Episode 38 – Danielle Grotjahn: What mitochondria tell us about disease, stress and cell death

Lauren (00:05):

A warm welcome back to another episode of Science Changing Life. My voice may sound a little different to the regular listeners out there. I'm your guest host Lauren Fish. Today we're learning all about the mitochondria. Well, you might remember them as the powerhouses of the cell from your high school biology class. It turns out they're a lot more complicated than that. Joining us is Danielle Grotjahn, who is studying mitochondria to reveal how they impact everything from cell stress to disease. First, Danielle shares what inspired her to pursue this type of research and how a microscope changed the trajectory of her life.

Danielle (00:40):

There wasn't any moment when I was younger that I sort of thought, you know, I wanna be a professor or a scientist. But my scientific curiosity was always a common aspect of my childhood. And I think for me, the initial curiosity was just growing up, being younger. I grew up in Wisconsin, playing outside in the woods. My grandparents had like five acres of land with streams and gardens. And so just really became fascinated with I guess just life

Lauren (01:11):

<laugh>. Yeah. The natural world. Yeah, the natural world. Exactly.

Danielle (01:14):

Yeah. And and then yeah, I I, it's a very cheesy story, but it's true. When I was nine years old I was gifted for my birthday a microscope kit, like a beginner's microscope kit. And I remember thinking it was so cool. It looked, you know, something, a real scientist

Lauren (01:32):

<laugh>. Did it come with a lab coat too, or It did

Danielle (01:35):

Not come with a lab coat, but it came with like the little glass slide.

Lauren (01:38):

Right.

Danielle (01:38):

And like all the oil

Lauren (01:40):

Plate, everything and,

Danielle (01:41):

Yeah. Yeah. Yeah. And so, you know, I would go around and I found it really fascinating to be able to take leaves or like scrape the inside of my cheek and, and look at it. And, and it was sort of like unlocking

an entire new microscopic world. I've been exploring the world around me, but it was now a new world, I guess.

Lauren (02:01):

Yeah, absolutely. I feel like I can exactly picture the microscope you were talking about. I feel like every kid in that range, like of that era had one of those. Totally.

Danielle (02:09):

Yeah. And, and there's something about when you're younger having like an adult thing, you know? Yeah. Like

Lauren (02:15):

You just, oh this is so formal. I'm sure your parents are very proud of the progression. I'm sure they're very thankful that they purchased that. Yes, yes. Absolutely. Yeah,

Danielle (02:23):

They can take the credit for that one. That, that's

Lauren (02:25):

Awesome. So with that covered, hoping you could tell me more about your scientific background, what led you to joining Scripps Research?

Danielle (02:33):

Oh, yeah. So as an undergraduate I enrolled in what's called this honors and research program. And it was actually a great program. It was at the University of Wisconsin Madison where I did my undergrad. And it basically mirrors on a some level what you can expect your trajectory to be in graduate school. So Oh, cool. Your first year you do kind of like rotations. You identify a lab, second year you write a proposal, and then third and fourth year you work on the undergraduate research project. Yeah. That's

Lauren (03:05):

So incredible. Cause I feel like undergraduate so rarely kind of mirrors the graduate experience. Yeah. So you would know exactly what you'd be getting yourself into, especially with something like science where you probably knew you wanted to eventually go to

Danielle (03:17):

Graduate school. Totally. School, although I can say I don't think anything truly prepares you <laugh>. I mean <laugh> like on paper it mirrors it,

Lauren (03:24):

But like, ok, yeah, this makes sense

Danielle (03:26):

<laugh>. Yeah. But it, you know, going to grad school was a different beast I would say. But yeah, so my undergrad research was focused, it was actually very different from what I did in graduate school. So I

was working in developmental genetics lab. Okay. And we used these tiny fish as a model organism. They're called zebra fish. Mm-hmm. <affirmative>. So my project basically involved collecting freshly fertilized zebra fish eggs, and then I would immediately collect them and then take 'em over to the microscope and then watch them literally life grow in front of me. Wow. So I'd watch him go from like a single cell and then it would divide to two, to four to eight continue on the whole

Lauren (04:05):

Mitotic process. Yes,

Danielle (04:06):

Exactly. My project was trying to look at how they call it the spindle apparatus. Oh yeah. It's the components that help basically pull apart the DNA and then also the cells divide how the orientation of that apparatus affected basically how the cell division process interesting occurred. Mm-hmm. <affirmative>. Yeah. So I was basically just watching these spindles go and, and calculating then with the images, the orientation and the cell shape and Wow. Yeah. Yeah. So it was like, I think that for me was really crystallized the idea of using microscopy and, and sort of having this visual representation of life mm-hmm. <affirmative> and then transforming that into quantifications or numbers that we can then understand how life works.

