Broadcasting from the University of British Columbia, where waves crash onto the shores of Wreck Beach. This is Blue and Goldcast. [music] I'm Santa Ono, the president and vice-chancellor of UBC.

And I'm Jennifer Gardy, a professor with UBC's School of Population and Public Health. Blue and Goldcast is a monthly podcast where Santa and I talk with people at the university about the big issues in higher education. Today, we're going to be talking about women in the science, technology, engineering, and mathematic fields, or STEM. We're going to meet one of UBC's best and brightest STEM stars, Stephanie van Willigenburg.

So my interested in mathematics goes back a long way, basically as long as I can remember. One of the strongest memories I have was being on holiday with my family. And we actually went to Thomas Edison's house. And we saw his laboratory, which was actually down at the bottom of his garden. And it was just amazing, just the space where he made all of these discoveries. And I thought, I want to do that.

This is Stephanie van Willigenburg, a professor of mathematics at UBC and the 2017 winner of the Krieger-Nelson award for outstanding research by a female mathematician. I joined her in her office to hear more about her experience pursuing a career in a field where there are very few women.

So the high school that I went to was called St. Ann's Convent. And it was a school just for girls, and in particular, the specialty there was science. And we'd actually get to do little research projects. And so for example, one thing would be, "Okay. If I give you a six-sided dial, like the one you can see up there, then you know how many different walks you can make around it. Can you find a formula to express that?" I think looking back, I never once thought that were any restrictions. And these women who were teaching me, who are all incredibly smart, incredibly articulate, were also excellent role models.

But when Stephanie got to university, she noticed things were different. In high school, she had never encountered the stereotype that women couldn't do mathematics. But in this new co-ed environment, that idea was prevalent, particularly meetings with her PhD supervisor.

One of the things that he said to me was if I got stuck, that I shouldn't worry blood clots women's brains aren't wired that way. And the most upsetting one was, I was about to submit my thesis, and there was a small mistake in one of the very small results. It's called a [inaudible]. And his reaction to this was, "Well, I've lost all faith in you." And when I actually got over what he said, it took me, maximum, a couple of hours to fix. It was nothing. I felt quite disillusioned. And so felt that I didn't really belong in mathematics, and consequently, after my first post [inaudible], I thought, I think it's time to leave academia. I was invited to give a talk at Cornell University. So I thought, well why not? I may as well go, give a good talk, be done. So it must've been one heck of a talk, because at the end of it, one of the professors, very well known, Luis Valera, actually came up to me and said, "I'd like to offer you a position." So we went down to the office to get the offer letter. But the office was shut for the day [laughter]. And so I thought, okay. And so that night, I didn't sleep at all, because I thought, oh my gosh, the next morning, I'll probably go in and he'll be like, "Oh, I was only joking." But that wasn't the truth at all. I went in the next morning. We got the offer letter. I signed. And then from then on, things completely changed.

Stephanie says she soon started to regain her confidence. She remembers one day, during a residency in Montreal, she was in the break room with her colleague, Sarah Mason, when Jim Hagelin walked in.

And he was like, "Well I was looking at this formula, and it seems like this huge, difficult expansion can actually be broken up into really small, very nice pieces. I wonder if those are interesting." And so Sarah and myself said, "Why don't we start looking at these things?"

So Stephanie, Sarah, and Jim flew to the Banff International Research Station to spend some time working on this problem. They thought they might be looking at something called a quasi-symmetric sure function. Mathematicians have been looking for this kind of thing since the 1970s, but every time they thought they had a candidate, the math just wouldn't work. So that's what Stephanie thought would happen here.

And as Jim, and Sarah, and myself started looking into this, we started discovering that, no, they were checking all the boxes. These functions we found were just doing everything that we wanted to. So we'd get up early every morning, have breakfast, and then work through until lunch time, stop for lunch, then work through the afternoon, then stop for dinner. Then we'd be so excited, we'd keep on going in the evening. And within a week, we actually hammered out all of the basic credentials of these functions. [music] So on the last afternoon, we thought we'd finally completed the project. And so it was beautiful weather. And so we went for a gentle hike along the river. And then suddenly, all four of us sort of looked at each other, and we went, "Oh, no. There's one small mistake [laughter]." And so we all got up, and we basically took a very brisk walk back up to the Banff Center, which is where this research station is. And then for the rest of the afternoon, through to the evening, we just hammered away at it and fixed it. And then it was done.

And then when it was really done, did you guys celebrate?

We did. We went to the Banff Springs Hotel for cocktails that night [laughter].

