it. And of course, it worked out in the end to lead to the discovery of oncogenes and so forth. It was a great era. Enormous advances were made, which we're still expanding from those discoveries now in cancer research. So it really did work.

I did that for a long time, and it was in that era that I was gradually coming to realize that there were difficulties for women in science that I had not imagined actually. I thought I had dealt with them, because I thought that the only problem was you had decide not to have children, and that once you dealt with that problem, there weren't going to be any more problems. I thought that Civil Rights had removed all the barriers to women by opening the doors of universities and letting women be hired.

INTERVIEWER: In a sense your good fortune might have led you to believe that, you know, things had been fixed.

HOPKINS: Absolutely. I remember, before I went to MIT, after I was offered the job. I was down at Cold Spring Harbor, and I was talking to Barbara McClintock, who was this great woman scientist there. She said, oh I hope you're not going to take a job in a university. I said why not. She said you won't be able to stand the discrimination. I thought, what is she talking about? You know, in her generation, a woman couldn't get a job in a university. So she had this notion of universities as being these terrible places that discriminate against women.

I didn't have that problem. I was doing just fine. I thought the only problem was you couldn't really be a scientist at that level if you wanted to have children. But after I made a decision I wasn't going to have children, which was a hard decision but one I made, and that was fine. I didn't think there would be any more problems. I discovered over the first 15 years that I was maturing as a scientist, that there were problems for women, and to some extent, I thought they might be connected to the field I was in, because I hadn't had them in the field I was in before. I realized the closer things got to medical fields, the more they seemed to be dominated by men. So I thought I would change fields and try something else for a change.

I had actually been interested from that very first lecture when I heard Jim Watson, not just in the meaning of life and the secret of life, but I wanted to work on cancer, which I ultimately got to do. I was interested in whether or not this revolution would ever lead us, in my lifetime, to being able to understand human behavior. So I thought, well, maybe I'll look for an organism in which you can study behavior.

INTERVIEWER: Before you go past that. Just before we leave the reasons that led you to move away from the medical establishment, what evidence did you have that there were these discriminatory problems? What kinds of events said to you it's not as simple as I thought?

HOPKINS: It's a long, complicated story and not easy to tell in a short answer. But it was a very slow, gradual realization for me. I sort of had a difficult time, and I thought it had to do somewhat with personality, that maybe I wasn't aggressive enough. Because in science, you really need to be aggressive. You need to be out there. I loved the intellectual debate and all that, but you have to be out there really pushing and struggling and so forth. I thought that might be hard for somebody who'd gone to Spence School, where you were brought up to be very polite. So I thought a lot of problems were just my personality wasn't aggressive enough. But with time, I saw that I really watched other women and how they were treated. I began to realize that they were all having a problem. I didn't think they were aware of it, but I became aware of it. I saw that they really weren't included at the heart and soul of what was happening. In some funny way, they weren't full participants in that system. It just wasn't as much fun, therefore, because the whole point of the thing is to be in the rough and tumble of the cutting edge, not to be excluded from it.

So it began to bother me, and I thought, as I say, the field I'd been in had been much better, so maybe it was the field. So I thought I would try another field, and I wanted to look for something in the field of behavior and using a genetic approach. I happened to learn that this woman, Christiane Nusslein-Volhard, who was the great Drosophila geneticist in Germany, had started to work on zebra fish, was exploring it as a system to do forward genetics to study early development. So I thought, oh that's interesting. Maybe you could use the fish to study behavior. So if I go on sabbatical there and learn how you do these large, forward genetic screens they're called, maybe I could use them to study the behavior of the fish. She wants to do development, but I'd like to do behavior.

INTERVIEWER: But the proposition in your mind was, is there a way of isolating the mechanism whereby behavior is or is not inherited or passed from generation to generation. That's a pretty radical thought at that time.

HOPKINS: At that time, well, as I say, the first time, that first hour goes back to 1963. You knew that whatever living organisms did, somehow, the information on how to do it had to be written into their DNA somehow. So some aspects of behavior had to be there too. Everything we are, in a sense, even the ability to interact with the environment and be changed by the environment, had to be written there.

So I'd always been interested in that, and I thought maybe the time had come. I wasn't sure, and that is a question. Was the time right to make that change? Actually, Susumu Tonegawa and I were neighbors in the lab at that time. We had adjacent labs, and he was thinking the same way, and we went and took a class together at Cold Spring Harbor. He did change fields and go into learning and memory. And I changed fields and went into zebra fish. But he really stuck with the brain and the learning and memory.

I got to the fish field, met Jani Nusslein, went to Germany. About two days after I arrived, I realized you couldn't study behavior in the zebra fish. The time was not right. Too hard. But in the meantime --

INTERVIEWER: How was it hard? What needed to be done first?

HOPKINS: It was just impossibly technically difficult. The behaviors were not well enough understood. If you're going to find the genetic basis of something, that trait has to be something you can easily track. The behaviors were too mushy; not crisp enough. At that time, the fish also as an organism for laboratory use was not well enough developed. So Jani was still trying to figure out how to raise baby fish. She had pots of paramecia and all these hideous things growing on the window ledges trying to figure out what was the best fish food for babies, you know. This was not high level science. This was really low level.