Lauren (04:55):

Yeah.

Danielle (04:55):

Yeah.

Lauren (04:55):

So, and like when something might go wrong or kind of all of the nuances involved in

Danielle (05:00):

That. Exactly. Exactly. Yeah. And then I spent a lot of time on a different type of microscope, like a confocal fluorescence, microscope they call it. And it's very powerful. You can look at things in real time, you can look at all these dynamics. And then very naively, I think as I was thinking about going to grad school, I was like, you know, what are, what are other types of microscopes mm-hmm. Over there

Lauren (05:22):

<laugh>.

Danielle (05:22):

Yeah. You know, and so you know, I found out about this like electron microscope, so that sounds pretty cool. And then, you know, somewhere in my Google searches, I came around this term cryo-electron microscopy, <laugh>. And I was like, that sounds fancy <laugh>. And so, yeah. You know, I think then I just, you know, Googled cryo electron microscopy and graduate programs and then Scripps came up as like the top one. Yeah. And so that's what led me to Scripps was honestly just that like naive curiosity Yeah. Of like following this like passion. And then, you know, of course Scripps is a top graduate program, so that really fit in nicely with sort of my ambitious goals of what I wanted to get outta grad

school. Yeah. So, yeah. So that's what led me here. So I made the move. I had lived in Wisconsin my whole life, so this is my big,

Lauren (06:14):

I was gonna say that was must have been a big shift.

Danielle (06:16):

Yeah.

Lauren (06:16):

Coming up West coast in San Diego.

Danielle (06:19):

Yeah. So yeah, it's like, I'm very happy here and I think that's, you know, probably there's lots of reasons why I'm still stayed here, but kind of the scientific environment is a huge component of that. Yeah,

Lauren (06:29):

Absolutely. And just being surrounded by it. Yeah. Especially up here like on the mesa and everything too.

Danielle (06:34):

Yeah. Yeah. Absolutely.

Lauren (06:35):

And then I do have to ask, is the mitochondria the powerhouse of the cell? <laugh>? I think all the scenarios will want to know the answer to that question.

Danielle (06:43):

So yeah. Mitochondria are sort of the main muse or inspiration of my laboratories research. And out of all of the cellular components, all of what we call these organelles, they by far have the best marketing team <laugh>. Cause they came up with this catch phrase that is burned into everyone's

Lauren (07:04):

Infiltrated everyone. Yeah. Yeah.

Danielle (07:05):

It's almost like a cultural phenomenon. I think so. Like memes on the internet, like I didn't learn how to do my taxes in high school, but I know the mitochondria is the powerhouse of the cell.

Lauren (07:15):

And you're like, that's more important. Yes.

Danielle (07:18):

Yeah. Yeah. So it's, it's actually like, it's a pretty powerful tool I find to communicate or get people interested maybe that are not scientists mm-hmm. <affirmative> in my research, because you say mitochondria and, and or you say powerhouse of the cell, it immediately triggers something. Oh

Lauren (07:34):

Yeah, I remember that. Professional biology. Yeah.

Danielle (07:37):

Yeah. But I have to say, if I were on the marketing and rebranding team mm-hmm. <affirmative> mm-hmm. <affirmative> for mitochondria, I might switch up their catchphrase a little bit. So we call 'em the powerhouse of the cell because they generate energy, the currency, the the cellular energy currency called ATP. But we now appreciate that they do a lot more for the cell mm-hmm. <affirmative>. And they're now sort of, people are changing, not just me, but others are sort of changing their catchphrase to something like the stress sensor or the signaling hub, or I think I even saw someone call them like the CEO of the cell.

Lauren (08:16):

Heard.

Danielle (08:17):

Yeah. Yeah. That is not my original. I, I wish I could knew who to give credit to on that one.

Lauren (08:22):

<laugh> someone else on the marketing team. Yes.

