Minerva Contreras (00:00):

So what is the mind? How can anyone lose it? How does the brain work? What is a neuron? What is the biology behind the brain malfunction? All these, and so many more, questions arose in my mind, and I knew there had to be a scientific explanation to what was happening to my dad.

Eric Cross (00:18):

Welcome to Science Connections. I'm your host Eric Cross, and that was today's guest talking about her personal motivations for studying the brain. This episode, we're exploring how storytelling and science are a powerful pair, with Mini Contreras. Mini is a neuroscience doctoral student on a mission to make science careers more accessible for children from underrepresented communities. Today we'll talk about her research, her new co-hosting gig on Crash Course, and how a family crisis sent her hunting for answers about the mind. Please welcome to the podcast Mini Contreras. Thank you so much for being here. I'm excited because there's so much about you and so much you represent that resonates with me as a teacher and the students that I serve. We've been doing the Draw a Scientist activity. Are you familiar with that?

Minerva Contreras (01:12):

Yes. How's it going?

Eric Cross (01:14):

Great. But I'm not glad it's going great, because of the reason why we do the Draw a Scientist activity. You know? So the purpose behind it is to show how students perceive scientists. We have a beautiful eclectic diversity at our school, of students from all different backgrounds. But our students still imagine scientists based on what they saw growing up, in cartoons and whatnot. So they draw it ... we look at the data; we analyze perceived gender, ethnicity, hair type, are they wearing lab coats? And then they notice that there's these trends. Like, we always draw the same people. Every class drew the same ... basically, someone that looks like Albert Einstein.

Minerva Contreras (01:48):

OK.

Eric Cross (01:49):

Yeah. I ask them, "OK, everybody name a scientist that's a woman. In your tables, come up with as many as you can." And they go, "....We don't know any."

Minerva Contreras (01:59):

Yeah <laugh>, that's sad.

Eric Cross (02:03):

Every once in a while, Jane Goodall gets a shout-out. And then Marie Curie. That's it. And then for them, 'cause something had failed them, like, whether it was pop culture or education, they just weren't exposed to it. Right?

Minerva Contreras (02:14):

Yeah. It's not their fault at all. Not at all. It's ours.

Eric Cross (02:19):

But for them ... it feels like they feel bad. And, all right: A scientist from a Spanish-speaking country. Any Spanish-speaking country. Name a scientist. And they're like, "What? Oh, I don't know!" And so once we go through all that, we talk about: Why is it like this? And then I show 'em a slide of all the scientists they probably grew up with, and I said, "They're all amazing scientists ... but do you notice the same trend that you saw?" And then we create scientist posters afterwards. And so I use the I Am a Scientist website. I have a Google spreadsheet that has 250 scientists from all different identities, cross-sections, everything. And they get to pick. And then, SACNAS has Chicano, Native American, Indigenous scientists, and they get to pick anybody that resonates with them.

Minerva Contreras (03:04):

That's awesome.

Eric Cross (03:05):

And so they do. And I'm just gonna show you right now. We're using Canva. So, right now, one of them, actually many of them ... this is one of my students' poster. Can you see it? So, you're on many of their posters. Because I said I was gonna talk to you today. So I kind of gave 'em a little bit of background. And so they were all on Google. So if you start trending on Google, it's because a bunch of 12-year-olds were Googling you all day.

Minerva Contreras (03:33):

You're gonna make me cry! <Laugh>

Eric Cross (03:36):

You inspired them. I showed 'em a clip from your Crash Course, and then I showed 'em a little bit about your background and some of them went on your Story Collider. And they got super into it. So it's all you and the inspiration you're doing.

Minerva Contreras (03:51):

Let me put myself back together. <Laugh> That's really cool. Thank you so much for sharing that with me. Really means a lot. Really.

Eric Cross (04:00):

All right, formal welcome: Thank you so much for being here. And because you're at the Salk Institute in San Diego, I'd love for us to start off and talk about some of the research that you're doing. Maybe just talk about some of the work that you've been doing at Salk.

Minerva Contreras (04:18):

OK. First, thank you for inviting me. I'm super-excited to be here. I'm even more excited that you're a local and I feel like we should be best friends now. OK? <Laugh>

Eric Cross (04:27):

Yeah. Yeah. It's official. It's done. We're here.

Minerva Contreras (04:30):

Great. Deal. OK. The question: What do I do for research, right? So I'm a PhD student. And I am officially a PhD student in the neurosciences grad program at UCSD. But my lab is at the Salk Institute, which some of the faculty are affiliated with at UCSD. And my advisor is Nicola Allen. And our lab focuses on studying astrocytes, which are these really, really cool cells in the brain that are not neurons. And they're a type of glial cell. And glia comes from the word glue, because many, many years ago, people thought their job was to just be there to offer this kind of net support for neurons. But now we know that they're super-important. And so what I do specifically, I'm interested in how these cells, the astrocytes, are able to regulate how our brain is able to change itself in response to experience. We know that our brain has the ability to change its connections, and it's really cool because when we're young — you must be really familiar with this because you're a seventh grade teacher, and the students can pick up things pretty quick — whether it's learning science or learning how to play an instrument or if they're interested in learning a new language, it's a lot easier to pick up those things when you're young, because your brain is a lot more plastic. So in other words, it can change a lot more than when you're an adult. When you're an adult, all these things become harder, right? And there's a reason for that. It's not like, "Oh, you're done learning; we're gonna stabilize everything." The reason for that is that the amount of plasticity that we have as young people, if we had it as adults, it wouldn't be optimal, energy-wise, for our brain. It would just be a super-high-energy demand. So there has to be like this stage of development — we call it the critical period — when plasticity is really high, where the circuits stabilize. And all of this happens with the input of sensory information. So whether it's vision or audio or whatever sensory information, as you experience the environment around you, these circuits are going to understand and interpret what are the connections that they need the most. And then they're gonna stick with those. And so there's still some plasticity when you're an adult, but it's not as high as when you're young. And so what I'm interested in is how these astrocytes are able to regulate change in plasticity, and what is different about them that allows them to, instead of allowing a lot of changes to happen, to be like, "This is enough. We're gonna put a break on these changes and we're gonna stabilize everything." <Laughs> I can go on forever, clearly.

