STEM Supremes: In Conversation with France Córdova

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TRANSCRIPT

Brooke Grindlinger

Welcome everyone. I'm Dr. Brooke Grindlinger, Chief Scientific Officer at the New York Academy of Sciences. Thank you for joining me for the second episode in our webinar series, "STEM Supremes: In Conversation with Women in Science." Throughout the series, we're speaking quite candidly with women who have broken the mold and crashed through the glass ceiling in their respective fields of science and technology. But their career successes have not been without some twists and turns, some anxieties, and gender barriers. Our guests are going to share with us their lessons learned, what excites them most on the horizon of their respective fields of research, and their advice for how to best support future generations of women pursuing careers in STEM. Whether you're joining us tonight via Facebook Live or on Zoom, I'd like to encourage all of our viewers to submit questions for our guests throughout today's broadcast.

Brooke Grindlinger

You can enter your questions into the Q&A box in the Zoom panel or tag your question on the Academy's social media channels with the hashtag #STEMsupremes. There's going to be a dedicated Q&A portion between 8:00 PM and 8:30 PM Eastern Daylight Time in tonight's broadcast. Without further ado, it's my pleasure to welcome tonight's guest. Leading astrophysicist, former Chief Scientist at NASA - I had to break out the NASA T-shirt - former Chancellor of the University of California, Riverside and Purdue University, and former director of the United States National Science Foundation, Dr. France Córdova. Welcome Dr. Córdova!

France Córdova

Thank you. It's really a pleasure to be here Brooke.

Brooke Grindlinger

Oh, the pleasure truly is all mine. I'm a geek for anything to do with space. So this is a real treat for me to be able to talk to you with our community tonight. So, let's start right at the beginning with your early life. I'm always really fascinated to learn about what first inspired a young individual to become interested in science. So can you tell us a little bit about where you were born and were there any early family influences that steered you towards, or even away from, a career in the sciences?

France Córdova

I was born in Paris, France of American parents. My father was working for a relief organization after the Second World War. And very soon after I was born, we moved to Germany where I lived for a few years, and then he decided he'd like to start off on his own, a business and we moved to California. So I really consider myself California-raised. I am the oldest of 12 children as the picture shows, there's about 11 of us there. And so that was a really profound influence on my life, being the oldest of that many children. I wouldn't say that there were any 'science motivators' in the family, because no one

was a scientist. We didn't have friends who were scientists. And so I was very much left to my own to discover the impulse in me to want to be a scientist. And that didn't happen right away.

Brooke Grindlinger

What was some of your earliest fascinations with science, perhaps as a teen? And what sort of messaging were you receiving at that time about girls, maybe pursuing careers in math or science?

France Córdova

I was inspired by the science fairs that our school and community had. When I was in the seventh grade, I did a report on the Bohr model of the atom, which I just thought was magical. I thought, "Oh my goodness, how did they know anything? How did they know there're atoms? And how did they know anything about what's inside of them?" So I think that's the earliest recollection I have of being inspired by science. And then as a teenager, I was very interested in technology. Lasers had been invented and people were just finding uses for them.

France Córdova

So I thought I'd do a science fair project on how a laser worked. And that was very interesting to me. But there were ... women were actively discouraged, young women at that time, from becoming scientists. All the messages I got was that it was a hard career to do when you had to go to this thing called graduate school and study for a very long time. And if I went to college, surely my mother would always say, "Surely, you're more interested in getting an MRS degree." I'm not even sure young women know what "MRS" is.

Brooke Grindlinger

I don't know. Will you share with us what that is?

France Córdova

Yes. That's for "missus" (Mrs.), in that I would find somebody and get married. And that was the idea. And so it just shows and my mother's fond of talking about that later on, like to groups of people, when I became, for example, Chancellor or President of a university she'd tell the "MRS degree" story. But, so there was just no encouragement at all. And as the little video clip in the beginning said, even my high school did not encourage women. They just never thought that women were going to become scientists or engineers.

Brooke Grindlinger

And as you referenced in the video clip, you had to ask permission of the administrators at your high school to study physics?

France Córdova

Yes. Well, understand I went to a co-institutional school. That's a very unusual type of school. It's neither all-girls, nor is it a mixed classroom. They have the girls on one side of the campus and the boys on the other. And so we were taught by different faculty. And so while most of the subjects we had like History and English, Math were the same, but not necessarily taught by the same faculty, the science classes were different and especially the Physics class. And so it was just presumed that the girls would not be interested in the physics class, but there was a small group of us. And interestingly, I still remember the names of all the girls in that group after these years, that really wanted to pursue

physics, because we had taken Biology and Chemistry. And so we asked, and I think that was a surprise.

France Córdova

The administration was not going to say "no," but they did have to figure out how to put us in the classroom, because it was just one class. So we pointed out that the art class still had some spaces and maybe there was some guys who would like to take art and they thought that was a marvelous solution. So they opened up the art class and they opened up the physics class. And that was it. All the other classes were just all girls or all boys. So it actually was our only mixed class, was that Physics class.

Brooke Grindlinger

Well, Bravo to you and your small group of girlfriends in high school for proactively going to your high school administrators to ask to join the Physics class. For those of viewers who might be parents and they're wondering, how do I get my kids interested and engaged in science at an early age when they're often fascinated with how things work. Besides science fairs that you mentioned, do you have any other sort of tangible actions and recommendations for parents, or even educators and working scientists about how to best engage kids at that young age, while they're still in school to get them interested in science?

France Córdova

There are a lot more opportunities for kids to do science at early ages. I know the National Science Foundation (NSF), that I was a part of for the last six years, is very engaged through their informal STEM learning programs and other activities and grants that they give, in providing opportunities to students. I went online a little while ago to see just what the offerings were for young people in either elementary school or high school. And I saw a lot of programs that, parks and recreation, community colleges, and community groups had for local students. The big universities also have summer programs, but those you have to travel to. That's expensive, often the programs are expensive. But there is a plethora of programs usually available and near one's hometown that they can do for the summer or even after school.

France Córdova

And NSF has been sponsoring for a long time, through its informal STEM education programs, television programs, and other mixed media programs, like "SciGirls", is one I would mention, that's been going on for the last 15 years. So one can Google that and find out their offerings, but they have role models and they have specific kind of courses, not formal courses, but just ways of enjoying different kinds of science with role models and mentors and learning how to work in teams and do projects together. And there's another program called, "Wire and Media", that I also think is very good for students to get involved in and see how different media are used for communicating science and how they can get more involved. So, I think with all the web resources that there's a lot of opportunity now.

Brooke Grindlinger

That's fantastic. Thank you for sharing some of those ideas. We'll capture those and put them on the New York Academy of Sciences' website with this recording after we conclude, so parents can follow up and pursue some of those ideas. So, I want to turn to your college years. You were the first woman at your high school to be accepted at Stanford University. So did you feel any kind of responsibility,

even at that very early age, to serve as a role model for other young women that might want to pursue higher education, or a career in STEM?