Nice. [music]

Sometimes with mathematics, you absolutely have that moment where you suddenly go, "Oh my gosh, this is going to work." But this was-- it was almost like being at a rock face, and you chip away at it, and you're like, "Hey, that looks like a bit of gold." And then you chip away a bit more, and it's a bit more gold. And then you chip away a bit more, and well that looks like diamond. And then once you've scraped away for a few weeks, you realize that basically, you're sitting on not only a gold mine, but a diamond mind as well. [music]

Well Stephanie, welcome to Blue & Goldcast. We are so proud of you here at UBC. We're proud that you won the 2017 Krieger-Nelson Prize, from the CMS. And we're proud of you because you're an example. You are a beacon for future generations of women in STEM, in mathematics. And your story is truly inspirational. If you don't mind, can we go back to the time when you thought about almost leaving mathematics? How did you supervisor make you feel with that comment?

Well thank you very much, Santa, for inviting me here today. And that's a really good question. So certainly, with his negative comments and the lack of support, you can imagine that my feelings were disillusionment, because this was a career that I'd felt that I'd really wanted to pursue. And yet I was being told that this really wasn't my path. And that's extremely demoralizing, as well. So I think disillusionment and demoralization would be the two key things that I felt. And of course, disappointment.

How wonderful it is that you went to Cornell, and you met somebody who obviously believed in you and who had a key eye for talent. So that's the other side, right, that when there are people who can demoralize you, there are people who can really lift you up.

Oh, absolutely. So the importance of mentorship is just huge. Having someone not only who believes in you, but you can also turn to for advice, you can use as a role model, that they can share your accomplishments when you succeed. But they're also there to build you up when you've been disappointed. So they don't tell you, "I've lost all faith in you." They say, "Hey, you know what, it's a good thing we found this out right now. Let's work out how to get round it." And that's really what ends up leading to success.

What can we do as UBC to help with this process?

So I think one thing is, be aware of the biases. For example, when you're in a hiring committee at UBC, you do go for a short training session, to be aware of such things. And that's very helpful. I think another thing would be also to every so often assess the working climate for female faculty, just in case there are stories we're not hearing. I think it's important to ask them and listen to them, for sure.

Those are some things that we're doing. I would first like to say, as the president of UBC, that we can do much more. We have been flagged by the Tri-Councils as being an exemplar of a major research institution that is trying to correct these biases. And if you look at the numbers with respect to Canada Research Chairs, both tiers, and [CIRCS?], and C150s, the data do show that we are doing better than most, in terms of hiring in an equitable way. But we cannot rest on our laurels. We have to do better. And I just wanted to ask you, in addition to what we are doing, do you think there is a need for department heads, provosts, deans, and myself to do more? I think the answer is yes. But what do you think?

So I'm incredibly glad that you said yes, because I agree with you. You've noted that there's definitely more that we can do. And as we mentioned earlier, role models are really important. So I think hiring more women in fields where they're a minority or making sure that we retain them, that's a really key thing, just so there are more role models. Another thing is that while it's excellent that there's a lot of diversity on committees, of course what that ends up doing is that because we women are being put on so many committees, what that's taking away from is our research time or our time with our students. So some sort of compensation, to be able to take that into account, would just be priceless, I think.

And we talked a little bit about what we can do at UBC. And you may or may not have heard that the Tri-Councils here, with leadership of our science minister, Kirsty Duncan - I'm a co-chair of the committee - is really trying to influence systemically what happens at a national level. And you're familiar, having come from Britain, with the Athena SWAN initiative. And I'm an advocate and champion of that, nationally. What do you think of that kind, at that level, beyond the university, beyond the department? Your department is doing well. But certainly, if you look at the landscape of major awards, if you look at Fields Medals, with some recent exceptions, or Nobel Prizes, they're mainly men. And so do you think that beyond the institution, that governments and funding agencies really need to set targets and expectations to do better?

Absolutely. I completely agree with you. I think that we as a university, we can do things. But yes, we really got to call all of these places that you've singled out into account as well and actually use what we can. As you said, UBC, it's a major research university. We have a lot of voice. And we should use that voice for good.

Santa mentioned the Fields Medal, which is a very famous prize in mathematics. But you have a very famous prize in mathematics, as well, the Krieger-Nelson Prize. Can you tell us what it was like receiving that accolade?

I was absolutely thrilled. So I can confess to you now [laughter], that they do let you know a few months in advance. And so that was just so exciting. But then having to keep it a secret from everyone was just unbelievably difficult. But I was thrilled, especially because in pure mathematics, what can quite often happen is, because your work is so theoretical, that it doesn't really have the impact right then. It'll have impact many years down the line, sometimes not even in your lifetime. So actually to be recognized so soon afterwards, I thought, was just fantastic. I was thrilled.