Eric Cross (07:23):

No, this is great. Please, continue.

Minerva Contreras (07:25):

The reason that astrocytes are in such an ideal position to regulate this thing that happens in our brain is because they literally attach their little processes or their little branches to synapses. And synapses are where neuron-to-neuron communication happens. So they wrap these synapses, and then they can sense what's happening there, and they can regulate what's happening there. And we know that they change with age. So I'm super-excited. I'm actually in the process of analyzing some exciting data and hopefully it'll be exciting stuff. So that's what I do. <laugh>

Eric Cross (08:07):

This is starting to make sense, for a lot of reasons. Because what I teach at my grade — it's seventh grade, it's right when puberty is really starting to take off.

Minerva Contreras (08:16):

Yep.

Eric Cross (08:17):

And dances and fads and memes and all of those things are super-active. <Laugh> And as TikTok — not so much now, but a few years ago, all the dances would come out and all the kids would pick 'em up super-quick.

Minerva Contreras (08:29):

Yeah.

Eric Cross (08:30):

And I struggle to stay up on 'em. But they just pick it up. Is there any correlation between, hypothetically, age of seventh graders and activity of these — you were talking about these astrocytes that are hyperactive. Is there an age where it's most active?

Minerva Contreras (08:48):

So, yes. For different things. I guess that would be like a little bit of like the motor cortex and the auditory cortex, I would say. And everything, right? You need to see these videos in order to learn the dances. I don't know. I actually don't know the exact age where this plasticity is heightened. It's a good question.

Eric Cross (09:09):

I'm just fascinated by the neurodevelopment of a teenager. And like you said, the adults, it would be hyperactive because it'd be ... tell me if I'm summarizing this right, but if we did that as an adult, if our brains were still functioning that way, we would just be overwhelmed.

Minerva Contreras (09:24):

Yes.

Eric Cross (09:25):

It would just be way too much, too active. And so does it kind of taper off like as you age?

Minerva Contreras (09:30):

The synapses I talked about, they can literally grow new synapses or retract synapses. And the brain is really cool in the sense that it has excitatory neurons and it has inhibitory neurons. So the inhibitory neurons inhibit the excitatory neurons. And it's like this like negative feedback loop, happening all the time, as you experience the environment. And so the inhibitory neurons are really important, because they kind of like stop hyper-excitability in the brain. We now know that there are some diseases that are associated with changes in plasticity, like schizophrenia and autism. And a lot of these things that you would expect in a healthy brain are not observed in diseased brains. And there's changes in these levels of plasticity.

Eric Cross (10:25):

This is fascinating, because as a teacher, I'm thinking about classroom management. And what my young people do in class. And some of the things are just ... they're off the wall. And you ask them — and they're great, loving, caring human beings — but <laughs> you could just see their biology just coming out of them. And there'll be times like, "Hey! Hey, what are you doing right now?" And they're like, "I

don't knoooow." <Laugh> And they're just reacting to stimulus. It's just reactions. And I feel like I could see, externally, what you're discussing, going on in the world right now.

Minerva Contreras (10:58):

Yeah, it's like, tzz tzz tzz tzz tzzz.

Eric Cross (10:58):

Yeah, yeah, exactly! It's just like a lightning storm! And then they come back, as an eighth grader or a high school student, and they're completely different. It's like night and day, just watching that development. I've been doing that for years.

Minerva Contreras (11:14):

Cool. I miss the seventh grade.

Eric Cross (11:16):

Yeah. <laugh>. It's so much fun.

Minerva Contreras (11:20):

I bet.

Eric Cross (11:20):

I say they're like the skinny part of the hourglass. Where they go from little kid to full teenager and everything is new. But you know, you gotta be a certain type of teacher for that. Some run for the hills. But for me, I feel like that's my spot, right there.

Minerva Contreras (11:33):

Mm-hmm.

Eric Cross (11:34):

So, you're currently pursuing a PhD in neuroscience. But the brain wasn't always on your radar, right? You were an art student prior to that. I thought this was fascinating. And I want you to talk about it, because as a classroom teacher, oftentimes at this age, younger students go, "I'm not a science person; I'm not a math person; I'm an art person." Or "I'm a science person; I'm not a creative." Very rigid, as far as what kind of person you are. Yet, you pivoted from this classic .... art to science. Can you talk about how you did that? What motivated you to do that?