France Córdova

Not so much at that age, I was just anxious to make it through college, but it's always daunting to go from high school to college and you just want to succeed and do the best you can. And I didn't know what I would major in exactly, because I'd been interested in so many things in high school. So, I wasn't thinking of myself at all as a role model. In fact, not until I went to Penn State as a faculty member and head of the department, did I think that I had the opportunity to be a role model. I was just a college student. We were fighting, the U.S. was at war abroad, it was all very anxious for students. I was happy to take many different subjects, languages and anthropology, and of course English literature, and all. And so I was just much more involved in developing myself as a person and finding out what I was good at, at that point.

Brooke Grindlinger

So it may surprise some of our viewers to learn that you studied English and not science as an undergraduate at Stanford. And you were a working writer before you became a scientist. So, can I ask, what was the catalyst for your pivot to forging a career as a scientist?

France Córdova

Yes, I was very interested in literature and still I am. I think it's just amazing that there are so many excellent writers and they've so inspired us for as long as they've been writers. And I pursued a career in English. I attended a couple of Physics courses early on, and they were not very interesting at all. They weren't taught all that excitingly, but I did attend Astronomy courses and I was much more excited about that. So I graduated in English and I kind of minored in Anthropology and was accepted to graduate school in Anthropology, but thought I needed some time off to do something else. And went back East, I wrote for a magazine, I had won a writing contest and I wrote for a Condé Nast publication in New York City. And during that summer, two things happened. One was the moon landing, which was amazingly inspiring to be there and see that, just an incredible happening.

France Córdova

And then perhaps even more profound, I saw on public television, a special about neutron stars, which had just been discovered. They had been hypothesized for a long time, but there was no evidence of them. And now there was, and I just thought when I saw that documentary and there were a number of scientists interviewed from the local area, I was in Cambridge, Massachusetts at the time. And I thought, "Wow, that's what I want to be by the time I'm 30, I want to be an astrophysicist." So the very next day I took a bus down Massachusetts Avenue and went to MIT and knocked on the door of a couple of people who had appeared in the documentary and just said, "Can I work for you for the summer? I'm free. You know, I won't charge you anything. I just want to be in your lab." And so they worked it out and then I just fell in love with research and with science. And one thing led to another and I eventually ended up at the California Institute of Technology and went for a PhD there.

Brooke Grindlinger

I love your initiative, "I saw astrophysicist on television. I went and knocked on their door." That is fantastic.

France Córdova
Well, there're all different ways of pursuing a career.

Brooke Grindlinger
No, that's terrific. So, as you mentioned, you boldly applied to do a PhD in physics at Caltech, and you were one of only two women in that PhD class...

France Córdova
In my physics class, yes.

Brooke Grindlinger
... Of eighteen. So were your parents and teachers and fellow class members supportive?

France Córdova
Well, my parents didn't know what was happening. They thought, "Oh, my goodness, we've sent her to Stanford it's not an inexpensive school. And she got a good education. Why isn't she making use of that?" And they ... but they had 11 younger siblings to deal with. And so I was kind of, I kept myself out of sight out of mind there. The teachers - that was another story. The teachers at Caltech were enormously supportive. They're the reason I got into Caltech and the PhD program. I was working for one of the faculty members doing some computer work for him and I asked him if I could audit courses. And he checked around and he said, "Yes, you can audit them." And I did. And I did very well in those courses. So then the faculty got together and admitted me, as a student without a physics background, but except for those courses that I'd taken for the year. So they were enormously supportive and I really feel indebted to that institution for their mentorship and their support.

Brooke Grindlinger
So at this stage of someone's academic career, particularly in the sciences and for women, is when we start to see women leave the pipeline, leave sciences towards the later years of their time in academia. And often they can experience some gender biases and that may push them out of pursuing a science career. Did you encounter any type of gender biases as a graduate student? And if you did, how did you navigate those? Clearly you proceeded in this career path.

France Córdova
Yes. And interestingly, I persisted where a couple of other students in my class did not, because they had been doing science and physics for a long time. And they actually discovered themselves. They discovered that that was not the career where they wanted to spend the rest of their lives. And I was the opposite. I thought everything I studied and uncovered, the beauty of science, of physics, the thermodynamics, the quantum mechanics, of course modern physics. I just thought ... my mind was just expanding, I thought, and I didn't want to let go. So, I was just driven to persist by the beauty of what I was uncovering. And no, I didn't feel in the slightest bit discriminated against. In fact, I think people realized there was no secret about my background or lack of it.

France Córdova
And the faculty were very supportive, and the other students were as well. I found another female student in a related discipline in planetary science and we just persisted together as friends and I felt

very welcome and supported there. It's a small school, very hands-on environment, all the research was in the laboratory, at the telescope. I was learning to be a rocket scientist, that's what my group did was launch rockets and build the payloads for them and then see that they were launched. And every environment that I was in I thought was very supportive. The other students were amazingly helpful.

Brooke Grindlinger

That's an incredibly positive experience. It's wonderful to hear. So let's dive into your research a little bit as a rocket scientist. Your PhD research was in the field of multi-wavelength astronomy, and you focused on double star systems. So I think we've got an image that we're going to put up for our viewers. Can you explain simply for our viewers what is multi-wavelength astronomy? And then tell us about some of your discoveries during this period in your career.

France Córdova

Sure. Well, the electromagnetic spectrum is what is represents the wavelengths that we know about in electromagnetism. And it spans a range from the radio and infrared (at the long wavelengths) to the shortest wavelengths, which are x-rays and gamma rays. And in the middle of that spectrum sits the optical band, which is the visible band that our eyes are sensitive to. And so there's just enormous possibilities for observing the universe. As this picture shows, projections of the Milky Way, which is that band along the middle. And in the different wavelengths spanning from the radio and infrared, through the optical, and onto the higher energies and shorter wavelengths, which are x-rays and gamma rays.

France Córdova

But when I first started out in the field, astronomy, and astronomers, I should say, were very well-defined by what part of the electromagnetic spectrum they were observing in. So there were radio astronomers, and there were infrared astronomers, and x-ray astronomers, the whole thing. And the ones of course that go back the longest in history are the optical astronomers, because we have ground-based telescopes and that's what they can see with their eyes is the visible region of the spectrum. And so, the old way of doing astronomy was to sit at a telescope and take photographs and other kinds of measurements of the sky. And then put the plates, once that they were examined, in a drawer, on a shelf or something, and nobody else got to see them. Well, everything changed when I was a graduate student. The NASA, for one, started launching these big observatories called the 'Great Observatories' in these different wavelengths.