Danielle (08:25):

Someone else on the marketing team. Yeah. Yeah. So so what's really fascinating about them is what we're starting to appreciate is that they're essential hub to receive different signaling inputs from the cell. And then they make these critical decisions of, of how the cell should respond. And so, for example, they have a huge role in dictating cell fate. So whether a cell activates pathways to stay alive and keep growing and propagating, or whether a cell initiates a program cell death mm-hmm. <affirmative> what we call apoptosis. And what my lab is really interested in is understanding how that happens. And in particular, what's even cooler about mitochondria is that a lot of its ability to respond to different stress signaling pathways has to do with its ability to change shape. So they, they're like these like shapeshifting, <laugh> entities inside the south. Yeah. So they can divide, they can fuse together, they can divide just parts of them. Like if they have a damage part, they can selectively get rid of that. They can be transported all over. So they're just, they're very dynamic. Absolutely. Which is like in contrast to kind of how you see them in a textbook. Usually it's

Lauren (09:46):

Like rigid structure Yeah. Powerhouse, you think. Yeah. Not really moving and just kind

Danielle (09:50):

Of like, just like chugging out the

Lauren (09:51):

Foundation. Yeah, exactly.

Danielle (09:53):

Yeah. Yeah. So, so my lab is interested in studying basically the interactions that help them change shape in response to these different integration of these stress signaling pathways. And we are harnessing a cutting-edge imaging technology to do this. So, you know, mitochondria have really been an inspiration for microscopists for decades. What a very famous cell biologist Pilate, he was the first to really image a lot and give us a, a view of the inside of cells and describe these entities that make protein called ribosomes in the cells. And he also has these very famous, beautiful images of mitochondria. So they've, and then, you know, throughout the last century you know, microscopists have not only looked at their, their structure and how they're shaped, but how they move all of these dynamics. But the one thing that we've lacked is really an ability to look at the very fine details of them mm-hmm. <affirmative>. So we can kind of see, it's like being able to look at a car and you see it move, but you don't really understand what are the parts that make it

Lauren (11:09):

Allowing it to do

Danielle (11:10):

That. Exactly. Exactly. And so traditionally what's been done is like if we're going with this car metaphor

Lauren (11:17):

<laugh>,

Danielle (11:18):

We can take apart the car and then we can look at the fine details mm-hmm. <affirmative>, so you could maybe like, take out the spark plugs, <laugh>, this

Lauren (11:25):

Is like the engine. The engine, yeah. My knowledge of cars is limited.

Danielle (11:33):

We could see that, but we haven't been able to see, okay, the detailed spark plug or engine architecture in the context of the overall car and this cryo-electron microscopy or this cryo that I do, it enables us to look at the entire car, the entire mitochondria, and all the detailed parts that make up the mitochondria itself.

Lauren (11:55):

So Cool. When you're talking about the cell death component, I remember one of my favorite quotes from my cell biology teacher in college was talking about your cells are in a constant battle if they should live or die. Yep. And my mind was just blown at that. I'm like, what? That's crazy.

Danielle (12:09):

I know. Yeah. I find you can't think too hard about, like, I, I had that before too. I was like, when you think about like, I can't, I have to stop myself from being like, there are mitochondria doing all these things in my bi, like it just

Lauren (12:21):

Freaks me out. <laugh>. You're like, no, I don't have any mitochondria. It's like completely separating yourself

Danielle (12:25):

From that. Yeah, yeah. No, it's, it's totally fascinating. And I think there's, even though they've probably, they're very widely studied, there's still so much we don't know about them mm-hmm. <affirmative> and they're very complex. And so it's really exciting for my group because when you're sort of the first to look at something in a completely new way, which I think is really what fuels my passion and curiosity for

Lauren (12:49):

Science. Yeah. And it goes back to what you're doing in your undergraduate day two, really taking those very fine details Yep. To kind of unlock whether it's, you know, that's something about disease or just the mechanism in general. Yeah.

Danielle (13:00):

Yeah. And for me, just, I've always been a visual learner mm-hmm. <affirmative>. So it just makes sense to approach biology, research and science from that first aspect of, I just want to see it, I want to look at it from every angle. Yeah. And you know, I think that's also anyone who's sort of worked with me knows that my go-to when I'm trying to understand information is to go up. We have a whiteboard and lab, we have several actually, but to just go up to the whiteboard and start drawing things or on a piece of paper, because that's really how I take in information mm-hmm. <affirmative> and understand it. And so I think that that's very much in line with how I approach my scientific research as well.

