Molecular Biology with Raven "The Science Maven" Baxter
Ologies Podcast
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Oh heeey, it's your shoe repair guy who just is curious when you're going to have children, and you're like, "Can I just have my shoes?" Alie Ward, back with just a teeny tiny, tiny ology with a very big guest. It is molecular and it's galactic all at once. Let's get right into it.

But first, thank you to everyone supporting the show at Patreon.com/Ologies. It costs about $0.25 an episode to join and submit questions to the ologist, so you can meet me over there if you want to do that. Thank you for hitting subscribe and rating the show, which takes literally two seconds and costs you no dollars, and also for leaving reviews which maybe takes 60 seconds if you don't proofread, which I don't even mind. And I read and appreciate every one, such as this one left this week by Philo.Sofia, who says:

> *I'm writing this review while curled up with my dog under my Ologies blanket waiting for my virtual physics class to start. Online school for my senior year of high school has been tough, but Ologies has continually reminded me of the world's many wonders and curiosities. Thank you.*

Philo.Sofia, thank *you*! Also, in exchange, please teach me how to use TikTok.

Okay, molecular biology. So, 'molecule' comes from the Latin for 'mass' or 'moles', or 'extremely minute particle'. And biology, of course, is the study of life, so molecular biology is the study of the little itty-bitty squiggly intricate structures that keep us alive, and breathing, and fighting off illnesses, and falling in love, and digesting a pizza.

Molecular biology is how molecules interact with each other to form life processes, and how proteins do a lot of our dirty work. This episode is really exciting because we're also learning quite a bit about how to communicate science from someone who has done a TEDx Talk, and been recognized by *Fortune's* "40 Under 40," and also Megan Thee Stallion. More on that in a moment.

This ologist though got her bachelor's and master's degrees in biology from Buffalo State University in New York. It is very cold there. And she's been an assistant professor of biology and a stem college coordinator for high school students, has worked in a private lab researching cancer cures, and is just a few tiny months away from getting her PhD in communicating science. So, she is busy.

Now I have been a fan of hers for quite a while since seeing her early pandemic video, "Wipe It Down," and we have gotten a chance to Zoom a few times and hang out talking about TV projects she's working to launch. I have retweeted her so many times that people assumed she had already been a guest on *Ologies*, but she hadn't! So we hopped on a call to make it official and talk about what a molecular biologist does, the grossest parts of her lab work, Space Camp, how different brains absorb information, her PhD plans, protein folding, DNA strands, and more with science communicator and molecular biologist, almost doctor, Raven "The Science Maven" Baxter.

Raven "The Science Maven" Baxter: My name is Raven Baxter and my pronouns are she/her.

Alie Ward: You're not the only Raven Baxter that people may have heard of. [*laughs*] I'm sure you get that a lot.

Raven: I get this a lot for the past… I think it's been . . . not 17 years. Or maybe it *has* been 17 years!

Alie: It's such a good name.

Raven: You know, I loved having it until the Disney Channel came in and just decided they were going to do their own thing. [*laughs*] [*That's So Raven theme music*]

Alie: I think a lot of people think of you as Raven the Science Maven. A lot of times I don't even think of you having a last name, I just think of you as Raven the Science Maven. [*laughs*]

Raven: That's good to know because I feel like I sometimes google myself as a metric. I google 'Raven Baxter' to see how many *That's So Raven* pages come up and that's been my metric for how well I've been doing. [*both laugh*]

Alie: Yeah, that's really going to screw up your Google Alerts, probably.

Raven: A little bit.

Alie: When did you come up with the Raven the Science Maven name?

Raven: I remember this specifically happened in a car. I was a YouTuber and I was documenting my hair journey. A lot of people don't realize that I didn't start growing my platform under science. I was growing it under hair and beauty.

I had a pretty large following, and people really enjoyed me, but I personally felt I had more to contribute to the space than just talking about hair, so one day I'm like, "Well, if I'm not, you know…" I was branded under "Really Raven" at the time, and I said, "I want to do something that's science related." I just came up with Maven. My aunt calls me Raven Maven, and then I'm like, "Well, what about Raven the Science Maven?" A maven's an expert in something, and at that time I'd just gotten a master's in biology, so I was like, "Oh, I'm an actual maven of science," so that's how it happened.

Alie: Done and done. Do you feel like you learned a lot of the ropes in terms of how you wanted to communicate doing your hair channel and your beauty channel?

Raven: Yeah, I think it was really good practice for me because when I started YouTube there was a really set way for doing a video and there was a set of norms that you had to abide by when you were making content.

The type of community I was making content, for the hair community, it's called Sisterlocks, and the Sisterlocks community can be a little disapproving when you stray from traditional hair care methods, etc. I was doing a lot of things that people didn't do, that were kind of forbidden. For example, when that hair paint wax… I don't know if you got into this trend, but those colored waxes that you could put in your hair instead of dying your hair. It was a temporary way of adding color. I would put that in my locks and people would be like, "No! You're not supposed to do that! It's gonna get stuck in your hair!" and this and that, which is true, but I wanted to try it, right? I wanted to have fun experimenting with my hair and that meant doing a lot of things that people were like, "Oh my god, why is she doing that? That's not how you're supposed to do it." But I did it anyways and I did it in a way where I was unapologetically like, "Hey, I just want to try new things."

Learning how to create content without being afraid of what people think, or being true to yourself without worrying about who cares or who doesn't want to see you have fun with X, Y, and Z has really been a good lesson for me as I've talked about science. And it was a good primer for me to understand how to come into the science communications space without worrying about how I'm presenting the material, if everybody is going to like it, or

is everybody going to approve of me doing x, y, and z and just having fun with it. It was really good practice for that.

Aside: Okay, for a quick discography of music videos that have gotten the world's attention, one of Raven's first was titled, "Big Ole Geeks" featuring her dancing around a sports car in these tall shimmery boots wearing a lab coat. She was joined by other female scientists:

[*clip from "Big Ole Geeks"*]

Big Ole Geek in this house/And we running through this place
I ain't no regular degular/Man, I'm really molecular
Gotta see the big picture/I'm a significant figure
Get more degrees, head get bigger/Gel 10% but I'm thicker.

And then, of course, there was the early pandemic disinfectant tutorial "Wipe It Down" which was an homage to Foxx's "Wipe Me Down":

[*clip from "Wipe it Down"*]

Lysol, wipe it down/Clorox, wipe it down
Lysol, wipe it down/Clorox, wipe it down
Wash your body/Wash your hair/ And wash your hands too
Get some soap scrub it down/And show me how you do it!