But she said, here look at these, and she gave me a plate of fish embryos. She said watch this in the microscope. So you watch it, and in the next 24 hours these single celled eggs turn into little embryos that are moving their tails. Beautiful.

INTERVIEWER: So you could see it happen.

HOPKINS: You could see it happen.

INTERVIEWER: But aren't they -- don't they have skin on them. Is the process concealed?

HOPKINS: That was the great thing. No, it was like watching a movie. It had a transparent shell around the cell, which had yolk inside to feed the cell. And that cell is going to divide every 20 minutes right in front of your eyes, and shape itself into a little fish overnight. It was so breath taking and so beautiful.

INTERVIEWER: There was this tantalizing cell specialization show that you could watch anytime you wanted, and that you could see perfectly well because of the transparency of the fish embryos.

HOPKINS: Right. Exactly. It was just breathtaking, and I had so much fun on sabbatical. I just fell in love with the fish. I thought, well, what we need to do is develop the technology that will make the genetics easier. Then maybe people will come along and develop good behavioral assays. Then after we've done all that, we can put the two together and I'll get to do this behavioral screen.

INTERVIEWER: Was there something about that image of the cells specializing and developing before your eyes under the microscope that spoke to you directly and said I dare you to figure me out.

HOPKINS: I wish I could say the answer was yes, but no, I really again was not that interested in developmental biology. I had been interested in cancer and behavior, and I'm pretty tracked. I was seeing the very long term thing of being able to use it. But I think I fell in love with the beauty of it. I saw that with this organism, yes, you could get the genes for behavior. Okay, we'll do that along the way. I'll just find all those genes that you need to make an animal. Okay, if that's the route to go to get to this goal, I'm willing to do that. It's pretty interesting. So that's what I did.

INTERVIEWER: You had to develop a whole range of tools. Describe what you needed to do.

HOPKINS: We had to figure out how to damage the genes. So what you're doing is saying which of the genes that you need to cause this single cell to turn into this little fish essentially overnight. In five days, it gets up and swims away and feeds by itself on prey. So that's very rapid development. So how many genes does it take to do that and which genes are they?

So we wanted to make a method that would allow you, essentially, to bombard the genes of the fish with like a bullet from outside, so that you would damage the genes one at a time. Then ask, okay, is this gene essential for this process to occur? No. Okay, we'll go on to the next gene. Is this gene essential? Then go through the whole genome like that and ask which of the genes do you absolutely need for this process to happen.

INTERVIEWER: And up to the time, the ways of doing that involved radiation or external chemical agents. What did you use?

HOPKINS: Exactly. So we wanted to tag the gene by putting in a piece of DNA that came in from outside that would go in, hit the gene, and stick to it basically, so that you could pull that gene back out and identify it very quickly. That was a method which had been used in flies many years before by Alan Spradling and Jerry Rubin. That method is called insertional mutagenesis. But it was absolutely unclear if it was possible to develop in an invertebrate to a level where you could actually use it on a very large scale and get it to work. Rudy Jaenisch had been the first person to do it in vertebrates, who was here at MIT. He had done it mice many years before, but it was so inefficient and so difficult and tedious that it was not useful.

INTERVIEWER: So you turned to some old friends.

HOPKINS: Turned to some old friends and took the viruses that I studied to try to understand cancer. Put them in the fish, and miraculously, ultimately it worked.

INTERVIEWER: So the viruses were the insertional agents for the DNA that would attach to particular genes, and then you could watch what happened.

HOPKINS: Right and then you could say, okay if I hit this gene, is that a problem? If it was, then you just go in and pull that gene back out and sequence it, and say, oh, you need that gene to develop. We collected hundreds of such genes and ended up identifying a quarter of all the genes that were essential to make this process work properly. So it was pretty exciting.

INTERVIEWER: And it's still going on?

HOPKINS: Well, we cloned all those genes and we found all those genes. Then a curious thing happened. Well, there were many, many genes, and we gave them away. People studied them, and lots of people worked on them. But along the way, a funny thing happened, which was that mutations in some of these genes caused fish to get cancer. And this was -- perhaps we should have been thinking about it, but we weren't. You know, we were thinking about just getting these genes that were necessary for making this beautiful fish. We had genes that actually were required to make a fish, but if you damaged them, but didn't completely take away all of it, just damaged it so that the gene was damaged. But you had two copies. You had one damaged, one good. Then you were predisposed to get cancer. We discovered a new class of cancer genes.

Then suddenly I said wait a minute, I love cancer. I'm back in the cancer field. Oh this is fabulous. I was very excited. At that point I teamed up with one of my colleagues in the Cancer Center, Jackie Lees, Professor Jackie Lees. She got interested in it. She heard me give a talk one day, and she got interested in it. She was at the cutting edge of the cancer field, which I had left. So we got back together again, and now we collaborate on this project.

INTERVIEWER: What's the scale when you're zebra fish operation was up and running at full scale? How many fish are we talking? What kinds of operations? How many people? That sort of thing.