Minerva Contreras (12:12):

Yes. I think one thing that I never really paid a lot of attention to is ... we must all be, but me, particularly, my teenage years, early twenties, I was really into like figuring out who I was and what my passions were. And so I would try everything, right? And I was in art school, actually, after being in business school. <Laugh> So I was in business school for three semesters. And then I was like, "This is, I don't know, it's kind of like boring. It's not really for me." So then I was like, "I wanna do something super-creative." And then I went to film school. And then I got kind of bored. And as I was in film school, I was in a directing class. For me, it was like, "How can you direct a person without fully understanding psychology?" Right? So I would start reading a lot about psychology. And at the same time, in my family,

my relationship with my father was kind of struggling. And I was seeing in him certain behaviors that were not typical and very, very strange. And they would just like leave me thinking a lot. And so these two things kind of like played an important role in me starting reading about the brain. And as I was reading about psychology, I wanted to know WHY. Right? So psychology tells you ... a lot of the studies in psychology are correlation. There's an association between this behavior and this experience, or things like that. But I always wanted to know WHY. So then that took me to read about the brain; like, literally brain anatomy. And then I learned that like there are these things called genes in your DNA that kind of regulate what happens in your cells, and that there are cells in your brain that regulate what happens in your brain, and that whatever happens in your brain regulates your behavior. And I was just like, mind blown. Right? So I was like, "I can't stop reading about this. I wanna know everything. I wanna be one of the people that figure out these things." 'Cause clearly there were a lot of black boxes, right? And so I moved to Mexico, 'cause school's way cheaper. And I was able to keep my job here in San Diego, but remotely for the weekend. So that was perfect, 'cause that money was enough to live. And so that's kind of like how it happened, really.

Eric Cross (14:33):

That's great. And it sounds like you were saying, because of your father's health challenges, that motivated you to become hungry. But you didn't just read a book or two; you course-corrected and said, "I'm gonna go a thousand percent, <laugh> become a scientist." What it sounded like you were saying is that your dad's health issues really motivated you to learn more. But you didn't just learn more. You went and completely course-corrected your trajectory of life, and said, "I'm going to become a scientist and study this." Is the work that you're doing right now, does that connect to what your father experienced?

Minerva Contreras (15:08):

In my head, 100%. But <laugh> ... so in science you can call something "basic science," where you're literally just trying to understand how things work. And then there's "translational," where you try to take this knowledge from basic science and turn it into something that translates into, you know, treatment for human diseases or things like that, right? What I'm doing is basic science. And actually, from the very beginning, we have a lab meeting and you get to present, every two months, your progress and your research. At the beginning of the program, I would, you know, give my background and then bring out schizophrenia, right? And how that is a plasticity; it's a brain disease that has a lot of plasticity, alterations, right? I'm passionate about it for multiple reasons. And so I tried to connect it many times in that meeting. And then everyone was like, "No, no, no. You're reaching too far." But I'm in a room full of scientists, right? And I think, just based on the fact that I went to film school and I did all these other things with my life, I'm always like, "How do I sell my story in a way that is super-interesting?" But in a room full of scientists, everyone wants you to be very objective. So for me, it does connect, 100%. I'm trying to understand how plasticity works in the brain, and I know that this disease that I'm really interested in better understanding and eventually hopefully finding a treatment for, I know that there's a high association between plasticity and the disease that I'm interested in. So even if I can't really say right now that I'm curing schizophrenia, I'm definitely, in my mind, understanding the things that are going wrong in the brain that allow these types of behavior to come out in a person.

Eric Cross (16:54):

I appreciate you explaining that difference between ... you said basic science, and then there's the kind of practical application where we hear about the science being done, and these breakthroughs ... but then there's this gap between when I could actually go to the doctor and get a prescription and heal

myself, right? And I got really excited when you said you took all of these different backgrounds and then you applied it into this boardroom of scientists. I've heard from different PhDs that it's not uncommon for people to go from being a bartender and then get inspired by, like, sea urchins and then just deciding to just go full-course into researching sea urchins like that. A lot of people with PhDs have these eclectic backgrounds. It wasn't always just academia. Now, your story arc is starting to kinda make sense. 'Cause I wanted to pivot and talk about Crash Course — which, by the way, just as a science teacher and a former science student at one point in time — the legacy of those videos got so many of us, and my students, through many of their science courses <laugh> ... I think it was John Green? The original ones?

Minerva Contreras (18:10):

I think it was Hank. Well, I guess Hank was ... I'm thinking about biology. But they're both in the videos. Yeah.

Eric Cross (18:16):

Yeah. They were both doing it. So I love Crash Course. I love the whole YouTube channel. And I was excited to find out that you and Dr. Sammy Ramsey are gonna be co-hosting the new biology course. And you're delivering the lessons in Spanish, which I played in my class, by the way, today, for my students.

Minerva Contreras (18:32):

Ooh.

Eric Cross (18:32):

And then the room got silent. And they were just <laugh> listening to it. And some of my students point at the screen. They go, "I show this to my sister! I show this to my sister!" They're losing their minds.

Minerva Contreras (18:43):

That's awesome.

Eric Cross (18:44):

You're already busy doing PhD research.

Minerva Contreras (18:48):

Yes. <laugh>.

Eric Cross (18:49):

How did you get involved in this and why was this important to you to do?

Minerva Contreras (18:55):

Yeah, so I'll start with the second question. So I went to undergrad in Mexico for financial reasons, like I explained earlier. And I think there, more than here, the divide between a scientist and the general public ... when I started in school and I started learning all these things, it not only like taught me all the basic things that I needed for my major, but it also taught me a different way of thinking about the world and the problems that our society faces. And so to me, it became a goal to be a bridge between

the general public and science. And the reason for this is because I know that science is important. I believe in the scientific process and how we use the scientific method to come, to solutions. And so I was able to see that the general public doesn't really trust science. And I think the reason for that is that when you read something about science, there's a lot of jargon and a lot of technicalities that I don't know; the audience seems very specific. So it became one of my goals to not only be a science communicator, but also do it in Spanish. Because I'm fully bilingual. I feel perfectly comfortable in both languages. A little bit more in Spanish than in English, but still. And so—

Eric Cross (20:19):

That's awesome. I'm still trying to get English right. <laugh> So praise to you for being multilingual <laugh>.

