

## Video Transcript – Exploring the Amazing World of Lichens

- Maggy Benson: Hello, welcome to "Smithsonian Science How," everyone. We're so [00:00:30] happy you're here joining us. We're connecting you to the real science and the experts here at the Smithsonian's National Museum of Natural History. I'm Maggy Benson and this is Emmanuel Kyei-Baffour.
- Emmanuel Kyei-Baffour: Hello everyone.
- Maggy Benson: And today we are going to go on an amazing journey to learn about lichens.
- Emmanuel Kyei-Baffour: Ooh, I'm liking me some lichens.
- (Laughter)
- Maggy Benson: Me too. I am totally liking the lichens. And today ... Oh and look at, we have this really cute monkey here. He's liking these lichens too. I bet in a moment [00:01:00] our lichen expert is going to be able to tell us why.
- Maggy Benson: She's going to take us on an exploration to better understand what lichens are and how scientists study them. And you know, I have to admit that I really didn't know what a lichen was until we started working with our expert Manuela Dal Forno.
- Emmanuel Kyei-Baffour: You know, me neither. And I wonder if our students out there know what a lichen is too? So students, if you look to the left, you'll see our very first poll question: "Have you ever heard of lichens?" Go ahead and let us know in the poll and [00:01:30] we'll be able to call it out. And also, if you have any questions, just go ahead and send them in the poll and we'll try and get them answered during our broadcast today.
- Maggy Benson: Yeah. Even though we can't see you, we can see all of your messages and all of your poll responses. We see that we have a classroom from Alaska and Mississippi. Hey guys, thanks for joining us today.
- Emmanuel Kyei-Baffour: Hello. (Laughter)
- Maggy Benson: So today we are in a lab in the Smithsonian's National Museum of Natural History, right off of the National Herbarium.
- Emmanuel Kyei-Baffour: Wow.
- Maggy Benson: This is where the United States keeps all [00:02:00] of its plant collection safe. And it's been around for over 150 years.
- Emmanuel Kyei-Baffour: Wow. Look at all of those lockers and closets. I wonder what's inside of them?

Maggy Benson: I think we're going to be able to see it in a little bit.

Emmanuel Kyei-Baffour: I sure hope so!

Maggy Benson: (Laughter) So without further ado, let's go and meet our lichen scientist, our lichenologist, Dr. Manuela Dal Forno. What do you think?

Emmanuel Kyei-Baffour: Yes, let's do it.

Maggy Benson: All right. Here we are.

Manuela Dal Forno: Hey guys.

Maggy Benson: Hey Manuela.

Manuela Dal Forno: Hello. Hello everybody out there. [00:02:30] Welcome to our lab. And this is where I actually do most of my work. So you know, I go out in different places, I collect lichens, and I come here and I get to see them under this microscope. So if you like that, you're going to see some of that later on too. And I also write down my ideas and results. So this is where I spent a lot of my time. (Laughter)

Emmanuel Kyei-Baffour: Awesome!

Maggy Benson: And we're going to explore all of those different kinds of things that you do for your research and in a [00:03:00] little bit today.

Manuela Dal Forno: We will.

Maggy Benson: But first, let's check back in with our students. Have our students heard of lichens?

Emmanuel Kyei-Baffour: 83% of our students have heard of lichens before. So we've got some future lichenologists out there.

Maggy Benson: Yes!

Manuela Dal Forno: Yeah, that's a great number, because actually most people don't know what lichens are. When I say "I'm a lichenologist" or "I study lichens," people usually say, "What?"

(Laughter)

Manuela Dal Forno: So, you know, it includes a little bit of an explanation about it.

Manuela Dal Forno: But the good thing about lichens is that once you know what they look for, [00:03:30] what they look like, you just go out there and you can see them everywhere.

Manuela Dal Forno: So (Laughter at an image of a lichen shaped like a heart with the caption "I'm lichen you") this is what I go for you know (More laughter).