YouTube comments sing her praises saying, "This song is catchy as hell , no pun intended." And, "I'm a 65-year-old man and you have me bopping to this jam when I'm washing my hands at home."

Now, her most recent video offered up info on vaccine technology and antibodies:

[*clip from "Antibodyody Antibody Song"*]

The category: biology/Lesson on immunology.
A little microbiology/This is the terminology.
I got the vaccine and now you got me on the right night
B-cells know the haters when they see 'em so it's fight night.

Was it retweeted by Megan Thee Stallion? It was. Children: Dreams can come true.

Alie: And you've been doing experiments since you were a kid, right? You've been mixing things around the house. Have you always been kind of science-minded?

Raven: Absolutely. I definitely have always loved science. I was an only child and raised in a single-parent household and my mom worked really hard. A lot of times it was up to me to entertain myself. Quite often I would find that I'd get drawn to the natural environment, looking at the clouds or digging in the dirt. Things that kids do. I feel like I engaged in scientific inquiry from a very young age.

Aside: So, meteorology and clouds, to grass stains, to a lab coat, how did this journey happen? Raven dipped into Space Camp, which, until adulthood, I thought Space Camp was a fictitious place. I thought it was like the Wonka factory. I had no idea it really existed. But since 1982, 900,000 campers have gone through their program, among them a bunch of real-life astronauts, and also Raven.

Alie: I didn't even realize Space Camp was real for a long time when I was a kid. [*laughs*] What was that like? How did you pair down what direction in science you wanted to go toward?

Raven: That's funny because it largely happened at Space Camp. I was pretty set on being an astronaut until I went to Space Camp and found out I was afraid of heights. [*"Don't look down, don't look down!"*]

At Space Camp, they really do give you junior astronaut training, so they put us in a high-altitude flight simulator and I immediately realized that I really don't like flying and I really don't want to be in a spacecraft, [*both laugh*] so I really had no choice but to focus back down to Earth, literally, and pursue sciences that are Earth-based.

When I went to college, I tried different majors out. I started in environmental law and policy and then later, as I transitioned in my academic journey, I found genetics and was so thrilled to learn that our bodies are so cool that they speak their own language, which is the genetic code. I'm sitting in this class, like, "Oh my gosh, none of my friends are in this class, they have to learn about this, this is so cool. Our bodies are speaking a language and we're the only ones that are taking a class on it." So not only did I think it was super cool, but I wanted to share that with everyone that I knew, but I just went down that rabbit hole of genetics and molecular biology and I never came out.

The language is our DNA; the genetic code. It is a sequence of nucleotides that contain instructions for proteins, and those proteins are doing the work inside of ourselves to generate our life processes.

The way that I like to see it is just a scaled-down version of how cities work, where you have the mayor, he's at City Hall, and that's often the central point of a city. And the mayor has his staff that he talks to, and he tells so-and-so to do this, and then they go do that, so it tells another person to do another thing and they go do that job. And everything that happens out from City Hall affects the entire city and that's how I think about molecular biology. It's a super simplified version of it where your DNA is the mayor and the mayor's staff are proteins that are carrying out different functions.

Alie: That's amazing. And they look, from what I've seen, kind of like gift wrap, right? Are there a lot of spirals happening? What are these proteins shaped like?

Raven: [*laughs*] That's hilarious. Proteins are really interesting. They have different shapes and sizes. They fold into these different shapes that determine their functions, but they don't start folded.

Aside: Okay, let's back up a little. [*truck backing up: beep… beep… beep*]

Raven: We can just start from the beginning. We have our DNA, which is inside of our nucleus, and it's very neatly packed and packaged in the nucleus and it gets read by other proteins inside of your nucleus into a different code called RNA, which is almost the same as DNA, but it uses a slightly different code. And then the RNA is read by proteins called polymerases and the polymerases then translate the information from your RNA to create a protein. As the protein is being made, it's basically like a spaghetti noodle as it comes out of this polymerase, and then as it's coming out it folds into these different shapes. The two basic shapes are beta sheets, which kind of look like a brick of ramen noodles, or alpha-helices, which are those curly pieces that look like, I don't know, rigatoni? I actually don't know. Is rigatoni even the curly one?

Alie: [*laughing*] I think so! I think rigatoni is. I should know, I'm Italian.

Raven: Don't quote me!

Alie: I'm the worst Italian in the world.

Raven: Oh no, it's fusilli. Fusilli.

Alie: Yeah, okay, you're right. You're totally right. [*both laugh*]

Raven: Fusilli pasta.

Alie: I think it's better to know more about molecular biology than pasta, but that's just because I was raised on so much marinara sauce that I can't even look at pasta. We ate so much as a kid. [*laughs*]

Raven: I can relate.

Alie: Just like, "Ugh." So, they're in those two different beta or alpha helix shapes. And then what do they do from there?

Raven: From there, all of these shapes and structures are determined by the protein's amino acid composition. And so depending on the composition of the protein itself, it'll fold and shape into different levels of protein folding. So there's primary structure, secondary structure, tertiary structure, and quaternary structure.

Alie: And those different proteins, the complicated ones or the simpler ones, are they bouncing around in our bloodstream to send messages? Or are they packaged to form different organelles and different organs? What happens to those curly, folded, very specific proteins?

Raven: They do so many different things. Where do we even start? They get packaged in the Golgi apparatus and shipped out to different parts of the cells. One place where they can go, they can get packaged out in a vesicle, which is basically just a little… you can call it maybe a little fat bubble. The proteins can get packaged into vesicles and sent to the cell membrane where they can release proteins out into the extracellular environment or present the proteins onto the cell surface. That can be the case for things like antibodies, or receptors rather, for different channel proteins. Things like that.

Aside: Right now, no matter what you're doing, there are tiny proteins cruising around your cytosol, which is the ooze that makes up the cytoplasm in your cells. And a Golgi apparatus is sorting some of them and popping 'em into fat envelopes, and you just have no idea how hard they're working in trillions of tiny factories, attaching labels to things and passing chemical notes back and forth like two teenage lovers in after-school detention.

Raven: Cells use molecules to communicate. For example, there are certain cell pathways that cause cancer, or there are certain cell pathways that we can study to understand cellular responses to immunity or things like that.

