Sweet Dreams Are Made Of Neuroscience with Rackeb Tesfaye

Nerdin' About Podcast Transcript, Season 1 Episode 13

Michael
Hey everyone, welcome to Nerdin' About, I'm Space Michael, and with me as always is someone who loves to knit, and as we move into the fall months, she's really coming into the prime time of her year, and that is Dr. Kaylee Byers. How's it going, Kaylee?

Kaylee
Oh my gosh, I'm really well, thanks. You know, I've actually recently taken it to the next level of my love of wool and animal fibers. A friend of mine just gifted me with an alpaca fleece, like a bag full of alpaca fleece, and I drove it six hours out of the city to one of the only mills that will spin it up for me. Right now, I'm thinking of what am I going to mix it with? Am I going to mix it with Romney, or Merino, or silk? I mean, I'm having a real time.

Rackeb
Girl, you transported me to like the early 1900s.

Kaylee
You have no idea. Last summer I bought a spinning wheel. It's 150 years old.

Rackeb
I have an instant urge to read Jane Austen. I don't know why that's happened.

Kaylee
So, we've just transported you to the past, but right now we're going to bring you right back to the present, because today we are chatting with Rackeb Tesfaye, that is who you just heard. Rackeb is a PhD candidate in the Integrated Program of Neuroscience at McGill University, the founder of Broad Science, an internationally recognized initiative dedicated to making science inclusive, engaging, and intersectional through podcasting. On top of all of that Rackeb is also a freelance science communicator. Rackeb, thanks so much for hanging out with us.

Rackeb
Thank you, this is a great way to spend my Sunday. I love it. This is fun.

Kaylee
We're going to talk all about science. I hope this first question isn't too basic. But what is sleep? What's this thing that I do every single day?

Rackeb
You know, I hope we're all getting some of it. I know, these are hard times to be sleeping well, but it's an altered state of consciousness. You know, I always find it funny like when I was taking courses on sleep during my undergraduate degree, we learned about how before the 1950s, people thought that our brains literally just shut down while we were sleeping like it was an incredibly passive process. That's really not true though, our brains are very much active, and doing amazing things. With the advances of electrophysiology, and brain imaging, we're able to get a better understanding of the different brain stages that occur during sleep, the different activities that are crucial for our well-being, physical and emotional, during sleep. When you ask that question, what is sleep? Or more importantly, why do we sleep? It's not a basic question, because we still don't know why we sleep. We know primary benefits to why we sleep. We've studied the different functions of sleep, but really at its core, why do we sleep? That is still a big mystery. There are many theories that have been proposed. So yeah, that's definitely not a basic question, Kaylee.

Kaylee
So how important is sleep for our brains? How much sleep should we be getting? And what does sleep allow us to do?

Rackeb
Hmm. Okay, so great questions, but there are multiple questions in there. So, I'm going to try to see which one to start with.

Kaylee
Sorry I got so excited!

Rackeb
No, no, you get equally excited about sleep as I do. So, this is amazing. I'm very, very happy about it. So yes, sleep is important for the brain just generally. So, I mean, if you go back to what I said earlier on, there are a few theories as to why we sleep or why sleep is important. So, they're kind of older theories that are more to do with adaptation and evolution. So, one is that inactivity at night is a survival function. So, if animals stayed quiet or still during the night, maybe they're less vulnerable or have an advantage to be alive longer, and not be preyed upon, or if you sleep during the same time as other predators, or predators that will prey on you, that you will have an advantage. Another one is conservation of energy, you're not expending as much energy when you were sleeping, so you can conserve that for during the times when you were awake. Going back to your point about why it's important for brain function. One of the leading theories for why sleep is so needed is brain plasticity, in order for us to structure, and organize our brains, it's also important for learning and memory consolidation. So, I'm thinking about this particularly in infancy where we get a clearer picture of this. So, infants spend about 14 hours sleeping.

Kaylee
[sighs] Oh, jealous.

Rackeb
Right? I know, take me back. Half of that is spent in a particular stage of sleep, which is called rapid eye movement sleep. This is what some researchers believe is incredibly important for brain development, and memory and learning. So yeah, it is important in short, and then I just want to talk about briefly another leading theory of why we sleep, which is restoration. So being able to restore, and repair, and rejuvenate our body. So, we know that when there's extreme sleep deprivation, and you see this in rats, dogs, humans, flies, we die. I mean, it's serious. When there is extreme sleep deprivation, there's damage to our neuronal cells, there's damage to our metabolic systems, we lose immune function. So, sleep is incredibly important to keeping us healthy, and to keeping us cognitively sharp as well.