France Córdova

And they said, "We're going to invite the world to propose to use these telescopes in all sorts of ways," whatever way they thought was helpful for understanding the universe better. And so they invited proposals, which were then selected by various committees, the best ones. And so I thought, "Wow, this is a great time to be a graduate student because I can poke around and try to understand these binary star systems that I'm so interested in, in all these different wavelengths. I just need to propose to use this telescope and that one, and this space telescope, and the other." And also many ground-based telescopes were opening up and becoming much less private, like old-school style, and more open to the best proposals. So it was a great time to be a student, and I and my generation were on the frontier of that, of exploring the entire electromagnetic spectrum across all those wavelengths, from the longest to the shortest wavelengths, or the lowest energies to the highest energies and then putting together a much more complete picture of what we were studying.

France Córdova

So in my case, I was studying these very close binary systems. Most of them were no farther apart from each other than the Earth and the Moon. So that's extremely close for two stars to be, and you can see in that picture that you're projecting. So that distance would be those two stars, the white dwarf star that's labeled, and the normal star, which was usually a very small, "normal" star would be in a very small volume. And the white dwarf is a collapsed star. It's like what our Sun will be in another four and a half, five billion years. It will have spent all its nuclear fuel. It will have collapsed down into something almost as massive as the Sun, but the size of the Earth. So very small, very dense, compact object.

France Córdova

So, there are lots and lots of these objects and they've been well-known, the ones nearest us, by ground-based astronomers, even amateur astronomers, going back for a century because when the star called the normal stars transferring matter onto the collapsed star, there's a huge brightening episode and that can happen at random times. And so, astronomers with backyard telescopes could see those brightens. And I wanted to understand them a lot better. What was the physics of collapsed objects? Their strong gravitational fields? And some of them have very strong magnetic fields. And so that led me along a path of not only using multi-wavelength observations to understand them a lot better because it turned out that they produced radiation, not just in visible light, but in x-ray light, infrared light, radio light, and so on. So we got to know a whole lot more about them.

France Córdova

And then we also studied other kinds of collapsed objects like neutron stars and black holes. And that opened up a whole new universe of knowledge and understanding about the world of collapsed stars, what happens to stars at the end points of their evolution.

Brooke Grindlinger

It's incredible to watch throughout the course of science and history how new technology and evolutions in technology give us the capabilities to see more and understand more and measure more about what's happening in the world around us.

France Córdova

Yes.

Brooke Grindlinger

So I wonder if we could go back to that last slide. There was a periodic table on the right-hand side of the slide. And can you tell us that we are truly all made of star dust as that slides suggests?

France Córdova

As Carl Sagan says, "We are all made of star stuff." Well, yes, this is very interesting. Of course, the periodic table of the elements is very, very old when it was first put together, but people did not understand what was the origin of the elements. And so now we have a key here in the slide that shows that, by color codes, and then you look at the top six boxes there, that where these different elements and how they were produced. And so this particular slide came around at the time that it was just a few years ago, and I was at the National Science Foundation and we had invested for decades in an experiment called the Laser Interferometer Gravitational Wave Observatory or "LIGO". And LIGO

discovered, because it kept improving its technology and we kept investing more and more of it, so a few years ago, it discovered for the first time gravitational waves on Earth. And that was a monumental discovery and the founders, developers, of the telescope got the Nobel Prize a couple of years later for that discovery.

France Córdova

Well, then the second really spectacular finding, that happened to be from the very first detection, it happened to be the result of two black holes merging. They were in a close binary system like that slide on the left-hand side, but instead of a white dwarf and a normal star, they're two black holes and they spiral into each other, they lose angular momentum, spiraled into each other and merge into a much bigger or more massive black hole. And so then a couple of years after that was discovered, another event happened, gravitational waves were detected, and it was deduced from the measurements that it was two neutron stars colliding instead of two black holes. And this merger produced light in the electromagnetic spectrum, which was observed by some 70 telescopes on Earth. And one of the signatures that was discovered by a telescope, they were both space-based telescopes and ground-based telescopes, one of the signatures was the signature of the elements of gold and platinum, the heavy elements.

France Córdova

And so that really nailed down that one of the origins of those heavier elements towards the bottom of the periodic table there, platinum and gold and other elements like that, is from merging neutron stars. And you can see now that exploding massive stars, which can be the white dwarf stars, or neutron stars, dying low-mass stars like white dwarfs, exploding white dwarfs as they create a lot of matter, they can go thermonuclear. All these different happenings among the dying stars in the universe. They don't go out with a whimper. They can go out with a huge bang and they can produce all these elements. So our knowledge of the periodic table of the elements is ever so much deeper and more profound with these kinds of observations of close binary systems.

Brooke Grindlinger

It's so amazing to think all of these things are happening very, very far away from Earth. But if I think about the wedding ring on my finger, that platinum is due to colliding, exploding stars. We wouldn't have it otherwise.

France Córdova

Yes, yes, it is a profound thing to think about. Yes.

Brooke Grindlinger

But let's get back to your career. By 1979, you had your PhD in hand and you began your scientific career as a staff scientist at Los Alamos National Laboratory near Santa Fe in New Mexico. And shortly after that, you headed up the Department of Astronomy at Penn State University. And then you broke through this incredible glass ceiling to become not only the youngest person, but the first woman to serve as Chief Scientist at NASA. Can you tell us about that meteoric career rise, and what were some of the initiatives that you were able to drive forward under your leadership at NASA?

France Córdova

So I was very fortunate while I was a department head at Penn State. I got an invitation to interview with the head of NASA - Dan Goldin is his name, longest serving NASA Administrator - for the position of Chief Scientist. And I think he was committed to looking for a woman to serve in that role. He didn't say so explicitly, but I believe it. And I was recommended to him by a person who chaired a committee that I served on in Washington, D.C. And so I thought that would be very intriguing to meet the head of NASA and get to talk with him, So I flew there and we had a wonderful dinner together and talk to lot about what his goals were for the agency. He was relatively new as Administrator of NASA, and we just very much hit it off and thought we're like-minded about what we thought were good goals for the agency and how I could be helpful.

France Córdova

So I got back to Penn State and I heard the next day that he would like to take me on as Chief Scientist and the university worked out an arrangement for me to leave for three years. I didn't want to leave my professorship. And so I went there on a three-year appointment. I hardly knew what the word "policy" was about when I went there. I was deeply engaged in my research. I wanted to be a research scientist and do observations of the universe and build experiments. I had learned to do that in graduate school, build rocket payloads, wanted to build, and I was proposing for satellite payload. And so that was a real surprise to me. And I asked a lot of friends, as one does when one has choices, "What do you think?" As some of my women friends would say, "What is my superpower?"

France Córdova

So, what am I good at? And so a lot of my fellow department heads around the country said, "Oh, you don't want to get out of research and out of the university life like that." And they weren't very encouraging. But there were two people who were: one was a historian of science, a woman, at Penn State. And she thought, well, you can't just talk about how important it is, which I was doing a lot of, for women to be in science and then not take this opportunity to be on a stage where you can really have something to say about that. And the other one was my mother. And you always have to figure that your mother knows you, right?