Alie: Now, you have worked in cancer research, you've worked around big vats of *E. coli*. You have done some really awesome work, and obviously you're working on a show right now called *Nerdy Jobs*, which I'm excited about. What was it like getting your master's and then studying on a corporate level? What types of things were you looking at? How does a molecular biologist do their work? Do you need the most gargantuan microscopes to look at these curlicue proteins? How do you do it?

Raven: Yes, you do! I was really lucky, I feel, because the type of work that I was doing was very diverse. I was working at what you call a contract research organization. That's an organization that big pharmaceutical companies hire out on a contract to carry out smaller portions of their research. So for example, the vaccines that are coming out right now for COVID-19, those large pharmaceutical companies could have contracted out portions of

their research by asking a lab, "Hey, we want you to isolate this protein and report back to us about X, Y, and Z." And then we do that, and then we give them the results, and that's it. Or they could contract them out for the entire project.

The kind of work that I was doing looked a lot different almost on a weekly basis or monthly basis. I was doing cell transfections, which is a fancy word for running experiments to insert DNA into cells. Or I was doing CRISPR projects, or I was trying to generate a new cell line that expresses a particular protein that we're interested in, or isolating DNA from bacteria by the gallon, [*splatting noise*] which is why I had to make basically gallons of poop, like you just said, because I was using *E. coli* as an expression host for the DNA and I had to get the DNA out of them.

It was really interesting. I was working with different types of cell lines; breast cancer cell lines, skin cancer cell lines, and even neuronal cell lines, which is really cool. I did some work on trying to understand… find the best drugs to treat Parkinson's disease, or brain diseases like Alzheimer's as well. That involved some really interesting and fun work using neuronal cells.

Aside: Neuronal cells, sidenote, are types of neurons in the brain. When we think of a neuron, you might picture a hand at the end of a long arm that has a bulbous other end, or maybe it looks like a tree; hence the word 'dendrite', from its root, 'tree'. But some research estimates there may be up to 1,000 different types of cells in our nervous system, depending on their structure, function, or location. My point is, our brains don't know everything about our brains. Studying our brains with our brains requires machines devised by our brains to study themselves, which is creepy! And also, not cheap!

Raven: The equipment that we use is often very expensive. I had the pleasure of working with this super cool machine called the PerkinElmer Opera, I think it's called.

[*male voice: "Introducing the Opera Phenix High Content Screening System, from PerkinElmer. For the speed and sensitivity you need. No compromise."*]

It was super cool because it's a high-content screening system. So we were able to test hundreds and thousands of drug compounds on different cell lines to find out what drugs work the best against a certain type of cancer and then we would formulate the drug.

Aside: Sidenote: I looked up exactly how expensive this machine is and I couldn't find a price tag listed anywhere, I was so frustrated! Then I started searching other avenues and found a 2018 grant proposal asking for the money to acquire such an item. They were looking for $893,169. [*whispers "Nice!" at the 69*] For that exact price you can also get a 5-bedroom, 4-bath, 300 square foot home in Pacific Grove, California. Or you can get two Rolls Royce Phantoms. Or you can buy an opera house in Phoenix, Arizona, which was purchased in disrepair by the city a few decades ago. Or you can look at cells up close, and crunch some numbers, and solve some pretty big problems.

Alie: And so you're just low-key curing cancer when you go into work. That's how it gets done! Right?

Raven: Yeah. That's the very beginning part of it. When you talk about clinical trials, that's where it starts; with the molecular biologists trying to find what drugs you should even be looking at in the first place.

Alie: You also are very good at sci-comm, and you're getting your PhD in science communication itself. What is that work like?

Raven: This work is so different. It's so different. I want to say, I feel like my PhD would have been a little less painful had I really understood and been trained with a social sciences background. But I also love it at the same time because I feel like I've truly mastered how to think like a STEM scientist, and now I'm master*ing* how to think like a social scientist. And I feel like I have a whole complete brain. It's really cool.

Alie: I imagine getting a PhD in science communication when you are already responsible for huge viral hits and you have a great following… Are you finding that in the course of getting your PhD you're acting more and more as a mentor to the people around you?

Raven: It's really interesting… Not really, because my PhD is in science education and a lot of the people that are in my program aren't doing the same work that I'm doing at all. I feel like I'm the only person who might have ever even focused on science communication itself. A lot of the work that other folks are doing is in the K-12 space and truly centered in the classroom, which is fine. But when we come together and talk about our research, it definitely looks a lot different.

Aside: Not only will she be getting that PhD very soon, but she's also working on a few academic papers about science communication and how vital it is for scientists to share the work they've done with the public. But how does one Comm Sci? What are they learning to help teach others how to teach others? Brains on brains on brains.

Raven: I think that I can talk about one of the things that really made my lightbulb go off that I learned as a graduate student in education. And this was an example that was given in, I believe the book is called *How People Learn*. There was an example given in the book about how people from different physical environments interpret information differently. The example that they gave was a very literal one where they described a study where they showed a set of pictures to people who lived in a very rural flatlands environment. And then showed that same picture to people who lived in an urban environment with skyscrapers and tall buildings. They found that people from rural environments interpret vertical lines differently than people who live in urban environments that have tall buildings and skyscrapers.

Alie: Oh my gosh!

Raven: Yeah! So I mean, when you think about that simple thing – people interpreting lines and shapes differently based on where they live and where they come from – you can only imagine all of the complexities that exist from person to person based on their upbringing and their personal experience. So I try to be very mindful when I'm educating someone that not only am I trying to teach them something, but I, in the same space, should be trying to learn as much about that person as possible so that I know how to teach them, or so that I can understand how they might be interpreting my information.

Aside: Whether it's one-on-one or via a huge, viral video, as a communicator it's important to know your audience and cater a little to what will affect them most powerfully. But how does she do that while staying true to herself and the art that she wants to make?

Alie: You have such a distinct voice and you have such a magnetic vibe when it comes to sci-comm. How do you find your voice in it?

Raven: I love this question [*laughs*] because it points me to a very specific moment in my life where I actively made this decision to exist as I am in any space that I occupy, but especially as a scientist. This moment happened when I was, I believe, a junior in college. I had started my very first undergraduate research experience. This is important for a lot of

junior scientists because it's quite often in college that we have our first formal research project where we have a hypothesis and we're actually using things around us to collect data, and it's a long-term thing that takes months and months. And it's a pretty big deal when you're just starting out.

My study was about understanding soil microbial respiration. That's a really fancy term for: How do the germs in the dirt produce gas, and how much gas? So in my experiments, I was taking dirt and putting it into a closed chamber, and the chamber had a measurement device on it that would tell me how much carbon dioxide… what different gas levels were emanating from the dirt itself. On a bigger scale, how do things like global warming or flooding impact how microbes in the soil produce gas?