Kaylee
You know, what that made me think of? A talk that I went to once in my master's sitting in the back row, and physically not being able to stay awake, pinching myself trying to stay awake, and nodding off and then like pretending to nod along with the talk somehow, like very aggressively. So how am I not able to control that?

Rackeb
So, when you don't have enough of it, there's definitely a buildup of pressure to go to sleep. That actually ties into the two different processes that we currently understand regulate sleep. So, the first is homeostatic pressure, and that is, like I mentioned, that buildup of needing to go to sleep, like the longer that you're awake. So that's kind of what you're talking about Kaylee. The second is, a system that I study more in my research, and it's called the circadian rhythm. So, we have a biological rhythm, the circadian rhythm, and it controls the timing of when we go to sleep, and when we're awake. It does a lot more than that, but for the context of this chat, I'll stick to sleep. This rhythm, it fluctuates, it rises, and it dips for about a 24-hour period. So, these dips correspond to different times during the day. So, for instance, our circadian rhythm, dips around 1pm, like after lunch, it's kind of called this like post lunch crash, I don't know if you've ever felt a little tired after you've eaten. Then there's another dip, I think it's around 2am. So, needless to say, there are these rhythms, and those rhythms are produced by a master clock in our brain, and that clock, it receives cues from our environment. So, the environmental cues help synchronize our circadian rhythms. So, these are cues like the main one which is exposure to light. So, when it's sunlight, that's the time cue that we should be awake. There are other cues that influence our circadian rhythm so that when we socialize, for instance, when we exercise, when we eat, and thinking about that, in the context of today, those are all routines that have maybe shifted in day-to-day life during the pandemic. Those anchors that allowed us to keep track of time are really important, and now that we don't have those anchors, and those routines fixed as we normally do, you know, that can cause us to have these altered perceptions of time. Like I don't know if you two are feeling like you're in Groundhog's Day, sometimes you

can't really put your finger on what day it is. You know, that has a lot to do with our circadian rhythms right now, and needing those routines.

Michael
Yeah, that reminds me of how challenging it is. Sometimes when I work in the planetarium, and I'm in there all day under the fake stars, and if it's summertime, and I come out, and its sunlight, my circadian rhythms are all jumbled up. It's very, very confusing for my brain to like, try to figure out what time is, and what's going on.

Rackeb
Exactly, yeah. it's so mind blowing to me to how salient these cues are, especially light.

Michael
So Rackeb here's another really basic question for you. How exactly do you study sleep? Andy Warhol made this film in the 1960s. I don't know if you've seen, it's called ‘Sleep’, and it's literally just six hours of someone sleeping. So, are you all just avant-garde voyeurs? How does this happen?

Rackeb
Oh, I remember hearing about that when I was in high school, and being like, "What is this?" So not to that extent, I would say. [laughs] There are two different methods of observing, and recording sleep. There is self-report or self-monitoring through questionnaires, and then there's objective measures. So just briefly, when I talk about self-reporting, this is typical, because it's kind of the easiest way to get sleep information. So, this would be, let's say, I'm trying to figure out if you have some concerning traits, with regards to insomnia, so things like are you having troubles falling asleep? Are you waking up during the night? You would get a questionnaire asking you, How many times a night? Would you say that you wake up? How long does it take you to get to bed? With my studies that I do with kiddos, we often have parents fill out these questionnaires, but you can imagine how there might be limitations to this type of reporting. So, what happens if the parent is not in the room to witness some of the night awakenings, or you know, there are cases where individuals believe that they're waking up more often during the night than they actually are? So, there are limitations to this type of reporting, and then on the other hand, we have more objective measures of sleep reporting, so one being actigraphy. So actigraphy, kind of looks like a Fitbit. It's a watch that you wear, and it records your movement. You can wear it throughout the day, or you can just wear it right before you go to bed. There's an algorithm that lets us know, when someone is sleeping, when they're waking up during the night. We even have sensors for lights on our actigraphy. So, one of my favorite things like back in the day, when I was doing my masters on sleep in pre-adolescence and adolescence, I would see that they would tell me on their sleep diaries that they went to bed exactly at 11pm, and then I would see that they have their lights shut off at 11pm, and then like a few minutes later, they would turn their lights on, and I'm like, “Girl, you've just lied to me. [laughs] I see your lights are on.”

Kaylee
Does that just pick up like room light? Or would it even pick up something like a cell phone light?

Rackeb
Ooh, that's a really good question. I actually don't know how sensitive those sensors are. In this case, it was definitely room light, and so I confirm that qualitatively while speaking to the teenager, but that's a good question. I'm not sure how sensitive those sensors are. Then the last way - and apologies if I've missed some something, but these are the major ways of observing sleep - is polysomnography. This is referred to as the gold standard of monitoring sleep. So, polysomnography allows us to measure brain activity during sleep. This is using the electroencephalogram which is a word that always trips me up.