Brooke Grindlinger

Absolutely.

France Córdova

Right. And so I just decided I would go for it. And it was a big jump because it was out of the area that I was comfortable in and I had succeeded. I now had, after 10 years at a Department of Energy lab at Los Alamos, I had become a full professor and head of the department. And by the way, the only woman in the department at Penn State. So, that was another one of my theses, that if you're going to be the only woman in a department, you should be the head of it so things don't get out of control.

Brooke Grindlinger

I love that. Can we get that on a t-shirt for everybody watching?

France Córdova

So anyway, I went off to NASA and I just really, really enjoyed it. So there are many things I did with other agencies, and I thought that was all wonderful to get to know how the federal government

worked, Congress. Every time the NASA head would testify to Congress, he brought me along with him as his Chief Scientist. And so that was all fascinating. But I think the most important thing that he would say that I contributed to NASA, because he was not a scientist himself but intensely interested in making science the driver for NASA's missions. That he thought, "If we're going to have a great engineering group that is going to put together these amazing feats," like we just saw one, right, on Mars a month ago or so. And NASA has been constantly doing that, that those experiments, that building of spacecraft, should be driven by big science goals.

France Córdova

And so he wanted me to bring in scientists to inform him, inform the agency, what was on the horizon, what were the big concepts that were going to be driving the new understanding of the universe, and what was NASA in the best position of that menu to address because of its own specialties. And so I brought a lot of scientists to NASA. We had debates, we had talks, and all that. And so I think that that was the most valuable thing I did as the Chief Scientist to the head of NASA, was really to help him lock in what was important to do. And I'll give you just one example of a result. At that time, the whole field of astrobiology, which is studying whether there's life beyond Earth, was not in a good place, because there had been the search for extraterrestrial intelligence and Congress didn't like that at all. And just as I was coming into NASA, they were closing down that.

France Córdova

But Dan Goldin took a different turn. Being illuminated by all these scientists coming in saying how important it was to understand how life begins, and how it develops, and were there the ingredients for that elsewhere in the universe. That was a very intriguing intellectual thought, and it didn't have to do with extraterrestrial intelligence. It has to do with extraterrestrial life. And so changing that emphasis was very important. And he just really took that up and put a lot of investment into astrobiology, even to helping NASA Ames in Menlo Park, California, create an institute for astrobiology and hiring a Nobel Prize winner to lead it and all. And so that was just one of the outcomes of scientists coming into NASA and looking forward.

Brooke Grindlinger

Incredible scope of work that you were able to introduce during your tenure there. So, after concluding your term at NASA, you continued your distinguished career. You returned to higher education, and you held senior faculty positions at the University of California Santa Barbara, and at U.C. Riverside, where you were appointed as the Chancellor from 2002 to 2007. And you're also President Emerita of Purdue University and the only woman to be President at Purdue. I want to talk a little bit about balancing, in academia, balancing family and career as a woman in science, because the ecosystem for particularly early-career scientists is very difficult. There's a lot of competition for positions, for grant funding. It often requires long hours, a lot of dedication and commitment in the lab as a scientist. And that time in a young scientist's career trajectory often coincides with peak child-bearing years.

Brooke Grindlinger

So I'm curious as an academic administrator in a leadership position, what was some of the strategies that you elected to pursue to support parents who were young scientists as they navigated the demands of competing career and family? And did you ever find it difficult to speak up on the issues impacting women, whether it was for yourself or on behalf of other women in academia?

France Córdova

I don't usually find it difficult to speak up, but it is much easier today because there's simply bigger numbers of women and we can band together and support each other in speaking up, and it's harder when you're the only one. And it's probably not even a good idea. It's a good idea to do an excellent job and show what you can do, but it's harder to speak up about these cultural and social issues. And so, really the more mature that I've become and the more positions I've held, the more confident I've become that my voice will be heard and people listen to it. And not only that, that I will have support and help and certainly I found that in my most recent jobs, that I've had a lot of help in moving the needle forward on some of these social, economic, cultural issues that surround one's ability to be in science and to continue in it.

France Córdova

So, yeah, I think the whole notion of work-life balance is out of balance because there is really no such thing. It's not like a scale that you can just precisely balance. People, just, they make it work. And we've seen that illustrated so well during COVID time of course, when everybody's had to assess, "How do I do all these different things? Teach my children, raise them, make sure they have their schooling, and still be working and handle things with my spouse," and so on. So there are always challenges and you have to make choices. And that's what life is all about. It's being faced with a lot of choices and you can't do everything. So I chose, not intentionally, but it happened that I had my children later in life, in my late thirties.

France Córdova

And so that was just because I didn't meet the man that I was going to marry until later. And so when I did, it just seemed right. We had children. But lots and lots of women make it work having children much earlier, but it is a challenge. There are things you give up, but there are big rewards. So I've always thought it was important in my jobs to try to especially make it possible for women to have daycare and to do some work differently at their own speed and time. I've been very involved, whether it was in the U.C. system, with moving the tenure clock, extending that, to having daycare centers and opportunities for women, to just talking to them and having informal conversations. Well, this is how it worked for me. And having other women talk about how it worked for them.

France Córdova

There's a very famous woman astronomer who was a friend of mine. So she passed away, named Vera Rubin. And now there's a whole observatory that we named after her in Chile that's being built. And Vera was one of the people who really moved forward the field of dark matter. And she would sit around the kitchen table, because that's what they had, with her four children and all of whom interestingly became scientists. And maybe it was sitting there with Mom doing their homework while she was doing her astronomy. But if you have a passion for something, you make it work regardless of how big the challenge is, but it's very good to be at an institution that values you for your contribution and that tries to make life a little easier for you.

France Córdova

So at NSF, for example, the National Science Foundation, we actually give grants to women for going to conferences and having daycare and that sort of thing if they were "a career award winner" and that kind of thing. And we've often thought about, it's just a question of money, of course, but extending that more largely. So every place I've been, yes, it's been definitely a goal to make the whole business

of integrating your work in your life easier for women, but it is a challenge, and this country doesn't have a universal policy, so every school, every institution, has to do the best that they can.

Brooke Grindlinger

So I want to touch a little bit on student diversity and inclusion. You were the first Hispanic woman to lead a University of California campus as Chancellor at UC Riverside. And can you share some strategies with us that you've found have worked, or perhaps some that haven't worked and where we've still got to do some more work where gaps remain to better support diversity, equity, and inclusion in education, certainly, but even in the sciences?

France Córdova

This is just so very, very important. I was fortunate that the UC campus that where I became Chancellor already had a head start on this with the efforts of my predecessor, who was Ray Orbach. And he really cared about diversifying the institution and admitting more underrepresented students and students from socioeconomic backgrounds that were challenged. And he made that a central goal of his ten year administration.