So that was my research project. I was doing this independently. I was a junior in college. I had an advisor and I'd go to the lab every day, collect my data, X, Y, and Z. This took me months. At the end of semester two, my advisor says, "Raven, you've been working so hard on all of this. You have great data. I think that you would be a great presenter at the undergraduate research symposium."

Alie: [*makes an excited squeak*] That's a pretty big deal!

Raven: Yeah, I know! For those of you who don't know what that is, it's basically that you get a chance to put your data and your research onto a poster – in this case it was a poster symposium – and all of the scientists line up… They form aisles in a big room, and you can walk around through the aisles and ask scientists questions about their research. And so that's what I was going to be doing.

And so my advisor says, "This is what needs to be on your poster," he explains how the data should look, et cetera. He didn't really explain too much to me. All I really knew was that I had to make a poster with my research on it. And I'm like, "Great! I worked so hard for this. Yeah, let's do this. I can't wait!"

Now, mind you, I'm a junior in college. The last time I had made a poster about anything was probably in middle school when I won an inventors contest. It was called the Invention Convention. And I won third place. [*applause*] It was Barbie's Fish-and-Row. It was a Barbie that had a boat that fished for her, so she could look cute in the boat.

Alie: [*laughs*] I love this!

Raven: So I had the Barbie, she was in pumps and sequins and stuff in this pink boat, and the boat was fishing for her so she could kick back with her little water bottle and just chill out on the ocean, you know, whatever. I won third place. My poster had sequins on it, glitter, stickers, Pokémon cards… It was a really intense poster. [*Alie laughs*]

So, fast forward, back from middle school to college. I'm like, "Hell yeah, I get to make another poster!"

Alie: Oh my god.

Raven: So, I go to the craft store, [*both laugh*] and now I have big girl money, okay? I'm in college, I'm not in middle school. I've got 20-dollar bills and stuff, right? [*Alie* laughs] So I'm at the craft store, my cart is overflowing with feathers, glitter, stickers, stamps. Gosh, different types of scrapbook paper, glue, ribbons, everything. *Everything*. [*Alie laughs*] And I was so proud. I lugged all of that stuff into my dorm room and I go to town making my poster.

And my advisor gave me a poster tube because he told me, "Put your poster in it. Roll your poster up, put it in the tube so it stays nice for your symposium." So, I finished making my poster, with literally *all* of the things I just described that were in my cart at the craft store, and he says, "I want to check your poster before the symposium tomorrow." Now, we're like the day before the symposium. I'm like, "Sure."

Now, I should probably explain what a poster is supposed to look like, normally. Posters for research conferences are generally just paper, okay? [*both laugh*] Just paper and one color of ink usually, and in Times New Roman, like the most plain, plain font you could ever think of. Maybe 300-500 words total, maybe a couple pictures, a graph, your references. I mean, it's just bare minimum, period, okay?

So, I come to my advisor's office, and he's like, "Okay, let's see your poster," excited for tomorrow. I take my poster out of the tube and you know how when you glue glitter onto stuff it doesn't really stay on, it kinda falls off? So, I'm unrolling the poster and there's, like, chunks of glitter falling out and, like, feathers collapsing to the floor, and it's all crinkly and stuff. He's like, "Oh… my god. Oh my god." [*Alie laughs*] Absolutely mortified! I've never seen anybody so disappointed in my entire life.

Alie: Oh no!

Raven: Even in my adult life, okay.

Alie: Oh no!

Raven: This is the most disappointment I've ever caused. So he says, not only "Oh my god, I can't believe… wow, what am I looking at?" But also, he said two things. I could either go home and redo this… He explained to me that the reason that he gave me the poster tube was that he thought that I was going to go to the printing office and have my poster printed and that I was going to pick it up from the printing office and put it in the tube. He's like, "That's why I gave you the tube. You can either go home and do this really quick and you might be able to get it to the printer's office and do this the right way, like the plain way. Or you can *not* go to the conference at all."

Alie: Nooo!

Raven: I know, right?

Alie: Nooooo!

Raven: And his reasoning was that he felt like people were going to laugh at me. He didn't want me to be embarrassed. He was like, "Everybody's going to laugh at you. This is a no. It's a no for me, dawg." [*Randy Jackson: "It's definitely a no for me dawg."*]

And I was like, "Hmm!" You know, I was like, "Wow." I had to take a moment, you know? This was somebody that I respected telling me this. Somebody who has a PhD in the field and has earned their stripes well before I was ever going to earn my stripes. I was like, "You know, if this is how this is supposed to go, I get it," you know? But I also had to sit with the fact that I really enjoyed making that poster! [*Alie laughs*] I had spent all night, I was so excited, you know, and I felt like I had really put my entire self into making it and that it was really representative of who I was as a person. I also had to sit with the fact that the whole point of going to the symposium was to present my research and that my research was going to be the same, regardless of whether I remade my poster or not.

So, I did not redo my poster. I actually went to the symposium…

Alie: Yes!

Raven: …with the glitter poster.

Alie: Yes!

Raven: Yes.

Alie: How did it go??

Raven: It went amazing! [*DJ airhorn*]

Alie: [*laughs*] Yes!!!

Raven: So like I said before, symposium, everybody's standing in a line. We form aisles and we're all standing next to each other with these posters on a stand, waiting for people to talk to us about our research. And I had people *lining up* to talk to me!

Alie: [*laughs*] Yay! Oh, I love it!

Raven: Literally, lining up. Nobody laughed at me to my face. [*both chuckle*] People were very inspired to see my poster. And they were excited to ask me questions about my research, and not only that, I actually won an award. [*Alie gasps*] Yeah, I actually won an award for my research.

Alie: Yay, oh my god!

Raven: Yeah, it was a student excellence award and it was because of my research, it had nothing to do with how my poster looked; it was just excellence in student research. And that was a very important moment for me. It's a really simple story but I was able to go back to my advisor and I kind of rubbed it in his face a little bit. [*Alie laughs*] Because yeah, he didn't know I was going to do that and I said, "Look, I got an award. I got an award for this and you said people were going to laugh at me."

I just learned from that point on, sometimes you don't listen to people when they tell you no. Sometimes a 'no' actually is a yes. A lot of times it actually does mean no, so like, don't take me out of context, but when people are denying you an opportunity to be yourself in a space where you belong, just as you are, you don't have to take that denial. You can say no to that and come as you are, and nobody gets hurt. In fact, people were coming up to me at the conference, business majors, music majors, etc., saying, "This makes me want to take a science class."

