Alberto Vazquez-Salazar:

As we try to understand better and better how life may have actually originated on Earth, we can extrapolate that knowledge to try to find life or signs of life elsewhere.

Announcer:

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Michael Holtz:

Welcome to Further Together, the ORAU podcast. As ever, it's me, your host, Michael Holtz, from the Communications and Marketing Department at ORAU. And, as I have regularly gotten the opportunity over the last couple of years, I'm interviewing a NASA postdoctoral fellow. ORAU manages the postdoctoral program for NASA, and I get the chance to talk to a number of these fellows every year, and one of those interviews is happening in this episode. I would like to welcome to the show, Alberto Vazquez-Salazar. Alberto, welcome so much, so glad to have you here.

Alberto Vazquez-Salazar:

Thank you very much. Thank you, I appreciate you having me, and I'm really excited.

Michael Holtz:

I always love talking to the NASA fellows, because I always learned something about A, NASA, but the different facets of research that are going on, because as a kid, kids think of NASA and they automatically think astronauts, but there's this whole other level of science happening on so many levels, from Earth science to astrophysics and beyond. I'm excited to learn what your research focus is and what you're doing at NASA, so let's start there. Where are you in your fellowship at this point?

Alberto Vazquez-Salazar:

I renew this year. One year just passed, in July of this year, I had my first renewal, so this is my second year as a NASA postdoctoral fellow.

Michael Holtz:

Awesome. Alberto, what's your research focus?

Alberto Vazquez-Salazar:

Well, in the lab, I work at UCLA in the lab of Professor Irene Chen. We are interested in studying a system that involves RNA and vesicles to try to understand how life may have looked like in very early stages of evolution. We use a very popular, I will say, hypothesis to try to understand this, which is the RNA world hypothesis. In the left, we basically take these hypotheses, take our RNA and try to understand how is it that RNA could have support life in the very early stages of evolution.

Michael Holtz:

Why is it important for us, speaking as someone who's not a scientist as a lay person, why is it important for this kind of research to be happening? Why is what you're hypothesizing important for us to know?

Alberto Vazquez-Salazar:

Well, in general terms, everything, all this research, at least for me from my perspective because I'm an biologist and I'm an evolutionary biologist, the big question is the origin of life. How life could have originated? That's one of the most interesting questions, if not, the most interesting questions at least in science. Of course, there's a lot of uncertainties. There's a lot of open questions in that area. Specifically, studying RNA, for me, it's extremely, extremely amazing, because RNA happens to do the job, so to speak, of what DNA does today in cell, which is the genetic molecule, the genetic carrier. But it also can do the job of enzymes, of proteins, the other major biomolecule in today's biology. Before we knew a lot of the things that RNA can actually do, before we discover many of those activities, people were asking, scientists were asking, from DNA, from proteins, what came first in an evolution? Was it DNA that appeared first? Was it proteins?

Turns out that one possibility is that, actually, RNA appeared first, and RNA was before DNA and before protein. RNA was doing the job of DNA and RNA was doing the job of this catalytic proteins, enzymes. It's fascinating how RNA can somehow simplify this question. Then, it's a very amazing molecule. It can do many, many things in modern biology, has many roles. When we look at that molecule in the lab, we have discovered the scientific community has discovered, that RNA can do also many things in terms of catalysis, in terms of mechanisms. From the origin-of-life perspective, it's extremely important to understand, try to understand how easy that RNA may have helped life in the very early stages of evolution. From my perspective, from the biology perspective, for me, that's an amazing question.

Michael Holtz:

Well, and as you're trying to explain this and explain to me why you're doing, I can see your passion for what you're trying to, what your hypothesis and what you're studying. I think it's amazing. The whole origin of life is one of the big questions, so it's very exciting to hear about this work. Alberto, has science always been something you've been interested in?

Alberto Vazquez-Salazar:

Well, yes. My mom, she's also a biologist, and in retrospective, I think that she always had her books around in the house, and I feel I was always somehow exposed to her books. She's a botanist, so she studies plants, or used to study plants, and she had all these specimens also in the house. I feel science was just some other thing that you can find in the house. You can go to the pantry and find the cereal, you can go to the studio and find books and find plants. It was normal for me, but I was also still very interested in other topics. I love history, I love technology, I really like many, many things. Of course, I think that as many of us or many people at least, as a little kid, I wanted to be ... Well, as a very little kid, I wanted to be a soccer player, an astronaut or something. But then, I really wanted to be a doctor, like a medical doctor.

