Ask A Biologist Vol 105 (Guest: Irene Gallego Romero)

What Makes You, You?

Nature versus nurture is topic you might have studied in school. But what does it mean for us? In short it is what makes you the person you are today. However, nothing is simple and the science behind the story of you is just as complex. It is a tale that is more amazing than anything you might have read, watched, or heard. Dr. Biology has the opportunity to talk about nature versus nurture with biologist Irene Gallego Romero. Listen in as they discuss the complex topic of what makes us who we are.

Transcript

Dr. Biology:

This is Ask A Biologist, a program about the living world and I'm Dr. Biology. Today we're fortunate to have a guest that we might not be able to have on the show or not for Zoom. The conversation today is with human evolutionary geneticist. Irena Gallego Romero. Irene is a researcher in the Melbourne integrative genomics unit and the School of Biosciences at the University of Melbourne, Australia, which is a little more than 8,000 miles from our studio. In addition to being a guest on Ask A Biologist, Irene is giving a seminar for the Center for Evolution and Medicine at Arizona State University. For this show, we're going to dive into a topic that you likely heard about nature versus nurture. The story opens with one of the most amazing information storage tools, something that is found in just about all your cells, all 37 trillion-plus of them. Yes, that's trillion with a T. This is the story of your genome. It's also the story of what makes you well, you. Because even though we carry trillions of copies of this amazing instruction set inside of us, it's not the only thing that determines what we'll be like as an individual. Join us as we talk about the story of you and us. Welcome to Ask A Biologist of Irene.

Irene:

Thank you so much. I'm delighted to be here. Dr. Biology. Thank you for having me.

Dr. Biology:

Let's dive right into our cells and this thing we call DNA. Can we talk a little bit about DNA?

Irene:

Yeah. So, I'd love to talk about DNA. So, DNA, I think is, is my favorite molecule, right? And it's not something most people have a favorite molecule, but when I was a kid in Spain, so I'm Spanish. I used to watch a TV show that was about the human body and how it works and DNA in that show was four little guys with interlocking hairstyles. So, if you've ever seen DNA, you know, that some bases go together, like somehow it links up the A and the T always go together and the C and the G go together. And they way they showed it in that show, which has always stuck with me is that a and T had pointy hairstyles that would fit into each other. And C and G had wavy hairstyles that would fit into each other. And I just thought it was super cool. I had no idea what was happening. I was eight years old, but it really went on from there. And I've always been fascinated by DNA and how that simple molecule, just those four little nucleotides can somehow encode the complexity of humans, but also of all life on earth. I'm like, how does it work? How does it do that? How does something so simple work so well at containing so many differences in creating so much diversity,

Dr. Biology:

Right? We're talking about information.

New Speaker:

Yes.

Dr. Biology:

And we're talking about very compact and we're talking about information that not only tells you how to make things, but how to do things, how to do work, because our bodies are always working. Even when we're sleeping, our bodies are very busy.

Irene:

Absolutely.

Dr. Biology:

DNA has to do that. So, let's talk a little bit about how this thing we call the genome. Does its thing.

Irene:

Yeah. genomes are fascinating. We talk about genomes and we talk about DNA and they're intangible. They're hard to visualize. So, I think it's worth, really taking a second to think about what they really look like. And the fact is that you've got a genome. If you were to print it out, it'd be 220,000 pages, more or less, which is a lot of information. Right. But somehow every cell in your body knows how to find the information it needs, the information it wants at the time it wants it. And what gets even more interesting is that obviously not all cells in your body need to find the same bits at the same time. Right. So even though we're not quite sure how it all works together, just yet, it's, it's a field that we're doing a lot of research on - to me it's just fascinating.

Irene:

At that level of saying, how do you find something in 200,000 pages of text when you have no table of contents, how does the body do it? How do your cells do it? And so another thing that you might not know about your genome, right, is that if you look at your genome again, you have 200,000 pages of text, it has to fit into each of your cells. And you've got 37.2 trillion of these cells in your body, right? Each of them has a copy of your genome. And if you were to take that DNA molecule and pull it out and out and string it apart, it'd be seven feet of information in each of your 37.2 trillion cells. So how does that work? To me? Those numbers are just fascinating and they're really humbling, but they're fascinating, interesting numbers. And so I really do think DNA is super interesting because how does it function?