France Córdova

And so I got to pick up where he left off, and really encouraged that, 'till what we achieved in the end was a universal same graduation rate, independent of ethnicity of our students. And yet 70% of them were from underrepresented backgrounds. So that's one of the very, very few places in the whole country that has achieved that, that everybody has the same high graduation rate.

France Córdova

And the way that that was done was to... They had terrific faculty that really recognized the talents that all students brought and tried to bring that out of them. And they recognize that numbers matter. You can't change things if you've just got a couple of students from one background, a couple students from another, that just doesn't change everything. So they wanted to make a welcoming, hospitable, encouraging environment. They would have tried to identify students whose backgrounds were uneven, not maybe what you really need to get a kickstart when you start your freshman year, so offer summer schools for free to those students, and a lot of efforts like that of camps to increase their social mobility.

France Córdova

And in fact, today, and for the last several years, UC Riverside has been rated number one by U.S. News & World Reports for social mobility, and Money Magazine has called it the "most transformative university." But it was little by little. These things don't happen overnight. You have to be committed to it. And above all, the students have to feel that they are supported and that if they fail or slip, that somebody's there to shore them back up and give them a helping hand. So there are many, many programs that you can do that with.

France Córdova

I'm also proud that they have, I think, one of the most diverse medical schools in the entire country, and I was happy to get that kicked off, but one thing leads to another. If you start with the commitment, then many things grow from that commitment.

Brooke Grindlinger

Some wonderful fingerprints, shall we say, that you've left on the institution. From your perspective, can you speak to the power of diversity in driving scientific discovery? Why do we have to have more diverse populations in the sciences?

France Córdova

Well, we can already see that diversity is leading to new discoveries and new achievements, excellent achievements. I have only to look at the recent Nobel Prize winners, the women who have won prizes in chemistry and physics last year. People like Jennifer Doudna, and her colleague Emmanuelle Charpentier in France, and Andrea Ghez at UCLA (and Jennifer's at UC Berkeley. I mean, these are in a population of only a few women among all the Nobel Prize-winning scientists. I think Andrea's like number four, a woman - she is really the Madame Curie of our generation - to win the Nobel Prize at a relatively young age and a woman in physics, and she's astrophysicist.

France Córdova

And when I think that their discoveries... And Jennifer and her colleague were the prime movers of the whole gene-editing approach, which has just really phenomenally revolutionized many areas of science. And Andrea discovering the identifying, securing the knowledge of the black hole, a massive black hole at the center of our galaxy. But these are discoveries that may not have been made without them. And you think how many women before that were discouraged, left the field for various reasons, were not encouraged and how many discoveries we're missing? And it's not just Nobel Prizes. It's just in everything. It's from leading businesses. We've had only one black woman CEO, Ursula Burns, of a Fortune 500 company. I mean, it's incredible to think what we're leaving behind by not encouraging women and minority students to excel and giving them every opportunity.

France Córdova

So that's how I look at it, that it's just increasing the overall discovery, potential knowledge base, ability to achieve excellence in all fields when we open it up and welcome and encourage everyone.

Brooke Grindlinger

So I'm hearing encouragement is extremely important. And I guess on the other side of that for women, confidence, and I hear this a lot. And in the first episode of this STEM Supremes series, our first guest, Elizabeth Blackburn, also talked about, I guess, having shaky confidence in oneself as a young scientist and how to build that and be more assured and I guess, pursue opportunities, be proactive, advocate for yourself.

Brooke Grindlinger

For young women and particularly minorities that are entering STEM fields, how do you advise them to power past the naysayers? If they're not getting that encouragement and not feeling others help to build them, build their confidence up, how do they just push past that?

France Córdova

Well, I think that naysayers come with every field, every job. There's an abundance of naysayers, no matter what you decide to do. You want to be a doctor or a lawyer or a teacher or a scientist, there are naysayers out there. People say, "You're too old, you're too young, you're a woman. You're this, you're that." You don't fit their preconception of what your goal is. But, and so that's what you have to... You

have to have enough confidence to ignore them, and you have to have enough friends. You have to have enough people that believe in you, in your dream, your vision, that they support you, no matter what that looks like or how crazy it is.

France Córdova

So I believe that having a small team of people is just absolutely crucial. But deep inside you, I think that even more than... What gives you confidence is your passion. And if you have that, if you know what it is you want to do, what you want to achieve, then nobody can stop you. And you might not have complete confidence along the way. I didn't have confidence I was going to pass all my exams. And I certainly didn't, but eventually I did. But it was just knowing that, for me, science is beautiful.

France Córdova

It's supremely beautiful to investigate something as deeply as you can and to search for the truth of it, and when you find it, it's just light bulbs going off all over the place, and you just think, "Wow." Sometimes you're the first person there to ever see that. And that's just an amazing feeling, and that gives you the confidence to persist.

France Córdova

I think persistence is the most important quality that you can have too. And that's what gets you through or around or over the naysayers, just believing that where you're going is the place where you really want to be. So it's what makes people climb Mount Everest and do all these amazing things is just having a goal and going for it no matter what.

Brooke Grindlinger

So you talked about the importance of having a group of people around you that are supportive, which brings us to the role of mentors in any scientist's life. And as someone who is mentored and then as a mentor yourself that helps shape and grow other early-career scientists, besides persistence, what were some of the other qualities or practices that were imparted to you by some of your mentors? And then, today, as a mentor yourself, what are some of the pieces of advice that you always pass on to those that you train, that are coming in the next generation behind you?

France Córdova

Well, I think of mentorship as a multifaceted thing, that all kinds of people can be your mentors. The people who work for you can mentor you, because maybe they have a skillset that you don't have. And you say, "Oh, so that's how you attack that problem, that challenge."

France Córdova

I think what real mentors do is to help you see a wider picture of what you're going into, look at it from different points of view, and examine your own motivations for why you want to go in that direction or why you have questions. And so when you're faced with choices, that's when I found that mentors can... Because a really good mentor will just listen to you, ask you questions about why you made some of the other choices you did about what's important to you, and help you pull out of yourself things that you don't even maybe have enough awareness of self to appreciate.

France Córdova

I always think of my Mom when I think of a good mentor, because she was just great at, really listened to you, but after all, she'd grown up with you, so she really knew where this was going to end up. But I don't think just identifying somebody that you want to be like and saying, "Will you be my mentor?", that that necessarily works, because they could have a completely different personality. They may have followed a much different pathway. They may even have some of their values are a little different. They don't balance things, maybe the family or the adventure or sport or whatever it is, other things that you might be interested that make you a whole person.

France Córdova

So I think it's good to have a number of people that are close to you that you can rely on just to talk with them. For me, that's really the best mentorship. And the mentorship you get in the laboratory that shows you how to do this kind of experiment, all that, that that's one thing, but there's a lot of people who can fill that role, but there's probably not many people who care about you enough to let you ask the important questions that you need to ask of yourself when you're looking to make choices.