Minerva Contreras (20:26):

So if I can do it in English, then I'm definitely gonna do it in Spanish. 'Cause my family and my closest friends, everyone speaks Spanish, you know? So I just wanna be the person that bridges the scientific community with the non-scientific community. And so how I got involved ... I try to do it with my wife. 'cause my wife is a medical doctor. And we try to make videos about health and a little bit of science and things like that. But we didn't have the level of production that Complexly, which is the company that does Crash Course, does. I mean, with the animation team. I mean, I just learned yesterday that this project has been in the works since 2019. So, it's a crazy process. And it involves a lot of people. And it involves a lot of talented writers and script editors, and so, it's a huge team behind this. So I have a friend in my PhD program, his name is Christian, he received an email from Yale Ciencia Academy, which is this initiative to connect Latino scientists. And Complexly reached out to them, and they were like, "We need someone that has experience with video or is comfortable on camera, that speaks Spanish fluently, and that has a biology background, is a biology professional. Preferably a scientist. And is into science communication." And so he was like, "This sounds exactly like you! You need to reach out to this person." And so I did. And they sent me a script. I read it — like, I filmed myself reading it. And then they called me, and right away I got it. So it was really cool. And I was like, "This would mean so much to me. Like, you don't know how much this would mean to me, to do this with you. I believe in the project, and I haven't even seen, you know, all of the scripts." And so, I don't know, I think we just clicked. And I'm so thankful for the opportunity. I mean, it's so beautiful. Every time we do a video or every time I read a new script, and then I'm allowed to give my input, too, right? And be, like, "This doesn't make sense to me." You're like, "I wouldn't really say this." And so it's not really a direct translation; it's also an adaptation. Because we want it to be culturally relevant for the Hispanic community. So it's just ... I mean, it's a beautiful project.

Eric Cross (22:46):

Yeah. Your energy is so great in these videos. <laugh> I'm basic Spanish. Like three, four, from high school. I'm listening to it, and even just the vibe that comes off these videos, you can feel. So keep doing what you're doing.

Minerva Contreras (23:00):

Thank you.

Eric Cross (23:00):

Because they're great.

Minerva Contreras (23:02):

Thank you.

Eric Cross (23:03):

Continuing with that communication theme, you're co-deliver the keynote for the next NSTA, National Science Teacher Association, this October. And I love the session title: Using Stories to Connect With All Learners. Every year when I start teaching, the first day, I tell my story — my why, of who I am — to my students. I start there. And I just wanted to ask you a little bit about you choosing that topic. Is there anything about our brains that have to do with stories and connections, at all?

Minerva Contreras (23:37):

Great question. First of all, it blows my mind that I'm giving a keynote for the NSTA conference. I'm like, what?

Eric Cross (23:44):

<laugh> Right? Isn't that crazy? That's awesome!

Minerva Contreras (23:47):

Yeah. I can't believe it. I mean, I don't know. I'm really fortunate. And I really believe in what we're doing. So yeah, I'm glad to be able to tell my story for the NSTA conference, and like you said, telling your why is so important. What's the deal with our brains and storytelling and the way we're doing these videos and why we're using this tool to try to teach biology? Yeah. So our brains are hardwired for storytelling. And what that means: Remember how I told you that like when you're young, all these connections are happening all the time and then like they like form and dissolve and form and dissolve?

Eric Cross (24:19):

Yes.

Minerva Contreras (24:20):

So when I say hardwired, it means that the wires have been hardened, right? Like, the wire from like one neuron to the other, and these circuits — which is what we call them — are hard now. Which is like...

Eric Cross (24:35):

Like, physically? Like, is it actually physically hardened?

Minerva Contreras (24:37):

No. So <laugh>, that's where I was gonna....

Eric Cross (24:39):

Or is it like hardened like it's stuck?

Minerva Contreras (24:42):

Yes.

Eric Cross (24:42):

Like, when you say hardened, what do ... OK, OK. Yeah.

Minerva Contreras (24:44):

So it's stabilized, right? It's very unlikely that it's gonna go away. And the hypothesis is that, you know, we needed stories in an evolutionary sense, because how did you warn others that there was danger? Or, you know, there's this food that we found and the community tried it and someone died from it. But before we had text or mass communication, when society was evolving, these stories came in really handy. Just basically for survival. When you use stories to deliver information, you kind of immediately trigger an emotional connection with the audience. And so, what we're trying to do is use these tools to make biology more engaging, more relevant to what's happening now in the world. Because, you know, the way you were taught by ... I don't know about you, right? But me, the way I was taught biology in high school, it was just like a bunch of facts that I needed to learn. And nobody told me that behind all these facts, there was so much really cool discovery that had to happen for us to understand these things. And so we believe that the way of teaching science is ideally teaching about the scientific process and the discovery. And these discoveries are done by a bunch of scientists from all walks of life. Although, as you know, opportunities for people from minoritized backgrounds have been lacking for some time. But now we're trying to change that. It doesn't mean that like people from minoritized backgrounds didn't have these scientific ideas, right? They just didn't know that that's what they were doing. So that's what we're trying to do. And that's why we think this is a really efficient way to teach science. Because your brain is already wired to do that. So you can use this tool, that your brain is gonna love, and then teach these concepts that are supposed to be really hard. But then if you make them like relatable, then it's a lot easier for the students to connect with the stories and to absorb the knowledge

Eric Cross (26:46):

In a way you're using science to teach science.