Manuela Dal Forno: I always try to look for fun shapes and I can have good pictures to show everybody.

Maggy Benson: It looks like lichens are even sending you love notes.

Manuela Dal Forno: I know, maybe right? (Laughter)

Emmanuel Kyei-Baffour: So you said we can find lichens anywhere we go out. So we're in Washington D.C. currently, and we have viewers in Alaska and Mississippi. Are there lichens there too?

Manuela Dal Forno: [00:04:00] Absolutely. So Alaska, Mississippi, D.C., everywhere. And lichens literally grow in any country in the world. So just go out there and you get to see a lot of these. For example, when you go on hikes, you know you'll get to see some lichens growing on the rocks. When you're around the city, you can see them on trees. And when you are, you know, in your backyard as well. Check out after the program, in the sidewalks, in archeological [00:04:30] sites, sometimes that you . . .

Emmanuel Kyei-Baffour: Wow.

Manuela Dal Forno: . . . go on vacation.

Maggy Benson: Yeah

Manuela Dal Forno: And even on cemetery (grave stones). Those are pretty common sightings. And one of my favorite is this one right now.  
  
(Laughter at a picture of cars and vans in a field, some are covered with weeds and one van is covered in lichen.)

Manuela Dal Forno: The car. I know, right?

Emmanuel Kyei-Baffour: Wow, wow!

Maggy Benson: They really are everywhere.

Manuela Dal Forno: Mm-hmm. I'm telling you.

Maggy Benson: Now, Manuela, I'm wondering how many more times we can say the word lichen without actually telling our viewers what it is.

Manuela Dal Forno: Okay, so let's get started. I have a lichen here, right? And can you [00:05:00] try to describe with your own words, how does it look like?

Emmanuel Kyei-Baffour: Well, it's kind of green, like a plant.

Maggy Benson: Yeah, It reminds me a little bit of like a moss that might grow on the bottom of a tree.

Emmanuel Kyei-Baffour: Yeah.

Maggy Benson: But it doesn't look like it has leaves or is very plant likes.

Emmanuel Kyei-Baffour: Yeah. And it doesn't look like it has roots either.

Manuela Dal Forno: Mm-hmm, the answer's yes. That's all right. So no roots, flowers and leaves. And what, you know, it seems like we're looking at one thing, right?

Emmanuel Kyei-Baffour: Mm-hmm.

Manuela Dal Forno: But it's [00:05:30] actually two different things growing together to form this lichen body. So in one hand you have fungi, you know think about mushrooms and mold.

Emmanuel Kyei-Baffour: Yeah.

Manuela Dal Forno: But there're thousands of different fungi and some of them make lichens. And on the other hand you have algae, you know,

Emmanuel Kyei-Baffour: Ah!

Manuela Dal Forno: That stuff that grows on lakes and ponds.

Maggy Benson: Pond scum?

Emmanuel Kyei-Baffour: Yeah.

Manuela Dal Forno: Yes.

(Laughter)

Manuela Dal Forno: And like seaweed. Also there's many different types of algae. But when they come together to form [00:06:00] these (Dr. Dal Forno refers to her specimens on the table), it makes a lichen.

Maggy Benson: Wow!

Emmanuel Kyei-Baffour: Wow!

Maggy Benson: Do they all look like that or do they come in different shapes and sizes?

Manuela Dal Forno: They come in many different shapes and sizes and we'll get to see a lot of their diversity today. So you get to see, you know, many different colors and different shapes and growing in many different places as well around earth. So look at that one has the eyes on, and this one is on the tree.

Emmanuel Kyei-Baffour: [00:06:30] Awesome. (Laughter) I heard a funny joke the other day. What did the fungi say to the algae?

(Chuckles)

Maggy Benson: I'm "lichen" it.

(Laughter)

Manuela Dal Forno: Well, that is a funny way to remember this relationship, right? So you're going to "lichen" this guys. (Laughter) Lichens are a fungal lifestyle.

Maggy Benson: What?