Alie: Oh, amazing!

Raven: Or, "What major are you that you get to do this stuff? This is so cool that you get to do this." It was inspiring to people even outside of my own field.

So, I try to carry that energy with me today, which is probably very obvious now [*both laugh*] that you've heard the story. But I just can't live in a space where somebody's going to tell me that I can't bring my glitter poster to the conference, you know?

Alie: 100%. Oh my gosh, I love this so much. Do you have pictures of it?

Raven: I wish I did! [*Alie laughs*] I really wish I did. It was such a long time ago. I think I was too scared to take a picture of it. But the glitter never left, I literally can't get rid of that glitter. It's everywhere still.

Alie: [*laughs*] It's in your soul and, you know, under the baseboards and stuff. I love it. Oh my god, that's so inspiring that it's okay to be more yourself than you think, you know? To show up with your whole self.

Raven: It is. It's a little scary, but it's never a bad thing to just embrace who you are inside, it's just never a bad thing. And once you get past that fear of what do other people think, "Are people going to laugh at me?" – which they might, and that's fine - it's just… the world is yours. Just go do it. Do it scared.

Alie: I love it.

Aside: As a person who has struggled with being scared to start making something that's important to me, I had to mine her for self-help strategies, because I am an information leech and that is my deal.

Alie: Your videos are incredible and they have explained so much great stuff. How do you know what you're going to make a video about? How do you start writing it? Where does the music come from?

Raven: Usually, it's a situation where inspiration just strikes me and I lock myself in a room [*Alie laughs*] for about 20 minutes and out comes a song. I don't think people really realize how quick the process is for me. It's often so quick that I don't know my own lyrics. [*Alie laughs*] If you look at my videos closely, you'll see that as I'm lip-syncing I actually miss a lot of the words. I don't know what I'm saying because I wrote the song in like, three seconds, and then I'm trying to record it on a video and I don't remember what I just said. Also, I have ADHD, so that's probably a part of it. [*Alie laughs*] But yeah, it's a really quick process.

Alie: Do you decide when you are writing it, kind of, what the video is going to look like, or do you just film a bunch of stuff and it just comes together in the edit?

Raven: Well, because we're in a pandemic and most of the work that I've done at this point has been during a pandemic, I have limited resources. You know, I can't go out to places, like, inside of the lab to film fun things. There's two feet of snow on the ground right now, I can't really go outside, so I just work with what I have and try to use my personality and my presence to add certain dimensions to what I'm doing.

But my partner, you know, he already knows, like, once I make a song, he's already committed whether he likes it or not, [*Alie laughs*] to helping with the music video. He's like, "All right, she's got a song. What angle do I need to hold the camera? All right." He loves it though. He's a huge introvert but he likes to be on the other side of the camera.

Alie: You two are now married, you met at math camp, correct?

Raven: We did meet at math camp, yes.

Alie: Just two hot nerds meeting at math camp, getting married like a decade later.

Raven: I know. I honestly didn't give him the time of day when we first met because he was so quiet, you know? I have a lot of personality so he didn't really stick out to me then; he was just the quiet hot guy. We love each other very much.

Alie: Aww that's great.

Raven: He has a Twitter account now, where he teases me relentlessly. So yeah, he's shy but behind a little fake account, he says a lot. [*laughs*]

Alie: That's @MrScienceMaven, right?

Raven: Yeah.

Alie: Yeah. [*laughs*] And you touched on a little bit that you have ADHD and I wanted to ask about how you have learned, maybe, workarounds, or maybe things that work for how your brain works. Anything that you've learned that you wish that you knew earlier?

Raven: I think that you really do have to give yourself grace. And just understand that your brain simply does not operate how most people's brains work, and it's not your fault, you know, that you do things maybe a little bit slower than other people because you need just a little bit of extra time to process. Or maybe you might get distracted, unfortunately, or off-task. Just have grace with yourself and understand it's not really a deficit, it's just a different type of life that you're meant to live and it can be your superpower.

I love trying to figure out new ways to accommodate myself and give myself grace. For example, if I had a meeting or something where I've had to concentrate for a long time, I like to just give myself grace and say, "You know what, you worked really hard to focus and stay still for this meeting. If you want to pig out, you know, or just be a goofball for the rest of the day, do that. You earned that, that's okay. If you can't handle anymore, that's also okay." And also, asking for help when I need it has been a really big thing, especially this past year. There's no one-size-fits-all answer for everybody, but I do think that knowledge is power and sharing information is the best thing that we can do.

Alie: I have so many questions from patrons. Can I just lob some at you?

Raven: Wooo! Yes.

Alie: Okay.

Aside: But before we pepper her with curiosities, we will of course donate to a cause of the ologist's choosing and Raven said she didn't have a preference, she'd just like the money to go to whomever needs it. As it happened, our mutual buddy Hank Green's Project for Awesome was this past weekend so we made a donation in Raven's name which happened to be at the final couple of seconds as they reached the $2 million mark! I logged on and they were a few hundred dollars short, so we made it happen. Project for Awesome is a project of the Foundation to Decrease World Suck and you can learn more about them at ProjectforAwesome.com. That donation was made possible by sponsors of the show whom I shall now yammer about, very briefly.

[*Ad Break*]

Okay, you had questions for Raven! But in addition to the question, you had praise, and compliments, and general fawning. I loved it.

Alie: Before I read your questions, Keslie Naffa says: Holy crap, I love her.

Raven: [*laughs*] I love you too, Keslie!

Alie: Crystal Haka just says: RAVEN THE SCIENCE MAVEN *insert Jonah Hill squealing and hand flailing GIF here*. Alanda Kohl says: Hi Raven, I'm a huge fan. I have no specific question.

Raven: I just can't! [*laughs*]

Alie: Yeah I love it. Florence Yuan says: Raven, I follow you on Twitter and I'm a big fan. Seb Cancino says: Hi Raven, I love how you illuminate Twitter. So yeah, just a lot of messages saying, *all caps squealing* because people are just very excited that you're on.

Raven: The feeling is mutual. Thanks, everybody!!

Alie: A lot of folks had questions, including Brandon Butler and Ashley Emanuele: Is the mitochondria actually the powerhouse of the cell? What is the mitochondria doing?

