

In our first episode of the Word to the W.I.S.E podcast we speak to Dr Judy Jeevarajan a global expert in battery safety with a focus on lithium-ion cells.

Dr. Judy is Vice President, Research, Electrochemical Safety Research Institute at Underwriters Laboratories Inc. Prior to that, she spent nearly two decades at NASA space centre in Houston.

A trailblazer Dr Judy by her own admission. worked diligently to create data driven success stories to establish herself as a much-acclaimed leader in her field.

Through Word to the W.I.S.E, we will continue to build on our legacy: driving transformative change in pursuit of a safer and more resilient society by inspiring more young women to envision a career in the field of STEM.

Remember, you too can nominate more remarkable women to be part of the show. Or just send in your questions for future guests on the Word to the WISE podcast.

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You can also read along as you listen to the Word to the WISE host *Shivraj Parshad* in conversation with *Dr. Judy Jeevarajan*:

**Host:** Dr Judy, thank you for speaking to the word to the wise podcast.

**Dr Judy:** Thank you for inviting me Shivraj. And I look forward to speaking to you today,

**Host:** If I were to ask you to go back in time. Dr Judy, can you recall when it is, you first realized that it was science that you wanted to pursue as a calling.

**Dr Judy:** I think I was always interested in science you know as a little kid, even in elementary school and middle school. I was very interested in connecting what I learned with what I saw in the real world. I was more interested, because of that, in botany and zoology type subjects. But when I went into high school, my marks in chemistry were the highest. So my mother said, you know, why don't you take chemistry in college? And so I did that and I think that really changed my whole world because I had excellent teachers in chemistry at the college. I studied both undergrad as well as graduate school. And I got so interested in the subject and my mind was always in the area of research. I know I always wanted to have a problem that I could solve. I made it look like a story. I just had a passion for research. So I just went into the area of science.

**Host:** And that passion is important, Dr Judy, but if I were to ask you, what was that turning point that led you to choose a career in this particular area of specialized research with battery safety?

**Dr Judy:** Actually, my PhD was in Electrochemistry, but. In the area of carotenoids, carotenoids are antioxidants. And so I was looking at the electrochemical reactions and how the radicals that are produced in our body are actually captured by the oxygen that is released from the carotenoids and prevents cancer formation. So I was studying electro-chemistry, part of it. But when I finished graduate school, I got a job in a small business company and my first project was to make room temperature, ionic, liquid electrolytes for lithium-ion batteries. And that was my first introduction into the field of batteries. And then I spent a year, as a post-doc at Texas A & M university, where I was just given a NASA project on lithium-ion batteries. And, you know, no direction was given. I was just told study them. So I started calling different cell manufacturers and, you know, I was very fortunate that every one of them actually provided me with cells. These were really early in this type of I would say optimization and commercialization of lithium-ion cells. And so, I know I got cells from Sony, Sanyo, Panasonic, SAFT and so on. I really don't know how they gave it to me because I was so fresh, but they did. And, I started studying them. I started cycling them, looking at the electrodes and I really got into it. I also started making my own electrodes in the lab, try to set up a glove box. It was very interesting and I was, uh, I got into that independent mode of research, uh, in graduate school, because that was what was expected from me from my graduate advisor. And so, uh, this was, you know, very interesting for me that they let me lead my own way. So that is how I got introduced to batteries. And then we moved to Houston. My husband first got that job as a NASA contractor. And when we moved to Houston, I was looking for something too. And, fortunately again, they said, Well, we need someone who has something, some knowledge about lithium-ion batteries and, you know, I had the job, within like over a weekend or so. And so I believe strongly in also I'm a very strong religious person. And so, I feel, you know, God always has a plan. And if you just do your own part, then things fall in place.

**Host:** And coming back to now, why is this area so important to you? Do you feel you can contribute perhaps more to grow its potential?