Emmanuel Kyei-Baffour: Wait, what? A lifestyle?

Manuela Dal Forno: Yes.

Maggy Benson: Can you explain what that means?

Manuela Dal Forno: Of course. So a long time ago fungi [00:07:00] partnered up with some algae and now they depend entirely on that to survive. So, it is really something that has been around for millions of years. And what you are seeing out there is this structure that they form together to form so many different shapes.

Manuela Dal Forno: And this, what we call the lichen body, the proper name is called a thallus.

Emmanuel Kyei-Baffour: A thallus, okay.

Maggy Benson: Now, for all of our students watching out there today, [00:07:30] how can they recognize a thallus in nature versus just some plant or some moss or even some fungus?

Emmanuel Kyei-Baffour: Yeah, how can we tell the difference?

Manuela Dal Forno: How about if we learned what are the different things that they bring to one another?

Emmanuel Kyei-Baffour: Awesome.

Maggy Benson: I think that's a great idea.

Emmanuel Kyei-Baffour: Yeah. Can you tell us more about our lichen lifestyle?

Manuela Dal Forno: Yes. So, lichens are a classical example of symbiosis. So you're seeing on TV now a clown fish and a sea anemone. You're also going to see a bee and a flower [00:08:00] and our rock stars, the lichens, okay.

(Laughter)

Manuela Dal Forno: So symbiosis literally means living together. And in science we actually have a lot of different examples. And the unique thing about lichens is that, while you are seeing the clownfish and the sea anemone, the bee and the flower, but when you saw the lichen, you saw one thing, all right?

Manuela Dal Forno: So right now we see a diagram to show you how a lichen is organized. And [00:08:30] you can see that the algae is forming a layer, all right? And then you can see on the top of that, and at the bottom of that you're going to have different layers with fungi.

Maggy Benson: So those green bubbles, that's the algae.

Manuela Dal Forno: Correct.

Maggy Benson: That's one partner. And the brown on the top and the bottom of that, that's the fungus.

Manuela Dal Forno: Exactly.

Maggy Benson: That's the other layer.

Manuela Dal Forno: Exactly.

Maggy Benson: So tell us more about this fungus.

Manuela Dal Forno: Okay. So you can see by the structure of it [00:09:00] that this fungi is sort of sheltering the algae, right? So imagine if you were a free-living algae and you're out there on your own. Sometimes there's too much wind, it's very cold, a lot of sun. So if you're living inside of the lichen thallus, you're protected from that. So basically, the fungus is providing the algae with this shelter, this very safe, stable environment.

Emmanuel Kyei-Baffour: Okay. Sometimes I feel like a free living algae myself.

Maggy Benson: [00:09:30] Yeah.

Emmanuel Kyei-Baffour: But if I were the fungus, I would want to know "What's in it for me?"

Maggy Benson: Yeah, really. (Laughter)

Manuela Dal Forno: Mm-hmm. Right? So the algae then, in return, (Laughter) is basically feeding the fungus. So algae, just like plants, they make photosynthesis

Emmanuel Kyei-Baffour: Ah, okay.

Manuela Dal Forno: And the products of that, the sugars, it shares with the fungus. So that baby won't be grumpy anymore.

(Laughter)

Emmanuel Kyei-Baffour: So I'm looking and we've got a couple of student questions here I'd like to get answered.

Manuela Dal Forno: Let's [00:10:00] go for it.

Emmanuel Kyei-Baffour: Tristan would like to know, how many different colors can lichens be?

Manuela Dal Forno: Tristan, I have never counted how many colors. But I'm going to tell you that pretty much any color you can think of, there will be a lichen to represent that.

(Laughter)

Emmanuel Kyei-Baffour: So another question is, is a lichen the same thing as a fungus?

Manuela Dal Forno: It is a very difficult to answer question, but I'll try to be [00:10:30] straightforward. So fungus and lichens are not the same thing. So lichen is formed by a type of fungi, but not all fungi are lichens. Hope that makes sense.