Raven: [*laughs*] Aaah! Yeah! So yeah, it definitely is the mitochondria of eukaryotic cells, meaning not bacteria, basically. What mitochondria do is they break down sugars and turn them into energy.

Alie: It's almost like something that breaks down gasoline in our cars?

Raven: Honestly. Yeah. Pretty much.

Aside: I looked this up and wouldn't you know it, molecular biology happens to be a little more complicated than a Honda Civic engine. But still, mitochondria do sort of burn our food fuel and produce a source of energy. This whole process is called 'oxidative phosphorylation' and it does require oxygen, just like a combustion engine. Also, there can be a bunch of mitochondria shoved into one cell. The swimmy sperm have mitochondria that run in a spiral, down its flappy floppy tail; kind of like ribbons on a really horny maypole. Your hard-working heart muscles, right now, are really jam-packed with mitochondria. So yes: Mitochondria is the powerhouse of the cell; it *is* useful information to know if you're into breathing and being alive and stuff.

As long as we're gossiping about spiral structures, let's get into the heroic helix, shall we?

Alie: Kiana Spinelli asks: I was told several times when I was younger that there were 6+ feet of a DNA strand in just one cell. Is this true or is that flim-flam?

Raven: Oh my gosh. So I don't know the exact answer to this, but I would not be surprised because DNA is supercoiled inside of your nucleus. It doesn't just hang out in there like spaghetti. It's wrapped around itself. It's wrapped around things called histones and it's very tightly and neatly packaged inside of your nucleus. So I wouldn't be surprised if you stretched it all out that it did end up being six feet or six-and-a-half feet.

Aside: I was so curious, I had to double-check this. Geneticist Dr. Barry Starr does confirm that it's about 6 feet – or two meters – of DNA strand inside each cell. He then calculated that each human being has around 10 billion miles of DNA in them, meaning that your DNA – *your* DNA right now, just as you're sitting here, eating pirate's booty or whatever – your DNA could stretch to the sun and back [*low pitch voice effect*] 61 times! What! You beautiful freak. You are just a living, pooping, work of magic. All of us.

Alie: I have a ton of questions and I will list all the people who asked about it because it is numerous:

Aside: Deep breath, I'm looking at you, Patrons Erik Pohanka, Gabrielle Stern, Austin, Davis Born, Colin, Mike Monikowski, Anna Guzman, Alanda Kohl, Adèle Maisonneuve, Madi Reeves, Morgan Coburn, Seth Suchy, Bennett Gerber, and Jenn 'Squirrel' Alvarez, as well as first-time question-askers Katie Willis, Melanie Lee, and NanoNaturalist (who called them foldy bois), and Gísli Balthazaar Kárason who wrote in, specifically:

Alie: This question just tickled me: As far as I understand it, a prion disease is due to a fucked up protein, which fucks up unfucked up proteins when they interact, but is it possible to engineer a "beneficial prion" or whatever? Like a blessed protein sauntering around blessing the unenlightened, common prots (that's what they're called now) so that they can work more effectively, efficiently, and blessedly inside our disgusting sacks of disappointment and gore? Is this how superheroes are made? The Prionic Man! We have the technology!

A lot of people asked: How terrified should I be about prion diseases? Colin asks: Please tell us everything about PRIONS. I hope I'm saying it right, "pree-ons," because I've heard that it's either pree-ons or pry-ons and I get very self-conscious about how to say it.

Raven: Yeah I've said pry-ons, but you know, I'm not saying pry-on to correct you, it's just… Let's cover all of our bases here. [*laughs*] So yes, hypothetically it would be possible for us to create a prion that can do this, but I don't think that we even have a good enough understanding of protein folding at this point to do that. I'm not sure if you caught what's happened recently with AlphaFold.

Alie: Yes! We have so many questions about that, too!

Raven: Oh, you do?

Aside: AlphaFold, sidenote, was developed by Google's DeepMind, and this AI program ranked #1 multiple times on predicting protein folding structures. Its last victory in such a competition was back in November and it yielded results that scientists called astounding. Everyone lost their shit about this, for good reason. It was nuts. A lot of people asked about it, including Hudson Ansley, Adam Drake, Jaime Jensen, and Sam Kilgour, who phrased it: How excited are you about DeepMind's protein-folding AI on a scale from "very" to "OMFG"?

Raven: I should say that my entire master's degree is about protein folding. I spent two-and-a-half years characterizing the structure and the function of a chaperone protein, which is a protein that helps other proteins fold. It took me two-and-a-half years to just do that, to look at the sequence and understand, based on these amino acids, this is how this chaperone protein should fold. The AlphaFold program can probably take the same information and do it in less than a minute, if not seconds.

Alie: Oh my god.

Raven: So within just a handful of years, we've been able to make this advancement in technology. This advancement – having AI help us understand how proteins fold and make those predictions – will help us to understand how proteins interact with each other. Because there are a lot of pathways (meaning chains of reaction) where things are interacting with other things in the cell. There's a lot of pathways that we are still trying to figure out. So it's very possible that we could make a protein to assist with prion diseases, but we haven't figured out the basics yet. But technology is very promising in helping us do that.

Aside: How do these "pry-on", "pree-on" diseases even start? I want to say that they are the work of a microscopic origami goblin, but is that true?

Raven: Yeah, prions are misfolded proteins. Proteins, when they come out of the ribosome as they're being made, they're folding based on their amino acid sequence, but there's also a lot of other checkpoints that are happening in that process that is acting as a safeguard to make sure that that protein's being folded properly. So we have other proteins that are called chaperone proteins, and literally they are helping the protein fold into its correct shape, and the protein shape determines its function. So it has to fold the exact right way so that it can do its job.

When that doesn't happen the right way, it can cause disease. Some things that can happen are… when the proteins are misfolded, they can accumulate together. They can stick together. They're affecting other variants of the same protein and causing them to misfold. So it's something that you really don't want to happen. Mad cow disease is one of them.

There's quite a few of them. I don't know them all because this is a very small subset. It's a really interesting area. I think proteins are so interesting.

Aside: So, a few, tiny tidbits: Prion comes from the portmanteau of the words "proteinaceous infectious particle" and I just read that the scientist who coined the phrase wanted it pronounced pree-on. So we have a real jif-gif sitch here. Please do not write to me, I don't want to hear it.

According to a 2019 *Seminars in Neurology* article, prion diseases share the commonality of abnormally shaped proteins that resist being broken down by heat, even extreme heat, and by chemicals, like proteases. There are a few variations: there's sporadic, genetic, and acquired. Don't freak out too hard though: prion disease is still pretty rare, with about 350 cases happening in the US per year. My main advice is just try not to eat a lot of brains. Isn't that helpful?