Dr. Biology:

Actually, as I'm watching you do this, I have to tell everyone that the cats just walked in front of you.

Irene:

Yes. [laughter]

Dr. Biology:

And the cat has a genome.

Irene:

The cat has its own genome.

Dr. Biology:

And even though there's a human genome, we don't all have the exact same instructions.

Irene:

No, that's what makes you, you and what makes me, me, right? Those little differences and understanding how they do it and which of the matter, and which of them don't matter. And which of them predisposes some of us to risk of cancer versus a risk of a heart attack or a risk of Alzheimer's or other diseases. That's the stuff that, again, is really interesting to me understanding how does it work and what happens when bits of your genome break? What does that mean? That's the research that I'm really interested in.

Dr. Biology:

Let's just say you and I, besides being male and female, if we were to compare our genomes and we put them side by side, how different are they?

Dr. Biology:

Yeah, it's a, it's a fantastic question. Right? So, if we think about, again, the seven feet of information in each of my cells, I take your seven feet. I take my seven feet and line them up next to each other. In every inch, we would find out on the 37,000 differences, which is a lot of differences. And this number is constant, right? No matter who you compare you on your brother, probably lot fewer you and your twin brother a lot fewer than that, but 37,000 differences per inch. So, a lot of differences on many of them explain many of the differences between us. But again, it's easy for me to say 37,000 per inch, but the real question is, but what does each of them do? Which one matters?

Dr. Biology:

And that's just comparing you to me. If we came here, your genome to your cats, that would be a whole other story, or even the simple onion.

Irene:

Yes. The humble on you on that has three times more genes than a human. I really like that image, right? So, plants in general have much bigger genomes than animals. That's due to the way they've evolved the revolution, but there's this idea. Sometimes when we talk about evolution, that humans are the end goal, that it's done now, but it's not. Humans are just one of many things that exist on the planet. We have our genomes plans have their own genomes, cats have their own genomes.

Dr. Biology:

The thing that fascinates me about the example of plants, having a more complex and larger genome than humans and other animals is why. I mean, I just still don't know that I have a full grasp of why, and I don't think we do.

Irene:

No, I would agree with that. Plants have really interesting, fascinating lives. They're the longest lived organisms on our earth. We have plants that are thousands and thousands of years old. And I imagine that takes a fair amount of effort on the way they reproduce, the way they grow, the way that if you break a plant in half, you can eventually get two plants out of that. Whereas if you break me in half, you're not getting two Me's after that. There is no coming back from that. And so they have such a different life, such a different existence that I think they just need different genes and different things to do. And then some of that ends up being encoded in the genome and the way these organisms exist. It goes back to my love of DNA. It speaks to that fascination with how these four simple elements, the, A, the C the T and the G can somehow go from making a bacteria to making a plant, to making my cat, to making me.

Dr. Biology:

There are also differences that occur. And it's a word that a lot of people have heard, and it's not always met with a good thought. And that's the word mutation. So, let's talk a little bit about mutations and the good, the bad and the cool.

Irene:

I agree with you. It's a word that is very often loaded, right? People say, Oh, a mutation, you have a mutation. Ah Oh. If we take a really, really, really long step back to the beginning of when the first organisms that existed on earth, right? They were little bacteria, they were doing their thing. And in a world that I can barely picture really, it's so different from what we know today. And they had their own little genome made out of DNA. And every time a mutation happened to them, their genome would change. Things would change a little bit. Right. And so, if you think about where would we be without mutation, there would be no humans. We'd still be little bacteria in that primordial, swamp 3.5 billion ago. And so, mutation simply means change. It's a difference sometime that change has good consequences.

Irene:

And sometimes it has that consequences, right? And so, humans are actually the product of 3.5 billion years of mutations and mistakes in DNA, copying that without mutation, there is no change. And so, cell mutations absolutely are responsible for your higher risk of disease or getting glioblastoma as a child or Alzheimer's or something other mutations mean that some of us have brown hair. Some of us have blonde hair. Some of us have green eyes. Some of us have Brown eyes. Mutations simply gives rise to diversity. And so, in that sense, I think they're actually quite beautiful and quite powerful. Right. And the other thing that's worth thinking about is that a mutation today that does something that perhaps we think is neutral, or we don't really understand its consequences. The value of that mutation can change with time and the environment. So, let's say we have a mutation that makes people taller.