Emmanuel Kyei-Baffour: Hmm. Yeah. Okay. Karen in our chat would like to know about lichens as an air pollution deterrent?

Manuela Dal Forno: Yes! You are thinking as a lichenologist already. And that is one of the most important uses of lichens. In bio-monitoring ,using [00:11:00] lichens mean that, well the lichens they are able to absorb everything that is in the air.

Maggy Benson: They don't have roots.

Manuela Dal Forno: They don't have roots, they don't have a cuticle. So whatever is out there, they are able to absorb, and if we test these lichens we can get different levels of air pollution, for example. And also whether they're present or not. There are some species that can be used as indicators for us.

Emmanuel Kyei-Baffour: Wow. So do you study all those types of lichens, like . . .?

Manuela Dal Forno: [00:11:30] Well, I wish, right?

Maggy Benson: It's a lot.

Manuela Dal Forno: It's a lot of lichens. There are 20,000 known species of lichens, so . . .

Emmanuel Kyei-Baffour: Whoa!

Maggy Benson: Whoa!

Manuela Dal Forno: So we cannot tackle everything by ourselves, right? So I actually, I love all lichens and then studied many different ones, but I'm focusing on the countries that in the map look or have the blue color. So United States and also many different countries in Latin America.

Emmanuel Kyei-Baffour: Wow. And do you get to travel all around the world to visit [00:12:00] these countries?

Manuela Dal Forno: Mm-hmm. Yes. Those are the places that I've been.

Emmanuel Kyei-Baffour: Oh my goodness. So students out there, if you want to travel the world and be a lichenologist, pay attention.

(Laughter)

Manuela Dal Forno: Yes! Absolutely.

Maggy Benson: So after you travel the world and collect these lichens, do you come back here to this lab?

Manuela Dal Forno: Exactly. And that's where I spend most of my time. So it's wonderful to be in the field. But you're so curious to see what you got, right?

Emmanuel Kyei-Baffour: Right.

Manuela Dal Forno: So you bring them here and that's when you can use microscopes-

Maggy Benson: Like [00:12:30] this one?



Manuela Dal Forno: Yes. And how about if we take a look how lichens may look under this scope right here.

Maggy Benson: Our team prepared one.

Manuela Dal Forno: Here we go.

Emmanuel Kyei-Baffour: Oh!

Manuela Dal Forno: Yes. Look at that.

Emmanuel Kyei-Baffour: Wow.

Maggy Benson: There's two different colors on just this one lichen?

Manuela Dal Forno: Yes. Isn't that cool?

Maggy Benson: It's really beautiful.

Emmanuel Kyei-Baffour: That's awesome.

Manuela Dal Forno: Yes. So this one is a very neat one. So that's what we do. We go out, we collect, we come here and work on all these different types of lichens.

Emmanuel Kyei-Baffour: So I have a question. [00:13:00] Let's say you're out in the field and you find a new lichen and . . . But I'm looking at the lichens on the table and they don't all look the same. How do you sort the lichens?

Manuela Dal Forno: Mm-hmm, good question because this is exactly the type of work that I do. I try to study as many different lichens to find out how diverse are lichens. So let's let our students start with that . . .

Emmanuel Kyei-Baffour: Yeah.

Manuela Dal Forno: By showing them the different main ways that lichens may look like. So [00:13:30] starting with the first one, lichens can be crustose, okay?

Maggy Benson: Crustose.

Manuela Dal Forno: Yes, so let's see if we can see this one up close here.

Maggy Benson: So this is all the same lichen, this pink and this green-ish white?

Manuela Dal Forno: Yes.

Maggy Benson: It's beautiful.

Manuela Dal Forno: Exactly.

Manuela Dal Forno: So the red one is right here is the border of the lichen. And the extra stuff that you see here is the bark because when you collect crustose lichens just like the ones that you see on your screen now, they can be on rocks, they are going to be on [00:14:00] trees, but they're so tight to where they're growing on that you need to bring a piece with you back to the lab to study them.