But then, at some point I realized, I discovered that I am very weak when it comes to blood and looking at my own blood. After I discovered that fainting one time in the doctor's office, I realized that maybe medicine wasn't going to be my thing. Something close to medicine is biomedical research, so that was the path I took first. But then, I discover, literally discover, evolution and specifically then how evolution, it's the science that connects everything in biology. I discover, thanks to a college professor I had, the RNA world hypothesis, and I got fascinated. It was an instant crush with RNA. I really fall in love with RNA, and ever since then, I've been obsessed with RNA and everything it does.

Michael Holtz:

That's amazing. Again, I'm not a scientist, but I'm a writer really from my earliest. When I could, like I started writing, you'd know when you fall in love with that thing, that you know you're supposed to do.

Alberto Vazquez-Salazar:

Yeah.

Michael Holtz:

It sounds like you had the same experience with RNA.

Alberto Vazquez-Salazar:

Oh, definitely.

Michael Holtz:

You just knew you this was your thing.

Alberto Vazquez-Salazar:

I knew it, and I remember exactly the moment in which I knew kind of.

Michael Holtz:

Okay, tell then.

Alberto Vazquez-Salazar:

It was a class, I was an undergrad. It was a small class. We were like 12 of us or something. One of the best professors I ever had in the National University of Mexico, at UNAM, it was the introduction to the class, which was cellular biology. He made us read the first chapter of, I think it was the third edition of the Albert's Molecular Biology of the Cell book, and he wanted us to read that book, specifically that edition, because that edition included a chapter on evolution and included the origin of life and this hypothesis. I read it and I thought, "Wow, this is really great."

I didn't know there was research on this. I didn't know that scientists were actually studying the origin of life. I think that was something that ancient philosophers used to do or something. It was really great. Then I remember, he quizzed us on the chapter, and one of the first questions he asked was, what is a ribosome? I didn't know at that point what a ribosome was, but one of my peers in the class extremely quickly answered, "Ribosome is an RNA molecule that has catalytic activity." And I was surprised and I was like, "Wow! Is that something everyone knows? Is that something I'm supposed to know? Did I miss that class in high school? What's happening?" I was really confused, kind of frustrated, because he made it sound like, "Of course, it's like kindergarten knowledge," but then-

Michael Holtz:

Everybody knows this.

Alberto Vazquez-Salazar:

Yeah. Then, I dig a little bit into the history because again, I like history. Turns out this discovery of RNA having catalytic capabilities was made in the 80s and it was a breakthrough in biology. It changed the paradigm, because before that, the paradigm was that only proteins were catalyst. When RNA was discovered to also be a catalyst, everything changed. I remember that was the moment in which I was completely immersed into RNA and I started to pay attention to the classes, to the parts where RNA was involved. I discovered that RNA does a lot of things in modern metabolism. Then, I took specialized classes on RNA and evolution and origin of life, and I discovered the details of all these hypotheses. It become kind of an obsession, like a healthy obsession, academic obsession, to just be aware of RNA roles and everything.

Michael Holtz:

Wow! That's awesome. I love that. I love when you find the thing and you know that this is where you're supposed to be, what you're supposed to be working with.

Alberto Vazquez-Salazar:

Definitely. It's not only that. It's also the fact that, in my university, I am from Mexico City and I studied in Mexico City, my undergrad and my PhD, and it happens that my university, UNAM, in its faculty has one of the best researchers, at least in my perspective, to study the origin of life, and they're also interested in the RNA world hypothesis. At some point, I was trying to find the courage to go to that lab, knock on the door and ask for an opportunity. I was really nervous, but I did it in the end with another friend of mine.

This professor, Antonio Lascano, turned out to be one of the most amazing persons I've ever met, and he became my mentor. I stayed in his lab for a long time to do my undergrad research thesis, to do my PhD, and his mentorship meant, still means everything to me. He's the one who helped me develop this passion for RNA. Like I already have to see if RNA is amazing, and his mentorship, his style, everything just developed further my interest in RNA, and in evolution, and in the origin of life.