Irene:

Taller is a good one, right? So, in a world where everything is big and tall and, um, you know, accessible to tall people, then it's nice to have that mutation. But if we start building everything for short people, then that mutation that made you tall. And that was great. Sometimes is actually really inconvenient. And so, the value of mutation can change with time. Some of them, I think nobody would argue are always negative. Again, a disease that kills you in childhood, never a positive thing, but others can be just really variable and have very variable outcomes depending on the environment in which you see them. And so mutation, yeah. Generally thought of as

negative. I would not say it's always negative. Sometimes it's neutral, sometimes it's positive. And ultimately, it's how we got here. It's how we existed.

Dr. Biology:

You actually brought up the idea of eye color. And then it made me think about, we sometimes simplify the idea of genetics and how genes work too much.

Irene:

Yes.

Dr. Biology:

And there are times where we make it seem as if you turn off a gene or you turn on a gene and you get, in this case, we'll say green eyes or blue eyes or brown eyes. And what we're learning more and more every day is that it's really complex. It's not just the one gene. And that's just talking about that. And you know, that's not just talking about eye color, so let's talk a little bit about how genes work.

Irene:

Eye color is a fantastic example. I actually teach it. When you go online and you say, what color are your eyes will my baby have? Well, if your father blue eyes on the mother has blue eyes then the baby blue eyes. And then you dig a bit deeper and it's like a 90% chance of blue is actually. A bit deeper still, it's complicated, actually. It's complicated. So, to me what's been fascinating is that discovery that, yeah, there isn't really a single trait that I can think of really well. That is just one mutation. There is no single gene for this, no single gene for that. There is always a lot of genes that contribute. And I think the reason it's hard to envision is that if you look at your genome, there is no gene for eye color, your genes make little proteins and proteins are small little building blocks.

Irene:

And they do little things. And even something as quote unquote, simple as eye color is really the product of a bunch of genes and a bunch of proteins coming together. And so this protein contributes a little bit to your eye color and that protein contributes a little bit to have your eye color too. And together you get somewhere in the shade of blue. There, isn't obviously just one blue eye color, right? There is many shades of blue, many shades of green, many shades of brown. There is a lot more nuance there, which I think actually does a disservice to people. Because it gives us idea that yeah, that genes are simple, that they're straightforward and, and they're not. Everything around us is so complex and so fascinating because it is complex because it's not straightforward. That's what I find really interesting understanding how any of these traits comes together from your genome, what bits of your genome. So, when I think of a trait, I never have a single sequence to go back to. Instead, I have to look across the genome for all the little building blocks that go on to give me again, my brown eyes or my brown hair.

Dr. Biology:

Right? So, we've been talking about genes. We've been talking about DNA, our cells. We know the pieces now. So, let's shift to your research. So, you study the people from the islands of Southeast Asia. There's an interesting mutation that some of the people in Southeast Asia have around milk. Can we talk a little bit about that and why? Just out of curiosity, why that would have occurred?

Irene:

I love lactose tolerance. It's a fantastic example of so many different things. So I'm lactose intolerant. You might be too, but most people in the world are not right. And so first actually let's define lactose tolerance. We are all mammals. And so, one of the parts of being a Mamo is that we drink milk. We birth babies, drink milk. And generally, that milk is from the mother, but in humans, many of us also go on to drink milk from other sources as adults, right? Mostly cattle, mostly cattle, milk, dairy. And so, within milk, there is one sugar called lactose. It's a very simple molecule and digesting, it gives your body energy. You break it down, it's a sugar, you get energy from it. Awesome. But most mammals only have the ability to digest milk until they stop breastfeeding until they are what we say weaned and most humans are like that too.