Minerva Contreras (26:48):

Yeah. <laugh>

Eric Cross (26:49):

You're using the science of how our brain works to teach science. Which just makes sense. But you were like, "Why wasn't it done that way for so long?" Like, you were right. Science for a lot of people was like just fact memorization.

Minerva Contreras (26:59):

Yes.

Eric Cross (27:00):

And when it's embedded in a story, all of a sudden, like it makes sense to us. And so many cultures revolve around or venerate stories, storytelling. And you know, even when you sit down and you talk about something with some of my students, <laugh>, I'm kinda like a bottom line "get to the point" kind of communicator. But some of my students, when they tell stories, it's like this whole ... it could just be what happened at lunch. <laugh>. And I'm like, "I ate some carrots and some ranch and that was it." But this was this whole story of who was there, what colors of what clothes they were wearing, like all of

this color in the story! But for them, that's how they communicate. That's how they remember the incident, the situation, and all of that. That's exciting that you're gonna be talking about that with Dr. Ramsey. I hope I could hear it. 'Cause I want to go. And I want to be able to listen to you talk about it.

Minerva Contreras (27:47):

It'd be so great to see you there. You should go.

Eric Cross (27:50):

I'm trying, I'm trying. <Laugh> Now, you're on Team No Sleep, clearly. Because you're doing all these things. And I got another one I want to ask you about. I don't know how you have the time to do this. You must have that gene where people could only sleep for four hours and they're fully refreshed.

Minerva Contreras (28:08):

I don't have that. I need my sleep! Sleep is important! <Laugh>

Eric Cross (28:11):

You don't have that. OK. OK. OK. I just wanna check. I always envy those people. My students swear that it's them because they go to bed late and wake up early and they're fine.

Minerva Contreras (28:20):

Tell them they need their sleep! Sleep is really important. Especially like at their age. They should get their sleep <laugh>.

Eric Cross (28:26):

I try. I try. Can you tell me about your directing role at Colors of the Brain? So, KIBM Undergrad Scholars Research Program? That is a whole other thing that you got going on. What are you doing with that initiative? What is that?

Minerva Contreras (28:44):

OK. So this started as a grad student organization in 2016 by other grad students in the program. And I joined when I joined the program in 2019. And at this point, we were like a mentoring organization of a bunch of grad students trying to demystify the journey into a PhD program for undergraduates. And this initiative was particularly designed to help historically excluded and marginalized populations in neuroscience, specifically. So as we were mentoring all these kids — or not kids, young adults <laugh> — all the undergrads, we noticed—

Eric Cross (29:23):

I do the same thing. <laugh> I say the same thing. And some of my first students are like 34 years old and I still call them kids. And I go, "I'm so sorry. <Laugh>. You're still 12 in my mind."

Minerva Contreras (29:32):

Yeah. If you're a student, you're a kid. I'm gonna be a student for the rest of my life, so I'll be a kid for the rest of my life. Hopefully.

Eric Cross (29:40):

<laugh>. That's fair. That's fair.

Minerva Contreras (29:42):

So when we were mentoring these kids, one of the things ... if you wanna get into a PhD program, you need to have research experience. Because especially nowadays ... back in the day, I don't know, some PhD programs probably admitted you without having research experience, 'cause doing a PhD is a training thing. So you are learning how to do science independently. It's like a training program, right? So even though you do reach some level of independence, you're a trainer. And nowadays, they're so competitive, and you do have to have research experience. And so we had some undergrads that were first generation, or came from historically excluded and marginalized populations, and they never knew about science or research. Like me! I didn't know that you could be a scientist for a professional career. And I didn't know what that meant. Right? Yeah! They don't know. And then all of a sudden they take a neurobiology course and they're like, "This is so cool! I wanna do this!" But at the time, they're already juniors or even seniors, right? So we noticed that all these kids that are coming to realize that they could be really interested in scientific research are coming kind of late in the game. And they don't have all the bullet points checked off that a privileged kid would have. So we created this summer research program where we fund them. Because the other thing is, all of these kids, there's a high correlation with having a financial need and belonging to these populations. So we fully fund them and we're supported by the KIBM, which is the Kavli Institute for Brain and Mind. They give us the money to be able to pay the undergrads, and then we put them in labs. And what's really cool about it is that we direct it. So we're a big group of grad students. It's not just me. There's like 13 leadership roles. And so we get funding from KIBM and we're able to pay the undergrads to do full-time research for 10 weeks over the summer. And then a lot of them, they've never been in a lab before, but we pair them with three different grad mentors. So that's us — the PhD students — and sometimes postdocs. And we answer questions for them. We tell 'em what the deal is. Like, what's the hidden curriculum. We give 'em advice. Based on their research interests, we're like, "Oh, these two or three labs would be really cool for you. Have a talk with the P.I. And then because they're fully funded, it's very likely that the P.I.s are gonna be like — oh, a P.I. is like the head of the lab, the professor.

Eric Cross (32:04):

OK.