Michael
Me too!

Rackeb
Right? It's a mouthful, science words, God. So it essentially allows us to measure your brain activity during sleep, but also different muscle movements. So, we're able to get a measure of your eye movements, or leg movements during sleep. So, you're hooked up to a bunch of electrodes, a bunch of physiological monitors there, and that really is the kind of the gold standard of us getting all that sleep information. It's hard. I mean, especially working in youth research, getting children to, to put all of that on, and to sleep in the lab for one or two nights. Like it's really difficult. So that's why the default is to start off with a questionnaire.

Michael
So Rackeb, you're monitoring me, you've got your cameras on me, you're got the questionnaires. Now, the other aspect of this is sleep disturbance, and I'm a really deep sleeper, and I live on a really busy street. Other people, though, have a really hard time with that. Your work brings together genetics, and sleep data to better understand sleep disturbance. Is there evidence that our sleep is linked to our genetics? Like does this mean that some people genetically need more sleep than others?

Rackeb
Yeah, absolutely. So, that is a great question. So, I should have mentioned when I was explaining about our biological clock earlier on, that master clock I was talking about is housed in our suprachiasmatic nucleus.

Kaylee
Speaking of scientific words!

Rackeb
I can only apologize for something that I have not created, but you know, and so essentially that master clock is regulated by a group of genes called 'clock genes'. Those genes mechanisms, actually one of the researchers who found them won the Nobel Prize a few years back for their study on fruit flies. So yes, our genes do regulate sleep. So, beyond that core clock gene network that I'm talking about, there are many different genes that have been implicated in different types of sleep disturbances. So, you know, when we talk about sleep, it's really important to break it down to what are we actually talking about? Because you can say, I'm a good sleeper or a bad sleeper, but we've got to be a bit more nuanced than that. Are we waking up during the night? Are we having troubles falling asleep during the night? Are we having muscle movements during the night? There's a whole bunch of different types of sleep disturbances that map on to different genes. So, I'm interested in the circadian, or the clock network that I spoke about, but also there have been some really interesting studies that have been ongoing, I don't know when the first one was, but the biggest sleep gene study that has occurred to date was in 2019, where the results were published, where they looked at 1.3 million adults.

Kaylee
That's wild.

Rackeb
Which is like, a massive, massive study. They wanted to know what genes are related to insomnia traits, and they found that variations within over 956 genes are linked to insomnia. Like, what is that telling us? So, there isn't necessarily one sleep gene, right? Like we're going to have to get a better understanding of how they interact with one another, the different types of genes that are involved. That tells us that there's also a huge environmental aspect to how we sleep. So, there's definitely a balance between genes, and the environment affecting how we sleep. So, to answer your question, in short, genes do play a massive role in sleep, those core clock genes regulate our core functioning of sleep, and sleep timing, but the likelihood that you're going to find people who have a whole clock gene knocked out is quite unlikely, because they have a huge evolutionary purpose. There are many genes, besides these networks that play a role in sleep, and we're still trying to figure that out, and how they interact with one another.

Kaylee
That's actually way more than I would have expected, like, 900 and some, that's a lot.

Rackeb
Yeah, you know, when I read it, at first, trying to figure out my thesis proposal, I was like, "Well, what is this going to do for me?" [laughs] "Where do I go from here?" What I find really, really interesting about that study is a lot of the variations within the genes that they found, actually also associate with psychiatric issues, like anxiety, depression, and they're correlated with one another, these genes that are involved with both sleep disturbance, and mental health issues.

To me, that makes a lot of sense in that, genes might be doing many different things, and might not just be responsible for one type of trait, and have different effects large, small, or maybe none, depending on if another gene isn't mutated. So, I think it goes to show how interconnected sleep is with other mental health, physical health issues. We know that with psychiatric issues, whether it is neurodevelopmental disorders, like autism, or ADHD, or neurodegenerative disorders, like Alzheimer's, Parkinson's, or anxiety and depression as I spoke about, sleep disturbance is often a precursor to a lot of these disorders, they often go hand in hand. So, I think, you know, we're trying to parse out what exactly genes do when it comes to sleep disturbance, but I don't think we're going to be able to understand it without understanding their role in both sleep and psychiatric issues.

Kaylee
So maybe if we take a shift now, you brought up earlier sleep disturbance in youth with autism, which is where you do quite a bit of your work in your PhD. And you are specifically looking at those underlying factors that contribute to sleep disturbance, and youth with autism. I didn't realize that youth with autism actually experienced greater sleep disturbance. So, could you tell us a little bit about that work? How much do youth with autism experience sleep disturbance? And what have you found?