Irene:

Most humans stop digesting milk at the age of two, three, four, or five at some point. But there's a few sets of people in the world who actually do digest milk until adulthood. So many people from European descent, but also people who descend from camel herders in Saudi Arabia or pastoralist communities. So that really depend on cattle for subsistence, for life, for everything in Africa and in India, they also retain this ability. And this is genetic. It's not skill that you can work to get better at. It really is a genetic trait. And the question is, well, why, what is the advantage of drinking milk into adulthood? And so, this is a case where we're talking about mutation earlier. This is a case where the mutation meant nothing until you started having the behavior that makes it useful. So if you think about being able to drink milk and adulthood is great.

Irene:

If you're actually drinking milk and adulthood in the absence of that behavior, who cares, if you can digest it, you're not drinking it, it doesn't matter. And so, what we think happened was that 10,000 years ago, around that time, when cattle was being domesticated by humans, in today, we call the near East, we used to call it the fertile Crescent. But also, again, these camel herders in Saudi Arabia or these pastoralists communities in India or in Africa. They were drinking milk. And if any of you are lactose intolerant, you know that drinking milk, if you're intolerant is not really enjoyable, it's not something that you want to do. And so, for me, it's always been a question of why were they doing it? But nonetheless, at some point in these people in parallel, different times, different places, there was a mutation in their genome that lets them keep turning on the gene that breaks down the sugar lactose until they're adults.

Irene:

So, it stays on their whole life, right? And so now when you drink milk as an adult, if you have that mutation, then you can break down the sugar. And we think that gives them energy. That gives them access to the way food sources. We actually don't really know what the advantages of drinking milk in adulthood. Why is it a trait that is advantageous? Is it because you have access to a source of liquid, right? A source of fluid that you don't have to worry that the river is contaminated, you're drinking milk. It's coming from the cow. It's probably fine to drink it. Or is it because it's got vitamin D or because you have access to calcium? We don't really know. But what we do know is that we see again, in these groups of people in the near East, in Africa and Saudi Arabia, they start being able to digest that milk in adulthood.

Irene:

So that kind of reinforces the behavior of keeping cattle, right? Like you say, well, we can actually survive pretty well from our cattle. So, we will keep keeping cattle. And then because part of

keeping cattle means drinking milk. That mutation becomes common in these people. It gives them an advantage. And so, you have this association between the behavior of drinking milk in adulthood and the mutation. But if you take one of those two things away, then the mutation is meaningless. If you stopped drinking milk in adulthood, but you have the mutation again, meaningless. If you have the mutation, but are not drinking milk also meaningless. And what I was really interested in was seeing how far East does this go? If you look at the map of the planet, right? So, humans evolved in Africa and they expand eastwards eastward, eastward. And I was just wondering how far east, what are people in Southeast Asia doing?

Irene:

What are people in India? So, in the Indian sub-continent in South Asia and Southeast Asia doing. And what we found was that in India, there is some populations where everybody's lactose tolerant and there are other groups where they aren't. And it wasn't quite clear, exactly know who, and when you couldn't predict it in grand lines, but you knew that if this was a people that had had, again, thousands of years of history of building their lifestyle around keeping cattle, then it made sense. But what we also found was that in Europe, we have yogurt, we drink milk, a lot of milk. So, this is what we call unprocessed milk products. So that sugar is there. But if you make cheese for instance, or if you make kefir or you make all of these dairy drinks that are processed, that are fermented, then the bacteria that are in the air break down that sugar for you. And so you don't need to have the mutation anymore to be able to consume the milk or the dairy product, it's not milk anymore. And so, it was a really fun part of a PhD, try to link up behavior in the sense of, are you drinking milk, or if you're not drinking milk, what are you doing with your dairy products? Are you fermenting them? Are you turning them into cheese? What are you doing and your DNA and how these things came together? Most of the time when you find a relationship, but not always

Dr. Biology:

Today, we've just amplified the term diversity. There are a lot of different kinds of people and different genes out there. Let's talk a little bit about how diverse they are.