Lauren (13:42):

So what is the biggest question in this area you're hoping to answer? The biggest obstacle you're hoping to overcome as you're studying these mitochondria at that very fine level?

Danielle (13:53):

Yeah, I think just going back to this idea of looking at the detailed structure of the parts and as well as having the context of the whole, so looking at the parts of the car and the whole car. So I think one of the, the challenges that we have with the type of microscopy we do, so I've talked a lot about cryo-electron microscopy or cryo-EM. There's a specific type that my lab specializes in, which is called tomography. It's like taking a microscopic CT scan of your sample. And in that you have this reconstructed representation of what the inside of the cell looks like. And part of the reason why we haven't been able to do this for, you know, until up until recently is because we've had this barrier in that it turns out, even though cells are very small when it comes to some of these microscopes we're using, they're too big to really penetrate and see all of the detailed information.

(14:56):

That's been a huge problem in the last five to eight years. Other groups have really harnessed technology to allow us to carve into cells and to trim them so that they're thin enough that we're able to actually visualize these fine details. And so I think what's really exciting for labs like mine that are just starting out, my lab is about three years in and we have this really unique expertise. When we started off, we were one of the few labs that's really specializes Okay. In this carving of cells and imaging CT scanning of cells. Yeah. And so the challenge with that is that sometimes you wanna go after a really exciting question. For example, how do mitochondria change shape? What are the components of mitochondria that allow them to change shape? Mm-hmm. <affirmative>, you start with this very ambitious question. You start tackling it, and then you realize there's some sort of roadblock, like technology roadblock mm-hmm. <affirmative> that you may encounter. And when you're on the bleeding edge of a technology, you may look around and realize that no one has solved this problem before mm-hmm. <affirmative>. And so you can't just use something that someone else has done. You actually have to, you

Lauren (16:09):

Need to invent

Danielle (16:09):

It. Yes, exactly. There's a plethora of questions that we're trying to go after in terms of what is the machinery that helps mitochondria divide mm-hmm. <affirmative>, how do these components assemble around mitochondria and really impart force to divide mitochondria membranes. We also wanna understand how not only the mitochondria, but other components inside the cell, like other organelles. There's another really fascinating organe. I mean, MIT counter is my favorite, but my second favorite.

Lauren (16:38):

I was gonna ask if mitochondrial was your favorite.

Danielle (16:40):

They're probably my favorite. Yeah. I have to say, I do have a love for another cellular component, which are called the cytoskeleton, which are those like spindle,

Lauren (16:48):

The little like microfilaments.

Danielle (16:50):

Yeah, exactly. So yeah, it's hard. Don't make me choose

Lauren (16:55):

<laugh>. I won't tell anyone.

Danielle (16:57):

Luckily they interact a lot, so I can look at both of them at the same

Lauren (17:00):

Time. <laugh>, you don't have to make favorites underneath the microscope.

Danielle (17:04):

Yeah. So we wanna be able to look at how these come together, but oftentimes it's just we hit a wall. And so we have to kind of take a break from addressing that specific question to kind of figure out on the technology side, how are we gonna overcome this barrier. Mm-hmm. <affirmative>. And I think that's yeah. One of the exciting, but also challenging aspects of being, you know, part of any sort of advancing or developing approach. Yeah.

Lauren (17:29):

Being a pioneer at the

Danielle (17:30):

Forefront of Exactly. Yeah. Yeah. So it really feels though, like my lab is at this perfect, like, we're just at the, the dawn of this era where we've spent a lot of time and hard work. I mean, the, I have an incredible team of trainees, postdocs, graduate students, technicians who have spent a lot of work implementing, you know, all the latest advancements mm-hmm. <affirmative>, and we've developed our own approaches. And now it's like this perfect like synergy of just being able to start to tackle some of these questions that, you know, I set out wanting to tackle at the beginning and, and now we're finally able

Lauren (18:06):

To do it. Technology roadblocks initially.

Danielle (18:08):

Yes. Yeah, exactly. Yeah.

Lauren (18:08):

But that's so incredible that you are Yeah. Really at the forefront of this and that you're really changing the game, not just in, you know, studying mitochondria, but I'm sure the rest of the cell

Danielle (18:19):

Yeah. Organized as well. Absolutely.