HOPKINS: Yeah. We had a number of fish. We had 4,000 fish tanks, and we had probably at any one time between 50,000 and 100,000 fish in the lab. The total number of embryos you have to screen in the microscope is on the order of 1 million. You have to look at them one by one by one to find the ones that have the defects. So that's a lot of fish going by, and we had a fantastic team of people to do it. We had 25 people, I guess, at the height of it for a couple of years that were required to process through this large number of animals. It was a very unusual experience, fabulous experience. They had to work as a team, so we had to work through many technical problems to figure out how to get people to work together. Science people tend to work individually, so this was a real team thing that was essential.

I had a couple of people who would come and just became obsessed with this project as I was and stayed with me. It really made it possible and helped organize this team of people.

INTERVIEWER: Did you discover something about your leadership capabilities, your ability to manage a team of people, male, female, different ages in this endeavor?

HOPKINS: Yes, that's an interesting point. I remember someone saying, oh don't you think it's going to be very hard to run such a large lab, and I hadn't thought about it. Why would that be hard? I guess that I think in science, when you're so driven by the question and by the goal and by the science, you solve the problems that come up. So the idea that you -- I don't think it crossed my mind, because we were all on the same page here. We had this common goal. It did turn out to be a very interesting challenge, and I actually enjoyed it. People were wonderful and had a good time, but it's certainly an essential part of it, getting people to work together; and sort of recognizing, you know, what people are good at. I think sometimes you learn that you can't put a person into a job they don't like. You gotta let them tell you what -- anyway, it was a terrific experience. Yeah. I liked it.

INTERVIEWER: Do you have a fish tank at home today?

HOPKINS: Never. Never. Never. Fish take a lot of care. I don't recommend it, particularly when you have to go to work and take care 4,000 tanks. So for the first year that I went to zebra fish, I took care of the fish myself. So, I was there 365 days the first year, and almost that number the second and third and fourth year.

INTERVIEWER: It's like a Gloucesterman, practically, scale of George's Banks.

HOPKINS: It was just because, you know, they require -- to get them, we didn't just need fish that stayed alive. We needed fish that would mate on demand. So fish have to be super healthy and well fed, but not overfed, you know, just right. So to get it right was a lot of care.

INTERVIEWER: At a certain point at MIT, you again were confronted with this issue of gender inequality in the sciences. How did that come up, and what did you decide to do about it?

HOPKINS: Well, I think, in fact, what happened was that I had, as I say, kind of left the cancer field thinking maybe this is not the right field for me; maybe it won't go back to being so much fun as it was when I was young. I'll change fields. I'd gone to Germany into Jani Nusslein's lab, and it was so much fun. I went back in the lab, worked in the lab night and day, had a fabulous time, and found it was a very much more compatible field.

So I came back to MIT just so excited about the fish and couldn't wait to get started. I had carried these fish back from Germany. I had them put in my tank. I then set about trying to get some very minimal resources to do this project that I was very excited about. I ran into obstacles, right away from the administrators in my department who controlled space and so forth. I guess I was quite a bit older by then, and I knew this was a very exciting thing. I just knew this was really interesting. I was of an age and status, I guess, where I was asking for very, very little; and I was old enough to realize I wasn't asking for anything compared to what most people had. I couldn't get it, and that was what finally really made me understand that I couldn't escape this problem.

So I was so determined to do this science by then, I said I'm not going to be blocked by this this time. I'm not giving up this new field that I've fallen in love with now. I'm going to do this work, and so I began this fight just on behalf of myself to get the resources -- this tiny amounts of space and resources -- I needed to start this zebra fish work. And it was in the process of that that I came to realize what the problem was really like.

INTERVIEWER: And you went about it as a scientist. I mean you found creatures, who had some of the same issues that you had, created an investigative technique for collecting data, and produced a result. Describe how you kind of banded together to figure out whether this was something that was just happening to you, or whether this was something much more broad.

HOPKINS: Well at first, as I say, it hadn't occurred to me to talk to anybody else. I began collecting data, measuring lab space with a tape measure, so I could convince my administrators that I deserved to have an additional 200 square feet of space. So I'd begun that, and I wasn't getting anywhere. I was getting more and more frustrated. I finally went to see the dean to ask for his help. He was this wonderful Dean Birgeneau. He listened to me, but nothing happened as quickly as I wanted it to happen. So I went to the provost and so forth.

Then finally, I sat down one day and wrote a letter to President Vest, and I said, you know, there's a terrible chronic problem in this institution. I'm sure you don't know about it, because if you did, you'd certainly want to fix it. I described some aspects of what I thought was discrimination against women, preventing them from doing science the way they should be able to. I showed it to a friend of mine. He said, you can't send that to the president of MIT. He won't know what the heck that means. He'll throw it right out and think badly of you, or whatever.

So I thought, okay, I'll run this by a woman scientist, another woman, and ask her what she thinks; make sure it's not offensive and won't offend President Vest. So I chose a person who was a very successful scientist that I didn't know very well. Because I wanted a very objective opinion of whether this was a polite, reasonable letter. I asked her to read it. She reads the letter. She says, I'd like to sign this letter. I'd like to go with you to see President Vest, because I agree with everything you've said here. I said, you do? I was just dumbfounded that I found somebody else who thought the same way I did.