Also, if you're worried about Chronic Wasting disease, which is spreading in deer populations in the United States, there's some info on that in the Cervidology episodes I did in September about deer. But let's talk about cuter things, like little itty-bitty proteins with legs marching a molecule down a path.

Alie: You mentioned also chaperone proteins, and Jacob Elsbree asked: How accurate is that viral gif of a cute little kinesin protein trotting around the cell carrying a backpack of what I assume is more protein? Is that at all accurate?

Raven: It's accurate, but the reality is that it is not walking that slowly at all. Those little bad boys – whatever, bad things… the little bad things, they are zipping across faster than you can even blink. So that's the only real difference there. I mean, obviously, it's not going to be that cute. That little thing is so cute. But yeah, he's running. He's running for his life.

Alie: A few people asked about motor proteins. Alicia Penney wants to know: Can you tell us about motor proteins? How the heck do they work?

Raven: Aaah! So the little guy walking is a motor protein and they carry cargo, basically, the cargo that are containing molecules, proteins, whatever. It could be anything. They could be carrying organelles; they can carry different structures within the cell. They can move chromosomes. They're working hard, okay? They're working hard. And they move in particular ways.

Think of this as a highway and one end of the highway is a negative side and the other side is positive. Dynein walks towards the negative end and they're carrying their cargo from the peripheral side of the cell to the center of the cell. And then kinesin is like dynein's sister and they are walking in the opposite direction. So they're walking towards the positive side and they carry their cargo from the center of the cell to the periphery of the cell. So in order to move their little feet, they use ATP, which is the energy currency of the cell, which comes from the mitochondria. So now we've come full circle back to the mitochondria. They're going so fast.

Alie: John Sansone has a question: Where did DNA even come from? How did random bits of atoms and molecules know to build themselves into proteins and then assemble into DNA strands, which now tell other things to build other DNA strands?

Raven: This is something that I think about too much and it freaks me out! ["*My brain is melting."*] That's a question about the origin of life because all living organisms on Earth use DNA to generate their life process and we don't necessarily know exactly how this all started. And

this will be a question that we are likely trying to answer for many, many years to come. But I love thinking about it because of all the possibilities. **Aside:** So, for years the hypothesis has been that DNA started with the simpler, single-strand, RNA. But in the past decade or so, other scientists are just begging to differ and say DNA, which kind of has a trickier sugar molecule as well as the double helix shape, could have arisen at the same time. It's even possible that a hybrid RNA-DNA molecule first arose and then split off into two forms. Who's to know? If you have a time machine let us know.

Now, one thing we are sure about is that these replicated codes have been encased in cellular goo and structures for billions of years. Billions with a B! Plus, in all this talk about DNA, I wanted to know if Raven had any feelings about Watson, Crick, and Franklin? Is that something that ever gets her goat?

Raven: Oh, it does. It's funny because I'm actually on the Rosalind Franklin Society's Advisory Board; shout out to Rosalind Franklin! Woot woot! But yeah, the way that I learned the story was that there were several scientists working at the same time to understand the structure of DNA. My understanding is that Rosalind Franklin, Watson, and Crick were all scientists who were… They weren't working together. Rosalind Franklin was working separately than the others. But the two guys, Watson and Crick, made a visit to Rosalind's lab as she was doing similar work, and stole some of her information so that they could further their own findings and, ultimately, win a Nobel prize for it. [*exaggerated*] Soooooo, there's that.

Alie: Yeah. Okay, a few people, Katrina Nguyen, Adèle Maisonneuve (*au Francé*), and Davis Born asked: Epigenetics, what's going on? How does it change DNA expression and pass it on to the next generation? Katrina asked: Will my children have my same weird quirks and habits?

Raven: This is really interesting and something that I wish I spent more time on when I was on my genetics kick. But epigenetics, it's a part of molecular bio that's looking at heredity but not heredity that's caused by actual alterations in DNA itself, right? The DNA has a code and that set of code, again, codes for proteins and protein products. But epigenetics, it's like there are changes on the DNA, like literally on it, but it's really cool. It's a different way of looking at heredity.

Aside: So, for a very quick primer on epigenetics. Your DNA is a big-ass long code kind of like a recipe or an ingredients list, and that double helix is a big-ole long scroll, just meters of it in each cell. How does a cell with all the instructions for all the other cells know to be a heart cell, or grow me one bristly mustache hair, or line my guts?

So, certain genes are turned on or off by signals or even proteins according to the function of the cell. But the proteins can also turn on and off other expressions of the cell in response to environmental factors and then replicate from there, and that is called your epigenome.

Now, speaking of hearts, many Patrons wanted to know what was closest to Raven's. Katie, Matt Ceccato, Earl of Greymalkin, Kathleen Sachs, Ira Gray, Ashley Emanuele, all had favorite questions, essential, favorite type of cell, or protein, or organelle, or nitrogenous base. Just normal questions you'd ask really any celeb.

Alie: George Powell wants to know: What's your favorite protein?

Raven: Oh! You know what? That's a really good question. I personally am fascinated by how people name proteins. There is a protein called the Pokémon protein.

Alie: What?! [*laughs*]

Raven: Yeah, there's a protein called Sonic Hedgehog, which is actually a critical gene involved in human development. There's a NEMO one, there's a ken and barbie protein. There's scramblase, which is an enzyme that scrambles phospholipids between the inside and the outside of the cell membrane. There's pikachurin protein, there's SPOCK1 that's in zebrafish and it causes the fish to develop pointy ears like Spock.

Alie: No!

Raven: Yeah.

Alie: I mean, Earl of Greymalkin asked: Do you have a favorite name or protein name? I had no idea why they asked us about the name. Who gets to name these?

Raven: The scientists that discover them get to name them.

Alie: Oh my gosh. A lot of animation fans, apparently.

Raven: Yeah. Yeah. I mean, these are really funny.

Alie: Obviously, there's so many things that must be difficult about trying to wrap your brain around these tiny protein structures, but what is the most difficult thing about being a molecular biologist, who is also a science communicator, who is also responsible for teaching so many people about very complicated topics? Like, what is the hardest part about it?