Emmanuel Kyei-Baffour: Oh!

Manuela Dal Forno: So crustose, crusty like.  
(Laughter)

Emmanuel Kyei-Baffour: Kind of crusty.

Manuela Dal Forno: Yes.  
(Laughter)

Manuela Dal Forno: Our next type is the fruticose lichen.

Maggy Benson: Fruticose.

Emmanuel Kyei-Baffour: Fruticose.

Manuela Dal Forno: Yes. And we can describe them as what? Hairy-

Maggy Benson: This one has a lot . . .

Manuela Dal Forno: Branching.

Maggy Benson: . . . of different colors too!

Manuela Dal Forno: Exactly.

Emmanuel Kyei-Baffour: Yeah!

Manuela Dal Forno: And they can be all tangled together. [00:14:30] So here we can actually see a couple of different species of lichens growing together. The main one being the-

Emmanuel Kyei-Baffour: Kind of like string. Strings.

Manuela Dal Forno: Yes. Also stringy.

Emmanuel Kyei-Baffour: Yeah!

Manuela Dal Forno: And then you see that they may also have very different appearances. Look at that one.

Emmanuel Kyei-Baffour: Ooh!

Manuela Dal Forno: It's mostly green. Then you also have some very showy yellowy ones-

Maggy Benson: But they all have that branch in common.

Manuela Dal Forno: Exactly. And that is the fruticose type.

Manuela Dal Forno: Okay. And the third type, okay, is I would say probably the ones [00:15:00] that you most see around is-

Maggy Benson: I've definitely seen that one.

Manuela Dal Forno: Exactly. (Laughter) So these are foliose lichens.

Emmanuel Kyei-Baffour: Foliose.

Manuela Dal Forno: Yes, because they look sort of leafy, you know. But each one of these is not a leaf at all. They're called lobes and when you see them, they are foliose lichens. And they're also very diverse and may have different colors. So we have an orange before and now we have this really beautiful green [00:15:30] one and even dark ones like these brown olive and black ones.

Maggy Benson: So can you give us an example on to be able to work through ourselves to be able to test our skills that identifying the three kinds?

Manuela Dal Forno: Yes!

Emmanuel Kyei-Baffour: Oh boy!

Manuela Dal Forno: Are you ready for a quiz?

Emmanuel Kyei-Baffour: I hope so.

Manuela Dal Forno: Okay. (Laughter) So I selected a picture that I took in Costa Rica and it has all different types of lichens. [00:15:56 Here Dr. Dal Forno shows an image of a tree trunk with a variety of lichens of different colors.] So it has crustose, fruticose and [00:16:00] foliose. (Laughter). I'm going to start with you, Emmanuel.

Emmanuel Kyei-Baffour: Oh boy.

Manuela Dal Forno: Can you spot which one is the leafy, the foliose one?

Emmanuel Kyei-Baffour: Okay. The foliose lichen, hmm, it kinda looks like on the bottom of the tree there was some foliose action going on. (Laughter)

Manuela Dal Forno: Yes! You got it right. Exactly. How about you, Maggy? I'm going to give you the fruticose, the branchy one.

Maggy Benson: The branchy [00:16:30] one. So that's the one that's branching, looks like hair.

Manuela Dal Forno: Exactly.

Maggy Benson: There's definitely some hairy stuff happening at the top there. Maybe off to the right?

Manuela Dal Forno: Yes. Yes, yes yes! (Laughter) [showing the image of the tree with three types of lichens] You guys are awesome.

Maggy Benson: There it is!

Manuela Dal Forno: I think we have two more lichenologists here too. So this leaves the crustose one, the one that is very attached to the substrate, is more or less in the middle.

Emmanuel Kyei-Baffour: I see.

Manuela Dal Forno: So we actually see at one that is entirely white and one that is white with red stuff.

Emmanuel Kyei-Baffour: Cool.

Manuela Dal Forno: Do you think our students are ready, too?