So we looked at each other and said, you don't suppose there could be others who agree with us do you? We decided we would make a list of all the tenured women faculty in the School of Science and see if any of the others agreed. So that's what we did. That was when we discovered there only were 15 tenured women in the School of Science and 195 men. It was very easy to poll them.

INTERVIEWER: Was it difficult to get them to sign the letter?

HOPKINS: No, so I thought to myself, well, this is going to mean the most if the person has been, you know, really very, very successful; visibly successful in science. Because we don't want people who are just complainers. We want people who really understand that this is a block to their science, if it's true. We didn't know.

So I chose a couple of women who are so -- I mean I'm always reading about them in the newspaper. I don't know anything about these people. I go and I say, knock, knock on the door. I want to raise a point. It's a little embarrassing. I wonder if you've ever experienced anything like the following. I would give them an example. The first woman said, do you have something I could sign? I want to sign something. Absolutely, I've had all these same problems. I was just floored. I just really was. By the end of the day, we divided the list in half, and she'd taken half the people. I'd taken the other half. We got back at the end of the day and we had 10 people that all wanted to sign something, because they'd had the same kind of experiences.

INTERVIEWER: And that's the letter that went to Chuck Vest.

HOPKINS: Well we decided not to send the letter. We decided, ah, this requires some more thought. So I didn't send the letter to Chuck Vest. Instead, we decided to strategize about how to deal with this problem. Well, what should we do? Now that we know it's not individual people, it's really a common problem. We need to take it on as a general issue. We spent the summer of 1994 talking among ourselves about what would be the best, productive way to deal with this problem.

INTERVIEWER: It's interesting that you describe this story of knocking on doors and collecting stories of women quietly who are worried about being cast as complainers. Yet right at the end, we learn that the date was 1994 instead of maybe the 1970s or early 1980s when you think this might have been happening. This all happened in the 1990s.

HOPKINS: Right.

INTERVIEWER: It's kind of shocking in a way.

HOPKINS: I think it's very surprising, and now I look back on it, I think I see what happened. I think that in the 1970s, Civil Rights, Affirmative Action opened the doors to the universities. A tiny number of women came in. And people thought, oh, well that was easy. Those women began to progress through the system and, like me, they all felt that Civil Rights and Affirmative Action had solved the problem by opening the doors.

Nobody knew there was another problem. Nobody thought about it. And as they went through it, it took them 15 or 20 years to figure it out, because they were so determined on science, so fixated and so certain. I think we were all so certain that science was a completely merit based occupation. Wasn't it? Weren't discoveries valued equally according to their merit? Was it possible that you could have people make equal discoveries and not have those people be equally valued? Is this possible? We gradually came to realize that's what was happening. But we didn't really want to see it. We wanted to believe, and we just wanted to do science. I think gradually those women, about on the same time scale, came to see what was happening; and finally realized.

Now, we have to say this. What was so wonderful about these women, as I say, had given their lives for this thing. Did not want to be political. Did not want to be radical. Just wanted to be scientists, and they'd had the problems. They saw the problems. But they said, we have to do this, because our students are going to face the same thing. It's our obligation to do this for our students. These were very remarkable women. That's what we did.

So we got together and we strategized, and nobody knew what to do. Because none of us had been part of the administration. There had never been a woman chairman of a department in the School of Science in the history of MIT. There were none in the administration at the time. Nobody knew anything. So we had to pool our little bits of knowledge just to even know how to approach the problem, really. And we decided to ask for a committee that would gather the data in a very systematic way and try to explain to the dean so he could understand it, so he could fix it. So that's what we did.

We decided not to go to the president but to go to the dean of science, Bob Birgeneau. It was a really extraordinary experience, honestly.

INTERVIEWER: And what you delivered was more of a report, a systematic collection of data and analysis of patterns of behavior.

HOPKINS: Right. We collected the stories of these women, their experiences; and we collected the data. So if a person had a particular problem, say about space, then we'd go and look at the space, and see was she right. Was there a problem. So we let the stories guide in the kinds of things that you needed to look at. Of course, it completely supported what these women experienced. What was extremely helpful was the dean had insisted that we have three men on the committee. I said I don't want any men on the committee. There are no men at MIT who understand this problem. He said you have to have men. I said, okay, but we want powerful men who can help us. That was critically important, because these men were department heads, and they understood the system. So they could tell, when they saw what happened to these women, that's not the way this is supposed to work. One of them took me and said, Nancy, we have to go and see the dean. This is unacceptable. So we went off to see the dean. This would have been very difficult for me to do alone, because what did I know? I didn't know what was normal, really from an administrator's point of view. So they were fabulous. So the whole experience for, I think, everybody was quite a wonderful thing.

INTERVIEWER: At what point did you think you might actually succeed at this, versus just having an argument that you knew was correct, even though it might get ignored in the end?