Irene:

They're super diverse. I can't really give you a good answer of how diverse they are, because we haven't worked with them long enough, but genetically, if we do a really shallow pass, we see differences. Just like we see differences between any sort of population, right? So, we see differences within Europeans, between Europeans and Asians, within Asians, between Asians and Africans within Africans. So, there are differences everywhere. Like again, those 37,000 differences. And so, we know there are differences in Southeast Asia, but we really haven't worked with these communities for long enough. And when I say we, I don't mean just myself. I really mean the scientific community has really not been working with these communities. And, you know, you might think, well, that's fine. Do we really need to study everyone? How different can it be? How can it matter? And the truth is it can be quite important to understand what is happening in the genome of these people.

Irene:

These people, they have the same rights to medical care, the same rights to treatment as, as you and I do. And so, if I don't understand how their genome differs slightly from mine, then I might not be able to design good drugs for them. And again, this might sound far-fetched, but there is a really good example of this, which was, um, the Vietnam war and the Korean war, which is one of

the first times that the U S sent mixed platoons, right? So African American soldiers and European soldiers out to fight. One of the rations they sent them was fava beans, kind of fava beans was part of their, their food. And it turned out that many of the African American soldiers had a mutation that made it hard for them to digest this that actually made them sick. And this mutation, if I remember correctly, I think I might be getting it a bit jumbled, but this mutation is also associated with protection from malaria, right.

Irene:

Which is more endemic in Africa than it is in Europe historically. And so, we see that mutation. And so, what happened was that everybody was getting the same rations, but not everybody was dealing with them equally well, and some of these reports are a bit anecdotal, but I think there is some substance to it. And so, you were getting the fact that we didn't know about these differences meant, actually, that we were treating some of the soldiers, providing them with subpar food and subpar rations. And so, it's things like that that can be important. And you can expand that obviously to drugs, to medications, to things like that. Right? So, when we design drugs these days, we do safety testing in all kinds of populations. We do effectiveness testing in all kinds of populations, but they don't always work equally well in different populations, right?

Irene:

A treatment for heart disease that is really effective in African Americans may not be as effective in European Americans. And some of that comes down to the differences in the genome that are common in African Americans and rare in European-Americans. Right. And I think I want to really emphasize that when I say they may not work as well in Europeans; I don't mean all Europeans. I mean, on average, there are still people in Europe for whom this drug is fantastically effective. And there are African American people for whom this drug does nothing because it becomes really easy to think, Oh, these are absolute differences between these two populations. These two things are different. It's a bit more nuanced than that, right? So, some mutations are common in some groups and not as common in other groups, we're not totally absent from them.

Dr. Biology:

It is possible today for people to go down to their local store and actually get a genetics test. And I could pick out all sorts of ways that I could have my genome sequenced. One of the things that, uh, you can do is to find out how much for, a less precise term, how much caveman or cave woman I have in me.

Irene:

Yeah.

Dr. Biology:

Neanderthals. So, let's talk a little bit about that.

Irene:

So many things we can talk about in that space. Right. So yeah, so you can absolutely go to 23andme or there another company called ancestry DNA and there was a couple of others that will let you spit into a tube, um, from the cells in your saliva, get your DNA sequence that genome, and then say, Ah, this bit of your genome is really similar to bits of the genome that we see in people from like cork Ireland. And that bit of your genome is really similar to DNA that we often see in people from, I don't know, like Addis Ababa, Ethiopia, right? And so we can scan through

your entire genome and be like this many bits match Ireland, that many bits matched Ethiopia, that many bits matched, I don't know, Brussels Belgium or whatever, and build a picture of your genetic ancestry.

Irene:

Right? And sometimes it's really tempting to kind of say, ah, genetic ancestry, cultural ancestry, these things are not the same. You know, you might feel like your family is Irish and genetically, you might discover very interesting things and very surprising things about yourself. But one of the things does not negate the other. But the coolest thing I think that you can get from these DNA tests is what you were saying. You were quote unquote caveman ancestry, right? So, when humans left Africa, 50, 60,000 years ago, we were not the only human like species in the world. Right. So, Europe was full of Neanderthals. And so, when humans came across Neanderthals shortly after leaving Africa, we clearly found some of them attractive because we had children with them. And I can tell you that without any doubt, because any of you listening that are known African descent have Neanderthal DNA in you.