Brooke Grindlinger

Very thoughtful. So let's move to your time leading the National Science Foundation. In 2013, you were nominated by President Obama, and in 2014, confirmed by the U.S. Senate for a six-year term as the 14th lead director of the National Science Foundation. You were charged with essentially driving America's engine for basic science discovery and innovation, and you had a multi-billion dollar budget at your fingertips. Share with us what some of your most critical priorities were at the NSF, and then some of your proudest achievements during your time at the agency.

France Córdova

So NSF's vision is to be an agency that creates and exploits new concepts in science and engineering and provides global leadership in research and education. So we always keep that vision. We keep the mission, which is to further the progress of science in front of us. And that keeps us on the straight and narrow, headed in what we think is the right direction.

France Córdova

So for me, there was so much to do, at the NSF, I just loved it, because I love challenges. I like figuring out solutions with a great team, and we had a wonderful team. I was able to hire a lot of women. For example, we had 50% of the leadership, perhaps even a tiny bit more, were women. And they were at all levels of the agency and just made amazing contributions. And they were a great team to work with to further the goals of making us a global leadership agency in science and education.

France Córdova

So there was the challenges of managing big facilities. There was the challenges of encouraging Congress to give us more funding so that we could fund grantees to do more science. We had a lot of pushback on some of our programs when I first started there, and we managed to inform Congress of what were the reasons that we were investing in those kinds of programs. And we kind of turned the agency around from only accepting proposals from all over and then evaluating the best and funding them to also putting a bit more of a strategic framework on our direction.

France Córdova

We came up with these so-called "10 Big Ideas" for investment. They were forward-looking ideas of the way the country was going. The future industries that the country should be involved in. Things like artificial intelligence and quantum research, and biotechnology, multi-messenger astrophysics and all, but many different areas that were very important to invest in. And so that was a game changer.

France Córdova

Other countries sought to mimic that, wanting to know how we did it, and all. Then Congress really liked it. Our budget started increasing. We developed the first public accelerator to encourage one's research discovery to move to the marketplace faster by certain kinds of processes that involved getting teams together that were interdisciplinary teams to work on problems. We addressed issues of harassment, of research security, protecting our research assets of research integrity, and all.

France Córdova

I think if you asked me what the biggest highlight was though, being an astrophysicist, it was the amazing seminal discoveries that were made, by accident, but I got to promote them and communicate them to the nation and the world, that were made in astrophysics, which were really life-changing, kind of once in a lifetime, but we had a few of them when I was Director of NSF.

France Córdova

I mentioned the discovery of gravitational waves, which led to Nobel Prizes. There was finally the understanding of the origin of cosmic, high-energy cosmic rays with an experiment that we had funded in Antarctica at the South Pole that discovered or detected neutrinos in coincidence with satellites that NASA put up in ground-based telescopes. And then we made amazing observations of the sun and with a telescope that NSF funded in Hawaii on the island Maui, and a detailed one had never seen before. And then too, the first the image of the shadow of a black hole. That was absolutely an incredible observation that was done with telescopes all over the world.

France Córdova

And all of these observations took a very long time to do, and you're showing us some of them. This one here right now is the merger of two neutron stars. And we announced it with the astronomers from all over that had made that observation, put together the big picture of what happens when neutron stars collide including the production of the heavy elements that we talked about earlier.

France Córdova

So we had in the few years that I was in... There's the black hole, the famous image, which many people made clever memes about. I always remember Homer Simpson holding up a donut that looked kind of like that black hole. And there's the Sun.

France Córdova

So that was very important that NSF... I mean, you're wearing a NASA t-shirt, which I love, and I loved my time at NASA, and I always wanted when I came there for NSF to be as well-known and appreciated as NASA. Of course, it is among scientists, and the women that I mentioned that won the Nobel Prize last year and the woman at Caltech, Francis Arnold, who won the prize a couple of years before that in chemistry, were all funded by the National Science Foundation when they started out.

France Córdova

So we're very, very proud of that, but I wanted more people to know about that NSF was funding these great facilities, and you just showed a slide of some of the really big ones all over the world that the agency funds, and to appreciate that we were really funding very basic research that led to big discoveries.

Brooke Grindlinger

So clearly NSF's investment in basic science research is so incredibly foundational to the work of researchers across the United States. Besides government support, do you think there's a role for philanthropists in supporting fundamental scientific research?

France Córdova

Oh, I definitely do. And I'm a senior science advisor to an entity called the Science Philanthropy Alliance, which is an alliance of over 30 foundations that all want to invest in basic research, and we help and encourage them. Of course, they don't need much encouragement, just sometimes some direction and some more understanding of what are the fields on the frontiers that they should think about funding.

France Córdova

So, yes, foundations can do kinds of support that the federal government can't do. And I've learned much more about that, being more involved with foundations now. And there are great partnerships between foundations and the federal government, where the foundations do some things, sponsor activities, workshops, and meetings and all that would be harder for the federal government to do. And they have the freedom of choosing people in different ways and in funding programs at all different levels of the STEM development pathway.

France Córdova

So I think that there's a great history in this country of philanthropists funding science. And indeed, my own field, astronomy, was principally funded by philanthropists for a very long time before the NSF was even created in 1950. So some of the biggest telescopes, like in Palomar Mountain and all, were funded through philanthropists. I think it's incredibly important. And they have a lot of flexibility for funding, which is great.

Brooke Grindlinger

Can I ask, you know, many scientists are quite well-versed in writing grants and proposals to federal funding agencies to request support for their research, but they're a little less sure about how to optimize their outreach to philanthropists, whether they're individuals or foundations. Do you have any tips for how scientists can best outreach and communicate with the philanthropic sector to obtain support for their research?

France Córdova

Well, that's just an excellent question. So that's one of the reasons the Science Philanthropy Alliance exists is to be kind of a home depot for that knowledge, to point people in different directions if they're interested in ocean science, or astrophysics, or biomedical sciences. And so, but there's a lot of different philanthropies of all sorts of sizes and different goals, and one can easily go online and see what they are investing in.

France Córdova

And many of them have calls for proposals because they have specific programs. And now is a great time. I think the philanthropies are very, very sensitive to what's happened with COVID, and how especially difficult it's been for young, emerging scholars, and they really want to help them. And so, I think we're seeing a lot more efforts to do that. So, yes, they can get in touch with Science Philanthropy Alliance that'll help point them to foundations that are just starting out. Or they can take the well-known ones, of which there are many, and go in and see online what kind of programs, what kind of grants they're giving because there's an awful lot out there on the web.

Brooke Grindlinger

Helpful. Thank you. And we'll make sure that we capture the name of that organization in our notes from tonight's conversation as well. I want to go back to something that you mentioned was one of the priorities that you tackled when you were leading the NSF, and you mentioned harassment. As NSF Director, you were compelled to act on some news reports of sexual harassment that surfaced around some grantees of the Foundation, researchers who had received NSF funding. Can you share with us some of the actions that you've taken in academia or in that position at the NSF to try and address harassment, and what else can we do to protect those that are vulnerable?