HOPKINS: For me, personally, the highest point, I guess -- there were two extremely remarkable moments. One was when the first woman said I want to sign this letter. Because I thought I was the only person in the world who knew what this was about. No one would ever understand. So suddenly, to have one other person understand it changed my life really. But we never knew, and it was tense. MIT was, I think, very concerned over whether there would be lawsuits, and whether they would look bad, and so forth. So it was a very serious issue. But the dean worked with us and responded. You knew he wanted to help, and that was enormously important. As the facts came in, one of the men on the committee said, okay Nancy, you've got to put this down on paper. So I began writing. We wrote this thing as a group. And I wrote the thing. It was a very long report. Not the thing was ultimately published, but it was a private report, 150 pages or something. Then I sent it to the dean. He looked through immediately. Whatever could be fixed right away, he fixed. So immediately, you knew that he really wanted to do the right thing. This was wonderful.

But the moment that was really -- the life changing moment was in 1999, when the summary of what we had done a couple years later was written up and made public. I asked the chair of the Faculty to send it to the president and see if he wanted to write something to go with it. Because we didn't want MIT to look as if they'd been blindsided, because they hadn't. We worked with them. We wanted to work with them. He wrote this comment that came back, the chair of the Faculty, Lotte Bailyn. sent it to me over the computer. I looked at this thing, and that was a moment that is forever in my mind, even now. You know, quite an emotional thing to see the president of the institution say, yes. This is true. This happened. And you know, it's brought to our attention. We have to do something about this. That he acknowledged the existence of this problem, had come to understand and acknowledge it. You couldn't have imagined this would happen, either that he would understand it or that he would be willing to publicly say it was true. So that was something.

INTERVIEWER: Up until that emotional moment, this had all taken place within the family of scientists, so to speak. People whose knowledge and sense of seeking the truth was more or less operating on the same principles, the same set of values. Once this report was made public, suddenly it was outside of the family. The media picked this up. This was a big public story, not only in science, but for the news media. How did people on the outside interpret what was going on, and how were you treated? What sort of things happened that maybe were unexpected?

HOPKINS: I think the whole thing was so unexpected. And the reaction to it was overwhelming, because, again, having first thought you were the only person who understood it. Then finding one woman who did, and 15 who did. Then the president, who did. Then suddenly to find women all over the United States who did. It really was extraordinary, very surprising. I thought we were really dealing with a problem that very few people could understand, because it was about these 15 women scientists who just wanted to do science. I didn't understand the breadth of this problem. I'm embarrassed to say it. Where was I? I think I spent too much time in the lab. I mean, I just didn't get it.

INTERVIEWER: I didn't say that. You said that.

INTERVIEWER: I said it. Honestly, it's inexcusable. I just didn't get it. So that was amazing. There was this deluge of press. I had not ever had such a thing or known to deal with it. I found the press was marvelous. People wanted to understand this story. They saw that MIT had done something of tremendous courage and integrity. I think they presented it that way. And they were right. I mean what Vest did in acknowledging it and treating it like a scientific problem. Here's a problem. We'll find a solution. It was so MIT. It was a wonderful thing.

Later, about a year or so later, came backlash, kind of negative press. Interestingly, I couldn't imagine. It came from women who, I gather, belonged to these right wing organizations like the Independent Women's Forum and so forth, attacking these women as being unworthy of anything and so on.

INTERVIEWER: On what basis?

HOPKINS: It's very hard to understand. They said this report was junk science. It wasn't science. It wasn't scientific. It was so strange. It was very hard to understand it. It was politically motivated, I believe. That was hard to understand, and hard to understand why it was coming from women, who, you know, here had come 15 women who had not just lived through this experience but had gone through the tenure process in the normal way; and had risen really to the top of their profession. I mean of these women, the majority, the vast majority of them are members of National Academy of Science. So these were women at the highest level. So why would they make this up? It just made no sense. So few people had experienced what they'd experienced. I don't understand it, to this day, what this negative thing was. I think at the time there was a backlash against Affirmative Action and Civil Rights Affirmative laws, particularly -- and I think people don't understand -- Affirmative Action of this kind opened the doors to people of equal merit. It did not open the doors to lower the standard. There's two different kinds of Affirmative Action, I guess. I can see, maybe, why people opposed the kind that requires you to lower the standard. But the level of faculty at MIT, the notion of lowering the standard just doesn't exist.

INTERVIEWER: Is it possible that your report maybe took this back to a more visceral moment that really, in some sense, binds all women together, when they have to make that choice as you did as a young woman in your twenties; do I do the family thing, or do I not? That, in some sense, that whole decision was suddenly in play. And you're going to hear from all sides.

HOPKINS: I honestly don't still completely understand this issue. I've learned a huge amount about it, but there are things about it that I don't understand. I think women's feelings about it is one that I don't understand. Because I learned about it in the sense that how could I, as a young woman, have been blind to this problem completely? Is this possible? I was. I think the good part of that is it makes me sympathetic to other people who didn't understand it. I mean, the fact that so many of my colleagues didn't understand. I understand it. How could they? I didn't understand it, and I was living it. So that's a very fascinating thing. When you have a certain mindset, it's very difficult to let the data come in. If you believe science is absolutely fair and merit based, you can't let in the information that it isn't. It just doesn't fit. But as scientists, why do we have such a hard time with this?

INTERVIEWER: What advice for young women considering science today would you have, confronted with some of the same issues?

HOPKINS: Well one thing is that things are so much better. So that's the first thing. I think the same problems persist, but they keep getting better generation after generation. So first, you couldn't get a job at all. Then you could get a job, but it was very difficult. Now you can get a job, and it's much easier. The next generation will be even easier. It'll be even more equal.