Michael Holtz:

I love it. Love it. Alberto, what's the trajectory for you from getting to Mexico City to NASA? What did that path look like?

Alberto Vazquez-Salazar:

It's a word that a lot of people say, and we actually do that sometimes without actually knowing we're doing it, but it's networking basically. Everyone talks about networking, and perhaps if you are a undergrad student and you don't know really what that means or what that entitles, but just talking to people can take you to a lot of places. I remember, as a PhD student, I think it was a second or a third year PhD student, I attended a conference in San Diego, which it was a conference on the origin of life, and my mentor, Professor Antonio Lascano, introduced me to my current mentor, my current PI, Professor Irene Chen. Antonio was very casual. He was like, "Hey, Irene. This is Alberto. He's interested in RNA. You work with RNA, why don't you have a chat?"

I talked to her. I spoke about my interest in RNA, specifically in learning some techniques that use RNA to study evolution at the molecular level. She does that in her lab. After the conference, we just stay in touch. When I graduated from my PhD, I think one of the first things I did was send an email to her saying, "I just graduated. I'm wondering if there's an opportunity to join your lab to keep working on RNA." There was an opportunity, so I joined the lab and I started to work as a postdoc. Then, the thing with NASA and the origin of life is that one of NASA's mission is trying to find, like explore the universe trying to find signs of life or life. There's many, many areas, many scientific, soft areas that converge into that mission.

We have engineer, which is what most people think when they think about NASA, and the space exploration to actually make these spaceships that go and explore the universe. But there's a lot of things that we need to take into account if our mission is to try to find traces of life in the universe. One of those things is, how are we going to actually identify life in the universe? We need to know how to study life here. What if life is not a very developed or a very complex cellular type of organism we can't recognize? What if it's something else? What if it's not life, but it's something that resembles life? That's how the origin-of-life research area enters, because the origin of life, there's a lot of people trying to identify what happened before life originated, what happened in the very early stages, what were the specific conditions.

In trying to do that, we're actually generating a catalog of conditions, a catalog of molecules that may give us a clue on what to actually expect in the universe. That's why NASA is interested in funding origin-of-life research, because as we try to understand better and better how life may have actually originated on Earth, we can extrapolate that knowledge to try to find life or signs of life elsewhere. All of that falls into the umbrella of this discipline that we call astrobiology.

There's a lot of flavors of astrobiologists. There's people who work on chemistry and the chemistry before life. There's people who work on RNA as a possible molecule at the very early stages of life. There's people working on different molecules, not just RNA, maybe other alternative polymers. There's people working on the geochemistry of the Earth at the beginning of life, everything. There's a multidisciplinary field, which is amazing. For that field, the people who study RNA and the origin of life, we can contribute to try to see how is it that life might look outside. Because of this astrobiology program and because of what we do in the lab, is that it was not easy, because it's definitely not easy to become a NASA postdoctoral fellow, but the ideas are there, the ideas are common. Our projects have a lot in common with what NASA wants, the objectives, the goals of the missions, et cetera. That's how, from being a biologist studying the origin of life, I ended up, so to speak, in NASA-affiliated postdoctoral researcher.

Michael Holtz:

Right. If I understand what you're talking about, the more scientists understand what's in the catalog, expanding that catalog, when you're out looking at Mars or wherever, the more of those little signs that we know, whether it's RNA or proteins or whatever those potential signs of life are, if we can see that somewhere else, then we may be able to extrapolate, "Oh, this happened here."

Alberto Vazquez-Salazar:

Exactly. Exactly. Or, it could potentially happen. That's why, for instance, the classic ... Well, not a classic. A very important molecule for life, it's water. We know that life needs water to sustain, to develop. That's why water is so important, and that's why we always hear in the news that, "Oh, this planet over there can have water. This other planet may have had water," things like that. Just like water is important marker for life, we have been discovering different molecules that may also serve as markers or biomarkers for life. We try to actually understand the process of the origin of life on Earth, because it's the one example that we know, to try to see if we can find that in the universe, which it's a huge, very exciting goal. There's a lot of people in this astrobiology program, as with this astrobiology goals working on that from different perspective, which is again amazing.