Rackeb
So, it's one of the main issues actually, that is reported in autism is problems with sleep, and particularly problems with falling asleep, problems with waking up during the night, and having shorter sleep. So, a lot of those traits map on to insomnia. In the literature, currently, the prevalence is up to 80% of youth have sleep disturbance. So, it is a major issue. It is not very well studied academically in our field. Also, it tends to not be treated, or focused as much in a clinical setting, there tends to be less focus on these sleep issues, because of course there are other major issues that need to be attended to when it comes to the disorder. So, it's often taken a backseat to many of the other physical, and mental health traits that occur alongside the autism diagnosis.

Michael
So how can youth improve their sleep? Are there therapies, supplements? I've heard some buzz around melatonin. What's going on there?

Rackeb
Yeah, absolutely. So, you know, one thing I want to preface this by saying is that sleep is very interindividual, and I don't think we hear that enough. What works for someone might not work for another person, right? The amount of sleep that we get, and that is good for us might not be good for our partner or our brother or sister, right? So, you know, that's something that we need to think about when we talk about treatment. Generally, what we do know is that, yes, melatonin has been effective for many youth with autism. Looking at the literature and kind of synthesizing what's already out there, it has been shown to improve certain disturbances like being able to fall asleep, and lessening night awakenings. What has really been shown to work is good sleep

habits, and sleep routine, and hygiene. So, having a sleep routine is really crucial. Being able to turn off your phone an hour before you go to bed, being able to have a routine that you're telling your brain "Hey, I'm getting ready for bed right now, and you should be too." Reading that book as a signifier that it's time to go to bed, there's, you know, a host of different really great sleep routines, and hygiene tips that are out there, and I'm happy to pass along to you, Kaylee and Michael if anyone wants to read them. Yes, just developing good sleep routine is crucial, and also, in addition to medication, if needed, if you go see a specialist, or a clinician, we know that cognitive behavioral therapy works. So, talking about maybe what are some of the stressors that might be causing you to not go to bed at night, and other different kind of behavioral steps that you walk through during that therapy is important as well. So again, it really depends on what the sleep issue is, and who that person is.

Michael
So, we've talked about genetics, and how it may impact sleep, and increased sleep disturbance among youth with autism. So how are you bringing these together in your research?

Rackeb
You know, one I'm interested in what are the long-term impacts of sleep disturbance on daily outcomes, and cognition. But I'm also interested in, why? Why do we see this increased risk of sleep problems in this population? We know that genetics plays a large role in the etiology of autism, that there are different types of mutation that increase risk in autism. So naturally, it makes sense to start looking into genetics to try to understand, is there something within our biology? Is there something that is not functioning correctly in our genes that might be contributing to sleep problems in autism.

Kaylee
So, if we identify those, let's say there are five genes with mutations of those 900, there are five that are specifically affected. What can that tell us?

Rackeb
Here's the thing, I don't think that's going to happen. So there, you know, there isn't an autism gene. To date, there are hundreds of genes that have been impacted, that have been implicated rather with autism risk. You know, similarly to what we were talking about with those 956 genes, you know, there are many genes that serve similar functions, or that work together to produce a trait. So, you know, what I'm starting to become more interested in are what are the pathways, the more umbrella pathways that might be implicated in sleep disturbance and autism? What are the overlaps between those pathways? Or, you know, maybe there are a specific set of genes with a type of biological implications that we should be looking at. So, I don't think that there's going to be one smoking gun of a gene that is going to be able to elucidate why this is happening. But I think when we start looking at the pathway level, the more broader levels, and the overlaps, then that's when we can maybe get more fruitful information. Then of course,

pairing that, and contextualizing that with the environment, behavior, cognition, like, you know, so it's a massive puzzle.

Michael
Should we get to some nerd herd questions?

Kaylee
Bring on those nerd hard questions!

Michael
So, if you want to get on the nerd herd questions, we do post the questions on our Instagram, and on our Facebook stories @NerdNiteYVR. Our first question – we got some good response on the sleep questions during this pandemic. Kebby commented that they have had a hard time getting to sleep before 6am. Lorenda has noticed that her dreams have been more vivid lately. What's going on here Rackeb? Is there a neuroscience explanation for this?