So I'd say, if you have the kind of passion for science that these 15 women had, you have to do it. You don't have a choice. It's a great life. I mean, if you love science, there isn't anything else that could ever be, I think, for you. It's like telling a person who wants to be a ballet dancer they shouldn't dance. Or a person who wants to play the violin they shouldn't play. You can't not do it.. It's just a fabulous thing.

But I do think that we have not seen enough leadership by women who've been through this experience in changing it fast enough for the women who come behind us. I'd like to see more.

INTERVIEWER: Tell me about the experience you had years after, probably six years after, the publication of the report; then your experience with Chuck Vest at MIT, encountering this notion of discrimination or women having a role in science; or there being a set of expectations about women in science that came from the president of another institution right in this town.

HOPKINS: Yes, well, there were many things that happened as a result of the MIT report on women in science. One of them was a consortium of presidents of nine universities that continue to meet to this day. One being presidents of Harvard and Yale and MIT and so forth. Another thing, of course, was we received a huge amount of email. I was asked to give many, many, many, many talks on this topic. Hundreds. One of them happened to be the one over at Harvard.

The only reason I agreed to give that particular one was that women faculty at Harvard said they had tried very hard to convince their president there was a serious problem for women at Harvard. He was not listening to them. So would I go and tell them some of things that MIT was trying to do to address this problem? So that was the reason I attended this meeting.

INTERVIEWER: When was the meeting?

HOPKINS: It was 1995. I guess it was January 1995, I think.

INTERVIEWER: You mean 2005?

HOPKINS: I mean 2005. January of 2005.

INTERVIEWER: All right, so you attended this conference to talk about issues that really you'd been talking about for many years, and were certainly not new to you. What was surprising about what happened over at Harvard?

HOPKINS: The topic of the meeting was how to increase, you know, the representation of women and minorities in the scientific workforce in the stem disciplines. And that was the topic. I had spoken in the morning, and Summers was scheduled to speak at noon. He didn't come to the morning session, so he didn't hear my talk for sure.

So he came in, and there had been a couple of articles in the Boston Globe because of the falloff in the tenuring of women at Harvard under his leadership, under his reign so to speak. So I thought that was certainly going to be a topic, and I myself had been at a very small meeting of four or five people with him in the fall and had brought it up and talked to him then. He didn't seem to be particularly interested in it. So I wasn't sure, but I was interested to see what he was going to say. I assumed it would be about how Harvard was addressing this issue, because he was a person who could really lead on innovative ways of dealing with the issues that had been identified over the past decade by the MIT report and zillions of others like it. Many of the women who have done this work for a decade or more were there. So lifetime people committed to this issue. So we were all waiting to hear, because this is one person who could really change the world quickly on this issue and make the playing field level.

We're waiting and waiting. In he comes, and he lists these three reasons why there are so few women in the science, engineering, technology fields right at the top of the talk. He says issues of intrinsic aptitude and family and that bias is much less important than people think, because economic theory would predict it would be driven out. I thought, I had been preparing, sort of shuffling my papers. I thought maybe I didn't hear correctly. So I've got to listen really carefully here. So I'm really focused on him. And it turns out this is what he's going to say.

So first he said that women want to have children and they can't combine those easily. I certainly agreed with that. But I thought his job was to figure out ways for them to be able to do that. I didn't realize he was just kind of dismissing it. I agreed with him. It was a problem. But we want him to fix it, not tell us about it.

The second one that it was an issue of intrinsic aptitude. He was using math SAT scores to say there so few women in stem fields, because they lack the intrinsic aptitude, and it was clear to me he meant genetic. That they were genetically inferior. I'm thinking, how is this possible? This is a man who is the leader of an undergraduate student body of which 50 percent now are women. He's saying these 50 percent are genetically inferior to the other half? I couldn't. No. What is this?

But it became clear this was what he was saying. I was extremely distressed by this. I thought this is outrageous. Here are the experts. We know what the problems are. We need someone to fix them. Here comes this person who doesn't work in this field, doesn't know anything about it really in depth, is going to tell us he doesn't have to fix it, because they're not able to do it anyway at the level of Harvard.

I thought the arrogance and -- this is beyond comprehension really. Maybe he has some trick at the end to make this palatable, but it's not palatable to me. I then looked around the room to see if others were reacting similarly. These women looked like they were in shock, honestly. There was a young woman, and I thought she was going to faint. I really did. She was just white. She was staring at me, as if she were trying to find somebody to connect with. I realized that everybody was reacting, that I could see the same in people.

So I turned to the woman next to me. I said this is wrong. Don't you think we should leave? It never occurred to me to stay and argue with him, because I had already argued with him. And women at Harvard and been arguing with him for two years. So I felt it was wrong to sit there and be abused in this fashion. This was so wrong. And she said that she would like to leave, but she was the next speaker on the program. She couldn't. I turned to the woman on my left, and she said I'm speaking after her. I can't leave either. But I think we should.