So this is awarded for exceptional research. And I know there are mathematicians listening, including Santa's family, who want to know. Tell us about the function.

Okay. Since the function itself is fairly abstract, I think maybe what I'll do is perhaps tell you a little bit about why people were excited about the function. So there are two different types of functions in my area, algebraic combinatorics, that are extremely useful and ubiquitous. So one of them would be sure functions. And these show up in quantum physics. They show up in algebraic geometry. And so people really like them, because they're useful. And then there are these other functions called quasi-symmetric functions. And again, people like them because of their ubiquity. They show up in category theory and discreet geometry. And so for a while, people have been thinking, well it'd be great if we had these two things get together and have a quasi-symmetric sure function, which would have the power of both these two other types of functions. But people didn't believe they existed. And so this is what happened about 10 years ago in Montreal, was that Jim Hagelin, Sarah Mason, and myself suddenly stumbled across this function. And we're like, "Hold on a second. It has the personality traits of a sure function. It has the personality traits of a quasi-symmetric function. Maybe we have discovered this quasi-symmetric sure function." And so that indeed was what we discovered. And that was what I won the Krieger-Nelson Prize for.

How do you stumble across a function [laughter]? "I was at the blackboard one day, put an A down, you put a B down, you put a little squiggly-- oh, there it is."

Sometimes it does actually happen like that. One of you is like, "Well it would be great if this function that you've written on the board, well it had these personality traits." And someone else will say, "Okay. Well see that little condition there? Why don't we tweak it just a tiny bit?" And then you say, "Oh well, and then let's just tweak it a bit more. Let's do an example." So you work it out concretely. "Hey, it's got all the personality traits we like." And then you keep going. And then you keep checking to see, what does it satisfy? What does it not satisfy? And then ostensibly, if it looks like a duck, and it quacks like a duck, it's a duck.

One of the things I like to ask mathematicians is what were they doing when they made a discovery? And some of them will say, "I was making pasta." Some of them say, "I was taking a shower. I was hiking up a mountain." What were you doing when you made a discovery?

So with this particular discovery, it was actually Jim, Sarah, and myself were having coffee. And I can even remember which room it was at UQAM, Université du Québec à Montréal. So I actually got to - because I was in Montreal as part of my sabbatical - go and revisit that room a decade later. And so I was telling everyone, "Hey, this is the room we made the discovery." But you're right. At other times, you get woken up in the middle of the night and think, that's it. So that happened one time when I was visiting a colleague in Paris. And he had this really tiny apartment. It was two rooms.

And so he was in one, I was sleeping on the sofa [laughter]. And there was the kitchen there, as well. I woke up, and I'm like, "Oh my goodness." So this was the large result in my thesis. "I know what all this data is saying. This is the equation." But I'm in this tiny apartment in Paris, where the walls are really thin. I'm like, "I can't get up and write this down, because I'm going to wake my host [laughter]." So yeah, so in that case, yeah, that was a wake up in the middle of the night example.

Now Stephanie, you've talked about mathematics being very theoretical. But you've also talked about the fact that sometimes it has a practical application. Could you give us an example of one such situation in mathematics?

Absolutely. So I'm going to take this example not from my area, but actually from your brother's area of number theory. So the theoretical aspect is something called modular arithmetic. And so what this is useful for today is that it's all about coding theories. So what makes your credit card actually be valid, or your social insurance number, that's all number theory. Also, cryptography is all based on number theory. So it has these hugely impactful impact on our lives [laughter].

So I can tell you that both my father, who was a UBC professor, and my brother, who is now at Emory, they work in the field of number theory. And they pursued number theory because the beauty of theoretical math. And I think that's still the ultimate. That's why they're in the field. And so I think in watching my brother, he was drawn into things such as the NSA and the CIA. They were interested in his work. But that's not why he did his work. And then now, there are physicists that want to talk to him about string theory and black holes, and things like that. That's not why he did the mathematics. So I would say watching him, he's been already excited with doing the mathematics, but the fact that there are other fields that care and are interested is, I think, in his case, energizing.

Yes, exactly. It's energizing. It's a bonus. But it's not what drove your passion in the first place.

