

## **Ask A Biologist Vol 073 (Guest Ashleigh Gonzales)**

### **Putting the Touch into Biology**

If you think of the instruments used to study biology, it is clear that most are visual. So what if you cannot see? How would you be able to learn about the microscopic world that is an important part of biology? Dr. Biology discusses a new tool for learning about this tiny world and other sciences with newly graduated student and biologist Ashleigh Gonzales.

#### **Transcript**

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**Dr. Biology:** This is "Ask A Biologist", a program about the living world, and I'm Dr. Biology. If you think of the instruments you use to study and explore the world of biology, it's clear that most are visual.

Of all the tools that biologists have been using to unlock the mysteries of life on earth, arguably the microscope is one of the most important. What if you cannot see? How would you understand the structure of the cell?

This is the question my guest has been researching for the past three years. Ashleigh Gonzales is a recent graduate of the Arizona State University School of Life Sciences. Her master's degree research has been exploring how to take the tiny world of the microscope and place it into the hands of the visually impaired.

The solution that she and her professors and colleagues have developed is opening the world of biology, including the microscopic world, to a new group of students and structures and researchers.

Welcome to the show, Ashleigh. Thank you for visiting with me today.

**Ashleigh Gonzales:** Thank you for having me.

**Dr. Biology:** How does it feel being finished?

**Ashleigh:** Really good. I'm glad to be done with school and excited to go onto the next thing and see where I end up.

**Dr. Biology:** On Ask a Biologist, our companion website, we receive questions from students who want to pursue a career in Biology. In fact, we have a pretty big section on just that topic.

One common piece of the road to a career in Biology is graduate school. If people don't know it, to earn a graduate degree in Biology, students must complete at least one independent research project.

You just finished your degree, so you finished this project. What was the focus of your research?

**Ashleigh:** The focus of my project was development and analysis of using 3D tactile images for blind students in science education. We developed a new type of tactile image, that is more detailed than prior tactile images. We applied them to classroom settings to see if they showed any improvement for blind students participating in Science and Math.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Dr. Biology:** Let me just describe one of these. At first glance they look like a black flat tile, you might think. They're about a quarter inch thick. When you look closer, you can see, or if you run your fingers over the surface, feel projections that provide details of the object that was imaged. In this case, it's a cell that's undergoing mitosis, which is cell division.

From these tiles, what have you been learning?

**Ashleigh:** We were able to figure out that if we preserve more detail from the original image, the blind or visually impaired students are able to get a lot more information from that image, rather than relying on someone's verbal description.

They're able to more clearly understand different parts of the image and break it down independently, with some guidance of course.

Once they start to learn how to discern images, they get pretty good at it. We're able to step back and let them look at the image themselves and try to discern it. We are also finding that this is a supplemental tool for sighted students, and it's bringing another level, another modality to their learning that they're really enjoying.

**Dr. Biology:** I'll want to talk about that a little bit later. One thing I wanted to talk about before we get off on too much of a tangent. We introduced this as a great tool for the microscope, but this is a tool for a lot of different imaging. While microscopy is what I would call exploring inner space, you've also been exploring outer space, right?

**Ashleigh:** Oh, yeah. I'm really excited about the astronomy courses that we did here. At ASU we were able to take constellations, and because of the way that we make these tactile images, the more intense parts of the images, the brighter parts, come out taller on the board in a tactile way.

We're able to show blind and visually impaired students which constellations stand out. Because the stars are brighter in the tactile image, they're able to discern a constellation out of a image of all the stars.

**Dr. Biology:** In this case, the work you started doing here, it's pretty much close to home, right?

**Ashleigh:** Yeah. It's something that I wanted to focus on. Trying to earn my degree in science was always very challenging, because the images that they provide now in a tactile format are very simplified.

I had to rely a lot on my own personal, visual memory of what things look like and a lot of verbal descriptions to put together what I was supposed to be seeing as opposed to what I was actually getting.

This was exciting for me, because it was a way to provide the real image that the peers are receiving to the blind student as well.

**Dr. Biology:** Right. If you didn't catch on to this, Ashleigh is visually impaired. You're totally blind, right?

**Ashleigh:** Yes. I have zero vision. [laughs] I lost most of my vision when I was 13. As of now, I have nothing. I had perception for a couple years, now I don't have that either.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Dr. Biology:** You turned out to be a perfect researcher for this sort of thing, because you still have some memory of the visual world. Being totally blind, thinking about how to bridge that gap, seems like this was a project that was waiting for you to take on.

**Ashleigh:** Yeah. I was excited when my professor from my imaging course, Dr. Baluch, approached me with the idea, because none of my other professors had ever shown that kind of interest before. It was really exciting when she approached me with the idea.

We took it from there and got a lot of other faculty on board and other students on board. I was excited to be a part of it.