Rackeb
Yes. So, a lot of people are having troubles with sleep during this time. So, I just want to stress that this is quite normal. You know, there have been studies that are coming out, one particularly in China, that showed people are having more symptoms of insomnia during this time. This tends to be even more salient in folks who are nearer to the outbreak of the pandemic, in the Hubei region. The question was having much more vivid dreams. So, this actually tends to happen when you're sleep deprived, and you don't get enough of REM sleep, which I talked about a little earlier as rapid eye movement sleep is the stage of sleep where you have your dreams. So, when you don't have enough sleep, the next day you tend to take less time getting to that REM stage, and you spend more time there, and you have more vivid dreams. This is what's been documented in previous studies. So, this is what's called REM rebound. So, sleep deprivation studies have found that if you don't get enough sleep, the next night, when you try to get enough of that sleep, you will have more vivid dreams. I shouldn't say you will have more vivid dreams, but it's more likely that you will.

Kaylee
That's really interesting. So, I know we talked a little bit earlier about the individual component of sleep, we're all individuals, we have different sleep patterns, Pitre asks "if it's a myth that we need all our sleep in one eight-hour block?"

Rackeb
So that's a really good question. So, when you're a baby, you don't sleep in any complete chunk of time, right? You don't sleep throughout the entire night you sleep in segments throughout the day, right? Then later on you're trained with social cues to have wake up time, and bed time, and so forth. So actually, no, I mean, segmenting sleep is not like unheard of, and not uncommon actually. So, in the pre-industrial ages, and you can look at some of the literature, there is mentions of having sleep 1 and sleep 2, people having multiple segmented sleeps, and

they would wake up during the night, and they would, I don't know, read, or smoke, or do night deeds, whatever you do during the night.

Kaylee
Night deeds!

Michael
[singing in the tune of Bob Seger] "Working on our Night Deeds"

Rackeb
And for those who are listening I mean sex.

Kaylee
Oh, my gosh, what's wrong with me? I didn't even think of that.

Rackeb
Yeah, but you know, this biphasic sleep is evident in our biology, and some people naturally prefer it. Researchers have mentioned that if this is something that you prefer, you should do it. If you are healthy, and you're happy doing it, and you want to sleep in like two different chunks, two different segments, then that's okay. There isn't really a lot of sleep studies to show the health impacts of this. It's not uncommon people have done it. I will say that what is really hard about this method of sleeping, is that it's not aligned with the way that we live our lives socially. You know, if you have some type of like cool work hours where you can do that, then I guess, you know, go for it, but it really isn't aligned with our social kind of cues and our social life cycle.

Michael
Speaking of the environment so talking about this eight hours thing. Pramodh asks why some animals get by on barely any sleep, while he's completely non-functional if he doesn't get those eight hours. So how do we compare with other animals in the animal kingdom?

Rackeb
All right, great question Pramodh. So yeah, animals do differ in sleep. I mean, giraffes can sleep for like five minutes a day.

Kaylee
What!?

Rackeb
They honestly can go two weeks without sleep.

Kaylee
That's bonkers.

Rackeb
Yeah, it's pretty amazing. On the opposite side of that spectrum, you have bats who sleep for like 19 hours a day. Like they sleep for the entire day. So, one potential theory is the brain metabolism rate of animals might have something to do with this. So, thinking about like, how much energy does the brain consume. Smaller animals who have higher rates of brain metabolism, they tend to need more sleep, while larger animals like cows, elephants, generally need less sleep. Like land grazing animals, like cows, they spend most of their day eating, and they have less time for sleep. Also, just like thinking about that poor giraffe. Like, you're so massive. I wouldn't want to sleep. You're just like, open prey season.

Kaylee
Oh, my gosh, that's a good point. Yeah, I would be on alert all the time.

Rackeb
I want to take another course on this, but some birds sleep with one eye open. Researchers have found this is especially true if they're on the outside of their group, and not within their flock protecting them, like they sleep with one eye just to make sure that there are no predators approaching. So yeah, I mean, animals do have different sleep timing, and different durations of sleep. I think there are many theories as to why.

Michael
Oh, man is it time to Nerd Out?

Kaylee
Bring on the Nerd Outs!

Michael
All right. So, we'd love to hear from you about what you have been nerding out about. You can email us vancouver@nerdnite.com. You can also message us on our socials @NerdNiteYVR. Russ has let us know that he's nerding out about the life on Venus story that just came out. Rackeb, how is the neuroscience community reacting to this Venus story?

Rackeb
I really am not that good with understanding astronomy or planets.

Kaylee
You and me both.

Rackeb
I think it's exciting. Every time I hear life on x planet, I immediately just like think of every single Hollywood movie, which I know is like the least scientific thing for me to be thinking about. Actually, what I am most excited about with this story is I think people get a little disappointed in

the general public when you have this big story about life on Mars, but you're talking about what was it called again?

Michael
Phosphine.