So I sat there and thought, you know, if I stay to the end, he's going to get up and leave. These women are going to sit there with their ankles crossed and in a state of shock, assaulted essentially. One woman told me afterward she felt as if she had been assaulted. So I thought, this is not right. I'm going to leave. I didn't want to make a fuss, but I didn't want to hide the fact that I was leaving. So I just quietly packed up my stuff, stood up, walked out of the room and went home.

I could not have stayed there, honestly. It was wrong. I just thought it was wrong. That would've been the end of it, but it happened by chance that a reporter from the Boston Globe, who had been communicating with me about a story she was doing for which you needed background information, wrote and said, oh thank you for your help on this story. By the way, how was that meeting over at Harvard today? She knew about it, because another participant had asked her if she was going to cover the meeting. So she knew that he was going to speak. She said how was it. I said, oh, I had to leave. It was just awful.

She said why? And I said it sounded like eugenics to me. I said I'm just too old. I don't have to put up with this nonsense anymore.

She said, do you think it would be a story?

I said, no, because I'm sure that he had some way of making it seem okay. But it was not okay. She was a very enterprising reporter. She had the contact information for another person who was there, so unbeknownst to me, she then went ahead, called that woman. That woman brought five people to breakfast with her the next morning, and I left town to go to New York to be with my fiance. I was in a taxi in New York, and my cell phone rings, and it was this reporter Marcella Bombardieri and she said, I've just met with the women who were at the conference, five or six of them. They said it got much worse after you left, so I'm going with the story. Can you tell me how you felt when you left the room.

I had just been sitting there thinking about it. If I'd stayed in that room, what would have happened? I felt sick. I thought, should I tell her the truth, you know, which I had just run through my mind. Or should I say something like, oh, it was unacceptable for the president of a university to do this? Something bland and diplomatic. Or should I say what it really feels like to be on the receiving end of a powerful person who is really abusing you, consciously or not, and has all the power. You have none. And you're sitting there. I said I guess I better say what it's really like to be treated this way, what it feels like. Because there's just one moment people read the newspaper. They throw it out. No one's ever going to see it again. People don't understand this problem. This is a chance for them to learn what it feels like. So I'll tell the truth here, exactly what it feels like. So I said I felt I was going to black out or throw up. Which is how I felt. That's emotionally how it felt.

She used the line. I pretty much figured she probably would. What I hadn't imagined was what the outcome of that would be.

INTERVIEWER: What was the outcome?

HOPKINS: Well, I was in New York with my fiance, and the phone started ringing, and it just didn't stop, you know? It just was amazing.

INTERVIEWER: Did it teach you something about yourself? About the media? About maybe the vulnerability of patriarchal power in a place like Harvard?

HOPKINS: Yes. It taught me -- the wonderful thing to me was I couldn't have imagined there would be that kind of uproar and reaction that so many people understood this problem and said this is completely unacceptable. If he had said it 10 years earlier, I don't think there would've been a ripple. People would have said why is anyone upset by that? Isn't that an interesting scientific question?

That so many people understood how bad this was meant the problem had moved further than I understood. That was wonderful news in some ways. What was very difficult for me, personally, was after this initial thing, there was a long period of time when Harvard refused to release the transcript of this talk. Instead, kind of the press there put out the idea that this was a speculative talk about interesting, cutting edge science, about the genetic inferiority of women, I guess. Which, you know, really is an old problem that's been around for a thousand years, and people have been researching it forever. It's not an interesting, cutting edge problem at the moment. A lot's known about it. And there's not a shred of evidence for it.

But that was how they tried to spin it. That how could these people be upset by this? This person is just exploring an interesting scientific idea. If you were researcher in the field, sure. That's an interesting thing to talk about. But for a president of the university, who, obviously it wasn't appropriate. Who doesn't know the facts.

So in that period of time when Harvard refused to release it, and the Corporation backed up the president, there was a turn in the press. I became, myself, the object of this negative attack by fairly mainstream press. People like George Will, for example, wrote an article calling me a hysteric, which is the classic way in which women have been silenced forever.

So you take a person whose whole life has been devoted to science and research, quietly going about their life in the lab. Suddenly, why would you target this person for this attack? It did not make sense to me. I, to this day, cannot easily forgive Harvard University for allowing that to happen. They could've prevented it. I was happy to meet with President Summers or anyone, and publicly explain what was wrong with this talk. Because just by saying what was wrong with it would have advanced the cause of women another decade in a flash. He had the opportunity there to advance this cause as Chuck Vest had done. All he had to do is come clean, be honest, say what was wrong, and move on. But instead, they didn't do that.

Finally, the transcript was released. He had made a tape of it, and finally it was released when a very courageous faculty member at Harvard stood up at a faculty meeting and said, you have to release this tape. Because, you know, friends and colleagues of ours are being misrepresented in the media by these false reports of what was said. This is not fair. So finally, they released it. But I think, I learned a lot about the power of the press, and how institutions deal with problems of this kind. And you know, I went to Harvard. I love Harvard. Harvard's a great institution, but this was not a great moment for Harvard.

INTERVIEWER: What explains the difference between Larry Summers and Chuck Vest in your view, without getting into a whole, big, you know, finger pointing thing.

HOPKINS: Yes. I don't want to say it. I mean, I don't know Larry Summers. I think he's said to be a great economist. I have a lot of respect for that, and it's terrific.