Maggy Benson: I think we should [00:17:00] definitely

Emmanuel Kyei-Baffour: Oh yeah.

Maggy Benson: Okay. . . give them a try.

Manuela Dal Forno: All right. So we also have a picture with all three types of lichens that is on your screen. How about if you talk to your colleagues, your lab mates, whoever you're with, your teacher and you have about 30 seconds to discuss which lichen is what. Is it foliose, crustose or fruticose?

Emmanuel Kyei-Baffour: And once you figure out your answers, go ahead and send them in the questions tab to us.

Maggy Benson: [00:17:30] While our students are thinking about that Manuela as a lichenologist, do you feel like you hit the jackpot when you find all three types?

Manuela Dal Forno: Yes, I sure do. (Laughter) And that's why I take beautiful pictures so I can pass on the information. And people can actually see how different they may look when they're all together.

Emmanuel Kyei-Baffour: Oh. I see, I see.

Manuela Dal Forno: Mm-hmm.

Maggy Benson: Wow!

Emmanuel Kyei-Baffour: What is... what are those lichens growing on?

Manuela Dal Forno: They're all growing on a fence.

Emmanuel Kyei-Baffour: Okay.

Manuela Dal Forno: So this was during one of [00:18:00] our trips to Brazil while traveling. And you know, when you take a break then there were the lichens. They are literally everywhere. (Laughter)

Emmanuel Kyei-Baffour: Awesome.

Maggy Benson: So I think our students are still voting on this. So we'll give them another second. We'll keep that poll open. But Manuela can you give us a hint? Hmm. What are we looking at here on this?

Manuela Dal Forno: Okay. So you are most likely trying to figure out which one is which. And usually, [00:18:30] I feel like the fruticose is the easiest one to spot. So they might look branchy, you know, and I think we are actually getting some of the answers right. So the left one is the branchy one, the fruticose type. And in the middle you see the crustose. And towards the right, you are seeing the leafy and foliose one. [00:19:00] So they did pretty well, huh? (Laughter)

Emmanuel Kyei-Baffour: I think we've got some future lichenologist out there that you might have to hire. (Laughter)

Manuela Dal Forno: I know. I hope so, right?

Maggy Benson: Yeah. We were taking a look at those responses coming in and everybody did really well on that.

Manuela Dal Forno: I'm excited to hear it. (Laughter)

Maggy Benson: All right. Well Manuela you have gone to the field, you come back, you look at lichens under the microscope, and you sort them, as our student lichenologist just did. What's next?

Manuela Dal Forno: Yes. So, what's next? Well, we are trying to put names on these many different [00:19:30] lichens. So our next step is actually to take a tiny piece of lichen and put them in tubes like this, you're going to see in the video. So we had students working with us and they're showing you right now the process of DNA extraction. DNA is short for deoxyribonucleic acid and it's the molecule that contains the genetic code [00:20:00] of all organisms. And in lichens, imagine that you're going to have DNA from both the fungus and the algae going on, right?

Emmanuel Kyei-Baffour: Yeah.

Manuela Dal Forno: And both of these have DNA inherited from their parents. And by comparing this different genetic information that you're getting, it will help you to find out how diverse our planet is because you can compare these to one another.

Maggy Benson: Wow. That's powerful stuff.

Manuela Dal Forno: I know.

Emmanuel Kyei-Baffour: So looking at that video, [00:20:30] it looked like you already hired some student lab workers. Is that the case?

Manuela Dal Forno: Yes, that is true. (Laughter) So, last summer we worked with two high school students Archana and Daniela and they work in many different activities as we saw today, related to in research., But I feel that the... One of their favorites was being out there in the L-A-B as we call it, the laboratory of analytical biology. (Laughter)

Maggy Benson: You know, they shared some of their insights after working with [00:21:00] lichens, let's take a look.

Daniela: Well, for me, I did not know what a lichen was. At first, I thought it was like an animal or something, but when I saw the background of it, I was like "I think I have an idea of what it is."