Michael Holtz:

It sounds so exciting. It really does to be on this forefront of discovering more and more about the origins of life and digging deeper into all of that. Alberto, you talked about networking, but in the cases of both of your lab experiences, there's also some courage. Walking into Dr. Lascano's lab and then walking into Dr. Chen's lab, or reaching out to Dr. Chen and saying, "I'm ready for this. I'm interested in this." Networking is part of it, but courage is part of a bit of it as well, to be able to say, "I want to do this," or, "I want to be part of work that you're doing," or, "Is there an opportunity for me?"

Alberto Vazquez-Salazar:

Yes, definitely. Yeah, you have to dare to do something and you have to set to mind to that. Of course, also something that happens and school doesn't really prepare us for that, is that there's going to be a lot of rejection, a lot of rejection. This is what I tell the students that I joined the lab or other students that I interact with, if you get rejected in trying to join a lab, for instance, especially as an undergraduate, it's not because of you. It's just how unfortunately the system works.

Sometimes there's no space in a lab for undergraduate researchers, because there's no funding for those. There's no space available because of that. No one really prepares for a lot of rejection in that sense, but that's something that every single PhD student, every single graduate student is going to tell you, you have to develop this kind of power to overcome rejection, to overcome negative results, to overcome a lot of negative things, and yeah, you have to always dare yourself to do something. Otherwise, I feel like in a normal pathway, if you don't dare there to do something, you're not going to be able to actually do it if that's what you want to do.

Michael Holtz:

Right.

Alberto Vazquez-Salazar:

Yeah.

Michael Holtz:

That sounds like great advice for up-and-coming scientists. Is there anything else that you would tell a young person or a young scientist who may be following in your footsteps?

Alberto Vazquez-Salazar:

I feel the other thing is that it goes right next to the daring to do things part, is that when you do dare things, there's a chance that you don't have, you're not successful in the first trial or the second. For instance, for the NPP, the fellowship program, there's people who get the fellowship in the third trial. Usually, if we dare to do something, if we reach that point, we have to be aware that there's a possibility of rejection and not success, and that's not bad at all. We need those things. If anything, what we are daring to do is we are daring to be unsuccessful.

I think those cases in which I didn't get the fellowship, I didn't get the job, I didn't get the position, no one talks about those. No one really talks about it. When we see someone's CV or career, those people, we only highlight the peaks of their career, the success cases. But to get to those, we usually have many cases in which we were not successful. It doesn't really matter. As long as we keep trying and we keep trying to improve, we're going to reach that point of success, that I get the fellowship, I get the position, I got whatever is that we are aiming for. I feel we need to be proud of our unsuccessful cases, of our unsuccessful job applications, unsuccessful grant applications, because we learn from those, and we have to be very, very, very, very proud of those. I'm very proud of all my mistakes.

Michael Holtz:

I love it. I love it. Alberto, last question for you. What brings you joy?

Alberto Vazquez-Salazar:

A lot of things, actually. I feel, being in the lab, working in the lab sounds cliche, but even though there's a stress and everything, things associated to that kind of negative things associated to that, being in the lab and working in there, knowing that I'm doing what I want and I like, it brings me joy. But also, being with my family brings me joy, being with my niece, being with my mom. Going to the movies by myself, if that's happening, brings me joy. Eating a delicious plate of food brings me joy. I love soccer. Watching soccer brings me joy. Playing soccer brings me joy. Reading something brings me joy. There's a lot of things that do, honestly.

Michael Holtz:

Good, good.

Alberto Vazquez-Salazar:

Yeah, I feel, in any scientific career, there's people who are, they're in another cabinet somewhere that are amazing people, great scientists. But me, myself, being just a mortal, I feel I do need this balance between things that bring me joy outside of the lab and things that bring me joy inside the lab, and I like that. I just try to enjoy life.

Michael Holtz:

I love it. That's great. Alberto Vazquez-Salazar, thank you so much for spending this time with me and letting me get to know a little bit more about who you are. I hope maybe later in your fellowship or when your fellowship is over, you can come back and tell us more about what you've learned and more about the secrets of the universe.

Alberto Vazquez-Salazar:

Definitely, if we get there.

Michael Holtz:

Absolutely. That's right. Thank you so much. I appreciate it.

Alberto Vazquez-Salazar:

Thank you. Thank you for having me.

Announcer:

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