Irene:

Right? So, we know that at some point, humans and Neanderthals came to get a Rudy really closely indeed, and had very happy families together, I guess. And so that bit of Neanderthal DNA is super interesting because it contributes to things. So, things like your chance of fighting off some infectious diseases, it also contributes a little bit to your weight, to your height, to your blood pressure, to a lot of little traits here and there. And so, it's really interesting to think that we have this legacy from our caveman cousins. If you want to think of him that way, that's been hanging around our genomes for the past 50,000 years. And then if we go back to Southeast Asia, which is the part I like to study, we learned that not only were there humans and Neanderthals in the planet, there were actually many other species of hominins hanging around, right?

Irene:

So, in east Asia we have another species called Denisovans. I say species, I may mean population. It's not quite clear what the relationship is, but we have Denisovans. And now Denisovans are fascinating to me because fossils are so limited. We have a little finger bone. So if you take your hand and you look at your little finger and the top of your little finger, the bone inside there, we have a bone like that from a child. From an eight-year-old, nine-year-old girl who died in Siberia around 60,000 years ago. But from that bone scientists were able to sequence her entire genome, which was fascinating to me. I find that just mind blowing, because what we found out when we sequenced that bone, we thought she was Neanderthal. She was not Neanderthal. She was a totally different population, a total different group.

Irene:

She was what we call Denisovan. And the reason we call her Denisovan is that the cave itself was called Denisovans So we have very few fossils of these people. We know there were not Homo sapiens. We know they're not Neanderthals. They are Denisovans. And they seem to have been in east Asia as long as Neanderthals in Europe. So, 300,000 years perhaps. Right. And what we don't know is how far South they were. We have recently found examples of them in Tibet. So, Siberia, now we're going South to Tibet and we think they might have been an Island Southeast Asia too. So, in Indonesia, in Papua New Guinea, and if not in islands at the station, then in the sea around there, right? So, places like Vietnam, Malaysia today, and the reason we think that is that again, I have Neanderthal DNA.

Irene:

If we look at the indigenous peoples of Papua New Guinea, the indigenous peoples of Australia, we also find not only Neanderthal DNA in them, but also Denisovans DNA in them, suggesting that again, as humans left Africa, first, we came across Neanderthals like them kept going further East. At some point, we came across Denisovans and we also liked them. And so, both of these archaic ancestors of ours have contributed to our diversity, to our genomes, you know, to this staggering diversity of humans, except that the Denisovan contribution is a bit more limited geographically. And so in that way, it gives us an insight into not only humans as a species, but really humans and our cousins, right. Humans and this diversity of human populations. So diversity in, into humans, and our close relatives that were around that co-existed for what we think might be an substantial amount of time, maybe thousands of years perhaps tens of thousands of years. That's a bit contentious that claim, but that we are the only ones left alive today. But for most of our history, we were not the only ones around here.

Dr. Biology:

So, the Denisovan are not studied.

Irene:

Nope

Dr. Biology:

It's the future if someone was thinking about getting into the world of genetics and doing some research, this is a good place.

Irene:

Absolutely. I think this is a fantastic place to go, right? I think to understand humans, you need to understand them in their context. And so that includes absolutely Neanderthals and Denisovans. And to me what's really frustrating is that the reason we don't know anything about Denisovans is not that we don't care about them. I'm not the only one who thinks they're fascinating, but the reason is that historically human genetics has studied people again, European descent, right? Whether they are living in Europe right now, or they're living in America. And there are reasons for that. Some of them are just, it's easier to work in Europe. It's easier to work in America. Like if you are based at a university in the U S or if you're based at, or if you're a researcher that's based in Europe, then it's so much easier for you to study Europeans that are around you than to travel the 8,000 - 9,000 kilometers to Asia and work there.

Irene:

Right? And because Denisovan DNA is not found in Europeans, it just doesn't get studied. So this is part of the reason that makes it challenging in some ways, but also makes it really exciting. The fact that you have to work in Indonesia, you have to work in Papua New Guinea. You have to work within Indonesian colleagues with Pawan colleagues and really bring together their expertise, their understanding their country of their history, which is of course I cannot claim to compete with it. Combine that with our understanding of genetics and really work together as a team successfully to understand the genetic legacy that these people carry, that I don't carry

Dr. Biology:

Before I let my scientists leave on Ask A Biologist there are always three questions they get.