Raven: Oh, the hardest part about what I do? Ah! That's a good one. Let's see. Hmm…

I think that maybe the hardest part of what I do is also one of the most important things that I do and, although it's hard I really do try my best, and that is to always just make sure that you're communicating accurate information. Oftentimes people may not necessarily go directly to the source for their primary understanding of what's going on in the science world and they're looking at people like me or going on social media to get their information. And it's just so important that, although what we do is fun and it's meant to be friendly and approachable, that we're always focused on giving as accurate of information as possible.

I'm very careful to only speak on things that I feel like I'm truly an expert in. If I'm not an expert in it I definitely point people to a resource, a person who is an expert, or I find very basic information and try to translate that the best way that I can. I definitely think that it's important to always be accurate first and then be engaging second. You can do those things at the same time, but definitely not one without the other.

Alie: Do you have any advice for anyone who is going into molecular biology, or science communication, or things that, if you had a time machine, you could go back and pep talk yourself about?

Raven: I think that maybe one of the biggest pieces of advice, I would say for somebody who's interested in doing both of those things, is make sure that you're applying to programs that will support you in both of your interests. There are programs that exist. They seem to be very few, but just keep an eye out for programs that can support your interest in being a scientist who wants to communicate and who has a desire to be a public-facing information source. Look out for programs that have opportunities for you to learn how to be the best communicator and the best scientist at the same time.

Try not to sacrifice your interests. There are a lot of times that, I've heard, people who are interested in being a scientist and an educator often have to choose between the two when they're looking to enroll in programs. It doesn't have to be the case. So, definitely look hard and make sure you find your home that's going to be good for you and will serve your best interest.

Alie: And what about the thing you love the most about what you do?

Raven: I truly love building community. And I think, because I am who I am, I tend to build communities that are very diverse, because I show a lot of different sides of myself, I feel like people from different walks of life and different backgrounds can relate to. And I try to be very transparent about who I am, and what I'm interested in, and what I'm passionate about so that people, who even aren't in science can latch onto something about a scientist that they see and maybe be more willing to listen and learn about science because they do relate.

And I also love bringing these communities together and conversations about important things and watching people in my community learn from each other and teach each other. That's probably the best thing that I enjoy about what I do.

Alie: You have a lot of projects going on. Is there anything that we should be looking out for? Anything that you're working on that you're really excited about?

Raven: Yes, I am! I'm always working on new things. That's one of the awesome parts about having ADHD. And I think a lot of people are like, "How do you do so many things at once?" I have help. I have people around me who want to see me succeed and try to step in where they can to make sure that everything runs relatively smoothly. But one of my most exciting things that I'm working on is my new fashion line, Smarty Pants.

Smarty Pants is really what I've always wanted to do for the STEM community. I've always wanted to give something to people that they could wear that expressed their sense of belonging in the fields and their desire to be seen for both the brilliance that they have inside and also make that shine from within to the outside. It's really meant to be clothes that empower you as you go on about your everyday work in STEM and beyond, because it's really not just for STEM professionals. It's for anybody who supports STEM, enjoys learning about STEM, or somebody who identifies as a smarty pants.

Alie: It's really infectious, the way you communicate your science. So, I'm excited to call you [*drawn out and silly*] Dr. Baxter. Any idea of the timeline on that; when we can pop all the champagne in the world?

Raven: That would be late April.

Alie: Ah!

Raven: I will be Dr. Raven, The Science Maven. Ah!

Alie: That's so exciting!

Raven: It sounds fake. [*laughs*]

Alie: That's so amazing. I'm so excited for you. Do you know how you're going to celebrate?

Raven: I want to throw a party, but we'll see. I just want everybody who's happy for me to also have the chance to celebrate. So, I'm thinking maybe an online shenanigans.

Alie: Yes, please!

Raven: I don't know. I'm thinking of a disco party. [*laughs*]

Alie: Yes, please!

So, ask smart mavens very simple, shameless questions because you only live once. And maybe your molecules may get rebuilt and refolded into proteins and become a frog. But why not learn while you're alive, and a person?

So to follow or to see Raven's videos or TED Talk, you can head to her website SciMaven.com or find her on Instagram @RaventheScienceMaven or on Twitter @RavenSciMaven. Those links plus links to her YouTube and her videos will be up at AlieWard.com/Ologies/MolecularBiology.

You can follow me, if you like, on Instagram and Twitter. I'm @Alie Ward on both. We're also @Ologies on Twitter and Instagram. *Ologies* merch is available at OlogiesMerch.com. Thanks, Shannon Feltus and Boni Dutch for managing that.

Thank you, Emily White and all the transcribers for making transcripts available. Those are linked in the show notes as well. Thank you to Caleb Patton for bleeping episodes so they are kid-safe; that's linked in the show notes as well. Thank you, Noel Dilworth, aka the best, who helps me manage all my scheduling because inside my skull is just one steaming scoop of chili; it doesn't always get the job done. Thank you also to Jarrett Sleeper who assistant edits and does so much more (like he just grabbed me a bag of carob chips to snack on, no joke, and I like them).

And thanks to the glitter on our poster, Steven Ray Morris, who now hosts three podcasts: *See Jurassic Right*, the *Purrrcast*, and *Everything But The Movie: A Star Wars Book Club Podcast*. Nick Thorburn wrote and performed the theme music. He is in a band called Islands, which is a very good band.

And if you listen through the credits to celebrate those people then I also tell you a secret at the end of the episode. This week… Okay so, we're getting some work done in the yard and it involves poured concrete and I feel really awful because I learned after that concrete is terrible for the environment and carbon emissions. That led me down a path of using stone stacking to build some other stuff in the yard, and I found out there are these free rocks you can get, literally by the ton, almost anywhere, and sometimes people will deliver them for free. The stone is called urbanite and it is just broken up concrete. It's just straight-up junk that they would throw away but you can get it for free and you could build stuff with it.

So, look up urbanite, like walls and stuff. Pretty cool! It looks kind of awesome. It looks like old stone walls, a little craggy. Anyway, urbanite, it's a thing, and if you are looking for it you can just check Craigslist under the free section for free concrete or urbanite. Some people are already hip to the name. And I realized, just now, that in telling you this secret maybe this might help atone for my concrete use before I knew any better. So just go on craigslist and look for free concrete or urbanite and Pinterest the hell out of it and let's try to use more of that and less concrete.

Okay, Berbye.

Transcribed by:
Madison Campbell
Aveline
Your pal up in Canada, Aska Djikia.
Natasha Shipman, Candler, NC
That box of leftover cupcakes you want to eat for breakfast, Elena Horne

More links you may enjoy:

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RNA or DNA?

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