I want to go back even earlier in a mathematician's formation, if you will. And great mathematicians come from many different circumstances. Ramanujan, as you know, came from a completely unexpected place, to really transform fields of mathematics. The question is this, one of the things that we want to do as a university is to increase the pool of future you, future individuals like you, Stephanies. And one of the things I've noted in talking to youngsters in primary school is that they don't really understand why mathematics is exciting, because of the way it's taught. And so the question I have for you is, how do we teach mathematics in primary schools? Because obviously, when I talk to people like you or other mathematicians, they're giddy about what they do. It's so exciting. But I think one of the concerns that we have is that in primary school, the excitement of discovery and why mathematics is beautiful isn't apparent when you're doing multiplication tables and things like that. Do you have any suggestions on how, as educators, or perhaps people in our faculty of education, might address that, to make mathematics come alive at a earlier stage, so that more people will be interested in pursuing that path?

That's an excellent question. And I think something that would be incredibly helpful is indeed to instill this passion of discovery. And so a lot of the time, what we do as mathematicians is we have data, we spot patterns, we explain the patterns. That's what makes us excited. And that's something that you can do, I think, with primary school children, as well, is you can give them puzzles in which they need to spot a pattern amongst shapes. It doesn't have to be numbers. It can be letters, animals, anything. And then once they've spotted the pattern, then go ahead and try and actually explain it. And a lot of the time, children actually have the innate ability to somehow explain what's going on. So I think if we can also have our teachers be brave

enough to, again, be willing to listen to the children, listen to their explanations, and somehow go away from memorization. I think that's what makes children and their teachers find things a little dry. Because I have taught such courses here at UBC. And that was exactly the feedback that the students, who then went on to be elementary school teachers, said, was like, "We didn't realize that if you understand why mathematics works, it's fascinating." But the memorization, it's what makes it dry.

I remember it was Math 101, here on campus, in the dusty old math building, as a first year undergrad. Math 100, I could make no sense of it. But Math 101, the instructor got up at the blackboard on the first day of class, and he drew a squiggle. And he said, "All we are going to do this term is figure out the area under the squiggle, by drawing increasingly thinner rectangles." And all of a sudden, everything that hadn't made sense in Math 100 clicked. When you get that perfect analogy and that way of relating it back to something that people can understand, that's gold. [music]

Absolutely. Spot on.

That was the last math course I ever took, though [laughter]. [music]

Well Stephanie, thank you so much for being part of Blue & Goldcast today. We are very proud of you. We are very proud that our mathematics department is a major center for fundamental research in mathematics. We think that you are a beacon that hopefully will inspire our students, but also students around the world. We don't know where the next Stephanie is coming from. We want to do everything we can to even the playing field, so we can find additional people like you that will find both gold and diamond mine.

Thank you, Santa. Thank you, Jen.

You can find links to Professor Van Willigenburg's work at our website, blueandgoldcast.com.

I'm Santa Ono.

And I'm Jennifer Gardy.

You're listening to Blue & Goldcast, a podcast from the University of British Columbia. Back in one minute. [music]

Hi, you've reached the voice mailbox of the Blue & Goldcast. We can't come to the phone right now, but if you're an artist or musician at UBC, please leave us a message telling us about your work, right after the beep.

Hi, my name is [inaudible], and I'm a producer director. [music]

Las Vegas, sin city, my city. The stage was my home when I didn't have a home.

I think UBC is the reason that I'm a filmmaker. I loved storytelling. I loved books. So I started an English Lit degree, basically. And I took a film production class in my third year. And I think from that point, I really loved the process of actually making films.

Some call me the Queen of Exotic Dancing. Queen of Burlesque, still at it at 85.

The legend, who needs no introduction, Tempest Storm.

Tempest was 85 years old when I first heard about her. And she's such a private person, even though she was exposing herself as a performer in such an overt way. And so I found that contradiction really interesting. And it took a lot of convincing to get her to want to be a part of the project. But I think that that was a worthwhile [laughter]-- it was worthwhile trying to convince her.

A reporter asked me, "What do you think about on stage?" And I said, "Feel just like Muhammad Ali. I'm the greatest."

Tempest Storm is easily the reigning superstar of burlesque.

She was a class act. And when she took her clothes off, it was almost artistic.

And my hope is that people, especially women - because our audience when we made this film is women - is that they feel that they can find some source of inspiration in her story. Bye. [music]

Welcome back to Blue & Goldcast. I'm Santa Ono.

And I'm Jennifer Gardy.

Now Jen, you are a scientist in your right, a very good one. And we're very proud of you here at UBC. Can you tell us a little bit about your own experiences?