**Dr Judy:** Yes. So if you look at how technology has advanced in the past, I would say couple of decades, even if you take the past couple of decades and look at just the last decade, it has grown in leaps and bounds. And so, you know, when you look at that type of technology and the need for energy and power to cover all those new technologies, then you can understand why we need a lot more affordable power. We also have the largest systems like the stationary, and our G storage systems that are really not easily portable, but on the whole, even with all of these, our awareness is actually helping us to get into this field. Like our, our awareness for our environment, you know, is helping us understand that we want to be, we want to have less pollution. Uh, we want to have a healthier environment and also save our resources for the younger generations. So given all of that, I think working in the area of batteries or in general energy storage is very important. So I think, you know, from our point of view, since we have so much experience in looking at what goes on around us and being able to detect that there might be an issue with a certain type of design or a certain type of environment clearly, you know, adds a lot of value. the other thing, I think that people really feel that our contribution is very important is in our thought process. We are very structured in how we do our research, uh, that is a certain flow on how we do it. That, uh, the way we do our work is very organized and very well done. And, our results you know speak for it. As you probably know, we shared our

knowledge through conferences, writing, journal articles and so on. So we don't just do the work, but we also share that knowledge in a manner that is easy for others to grasp also. And that is why I think our work is very important.

**Host:** So clearly Dr Judy, you've taken on a thought leadership role. You're contributing to industries at large, but did you personally have any particular role models by pursuing this career path or was it purely circumstance?

**Dr Judy:** I did have a lot of respect for women in leadership positions and I always admired, you know, the strength that they had. Because it is perseverance and commitment and passion that brings them to those positions. Because of our society. And the whole world know, has that kind of an attitude where people expect women to have a certain role in the world. I wouldn't say I had a role model. I think it's just probably my teens, my mom, my grandmother, they were all very hard workers and they were very you know, family oriented too. So they knew how to balance between work and, a career. I, myself, was brought up in a very protected environment and I was very timid. I never expected myself to grow in this manner.

**Host:** Now looking back at your career, especially at NASA, what would you say posed the biggest challenge to your establishing your credentials as a woman scientist, to be reckoned with.

**Dr Judy:** That was a real challenge for me because there were two disadvantages for me. I wouldn't say disadvantages or 2 points that you know, was against me. One was being a woman. the other one was being a woman of colour. So, you know, you are fighting against people who have a better, you know, they've been brought up here, grown up here. They know how to talk, you know, all y'all are, depending on is your expertise and, you know, your knowledge, of course by the time I was able to express myself really well. Uh, with the data I had, but I had to work very, very hard. And I also, you know, did not grow up in the ladder, because of these limitations. But in general, if you look at my expertise. They were well recognized because of the nature of my work and the fact that I always took data and I explained it to people and I made them understand why we needed to be concerned about certain things. So at the higher levels, I had a lot of respect and that is what really kept me going, because I was working with so many different types of people every day. The problems were different every day and I was helping people everyday, but just all kinds of people. So it was very interesting for me to be doing that. And also, you know, at the end of the day, I had the responsibility of approving all batteries for human operated space flight. And so I took that responsibility also very seriously. People did recognize that some people didn't like me for it, but, uh, you know, uh, people did recognize, that I had the capability.

**Host:** With the benefit of hindsight though. Dr Judy, what do you think you actually gained by standing your ground? Because you talk about how you take real data and make sure it's so irrefutable, then no one can doubt your expertise. So what, what do you think you actually gained by standing your ground?

**Dr Judy:** So safety, right? When you think about, what I was doing, this was batteries being flown in space for a human rated environment, and it's a confined environment. When we were there, we had the policy of zero tolerance to fire. And I took it very seriously because you kind of actually know these crew members. And even if you don't, you know, you'll realize these are humans, you know, just like you and losing anyone is a huge tragedy. We all felt that because we were there during the Columbia days and the crew was, uh, with the accident it was very heart-breaking. My goal was to make sure that we never took any shortcuts. And so, you know, there were times when I had to actually do, on my own, funding do testing, for projects that did not do the work they were supposed to do. And we would keep the technicians around the clock to get that work done before the batteries were flown. So, I wanted to be sure that, that I did not lose sleep on this. And, uh, that is what I think was important for me to show that, you know, things can happen that we could prevent. Where you could reduce the risk that's why I was very passionate about making sure that we were safe and that I actually had data to show to people that; this is what happens if you don't have this, the safety precaution or control.

**Host:** And clearly you, you went the extra mile, and you went above and beyond Dr. Judy. So how did that make you feel when you were doing all this to make sure that the larger picture, the bigger picture, the mission was the one in sight.