Lauren (18:20):

How everything

Danielle (18:21):

Interacts. Yeah. I mean, I think there's, you know, when before I started to be a group leader, I think I had this fear like, I'm gonna run out of ideas or, you know, <laugh>, but actually it's the opposite

Lauren (18:34):

<laugh>, right? There's like, there's too many questions, there's

Danielle (18:36):

Too many questions, and you have to pair it down and, and yeah. The, the biggest challenge now is, you know, kind of prioritizing or focusing and figuring out what are the interesting questions that you wanna go after. because it's, yeah. There's not you know, there's certainly

Lauren (18:54):

A long, long list,

Danielle (18:55):

Long, long list. Yeah, exactly. Well, and

Lauren (18:57):

What you were saying earlier about how in science you have to get more narrow, right? You have to kind of focus on something, but I also feel like the more narrow you get and the deeper you go, the more questions you have, because biology can always get that level. Absolutely. and more complicated. Yeah. And so yeah. I'm sure the questions just keep coming as you're starting to learn more.

Danielle (19:18):

Yep, absolutely. And that's what's really great about being at Scripps. And also I think Scripps has several other faculty that are similar to me where they have this unique tool mm-hmm. <affirmative> or approach, and then it really lends itself well to collaboration. So in my lab, we're really focused on mitochondria and harnessing this imaging technology to look at mitochondria, but I can sort of feed that other thirst for looking at other parts of the cell mm-hmm. <affirmative> by collaborating with other labs that are focused on other parts of the cell. And in that sense, it really gives a great back and forth scientifically for making new discoveries.

Lauren (19:58):

Right. And I think everyone I've talked to at Scripps has just really echoed that collaboration is inherent in every lab here. Yeah. And you know, you're at the, you know, cross section of so many different disciplines Yeah. Like structural biology, molecular biology, and just to be able to have, you know, access to like other people and people willing to talk and collaborate openly Totally. I think is definitely something really unique to the culture here.

Danielle (20:22):

Yeah, yeah. No, absolutely. And I think the fact that I can talk to not only people who specialize in areas different from mine, but like the top researchers in the field <laugh> that are different than mine, you know? Yeah. Chemistry and chemical biology and neuroscience. I mean, it really is, it makes it incredible that you can interface with Yeah. Th those that are really on top of the game in that aspect and, and learn from them and just try to understand what makes them curious about science and, and how maybe what we're doing in my lab might be able to help them illuminate new views. Mm-hmm. <affirmative> of what they what they're interested in

Lauren (21:07):

Studying or Yeah. Or if they're asking similar questions that you are asking and what they've learned from their own discovery. So yeah. We've talked a lot about the form of mitochondria and the structure

of mitochondria, but how do, how have you found that mitochondria implicate things like disease or kind of the inner workings of the cell? Totally.

Danielle (21:26):

yeah, I mean we would probably need like two hours to go over

Lauren (21:31):

All.

Danielle (21:32):

Yeah. It turns out mitochondria implicated in so many aspects of cell health. And because of that also in disease, just to narrow down the things that my lab is interested in, one, as I mentioned before, there's this self fate aspect about mitochondria. And so that's really important for diseases such as neurodegeneration. Mm-hmm. <affirmative> where you have mitochondria thought to play a role in the neuronal cell death process. And so a lot of neurodegeneration at the heart of it is overactivation of pathways that lead to premature neuronal cell death. On the flip side, you have diseases like cancer where the pathology or the detrimental aspects of cancer are that you have uncontrolled cell growth mm-hmm. <affirmative>. So you have these two sort of very groups of devastating diseases where one of them, on the one hand you have where you want to preserve the life of, of cells, and on the other you want to control the division and sort of control that program cell death aspect.

(22:44):

Mm-hmm. <affirmative> and mitochondria or sort of play a role in, in both. Right. But we don't quite understand how their function ultimately leads to these very distinct outcomes. Mm-hmm. <affirmative>. And one thing that's similar is if you look inside of, for example, cancer cells, and if you look inside of for example, tissue from a patient that suffered a, a neurodegenerative disease such as Alzheimer's, what you find in both of them is that the mitochondria are very fragmented. Interesting. They're very small. So there's like this hyperactivation of the division, or we call it the fission pathway mm-hmm. <affirmative>. So that's confusing <laugh>. Right.