France Córdova

This was a real adventure for me in addressing a real issue that has to do with the culture of research. And I learned a whole lot through this effort. And again, coming back to mentorship, I learned a lot from the community and a lot from my leadership staff, many of whom were very young women, and were very more attuned than my generation was to this issue. Because in my generation, when you were all alone, as we were talking about earlier, it was just hard to... You just have to ignore that, right? But now, there's much more of an activist effort to try to address that challenge. So, I learned that you can't address anything unless you face it.

France Córdova

And that's the biggest thing I learned at NSF, that every challenge, if we could name it, we could face it. And if we could face it, we could do something about it. And we thought very hard about what was it that we, as a government agency, could do? I think whether you're an individual or you're an organization, there's something you could do, but there's some things are more appropriate depending on what kind of an organization you are and how much support you have, what your sweet spot is. And for us, our sweet spot was the research that we were conducting and the integrity of that research. And if there is a harasser in the research environment, then the money that we are putting into it cannot be used effectively. And the students cannot do their research, and so on. It disrupts the whole environment.

France Córdova

So, when we looked at it with those glasses on, that framework, we realized that what we were really protecting is the research environment. If we could go after, in some way, the people who were doing, the harassers. The very first things we tried didn't work at all. We put out a notice to all the presidents and provosts of the universities. And I did this together with the head of NASA, Charlie Bolden, at the time. And we said, "Can't do this. Otherwise, we could take away all your money." Well, that didn't have much of an effect. It was still a lot of media reports and stuff. So, we really scratched our heads and we thought, "Well, how can we get them where it hurts, where it really counts, and clean up the research environment?"

France Córdova

And we thought, well, we need to know when there's an investigator is harassing others in that environment and see that we are not funding that environment, that research, unless they're removed from it. And so, without going into details, we changed the terms and conditions of our grants to insist that universities report to us when an investigator, principal or co-investigator, was put on leave and/or let go. And then, we would come in and decide whether we can continue the grant, if the university could produce another, an alternate, lead investigator or not.

France Córdova

And so, that really sent a message loud and clear. It's like being a surgeon. You really went to where the problem was occurring and what to do about it. And it became a model for the other agencies who then have followed that, I believe. NASA has done that now. NIH did some similar things. And other countries, our little group of people who were leading that effort then went to inform a couple of other countries of what they had done so that they could look at their policies, not just in agencies, but for the countries as a whole. So, it had a big effect, and it taught me that no matter who you are or what organization you're in, you can, but it has to be surgically precise, appropriate for your own organization. What can you do to make sure that the environment is as free as it can be of harassment?

Brooke Grindlinger

Well, bravo, for taking such a strong stand. And as you say, hitting them where it hurts, really making a difference. That's terrific. And it's wonderful to identify something that other agencies in the United States, but around the world, another approach that they can also take and implement immediately. So, you concluded your term as NSF Director in 2020. I wanted to ask in what ways do you hope the Biden-Harris administration will be an ally to the scientific community in both the United States and abroad?

France Córdova

It already, of course, is. It's taken a very strong stance with COVID, and with climate change, into relying on science to lead the way. It's elevated the position of the present science advisor, who's the Director of the Office of Science and Technology Policy to a cabinet position, and brought in, for the first time also, a deputy, who is a person who is a social scientist because that is so important in moving forward. And the others that it's pointing now to senior positions have very great respect for or are scientists themselves. And so, I have great confidence that this administration will continue to be relying on science to inform its policies. And I think that's very welcome among all of us.

Brooke Grindlinger

Indeed. I want to turn and take some questions from our viewers this evening. The first question I'm going to take is from Kirsty. She says she's the only girl in her physics class at the moment. And one of the things that she's noticed is that she struggles to find the confidence in her answers and ideas. She would love some advice and also says, "Thank you," for inspiring so many girls.

France Córdova

Oh, well, thank you. So, I was there, once upon a time. And I think if you love it, you should just continue with it. I think everybody at an early stage of their career feels some insecurities about... You don't know everything, and there's so much to learn. And some of us are better at say, writing than

speaking, or we're better at thinking than either writing or speaking. We all have different gifts for communicating. And so, I wouldn't worry if your answers seem awkward right now. They'll refine themselves as you listen and as you hear others talk about physics. I would definitely, when you get an opportunity and if you have time to go online, there's so many webinars that physicists are giving now and wonderful ways to hear them talk about their field.

France Córdova

YouTube is just full of great... When scientists talking about not only what inspired them, but talking about the substance of the field themselves. So, I would not let myself get discouraged. That's all I can say. I started out with no background in physics. I started graduate school like that, just taking a few courses, auditing. And I managed, but I hung in there. And people asked me what I did for comfort. And I said, "Well, I was a literature major. So, I turned to the great books." I read poetry in my spare time. And those very sad poets always made me happy. And so, I went back into science.

Brooke Grindlinger

Great advice for Kirsty. Thank you. We have a question from Mac: "Do you think narrative or fictional stories can be powerful in providing positive, diverse portraits of scientists? If so, should we increase these types of stories?"

France Córdova

Oh, absolutely. I think both have a tremendous effect. Somebody just sent me, a couple of days ago, the X-Factor, the Dana Scully Effect. So, obviously, Dana Scully is a fictional character. But apparently, she turned a lot of young people on to science, even though that was an extreme way out there. But some fictional works have been transformative over time. The history of literature shows that. And so have some really powerful, true stories. Like I love the stories of Marie Curie, and Lise Meitner, and the few women that were in physics. And of course, since most of my mentors at an early age were men, I was very much inspired by the story of men going to the Moon. Because it was the physics I was inspired by, and it didn't matter to me whether they were men or women.

France Córdova

So C.P. Snow, who's a writer I really like. He writes a lot of fictional work, but he wrote a book called 'The Physicist', which is based on the physicist, the great physicists of the middle of the last century, the 20th century, who really changed quantum mechanics, and relativity, and all. That's a wonderful book to... He talks about the troubles they had with each other, and also, the encouragement, but the whole story, the good and the bad. And yeah, I think it's really helpful to read about people, whether they're fictional or non-fictional, Mac.

Brooke Grindlinger

Well, I have to admit that probably my two favorite fictional scientists, one is Dana Scully from the X-Files and the other one's probably Indiana Jones. So, I love that. Bring it on. Bring it on. My next question, it comes from Alison. She asks, it's been about a year since the end of your term leading the National Science Foundation, which coincidentally, is Alison's employer. She says, "What activities have you been up to since then? And what other amazing things do you foresee for yourself for the rest of your life?"