**Dr Judy:** Yeah, it really makes you feel good. Right. You know, when I was getting ready to leave, there were many people, including the program manager for the International Space Station who, , called me up personally and was, uh, they were very upset that I was leaving, you know, the words he said was, what is She going to do without you? And the, she was space station. So you really, you know, feel good, when of course I knew he always respected me because, you know, we had a very good, you know, anytime I typically never had to go there, but then there were times when there were really big controversies and so I would need to be at the meeting personally. And so, you know, I've talked to him a few times and, and so he knew where I came from, and he also knew that I had a good balance. So that made me feel good that people respected me and had the trust in me and so on. So looking back, even there I would say because of that trust and that respect, that was why, I kept going, even though there were other pressures, that, were a bit discouraging.

**Host:** Now there is a tendency amongst some women to believe they can't have it all. A career in science and a great personal life. Where do you think this comes from? And do you believe it is changing?

**Dr Judy:** I think, everyone's life is very different. Every family's very different. And so what I will say, I mean, I've tried to advise people but I really think it's up to them to find a balance. So I'll just give you an example of my own, you know, family life. I have 3 kids and I had my first one when I was doing my Masters, my second and third, when I was doing my PhD. So, I worked very hard. Eight hours a day was my time in the lab. Of course, I had to study after that, after cooking and cleaning, and of course my husband helped me a little bit by watching the children while I was cooking. But then it was a struggle, but then that also made me accelerate, you know, what I had to do and I finished my, graduate school or PhD in three and a half years. But going into the job situation. You know, kids were in school. My husband would never take off

from work. And, you know, slowly I started traveling, as they got older. I got to go to conferences mainly. And, uh, the only condition my husband, put was he said, when they have exams, you need to be at home. That was the only thing he said. You know, later as they got into high school, I was able to do more, go to review meetings and conferences and so on. And then my travel of course started to get more intense, but family always came first for me. So I think it's up to, up to everyone to find a balance that will work for them. And also, you know, be happy about what the decisions you make. There should not be any looking back and saying, oh, I wish it wasn't like that or I wish I had done it this way. I think everything happens for a reason. And if you can work as a family and find a balance for yourself, that would be the best thing that can happen.

**Host:** And, you know, in the past there were many more trade-offs that women had to make and you've alluded to your personal life and kind of the balance you brought about. Do you think it's changing, looking around you, other the women that you interact with or meet?

**Dr Judy:** A little bit. Like I said, sometimes I see. certain women especially from our Indian origin who think that to have a career is to be by themselves in whatever part of the world they want to be and, leaving the family behind and and doing things like that. And I don't know their circumstances. But I really feel that, you know, the best part of your life is that every time on your life has a purpose. Right? So I feel like they are losing a big part of their lives when they do that. I sometimes try to tell them, you know, why don't you find something where you can have a balance. I think the younger generation is quite different, but if you look at my generation, people, women are still struggling with finding a balance between work and home because they don't get too much of a support at home. But with the younger generation, I see more of sharing of responsibilities and more of discussions between, you know, husband and wife and more understanding. And so I think this is a positive thing.

**Host:** Now coming back to your work. Dr. Judy, what has been the most fulfilling part of your work?

**Dr Judy:** The most fulfilling part, I think is the mentoring part. So, what I learned I like to share it. I've been very fortunate to work with graduate students from different universities. The fact that I have some knowledge that I can share has been giving me a lot of satisfaction because not everyone can learn everything from a book. You have to have the practical knowledge and everyone does not get the hands-on experience that I've been able to get. So, mentoring students, with all the information that I have, really has been very fulfilling for me.

**Host:** And that brings me to our final question, which is of course, linked to what you just said. For those young women listening to this conversation. What is the one piece of advice you would give them?

**Dr Judy:** This is something that I tell a lot of students. There are two things that I would say, you know, that it will be good for them to follow, which is passion and perseverance. So, if you have passion for what you do, then, you know, you can develop the perseverance and you can achieve what you want to do. Those are the two main things I think are very important in life. I

have had several people, especially, you know, young children ask me, how do I get to work at NASA? Do I need to be an aerospace engineer? Do I need to learn about rockets and so on? And I tell them, you know, NASA needs everyone, from a photographer who can take really good pictures to someone who can actually make that rocket go into outer space. So there's a whole, you know, hundreds of different fields between that and this. You should be able to put in that commitment and have that commitment and perseverance to put in all the work that is required to reach that goal where if that goal is to work at NASA. Whatever you like, develop a passion for it, and persevere to do the best in that area.

**Host:** Passion and perseverance. Dr Judy, thank you ever so much for speaking to the Word to the WISE podcast.

**Dr Judy:** Thank you, Shivraj.