Archana: I think I knew that they were the little things that grow on trees that you see, but I guess I thought that they were just plants. I never really realized how complex they were. How it was two different organisms living together.

Daniela: I've grown to love lichens because [00:21:30] I see them everywhere now. Now that I know what a lichen is, they like, I can see they grow on trees, on rocks. It's amazing.

Archana: I think just seeing things from a distance you never really get to truly appreciate it. And now, after working with them for six whole weeks, over the summer, spending five days a week, right there with the lichens, really allowed me to grow to appreciate them. And, yeah, I do like lichens.

Maggy Benson: (Laughter) I wonder how many more times we can [00:22:00] like lichens in this show? (Laughter)

Emmanuel Kyei-Baffour: So Daniela and Archana actually had some questions for you and we're going to, let's take a look.

Manuela Dal Forno: They did.

Daniela: I was wondering, was there anything in particular that happened during your childhood that made you take this path of becoming a biologist?

Manuela Dal Forno: Great question. So, I feel that I had a lot of contact with nature while growing up because of my grandparents and my [00:22:30] parents. We used to go out to the country a lot, but I think especially during my... When I was a high school student, I had a little forest behind my school and I would just go walk around and one day I saw a really beautiful fungus and I just started to visit it, calling my friend "Fungi", until one day he wasn't there anymore. That was really [00:23:00] impactful and I'm like "Something needs to be done about that" because it seemed like someone had removed it. So . . .

Daniela: Okay.

Manuela Dal Forno: I think I made a decision. I was in between two different things and I decided that I wanted to follow the biology path.

Daniela: Okay.

Maggy Benson: Manuela, that was a really wonderful introduction to how you got into biology.

Manuela Dal Forno: Thank you, Maggy.

Maggy Benson: I'm sure you're inspiring all the students watching at home today to look at biology more seriously.

(Chatter, laughter)

Emmanuel Kyei-Baffour: [00:23:30] So you've taken us on an incredible lichen journey and taught us so much about the lichen lifestyle. Is there any way we could take a journey out into the Herbarium?

Manuela Dal Forno: Yes! So the Herbarium is actually right outside here. Why don't you follow me? And we can take a look.

Emmanuel Kyei-Baffour: Awesome! Let's go.

(The group leaves the lab and walks through several corridors of tall white cabinets.)

Maggy Benson: Yes. [00:24:00] So we made it. (Laughter)

Maggy Benson: This is amazing,

Emmanuel Kyei-Baffour: Wow!

Maggy Benson: Students check this out. There's row upon row of cabinets and, I mean they even stretch all the way down here and all the way down there!

Emmanuel Kyei-Baffour: Yeah, there's like an echo!

(Laughter)

Manuela Dal Forno: Yes. Welcome.

Maggy Benson: What's inside?

Manuela Dal Forno: This is the National Herbarium. So all of these cabinets that you see, they're filled like this. Let's take a look how samples . . .

Maggy Benson: Wow!

Manuela Dal Forno: . . . are organized. So when [00:24:30] you take out each one of these folders, what you're going to see is a plant, okay, that has been dried and pressed. And then this is how they're going to look like. Okay?

Maggy Benson: Wow!

Manuela Dal Forno: And guess how many samples we have in the National Herbarium? Of plants?

Maggy Benson: Oh, gosh!

Manuela Dal Forno: Let's start with plants

Emmanuel Kyei-Baffour: Hmm. Like . . .

Maggy Benson: Well, I know it's been around for 150 years, so there has to be a lot.



Emmanuel Kyei-Baffour: 150,000. [00:25:00]

Manuela Dal Forno: [00:25:00] That is-

Maggy Benson: A million?

Manuela Dal Forno: Yes. We're getting closer. So the National Herbarium has over five million plants, or samples in general, . . .

Maggy Benson: Whoa!

Emmanuel Kyei-Baffour: 5 million?

Manuela Dal Forno: . . . because one quarter of a million are lichens.

Maggy Benson: Wow!