Rackeb
Right, and they're like, what's phosphine? Is that a human? And then you hear, well, we don't know how phosphine is created, but we've been able to figure out that it hasn't been chemically created or that it might be biologically created, or something along those lines. I think what this is spurring is this dialogue as to how we approach scientific questions, which is not proving a theory, but disproving certain theories. So, I think the dialogue when it comes to the story is really exciting, because folks are like, "What are you telling me like, why should I find this fascinating?" And you're like, "No, we've been able to deduce some things that we have not. We've been able to say that certain things aren't happening, which we haven't been able to say before, and this allows us to continue on with our investigations." I think that that dialogue is really exciting to me.

Michael
Yeah, that's exactly it. That's exactly the conversation that we've been having on our lives - we go weekly to YouTube about this. Even the big questions, that's what it comes down to like we're talking about dark matter and scientists make these big inroads. What they're doing is basically just discounting one area. Like okay, we know dark matter is not this, we know it's not this. That's exciting to scientists, but as communicators sometimes it's a bit challenging to get people excited and say, "It's not this!" [laughter]

Rackeb
“We haven't found anything!”

Michael
Rackeb, what have you been nerding out about?

Rackeb
Oh, God, that's a great question. I’ve been nerding out about everything from the great coffee that I'm drinking, to the great books that I'm reading, but I've been really excited about starting my own CBC science column. Which is really, really cool. So, I just basically get to do what I do at home by myself, which is talk about science, and nerd out.

Kaylee
Which is pretty much the best time. I just actually listened to your CBC episode, and you were talking about blue jeans, and threads found in the Arctic. It was incredible.

Rackeb
Yeah, just like - science is cool. I came across this study by researchers at the University of Toronto who found that these little small microfiber threads, these millimeter pieces of fabric, fall off your jeans, end up in the water through washing them in your washing machine, or being picked up by air, and then they are landing in the Arctic. I mean, obviously has major implications for how we study our environmental impact. Who thinks about studying this? How do you study this? It's just really cool. And like, just to hear like the stories of how this research came about, like completely accidentally, they had a bunch of sediment like segments from different lakes and the Arctic Ocean. They just were like, "what is this blue piece of fabric that we're finding?" Then they decided to research it. I mean, that to me is, that's what I want to talk about when it comes to science, you know, those types of findings that we don't necessarily hear about.

Kaylee
So, you just had your first episode, and then you're going to be on every month, correct?

Rackeb
Yeah, every month, and it's really great, because I definitely have a bit of editorial flexibility in terms of what we get to talk about. So again, emphasizing these stories of science, highlighting graduate student researchers, I think is incredibly important. We are the backbone of scientific research. Oftentimes, when you read about these discoveries, you often hear from the PI who is incredibly important, obviously, but the graduate students often get left out of that kind of mainstream conversation. I really want to be able to highlight the incredible work that they're doing. Also, just trying to talk about solution-based stuff as well. So, like, what can we be doing? I mean, we're living in a time where I think we feel really helpless and like, have lost this sense of agency during isolation. I think it's really important to talk about, what are some things that we can be doing in our everyday lives right now, that can definitely impact us, the people around us, and also our environment. So those are some stories that I'll be focusing on.

Kaylee
Well, we're really excited to hear more about those. Michael, have you been nerding out about your own personal impact lately? Like, what's going on with you? What are you nerding out about?

Michael
Well, I am nerding out about my identity, Kaylee. So tonight, as we record this, I'm going to be hosting drag artists Shanda Leer, and Karmella Barr in an online discussion around identity in the universe. It's going to be taking a look at some seminal years around school because kids are going back to school, and kids going back to school is a time when we start to form our identity. This event is going to be over by the time this podcast is released, but what I want to say is that as we move into another quarter of this pandemic, and it's now looming very large, that there is going to be a sector of society that is not going to come back for quite a while and that is live performing arts. The thing is that there are some things that can adapt, like sports

that make money from live audiences, and sure a lot of society is getting by with other forms of entertainment, like Netflix and books. We can get by but there are some institutions that are really suffering right now, and it's the artists themselves the performing artists, they are losing their identity not having a chance to perform in front of a live audience, and to express themselves in front of a live audience. That's concerning, because we're also losing out on the young people, the new breed of performing artists, sure, there's TikTok, and that's gaining popularity, but those are like little tiny bite size expressions. I don't think it's enough for kids to fully express themselves in a new way. It certainly helped me in my development as a human to express myself in front of a crowd of people. So, what I'll say to everyone listening is that what we can do right now is to support these artists that have no outlet. I mean, we're talking about drag artists, there's comedians, theatre performers, but it's also the technicians, the producers, the people that live for creating these live experiences, to make us laugh, to make us cry. It's not just about giving them money. It's about showing appreciation for them. So, when you see the that they're doing live streams, you know, theatre companies are doing live streams, these institutions that are going to be so badly damaged, and some of them are not going to come back. So, the least we can do right now is to give them love and support as we move in to these colder months.