Lauren (23:30):

They are two different faiths, two different outcomes,

Danielle (23:32):

Two, two different outcomes. And so something must be very different about the interactions that mediate the division of mitochondria where in cancer as opposed to a, a neurodegeneration mm-hmm. <affirmative>. And so, okay. So that's interesting aspect number one. But it turns out that even in just a normal healthy cell, mitochondria are constantly dividing, fusing, I mean, and that's just a normal part. So it's not like dividing mitochondria automatically equals disease. I mean, that's a part of their function. Right. And it turns out we don't even really understand how mitochondria divide even in a healthy situation, even in a normal functioning cell. And so what my lab is interested in doing is looking at all these different contexts, both in healthy states mm-hmm. <affirmative> as well as in, for example, patient derived cell lines or different models of disease in cell culture to understand what is this machinery that helps mitochondria divide. And by understanding what it looks like, how it assembles, how everything interacts on that very detailed level mm-hmm. <affirmative> both in healthy samples as

well in these two very distinct disease states, we might be able to understand what areas we can eventually target or to halt the progression of this from happening. Right.

Lauren (24:55):

And just better understand.

Danielle (24:56):

Yeah.

Lauren (24:57):

That's really interesting that you know, just comparing it to normal cell division, we know so much about the cell division Yeah. Mitotic process, but why has understanding mitochondria division been such barrier? Is it because of the technology? Yeah. Kind of dearth of Yeah,

Danielle (25:13):

That's a great question. I should say. You know, we do know quite a bit about it. We know a lot about what proteins or what these molecular players are involved. Mm-hmm. <affirmative>, we know that there's other, this endoplastic reticulum, I guess my third favorite Organal,

Lauren (25:28):

<laugh>, <laugh>,

Danielle (25:29):

We know that that's involved. We know my second favorite the, the filaments are involved mm-hmm. <affirmative>, but we don't really quite understand how they assemble. And Yeah. Getting to your point, it's really because we haven't had a way to dive inside of cells and look at it with enough detail to be able to understand those interactions. Right. Part of the problem too, a lot of times in biology, in order to understand the details of something, we sort of take all the components out of their cellular environment mm-hmm. <affirmative>, and we look at them in isolation. But it turns out with mitochondria, they rely so much on their interactions with everything itself

Lauren (26:02):

In the environment. Yeah.

Danielle (26:03):

That you can't really do that. It, it's like observing a lion in captivity versus out, you know, in like in environment

Lauren (26:11):

Sexual habitat.

Danielle (26:12):

Right. Yeah. Yeah. So that's been a huge challenge. And so that's really why a lot of these questions have been left unanswered. So

Lauren (26:20):

When you're not in the lab, what are some of your other hobbies or interests? <laugh>

Danielle (26:26):

That is a's favorite question? <laugh>. yeah. I think as a graduate student I got really, and also just living in San Diego, it's hard not to become very active when

Lauren (26:38):

You're here. Yeah. I think you have to. It's just part of the culture. Yeah.

Danielle (26:41):

Yeah. Like if you're sitting your couch and this, it's just sunny outside, it's like passive aggressively sunny, you know, <laugh>.

Lauren (26:49):

Yep.

Danielle (26:49):

Yep. You're like, I gotta get out. And so, and, and for me sort of working out and exercising became a huge stress reliever mm-hmm. <affirmative> as a graduate student. And so, you know, I think I carry that with me now. I love to be active. I do lots of different workouts. Like I love yoga. I do the spinning, like in indoor recycling and you know, beyond that, just going to the beach also. I recently purchased a paddleboard. Cool. I've been going on that. Yeah. So I think for me, that's probably outside of work, like if there's an activity I'm gonna choose to do, it's probably something either outdoors mm-hmm. <affirmative> or something very active.

Lauren (27:28):

So final kind of roundup

Danielle (27:30):

Question. Okay. If

Lauren (27:32):

You could give one piece of advice or wisdom to an up and coming scientist, what would it be and why?