Emmanuel Kyei-Baffour: Wow!

Maggy Benson: And I guess you have to store them all in stacks all dried out to be able to fit them all

Manuela Dal Forno: To fit all

Maggy Benson: In one collection.

Manuela Dal Forno: Exactly. Yes.

Emmanuel Kyei-Baffour: 5 million

Manuela Dal Forno: And lichens, and you saw, you know, the plant is a directly on the sheet while lichens are usually [00:25:30] kept in these envelopes like so it can be in boxes like these or some Herbarium also pressed them here.

Maggy Benson: So what's in there?

Manuela Dal Forno: Okay. This is my favorite lichen. it has to be really special, right, for it to be.

Maggy Benson: You love all lichens. So this has to be really special.

Manuela Dal Forno: It is, right? And I'll tell you why in a second or you can probably see it right?

Maggy Benson: It's beautiful! It looks like artwork!

Manuela Dal Forno: It does. It sure does [00:26:00] look like artwork.

Maggy Benson: What is it?

Manuela Dal Forno: So this is a new species of the group that I'm working on, Dictyonema is its name. And it just represents so much because, well, among the so many important things that in an herbarium is, you know, it also is a snapshot for the past, if you think about it. Because this lichen right here was collected in 1975 in Panama by [00:26:30] the lichenologist that was here, Mason Hale. I really get to see what he saw back then in Panama and it looks so beautiful. So it just how looking into the past and if kept in a well-maintained environment like this herbarium, it may, it will, last hundreds of years.

Maggy Benson: So . . .

Emmanuel Kyei-Baffour: So if I'm a student at home and I am liking the lichens (Laughter) how can I get involved?

Manuela Dal Forno: [00:27:00] Yes. So Emmanuel there are a lot of lichens. So there are 20,000 known lichens, there's just not enough lichenologists right out there.

Emmanuel Kyei-Baffour: Right.

Manuela Dal Forno: So, there's so much work to still be done. As we were for example, working in the Galapagos Islands, we found so many new species there. And also we found out that what used to be considered one species, *Cora*, [00:27:26] is actually a hundred different ones.

Maggy Benson: Oh, my gosh!

Emmanuel Kyei-Baffour: Wow!

Maggy Benson: So [00:27:30] there's a lot of opportunities for a student lichenologist to make new discoveries.

Emmanuel Kyei-Baffour: Mm-hmm.

[Manuela Dal Forno: Absolutely.

Maggy Benson: How beautiful!

Manuela Dal Forno: Yes. You can make significant impactful discoveries studying lichens.

Maggy Benson: Maybe they'll be your interns one of these days.

Manuela Dal Forno: Yes, I'll be waiting for them.

Emmanuel Kyei-Baffour: Awesome! Well, some of our students have a couple more questions that we can fit in. Somebody would like to know are lichens like coral reef on land?

Manuela Dal Forno: That is an interesting idea. I guess you could... [00:28:00] Well, as long as you know that corals are animals and lichens are not. I think is a pretty good comparison or even sponges.

Emmanuel Kyei-Baffour: Have you ever been surprised by the results of a DNA test when testing lichens?

Manuela Dal Forno: Absolutely. Absolutely. Sometimes, you know, anything can happen. So sometimes you think it's one thing and it's not. And sometimes you're just confirming what you thought it was just based on your observation. [00:28:30] So either way, you feel pretty good about that.

Emmanuel Kyei-Baffour: Do any microscopic organisms live inside lichens?

Manuela Dal Forno: Ahhh! Yes! You are thinking as a lichenologist. So many different organisms can live inside a lichen or on top of the lichen. So there's a lot of research going on with that actually.

Emmanuel Kyei-Baffour: Awesome. Thank you so much for answering those student questions for us.

Manuela Dal Forno: Thank you Manuela for this amazing lichen journey, as you said Emmanuel. [00:29:00] This has been so lovely. And thank you students for tuning in today and sending all of your awesome questions. We hope you enjoyed the program.

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