It's been interesting. As a women in STEM, I would say that for the first part of my career, it was very similar to Stephanie's. I didn't feel any-- I didn't really notice any discrimination. But it was really as I started to move up the ranks and interact with - I'm just going to come out and say it - an older demographic of scientists, that I started to realize that, yeah, there is visible discrimination. And it's very tangible, and it's very real. A terms that's used frequently these days are microaggressions. And you just start to notice it. It may not be one big you're denied this promotion or denied this opportunity. But there's subtle little things, where you find out that a bunch of your friends have been invited to collaborate on a project. And you look, and it's all male. You are asked to speak at a conference, and you look at the other speakers and the panelists, and they're all men. Just small things where you don't see yourself, and you don't see your colleagues reflected in some of the higher profile activities that are happening in STEM.

Well those microaggressions, cumulatively, are very serious. And there are things that we can do. You probably know of the movement where men refuse to speak on panels that are primarily men--

Yeah.

--unless there are women represented. And I signed up for that.

Awesome. I'm so glad you have.

And I hope that more faculty members and all kinds of individuals on the staff at UBC will embrace that. Because that's the way you break down those microaggressions.

Yeah. Just naming them and making people aware of them. So my friend, Jonathan Eisen, he's a faculty member at UC Davis, in California. And he's always been a vocal advocate on Twitter, calling out what he calls YAMMMs, yet another mostly male meeting. And now you've got this term [manol?] that's entered the lexicon. And you've got Twitter accounts, like GenderAvenger, that let you call out conferences, either for doing a very poor job, or lauding conferences that have done an exceptional job of representing diversity, not just as regards to gender, but across every aspect of science and life. So it's really amazing to see these things happen and see so much attention being paid to it, not just by the younger generation you would expect this sort of positive change and social justice orientation from, but from all tiers of academia.

Well I'll have to remember that word YAMMMs and really make sure that people are aware of those kinds of biases that do occur. We really have to take a principled and clear stand against that in every discipline. Tell me a little bit about your field. What's

the gender breakdown in your field like, especially when you were a student? And perhaps what is it like now? Is it getting better?

It's really good. The life sciences, I think, have always been out ahead of some of the other STEM fields, in terms of having fairly equal, if not majority, female representation. I remember being an undergrad here at UBC in the late 90s. And my biology classes and microbiology courses were more than 50% female. And just a few years ago, UBC's medical school, the admissions of female students surpassed those of male students. And it's just been on an upward trajectory since then. So working in a place like the School of Population and Public Health, and working out of an institute like the BC Centre for Disease Control, public health, it's one of those life sciences where it is very, very female dominated. So I feel very lucky to work in a space like that. And I often wonder if it goes back to the history of role models in those fields. Canada women who've been admitted to medical schools for going on more than a century now. So maybe it's that legacy of mentorship.

But it's interesting, even with that being the case-- and I'm so happy that's the case. There are great women scientists, like Janet Rossant. But still, you talk about the microaggression. So at some level, as you are promoted and move up your career, even with that pool being strong, we still have a lot of work to do.

There's a lot of work to do. But I'm hopeful.

Well that's wonderful. Why do you think diversity, especially gender diversity, is important for all fields, and especially for your field?

Any time you've got diversity, any time you've got different voices in the room and different perspectives around the table, you just end up doing better work. I mean when you've got multiple perspectives, multiple people bringing their lived experience to a problem, you end up with a better solution. Diversity just betters everything for everybody.

And it extends well beyond science. I can tell you that in my executive, the fact that it's majority female, I believe it's much better because of those different perspectives. And I'm so grateful that's the case. [music]

That does it for the December edition of Blue & Goldcast. You can find links to our guests' work as well as previous editions of the show at blueandgoldcast.com.

You can also subscribe to our podcast on iTunes or anywhere you get your podcasts. Just search Blue & Goldcast. And while you're there, give us a rating and review. It helps more people discover the show.

If you have a topic you'd like us to cover, an artist you'd like us to feature, or you just want to ask Santa or I a question, send us an email at feedback@blueandgoldcast.com. You can also tweet at us. Santa is @ubcprez. That's prez with a Z. And I am @jennifergardy.

We're back with a new episode next month. Next year, actually. Happy holidays to you and yours. We'll be back with more programming in January 2019. Thanks for listening. [music]

Did you just record that?

Everything. It records all the time.

So all of this--

They follow us everywhere.

--very casual stuff, you actually play here and there?

Well I pick one funny moment, yeah, and it plays at the very end.

Do you make cameo appearances with your voices like this?

There is one point where you're giving me a hard time [laughter].

Comedy gold here on-- it's the blue and comedy goldcast.