Irene:

Oh gosh.

Dr. Biology:

All right. First one. When did you first know you wanted to be a scientist? Was there an aha moment?

Irene:

There were two. So, the first one was the, the DNA with the interlocking hairstyles, not middle of cartoon show. And then when I watched, this is a terrible answer. When I watched Jurassic park as a, I was 12 years old, 10 years old, I think in the original Jurassic park, there was a little cartoon guy called Mr. DNA. And I came out of that movie with nightmares about dinosaurs for years. But I also came out of that movie saying, I want to do dinosaur DNA. And obviously that's never going to happen, but it was love at first sight. It's always been DNA for me. I think those two were the most formative experiences of my childhood. I mean, again, it was a bit jokey, but I thought about making pet velociraptors. I thought that would be amazing if I could get a, a little miniature velociraptor to follow me around, they were the scariest of all of the dinosaurs in the show, but there was something about it that I just thought that would be awesome. Now I've realized I can't do that, but it's still

Dr. Biology:

[Laughter]. You can always dream. You can always dream. And if nothing else make a fantasy story, I could see it. Well, now that we have you as a scientist, I'm going to take it all away.

Irene:

Okay.

Dr. Biology:

I'm not going to let you be a scientist anymore. So the question is, if you could do or be anything, what would you do or be?

Irene:

I think that answer would have changed many times in my life. So, I speak multiple languages. It's because I grew up in different countries. So, I learned multiple languages. So, I really like languages. I love understanding the relationship between words, how a word in one language becomes a separate, but similar word in a different language. So, I'm kind of cheating, right? Because these languages reflect the history of the people that speak to them, kind of like their DNA, but it's social science. So, I would have really liked to be a linguist or also perhaps a translator. I really like going from one language to another and trying to capture the nuance of things, said in one language into another.

Dr. Biology:

The last question.

Irene:

I'm ready.

Dr. Biology:

What advice would you have for a young scientist or perhaps someone who always wanted to be a scientist and is thinking about shifting careers? Ooh,

Irene:

This is a tough question. So, my advice would be if it makes you happy to pursue it, but on the other hand it can be tough. It can be challenging at times. My other bit of advice if you're going to go into science, which I think is a fantastic thing to do, surround yourself with people who support you while you do it and accept that it doesn't happen overnight. It takes time. If you're young and thinking of science, you need to do an undergrad degree in science and then get a PhD in science. And then you finally feel, at some point, someone says to you, Hey, you're a scientist, but actually you can be a scientist much younger than that. You can be a scientist in high school. You can be a scientist in middle school.

Irene:

All it takes is the right mindset. Right? Keep that curiosity, keep that skepticism and just ask questions and don't give up. If it seems really far away, don't give up. You can absolutely do it. Everybody can do it. Sometimes we make it seem like it's really far and really hard and really distant. But it's really about how you think about the world and how you interact with the world. And it's about being thoughtful and saying, Oh, the sky is blue. Why is the sky blue? Okay. But why, but why keeping up that sort of what happens if I break this? But what happens if I do that? That's really my big advice. Don't lose that curiosity.

Dr. Biology:

Ah, excellent. I love curiosity. Well, I want to thank you for joining me on Ask A Biologist.

Irene:

My pleasure. Absolutely. My pleasure.

Dr. Biology:

You've been listening to Ask A Biologist and my guest has been human evolutionary geneticist. Irena Romero. Irene is a researcher in the Melbourne Integrative Genomics Unit and the School of Biosciences at the University of Melbourne, Australia. Now, if you want to learn more about DNA and your cells, there are two stories that can give you more details about this instruction set for life that are found on our website. The first is Biology Blocks of Life that talks about our cells. And the second is DNA ABCs. The Ask A Biologist podcast is produced on the campus of Arizona state university and is recorded in the grassroot studio housed in the School of Life Sciences, which is an academic unit of The College of Liberal Arts and Sciences. And remember, even though our program is not broadcast live, you can still send us your questions about biology using our companion website. The address is AskABiologist.asu.edu. Or you can just Google the words, ask a biologist. I'm Dr. Biology.