Minerva Contreras (32:04):

It's just very likely that they're gonna say yes. But the other cool thing is that we tailor the list of the faculty that we offer for them to join in their lab, because we want faculty that are gonna be mentoring these kids to be faculty that have a track record of being supportive of historically excluded and marginalized communities. So it's a whole thing. I'm super-passionate about it, too, because I believe in offering these undergrads an opportunity that otherwise they might have not found without our program. Of course, all of this comes from my passion to make science more accessible to these communities.

Eric Cross (32:40):

There were so many things that you said in that description that I feel like I could talk about. But did you say the words "hidden curriculum"?

Minerva Contreras (32:47):

Yes.

Eric Cross (32:48):

<laugh> That by itself opens up a whole other can of worms. And then you're also addressing this ... this reminds me of those jobs that say entry-level, but you need five years of experience.

Minerva Contreras (33:00):

Ah, yes.

Eric Cross (33:01):

And you're like, wuh? Or the whole internship thing ... but it's unpaid?

Minerva Contreras (33:05):

Yep.

Eric Cross (33:05):

Like, all of these kind of things that exist. And then you're also partnering people with mentors who not only have credentials in the right fields, but they have the experience and the heart and the skills and the empathy-connected piece. They can resonate with the humanity of this up-and-coming scientist. The way I hear, it's almost like you reverse-engineered what people wish they would've had.

Minerva Contreras (33:28):

Yes.

Eric Cross (33:28):

And then kind of almost create a program out of it. Is that -- am I hearing you right?

Minerva Contreras (33:31):

Yep. 100%. That's exactly what we do. And that's what we tell them. You know, we're like, they're undergrads and they see us as the directors or the leaders in the program. And they wanna see us almost as professors. And we're like, "No, no, no, no, no. We were exactly where you were like four or five years ago. We know what the deal is. You can trust us. We know what it's like to be you in this situation, and we wanna be here for you. And all those things that you feel like it's not safe to tell your professors, you can tell us. And we're gonna solve this together, because we went through it. We know what it's like to not know what you're doing. And we're here to show you that you can be successful, no matter what your background is, no matter what the difficulties of your life have been, no matter what your racial background or your socioeconomic status. You can do it. And if you're passionate about this, we believe in you and we're gonna give you all the tools to succeed." <laugh>

Eric Cross (34:21):

You got me ready to open this link and sign up right now. I was like, "Can I go back and do this? I wanna be in this program!" That's amazing.

Minerva Contreras (34:28):

Yes, you can come join us.

Eric Cross (34:31):

I'm only a little bit kidding. I love my students. I love my students. I'm not going anywhere; don't worry. "Mr. Cross! In the podcast you said this!" My students listen. They do. And they come back and they tell me, they give you feedback. Little 12-year-old feedback. It's amazing. OK, so I'm taking notes and I'm writing down just these identities that you occupy and here's what I've written. Like you're, first of all, like, you're this amazing scientist. You're a content creator. You're an amazing person, a human being, who you are as a person.

Minerva Contreras (34:57):

Thank you.

Eric Cross (34:58):

You're also Mexican, female, member of the LGBTQ community. All of that to say you've changed what my students perceive a scientist to look like. How does it feel to be a role model?

Minerva Contreras (35:13):

Um. It's really fun.

Eric Cross (35:17):

You're like, "Uhhhh, you just gonna put me on the spot right there?" <Laugh>

Minerva Contreras (35:20):

It gets me a little bit emotional, honestly. I mean, I didn't do this to become a role model, obviously. I mean, I entered the space and I recognized that there were not a lot of people that looked like me or were like me or came from a background similar to mine. So in that sense, I knew it was important to stay true to myself. And, you know, being in an academic space, there's a very strong tendency that you have to fight. I mean, we're social beings. We wanna fit in all the time. And instead of you becoming a person that imitates the norm in those spaces, that we know what the majority is and what the majority looks like, it's really important to stay true to yourself. Because you never know who's looking at you. Right? And if they see you staying true to yourself and you know, wearing all these flags that you talked about, then it's inspiring. Right? And then it tells them that there's a space for them here, too. Even though it may not look like it. We're working on it. It's important to stay true to yourself and demonstrate that there's room for you. And there are some systemic barriers, for sure. But when I came in, I wanted to like find a role model that looked like me, right? And that was hard. And so what I had to do was instead of trying to find someone that checked all these minority boxes that I checked, focus maybe on one. Right? So, like, a woman scientist. And then I was able to perceive that you can connect with people on that level, too. So even if there's people that are not fully like you are, you come to realize that you're not as different. And so, it's not us that you have to convince — it's clearly the system. But we're working on it. So it's hard to believe that I'm a role model. It feels amazing. And it really means a lot. And I do feel very much responsible to exist in this space, staying true to myself, and, and just continue making this space more accessible for people like me.

Eric Cross (37:18):

That's awesome to hear. I can tell you, as somebody who's in the classroom — and this is just the voice of many other classroom teachers — is that while you're doing all of this work, oftentimes we don't get to hear the impact that the work that we're trying to do or the impact that what we represent has on the minds and hearts of young people. But it does. And I get to see it. A friend of mine that I've interviewed on the podcast before, Dr. Desiree Whitmore, she's a physicist. She's at the Exploratorium. She's an amazing friend. And she was one of the first people that I met that made me feel comfortable in my own skin, having my identities as an academic, as a teacher, but then also this biracial guy who grew up in Southeast San Diego, who has this other part of his identity that isn't always represented in academia. You know, if I'm coming in street clothes or the music I'm listening to, or if I'm code switching, there were times in my life where I feel like I had to suppress that aspect of who I am.