Rackeb
I love that. Yes. 100% all the emoji hands are up.

Kaylee
I mean, that's one upside now I guess we can use a lot of emoji hands. I think you're right, Michael. I think that link to identity and how that changes is so important. I love that the message is like get out and support even if you're supporting from your living room.

Michael
Exactly. You know, and that's what we do it for. I mean, sometimes a lot of these artists, they don't do it for money, but they do it, because it's part of who they are. Can you imagine if you couldn't be part of who you are? It just seems really sad to me? So, Kaylee, what is something that is something that is part of you that you've been nerding about?

Kaylee
I've got a lot of things that are about me. I think the thing that I've been nerding out about lately that I'd love to talk about, is actually a paper that I found through you, Rackeb, so maybe we could chat a little bit about it. So, okay, I know, I'm preaching to the choir here, especially, but communicating science is really important. There are many ways to communicate science. One way scientists do this is by sharing their papers on social media, like through Twitter, and there's a recently published study in PLoS Biology, where Drs. Carlson and Harris, look at preprints, shared on Twitter, and who's engaging with them. So, for folks who are not familiar with preprints, these are essentially studies that are published online before they've undergone peer review by other scientists in that field, and they haven't yet been published in a scientific journal. So, to determine who is engaging with these preprints, they looked at Twitter bios, and the bios

of the folks in the networks of those people sharing and talking about those articles. So, for example, if you read my bio, they would determine that I was an academic. They'd also know that I'm real into rats, and also science communication. So, they could glean those things from just my Twitter bio, and then based on those bios, the overarching finding was that most of these preprints shared on Twitter are actually tweeted about and shared by other scientists. Did that surprise you Rackeb?

Rackeb
Absolutely not. I mean, if you just break it down, and you say, I'm going to share preprints on social media in order to engage a general audience, I mean, just that sentence alone, right? It's imperative that we make articles accessible to whomever wants it, particularly because our scientific research is funded by taxpayers. So, I do believe that that information should be made accessible, and if it can be found on social media, then I think that is wonderful, and it's great. I think that if you are going to be using preprints, as a way of engaging folks who are not in your discipline, then there are some issues with that. This is not to tell people to not be sharing these preprints. on social media on Twitter, specifically, the most number of scientists on social media are found on Twitter. I don't think that the paper looked to see whether or not engagement was coming from scientists from the same discipline, or if there were any other disciplines that were also interested in a preprint paper. So, I'm not sure if there was any kind of cross discipline engagement that was going on, which would be interesting to see. I definitely think that it does allow for more engagement, and more dialogue with researchers that you're not necessarily connected to, and I think that's a wonderful, wonderful thing, especially for advancing a field. But when we talk about engagement with the community, I think, first and foremost, what you need to know is, what does the community want? What is the expected outcomes, or what can be the most beneficial outcome for your community when it comes to your research. I think that is something that you need to have a dialogue about with that community. Then of course, using your findings, whether it's in a preprint, or a published paper, and formatting that in a way that is digestible and accessible. So, whether that's in I don't know, it could be like a comic book, or it could be in a podcast, or a video, or a talk. I mean, so while I find that that paper was really cool, and used really amazing big data techniques there. I did not find that particularly novel or surprising. I don't know if we want to talk about another finding.

Kaylee
Yeah, we're going to get into it. So, the first one, I'm, I'm on board with you. Not surprised. You know, this is important work. I'm interested to know that, and I think that's exactly it is like, what's your what's your intended impact if your impact is just to engage with other scientists, then that's great. But one of the really interesting things that this paper points out, and this is something that you shared about that paper is that the study also looked at how people with different political affiliations, engage with preprints. So, based off those brief Twitter bios, the authors find that preprints on topics such as ecology and science communication received a lot of engagement from left leaning folks, and like nobody can see me raising my hand right now. But like, hey, it me.

Rackeb
It's also her left hand. [laughter]

Kaylee
But other areas of research such as genetics, neuroscience, and animal behavior, have high engagement rates among audiences with far-right views, including white nationalism. Rackeb, you're a neuroscientist who works with genetic data. I was wondering what your take on this is. Did that surprise you?