I think of the institution. The president represents the institution. MIT acted the way you want institutions to behave. They acted the way scientists and engineers particularly want to behave. Here are the facts. This is what we understand to be the truth. We have to stand by it and we take the consequences, what they are.

It took a lot of courage to do what Chuck Vest did. He did the right thing in a very simple way. While Harvard, you know, just did the opposite, really. They covered it up, stonewalled it. Tried to pretend it was okay. It was not okay. I'm still waiting for them to apologize to me.

INTERVIEWER: Do you find that today you have to balance your identity as an advocate activist on the issue of gender equality in academia with your identity as a cutting edge scientist in molecular biology?

HOPKINS: I think if I had had a choice, I would never have done this work on behalf of women. I would have preferred to just be a scientist. But when I began, even though I didn't understand the issue, I knew other women had made it possible for me to have a job. Women, men. Many people had, you know, made it possible. I had a feeling my time would come.

INTERVIEWER: Just repeat that again, sorry.

HOPKINS: I had known when I was young that many, many thousands of people had given most of their lives to make it possible for me to be able to be a scientist as a woman at MIT. I had a sort of feeling my time might come. I hadn't envisioned this, believe me.

So when it happened, I did it initially to try to get space for myself so I could do my own science. Then, with the women getting together, and then the press came together, you saw that this was really working. It was going to make it easier. So I thought, as long as this is moving things forward, let's just go with it. So other people don't have to do that. That's another piece they don't have to do. Let's move as far as we can.

It wouldn't have been my first choice, but it was, I mean, an extraordinary experience. The bonding with the women, the reaction of MIT were fantastic things. Science was my first love.

INTERVIEWER: On that, how has, broadly, outside of the issue of gender issues, how has the MIT student changed in the years that you've been here? How has the institution changed? What was it when you came here? And what is it today that's very different from that?

HOPKINS: In some ways, even though there's been enormous changes in the student body, certainly diversity of the student body is astonishing today, which I think it wasn't when I came. For me, it's remained the same. MIT is the place for people who cannot live without science; whose passion for science and engineering is so great, that that is, for them, what life's all about. That was what MIT was to me when I came here. That's what MIT is to me today. That's how I've always thought of it, through all those changes. I knew they were happening, but the thing that mattered to me has not changed. I've gone on sabbatical twice to fabulous institutions, but you realize when you get away from MIT, there is no other place like MIT. For people who passionately love science, this is it. That has remained the same for all the years I was here.

INTERVIEWER: We're speaking the day before Valentine's Day. Recalling your remarks a little while ago about having to choose between the Maternal Grim Reaper and a life of science, you know, into 2004, 2005, suddenly, your life changed in a way that you might not have expected. You were using the word "fiance" a moment ago. Apparently you can have it all. What happened?

HOPKINS: Well, miracles do happen. It was very surprising. I had really never thought of marrying and was very happy in being single. But when I got to be 60, I guess, I thought I should take a little more time off from work. My roommate from college had a house and island in the Thousand Islands. She had always asked me to go up for the weekend. But it was too complicated to get there, and I just couldn't. I thought, I should go there. That should be a nice place, and I'll go. She sent a man to pick me up and drive me to the shore where you took a boat to get there. I thought, oh, why do people keep doing this? I don't really want to meet anybody. She sent this man, and, you know, that was it. One hour later, it was a done deal.

INTERVIEWER: That was kind of a Watson moment.

HOPKINS: It was the second Watson moment of my life. Thank you. Yes it was. Just knew in one hour. That was it. Quite astonishing thing.

INTERVIEWER: you were married --

HOPKINS: When I was very young and divorced when I was 30.

INTERVIEWER: But you remarried --

HOPKINS: We got married six months ago.

INTERVIEWER: Six months ago. Congratulations.

HOPKINS: Thank you.

INTERVIEWER: Last question. Thinking back, or at least until I check with the producer here, do you think -- certainly you've described a life in science where extraordinary change has happened in opportunities for women. But even you were sympathetic with the idea when Larry Summers said, well, women are going to have to choose between family and science. And that that is an obstacle. Can you envision the day when, in fact, institutions are so welcoming of women and so, maybe, sophisticated about the issues of gender equality that women scientists will be able to have families and be able to do both, and not have the choice as stark as it was for you when you were 29?

HOPKINS: I think it's already happened to a considerable extent, because the women who come in today expect to have children. It is different than when I started, and there are many reasons for that. Some are actually scientific or technical. The ability to have children later and safely and so forth, and some societal changes in the women's movement. Many things. But if it's that much better, I assume it will just keep getting better.

I think it's not a simple problem. It isn't solved yet. But I think it will keep on getting better, and I think we'll look back on this and say what were they thinking. How strange. So I think we're about halfway there.

INTERVIEWER: That's great. I do want to give you a chance to thank all the zebra fish for the extraordinary sacrifice they've made on your behalf. Would you like to do that now?

HOPKINS: The zebra fish. The zebra fish have been fantastic. The people who worked with me have been fantastic. And the women who worked with me were extraordinary. So many people to thank.

INTERVIEWER: Thank you very much, Professor.

HOPKINS: Thank you.