Minerva Contreras (38:16):

Right.

Eric Cross (38:16):

Because it just didn't feel like ... it didn't feel good to show it. But I also felt like I was holding back who I was.

Minerva Contreras (38:23):

Right.

Eric Cross (38:23):

And it wasn't until I started making those friends or seeing folks that have really gone after it, but then were also, like you said, true to themselves. I love what you said about the person didn't have to kind of check off all the same boxes that you have in your identity, but the fact that they were true to themselves in general, that's kind of contagious. At least I felt it was. Like, they're real. They're a hundred percent them. And it's not the norm. So I could be me! And that's OK! And I can empower my students to do the same. That feels good, to be able to do that.

Minerva Contreras (38:57):

Yes. A hundred percent.

Eric Cross (38:58):

I want to go back to young version of you. So as we roll down to school days, you mentioned this earlier — you said a lot of biology and science was kinda like memorization, when you were in ... maybe kindergarten through maybe high school? Was science for you as a student ... what was that like?

Minerva Contreras (39:16):

I have like really bad recollection of when I was really young. I went to school in Mexico all the way through ninth grade. And then I came here for high school.

Eric Cross (39:26):

Can I ask what part of Mexico that you went to school? You were —

Minerva Contreras (39:28):

Right across the border. Tijuana. That's where I grew up.

Eric Cross (39:32):

OK. Got it.

Minerva Contreras (39:34):

Science, maybe we had like a couple hours a week in elementary school, primarily. And I remember like thinking it was fun, but it wasn't ... I don't know. I wasn't really a kid that ... I guess I wanted to be a veterinarian. How do you say that? Veterinarian? Yes. <in Spanish> Veterinaria?

Eric Cross (39:54):

Yeah! Like, animals. Yes.

Minerva Contreras (39:57):

So my mom tells me that. And that's like, you know, "What do you wanna be when you grow up?" But my reason was that I loved dogs; it wasn't really like scientifical. But I remember I thought it was fun, and it was kind of like, in my head, it fit into the category of like P.E. and arts and music, and science! It's the fun class! But I didn't really think back then that you could do that for a living, you know? So I don't know. I guess I thought it was just like the knowledge that you needed to pass exams and graduate school, or something. I don't know. I wish I had an origin story, like the scientists that are like, "Oh yeah, I was seven years old and I saw this...." I don't really have that.

Eric Cross (40:42):

It's funny you say that, because I totally empathize with the origin story. 'Cause we never feel like we have our own, even though yours is incredibly powerful, as an outsider that listens to it. But one of the things ...as a classroom teacher, that what you said validates me, is that you remember how you felt about science. Right? You remember the emotional impact. You remember that was fun. And as simple as that is, if you had a memory that it wasn't, that it was bad, or you had a negative impact on it, you might not have gone into the field that you went into. Possibly. If that was a bad experience. And so there were at least enough experiences where you left those early years of education that were positive for you.

Minerva Contreras (41:25):

Yes.

Eric Cross (41:26):

And also that you felt empowered enough that you could pivot from doing art into becoming a neuroscientist. And that even if you said you don't have an origin story, but that alone is powerful. Because oftentimes as educators, you're figuring out what are the things that matter most in teaching? There's a lot of things that we have to teach, and we only have a short amount of time. But those experiences, for your students, when they leave. 'cause you never know who's gonna be the next person that goes on and makes the next discovery. You don't know how your little segment of this nine months or ten months that you have them, how that's gonna shape who they become later on.

Minerva Contreras (41:58):

One hundred percent. Yeah.

Eric Cross (41:59):

And so I love what you said.

Minerva Contreras (42:00):

Yeah. I mean, you have such an important job. And I think, listening to your podcast, and the fact that you do this, it's really cool that your students have you. And that you care so much about figuring out what science teaching is, more so than the curriculum, and what that means. And I can tell that you have a goal in life to inspire these kids and communicate science in a way that is just not a class, but something that influences your life forever. And I know they're gonna keep you in their hearts forever. Like, you're just that kind of teacher. I have teachers that I remember with great love, just 'cause they had an important impact on me.

Eric Cross (42:38):

Can I ask you, is there anybody that stands out to you, that you remember? I know you said your memory isn't that great. But is there any class or any point in time or specific teacher you remember that just comes to mind?

Minerva Contreras (42:49):

Yeah. I think she was my fifth-year teacher. She was like ... I don't know, she kinda believed in me, in a weird way. There was a state competition of a test that you can take that they had Spanish, which which is kind of like English. So the same, like Spanish. And math, and I think it was history, Mexican history. And she was like, "Oh, you can totally do this. We're gonna sign you up." And I wasn't a straight-A student or anything. And she signed me up. I didn't study for it at all. But she would invite me to her house, to study and prepare for the test. And instead I would just ... her kid was also in my class, and so we would just play all day and never actually study. And I took the test, and they didn't even tell me how I did. 'Cause I think I did that terrible. But it wasn't, like, studying for the test; it was just the fact that she believed that I could do something amazing. And the fact that she wanted to connect with me on like a more personal level was just really cool. It was, I don't know — it taught me that teachers are humans, too. You know, at a super early age. It's so crazy that when you're a little kid, you see teachers as weird parts of life that are not really human. So every teacher that humanizes a teacher is <laugh> very much appreciated. <laugh>. Isn't that true though?