Rackeb
Again, not surprising. For most of us, in the Twitter world, we have seen, particularly of late, seen discussions about misinterpretations and just a lack of understanding of how to use race-based data in neuroscience and genetics. I mean, I think it's very clear that there are some researchers who are still not defining race as a social construct, right? Or, or when we look at the implications of race, what we're actually looking at are the implications of racism. Right. I think even before we talk about who is engaging with this research, I think it's really important. and I think this is a prime time right now, amidst all of the conversations and protests that are ongoing to be reflecting within our own disciplines: How are we including marginalized folks within our research? Especially given that genetics, and neuroscience have an awful, awful history of perpetuating and creating really, tools of oppression for these communities? So, I think first and foremost, we need to start having those conversations within academia. So, with that paper in talking about networks of white nationalists being more engaged with genetics, and neuroscience, and kind of bringing it back to theories of eugenics and fitness, and natural selection, and all these things that I would rather not talk about on a Sunday. I think what the authors brought up, was very interesting. So, the authors who produce this work, their intention is not to support these ideologies, but here we are having audiences interpret them in a way that suits let's say, you know, their beliefs and their ideologies. What do we do as a community? And most scientists are afraid to engage with these conversations online. They're afraid to engage with these groups online. So, one, we know that that is incredibly harmful, because it allows this misinformation to continue to spread. We know from studies that have been done recently, that misinformation, disinformation spreads really quickly, I think it was an MIT study that found that misinformation on Twitter spread 70% more than information that has been verified, and fact-checked, I mean, that's wild, right? So, we do have a responsibility as researchers to be raising, and flagging concerns of how our research is interpreted, and being discussed, but also something that is very interesting. Something I'm happy that the authors flagged is that social scientists have been studying the way that white supremacists, and white nationalists talk about science studies. So, Dr. Aaron Panofsky, I believe, is a social scientist at UCLA, who has studied how white supremacists who take 23andMe tests, those direct to consumer tests, and getting back the results, a lot of them are like, finding that they're, they're not 100% white, they're not 100% European ancestry. They're like, “uh, what does this mean about me”, right? They're grappling with this idea that they might not be 100% pure. They're discussing it in ways that can be nuanced. So, what he's finding is that they don't necessarily not understand genetic testing, and kind of the mechanics behind how you get a result, but they're using it in a way to justify their beliefs. I believe one of the ways that they have been able to validate the results, is

well, a lot of us had to go and colonize these places. So naturally, we were victims of attacks. So, these are badges of pride that our ancestors have had to wear in order for their sacrifices in order to give us this land that is rightfully ours, and to give us this world that is rightfully ours, and just like really, well, awful, awful. interpretations,

Kaylee
That's a lot of mental gymnastics, you have to go through to get there.

Rackeb
Right, exactly. But it's not to say that they need more information about how genetics works, right. So, it's a bit more nuanced than just saying like, oh, okay, they don't understand it.

Kaylee
Yeah, I think that's so important, and I love that point in that paper where they say to be able to then engage as a scientist, and correct some of that misinformation can actually be incredibly beneficial, and helps prevent that spread of misinformation. Then also understanding that these things are misinterpreted from the meaning of the scientists, but are taken towards a political gain, and something we need to be addressing.

Rackeb
Absolutely, and again, it just highlights the need for more interdisciplinary collaborations with social scientists. I think a lot of times when this work is done, especially with large genetic studies, that social scientists aren't often involved, or historians aren't often involved. So, this needs to broaden our discussions, and our understanding of like, how do we interpret these studies that have yes, biological implications, but they have social and political implications as well. So, we need to be able to have all this expertise involved in order to present these results in an ethical way.

Kaylee
I totally agree. I think that's a really great point. I think the other thing that really stands out to me, one of the takeaways is that if you're still thinking that science is removed from politics, may I submit to you exhibit-A.

Rackeb
I mean, even the very statement right of it not being political is a political statement.

Kaylee
Maybe like to wrap up this nerd out, if you're interested in this conversation, it's such a brief one, I highly recommend the two-part Broad Science episode called "The Social Life of DNA", you need to go listen to it after this.

Rackeb
Thank you so much. Oh, you're awesome. Yeah. Cheers, guys. This has been really, really fun, and we did that episode a few years ago, but I think it's a conversation that I think is going to persist for a long time.

Michael
Yeah. Thank you so much Rackeb for hanging out with us this Sunday morning. If people want to learn more about your new work with the CBC. Where should people go?

Rackeb
So, on Twitter, I am @RackebT I'm sure you can find the spelling of my name in the show notes.

Kaylee
Thank you, Rackeb. This is so fun. Thank you, also, everybody who listened. If you want to hear more from us, you can follow us on our socials @NerdNiteYVR. We'll be back in a couple weeks, and until next time, turn down the lights, turn off that phone, and get yourself some good sleep habits.