France Córdova

Oh, that's a question I'm wrestling with right now. I've been up to several things. I've been very involved with foundations, so I mentioned the Science Philanthropy Alliance, but I also chair the American Institutes of Physics' new foundation, so I'm the chairman of the board. And I've brought some other people that are well-known to NSF onto that board to raise money. And one of the programs is about students, the Students in Physics Society, and to encourage them, keep them in the field, fund them, and so on. I'm a trustee of my alma mater, Caltech. And so, I really like that work too. And I am a consultant for a venture capital company, and I really like... Venture capital is so close to what NSF does, investing in new ideas and young emerging ideas. In that case, it's companies, not the actual research itself. But they have a lot of similarities. They like having a technical person on the board. But I, more recently, because as COVID is, hopefully, winding down, I've been asked to do a number of things. And so, that's my next choice. A lot of people say, "Well, why don't you retire, and go climb mountains, or sit on a beach, or something like that?" But I've never sat on a beach. And so, no, I think I'll definitely do something. And I'm looking very seriously at some opportunities. The mentorship question that you asked, Brooke, reminded me of that because when you're very young, you turn to your friends, and you say, "This choice, that choice?" And now that I'm not so young, I still turn to my friends and I say, "Hmm, who am I? Am I this person? Am I that person? What should I do next?" So, you never outgrow it. You never outgrow your need for wise counsel, from the people that know you and have some idea of where maybe you should be headed.

Brooke Grindlinger

Indeed. And we're all still evolving, no matter your age. You're still evolving throughout your career. Next question is from Barbara: "With regard to work/family balance, you mentioned that we all have to make choices and eventually make it work. The pandemic has underscored just how hard some of those choices can be. For example, some women must choose between leaving young children at home and losing their job. What were some really tough choices that you had to make to succeed?"

France Córdova

Well, I feel really blessed. Actually, I'm right now in the home of my daughter, who left her job to take care of her children, small children, very small. One on the way. And so, that's the choice she made. And she's a very bright young lady with a couple of Masters and all. Eventually, she'll go back to work, but this is the choice she made, and she's very happy with it. I feel, yeah, I had my children later. We had the money to have daycare. I really had invested a lot in becoming a scientist, and there was nothing that really would have stopped me from wanting to do my research and stay in the field. And so, I made that work by taking my children, after a few weeks after birth, to daycare.

France Córdova

And that was very hard to do, especially when things happen at daycare that aren't so pleasant. But they're wonderful children now. So, children are very flexible, and then, they get past all these things. And so, I made the choice that I could live with. And I think one of the most important choices we haven't talked at all about is about who you pick as your partner, your life partner. And I just, serendipitously, very amazing, picked the right person for me. And so, that person has always been amazingly supportive and helped out more than 50% with everything that we were faced with, and moved all the times that I moved in my career, moved very graciously, and found other things to do.

France Córdova

So, I feel very, very fortunate in that I hung on to what I wanted to do and believed in. And I found people around me that wanted to help me do that. So, I wish you good luck in that. Yeah, it's tough. But life is also long. I'm probably doing better than the cat with nine lives. There are many lives.

Brooke Grindlinger

Indeed. I'm going to try and squeeze in one or two more questions before we have to wrap up tonight. Next question is from Tanisha. Tanisha asks, “I’m not that into physics, but I love chemistry. Would it be possible for me to make a career in astronomy?"

France Córdova

Oh, absolutely. Astrochemists are... There's so many molecules being found in these clouds, called molecular clouds, way out there. I mentioned in our interview here, our remarks, about Carl Sagan saying, "We're all star stuff," and about the elements, and understanding the origin of the elements much better as we investigate the universe. The understanding whether there's life beyond Earth or not is a chemistry. It seems to be a biology question, but you have to have the chemistry first before you get the biology. And so, I think the universe is wide open for astrochemistry, and that's... Learn more about infrared astronomy. That's where you see the signatures of these molecules and elements. I think there's even been beer - formaldehyde - and all, discovered out there. So, there's all kinds of stuff.

Brooke Grindlinger

Oh, well, you've made someone very happy with that answer. Last question I'm going to squeeze in is from Rafiou, and I hope I'm pronouncing that correctly. Rafiou says, "Thank you for inspiring us. What can we do to make science more global and help enthusiastic young scientists around the world reach their full potential, even if they do not have the means to pursue exciting and cutting-edge scientific careers?"

France Córdova

Yeah. What a great question to end this on. It's a terrific question because we are citizens of the world. And when you're up in one of those NASA satellites, not the up on the satellite, but say, on the Space Station, when you look down, you don't see any borders, and you realize that we are all citizens of the globe. And that's something we should relish, enjoy, support, and nurture. And there are so many opportunities, no matter what field you're in, and it doesn't even have to be science, of course. It can be law or medicine, education, giving aid. I mentioned I was born in France because my father was with a company called Care, that was in charge of all those care packages that are given to folks in need all over the world.

France Córdova

And so, I am really attuned from my travels in astronomy to the more global needs all over the world. And when I was president of a university like Purdue University, I could see some of our scientists were doing amazing work in places like Africa and in helping people in devising new technologies to keep their food safe or to produce grains that were richer, increasing the food supply, and all. There's water issues. There's just, everywhere you turn, there are so many important issues to dive into. And Brooke mentioned the Biden-Harris administration are really looking forward to a much more expansive approach to the rest of the world and how we can all work towards common goals.

France Córdova

Because the biggest challenges we have, whether that's pandemic, or world food supply, and water shortages at all, and poverty, climate disruption, are not national problems. They are global problems. So, they call for global solutions. So, anybody who's a listener who wants to head off to the United Nations, or USAID, or anything, you have my full support. I think that would just be marvelous for us to try to make an impact in so many creative ways there.

Brooke Grindlinger

That's a wonderful, inclusive way to draw our conversation to a close tonight. We are out of time. So, I want to say Dr. Cordova, this has been such a treat. Thank you so much for sharing your journey with us tonight, as well as your wisdom and advice for so many of our viewers. It's really been special to have this time with you.

France Córdova

Thank you, Brooke. And thanks to the audience. I've really enjoyed this.

Brooke Grindlinger

And I want to thank all of our listeners and those who participated in our Q&A, and remind everyone that a full recording of this event is going to be immediately available on the Academy's Facebook page, and also, on our website, nyas.org, in the coming days. And I also want to take a moment to thank my colleagues behind the scenes who work tirelessly to bring programs like this to you. For today's webinar, they are Danny Habashi, Derwin Knox, Crystal Ocampo, Susan Schultz, and Dr. Melanie Brickman Borchard. Thank you.

Brooke Grindlinger

And finally, I hope you will all join us for the next episode in the STEM Supremes series. On Monday, April 12th, I'll be joined by pioneering computer scientist and winner of the Association of Computer Machinery's 2008 Turing Award, Dr. Barbara Liskov. Now, every time you exchange an email with a friend, or check your bank account, or run a Google search, you are riding the momentum of Dr. Liskov's research to develop modern computer programming languages. So, I look forward to welcoming you back to the Academy, albeit virtually, very soon. In the interim, please stay safe, and healthy, and good night.