Eric Cross (44:15):

It's so true! <Laughs> It is true. This is exactly why I tell my story. Like, it's 100% true. They think we live in our classroom and then we just go into a closet and like, that's where we are. And they see us in public and it's like they see ... for me, it's a Sasquatch. 'Cause I'm tall. I know you can't see from here, but it's like they're seeing some kind of mythical creature when they see us in the wild.

Minerva Contreras (44:35):

What?! What?? <Laugh>

Eric Cross (44:37):

Yeah. It's true. It's like, if you see 'em at like a Costco or you see 'em at an ice cream shop or a grocery store or something, and they see you and their eyes get really big. <Laugh> And depending on the type of student it is, if they're with their parent, they'll try to avoid you or they'll get excited. And parents always wanna talk about, you know, "How's my kid?" All these other kind of things. So you have this impromptu teacher conference. But yeah. It's really funny when they see us outside of our context. They're like, "Shouldn't you be at school, my brother?" "It's Saturday! <laugh> I gotta eat too!"

Minerva Contreras (45:06):

That's so funny. I don't know what that is. It's interesting though. Yeah.

Eric Cross (45:11):

It hasn't changed. It hasn't changed all those years. Do you have any feelings on how you'd like to see science be taught? From how you experienced it to now, knowing what you know, is there anything you would change or include or add or modify?

Minerva Contreras (45:27):

So in the videos for Crash Course: Biology and Biología, we mention a lot of scientists that are not the typical scientists that everyone knows, right? So it'd be really cool to include them and what they did and how they came to their discoveries. I would love if teachers just included it. Like, "OK, this is a cell and this is the nucleus and in the nucleus there's DNA and DNA is important. Like, how do we know that? It's just so cool the way that we learn that genes are what regulates everything that happens in your body, and how Rosalind Franklin was super-involved in the discovery of the structure of DNA, and at first no one talked about her, because she was a woman working in a men's lab." And little things like that. And I think that like if the students heard those things, all the stories that are behind the scientific facts that we know and we teach in school, they would just be way more interested. And I feel like they would be more memorable. So if you do that, thank you for doing that. <Laugh>

Eric Cross (46:35):

So I'm hearing that storytelling element, what you're talking about, being integrated, a hundred percent. Some of these stores are wild. Like, we do the phenylthiocarbamide, PTC, paper?

Minerva Contreras (46:47):

Uh-huh.

Eric Cross (46:47):

I dunno if you remember that one? And you just taste it, to see if you're a supertaster.

Minerva Contreras (46:50):

Oh yeah, yeah, yeah.

Eric Cross (46:51):

And the story behind it is two researchers were working with the chemical for some other reason and it blew in one of their faces and they tasted it and they go, "This is bitter!" And the other guy tasted it and goes, "No, it's not!" And it made them start wondering, like, what caused this? And I tell my students, "Look, don't go eating things and trying things to have new discoveries in science <laugh>. Like, don't.

Many people who've tried that and they didn't write down any data. 'Cause you could run any experiment .... ONCE." And then they sit there and they go, "Wait. Ohhhhhhhhh." Yeah. But you're right, there are all kinds of these wild stories that are really interesting. They can be a Netflix special.You know, how these things were discovered.

Minerva Contreras (47:32):

Yeah. Related to the tasting thing: My entomology professor in Mexico gave us these pills that block your acid receptors in your tongue. And so—

Eric Cross (47:41):

Ah! Miracle berries!

Minerva Contreras (47:43):

I guess? I forget what they were called. But then he would give us lemon, and it was so weird! 'Cause it was so sweet! You know? And I mean, I remember these things. I probably don't remember like the science behind it. But I mean, yeah, they block your receptors. So. <Laugh>

Eric Cross (48:01):

But you remember eating the lemon and it tasting sweet! And you're like, "What was that? How did that work? How did you hack into my taste buds just now?"

Minerva Contreras (48:07):

Yeah. It's just really cool. Yeah.

Eric Cross (48:09):

Yeah. Minerva, thank you so much. One for making the time to be here. I know you're super-busy. Thank you for the work that you're doing and sharing your story and for all the additional things that you're doing. And thinking about where you come from, the students, the people that are looking at you and just bulldozing this pathway for the people that are gonna come behind you. Who are my students. And this is literal, 'cause we're in the same city. <laugh> You are trailblazing this pathway for them, and inspiring them, and you will do so for years to come. Because you know, if you got some time, maybe you can come visit my students in the classroom. Because they'd love to meet you. No pressure.

Minerva Contreras (48:47):

Thank you so much for having me, and I would love that so much! Let's make it happen. I would love to visit you.

Eric Cross (48:54):

All right. All right. Everybody heard it? Everybody heard it! Everyone heard it! We got it! We recorded it.

Minerva Contreras (48:56):

Let's do it. <laugh>

Eric Cross (48:57):

All right. Awesome.

Minerva Contreras (48:59):

I had a great time. Thank you so much.

Eric Cross (49:02):

Thanks so much for listening to my conversation with Mini Contreras, doctoral student in neuroscience at the Salk Institute in San Diego, and director of Colors of the Brain. Check out the show notes for links to the resources Mini and I discussed. And we'd love to know what you thought of this episode, in our Facebook discussion group, Science Connections: The Community. For more tips and strategies, visit Amplify.com/Science Webinars and sign up for one of our sessions, including the upcoming Science Connections webinar in October. And if you're going to NSTA, make sure you catch Mini's keynote. And visit Amplify at Booth 192. You might just see me there. Thanks again for listening.