Danielle (27:39):

So I think probably the best piece of advice I could give is to as early on as you can really identify, recognize, and then eventually celebrate both your strengths as well as your weaknesses. And I think this is something that, you know, I take very seriously because I, for a long time, I never really felt like I identified as like a scientist mm-hmm. <affirmative>, although, you know, I always, I pretty much excelled in my biology courses and high school and in college and, you know, I was in a lab, but I sort of felt like there was some part of my personality that didn't fit, you know, the quote unquote mold s scientist mold. Right. Exactly. And, you know, it didn't really phase me too much, but it was always kind of this lingering thing. And I couldn't quite put my finger on it though, because it's, yeah.

(28:41):

Like I said, I mean, I was in the same study groups as everyone else. Mm-hmm. <affirmative>, I was doing the same things and my same cohort of graduate students and whatnot. And I actually they, I took sort of a career planning course as a graduate student mm-hmm. <affirmative> and part of that, they have, you go through the sort of battery of these different personality and strengths finder test mm-hmm. <affirmative>. So I did like the Myers-Briggs Oh, right. Strengths finder. Yeah. Like all of that. And that was super illuminating for me because, you know, you kind of go through it and you can identify those parts of you and you, you read it and it's like, wow, this is like, this is me, this is me. Like this is like crazy. you know, and it's a spectrum mm-hmm. <affirmative>. So there's some things you're kind of like, oh, I don't know. But like there's, you cling on to those things that you really identify with. And then on top of that, being able to really identify what your strengths are, like, what your natural sort of inclinations are, what do you nat everyone's born with, like certain natural abilities doesn't mean that you can't develop, you know, skills in other areas you weren't born in, but you have this natural tendency. And part of this, I think was also, they had this list of what would be the

Lauren (29:55):

Career, career, ideal career based on your personality.

Danielle (29:57):

And I think scientist was like number eight or number 10, <laugh> three. And at the top was like social worker, teacher, you know, lots of other sort of things. And you know, I think that actually was, I wasn't discouraged by it. It was like an aha moment. I was like, oh, wow, this is actually really kind of crystallizes this feeling that I've had. And it's not like there's something wrong with me. Or most importantly, it's not that I don't belong here. Right. I've made it here. I'm, I'm here already. Right. It's that this can kind of explain like, my natural inclinations towards certain things is different than maybe others. And I think, you know, it's not just science, but we, I think science definitely on certain aspects, it selects for certain personalities Right. Over others. And it doesn't mean that if you have a different personality, you can't be a scientist.

Lauren (30:50):

Absolutely. Yeah. Well, and you can, I mean, like you mentioned teaching, that's such a huge part Absolutely. Of your work here and leading a lab.

Danielle (30:57):

So I think for me that yeah, that's exactly what happened. It was that it was that moment where I realized, and I, I could focus on that and think, what, what is it about the things that I'm naturally good at that I can bring and actually enhance the scientific community? And on top of that, it also helped me understand areas that I struggled with. Mm-hmm. <affirmative>, you know, why was, you know, in certain certain ways that I, like we were talking about, I'm a visual learner, you know, that there's a lot about how you perceive and input and output information mm-hmm. <affirmative>. And I think for me, it was also very useful to understand what areas I sort of don't naturally gravitate to and what I can do for myself to sort of compensate and overcome for that. Right. And so I think that's really important because there's this concept that can happen called imposter syndrome, right.

(31:51):

Where you, it's exactly what I, you know, I feel like I don't belong. Right. Like I'm gonna be found out. And so for me, I think this, as a group leader now, it's really something that I value and place a lot of

weight on, is really creating in my lab a very diverse environment that span different personalities, different demographics, socioeconomic statuses. Mm-hmm. <affirmative>, all of these across the spectrum of diversity. Right. Because I think it's important to have not only all different voices, but to think about how the labs can better represent the communities we hope to serve. Absolutely. And so, yeah, I think that that would be my advice is, you know, if you're feeling sort of, I don't know, insecure or not, that you don't fit in, try to understand yourself a little bit better and contextualize, and I identify what you're really good at. Mm-hmm. <affirmative> and what you can, how you can harness that right. And bring it to the table.

Lauren (32:45):

And with that stage advice that brings us to a wrap for today. Many thanks to Danielle for hopping on and giving us a much better understanding of the different roles that the mitochondria play in the cell, and especially how these organelles can impact diseases like cancer and neurodegenerative disorders. To learn more about Danielle's research and other Scripps research content, be sure to check out the show notes. A big thank you for tuning in with us today on another episode of Science Changing Life. Until next time.