**Dr. Biology:** The technique you're using is pretty revolutionary in the sense that it wasn't just a matter of making something 3D, it was actually 3D with a purpose and very carefully crafted to give more information than just a spatial location, right?

**Ashleigh:** Right, that was really important to me because, like I said before, "The current tactile images that are being provided are adequate but not anything impressive, or over the top." It was really important to me that if we were going to do this, we were going to provide a further level of information and detail that students weren't getting at that point.

**Dr. Biology:** Let's go back to the tile that I was describing earlier, the one about the cell, and it was going through cell division. When you first used your hands to actually interpret that, is that the first time that you actually interpreted a cell dividing, or did you have a good concept beforehand?

**Ashleigh:** I had a good concept as far as the cartoon diagrams you see in textbooks a lot of the time. I had never actually seen a real cell dividing, myself. I remember seeing cartoon graphics or diagrams in textbooks when I was younger, but I've never actually seen the actual cell dividing.

This one that we made was from a real picture, from a real microscope, and it was a real cell. That was definitely different for me.

**Dr. Biology:** What stood out for you? What did you get out of that...

**Ashleigh:** [laughs]

**Dr. Biology:** ...tile that was so different?

**Ashleigh:** It's not clean cut like those pictures are. [laughs] The pictures in textbook are very simplified and straightforward so you can see and identify every little piece and organelle, but real cells are not that simple.

I think this was a way for me to see that it does take time to break down what you're looking at. It's nice to be able to do that independently rather than having someone there telling me, "OK, there's a nucleus and there's spindles and the cell splitting." It's nice to see that myself.

**Dr. Biology:** What about the research on the tiles? I know you're a good person to do the early testing on it, but you actually did a lot more research.

**Ashleigh:** We were able to do a participation study with the public. We invited blind and visually impaired adults of all backgrounds into ASU to do a science activity. They did one astronomy and one biology. We had half of the students using the tactile boards and half of them using the old version of tactile graphics.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

We were able to have them test out the boards and give us feedback. They did a quiz so we could assess how well the boards actually helped them with the assignment. We got a lot of verbal feedback, and a lot of survey feedback. It was a really good experience.

**Dr. Biology:** For the students that could see, you had a big improvement, as well.

**Ashleigh:** Yeah. When we used these boards in actual pilot courses here at ASU, we provided them to the blind students and the sighted students in the same classroom so they had the option if they wanted to try the tactile boards as a supplement to their printed material, they were able to.

A lot of them really loved it because it provided a hands-on way to interact with the material and really get involved in the lab that they were doing.

**Dr. Biology:** I thought I read that you actually had better performance in their actual exams.

**Ashleigh:** Yes. In one of the courses that used the boards or had them available, they took a quiz every week. The scores on their quiz overall was higher than the side-by-side course, which was doing the same activities without using the boards.

**Dr. Biology:** When this was first introduced to me, I was intrigued because we know it's important to take notes when you're in a lecture or you're in your lab. There's another channel of learning that goes on when you write those notes.

In this case it seems like you tapped into another channel for the sighted students so that it actually imprinted on them better than if they didn't do it. I would be curious to see how this plays out down the road.

**Ashleigh:** I think it could be really interesting. There's been a few studies' already that I've looked into that have researched using models and using hands-on tools. All of the studies have shown positive results from sighted students using hands-on materials.

I think it just gives them a way to feel more a part of what they're learning and really interact with the material, rather than just hearing the lecture or being told something is the way it is without them experiencing it themselves.

**Dr. Biology:** How many different kinds of tiles do you have right now?

**Ashleigh:** Oh God, I don't even know. I want to say we have at least 50 different things, probably more. It's been really exciting because we've been able to use the [indecipherable 10:33] U's in different setting and test out different ideas with them, and all of them have been really positive.

We've got all kinds of astronomy tactiles. We've got some fossils, and we've got DNA in the cells. Now we just have all sorts of them.

**Dr. Biology:** For astronomy, I know you've been working with NASA.

**Ashleigh:** Yeah. I was able to get a NASA space grant internship as part of this project. They were all very excited about contributing to this research.

I was able to take these materials to a lot of their outreach events and show them to the public and get other people excited about the project. I'm really excited that I was able to do that. It shows that there's larger people that are very interested in this research.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Dr. Biology:** They're not inexpensive though to make, right?

**Ashleigh:** As of now, they're probably approximately \$50 to \$60 a board. The reason is because someone has to run the computer numeric control machine that makes them.

If we can find a better way to streamline the process, which I don't think will be difficult if we had larger resources, then the price of the boards would go way down. The cost of them does not come from the actual material. The material itself is very inexpensive. It's more the manufacturing of them.

**Dr. Biology:** Have you thought about using something like a Kickstarter program to do this? I could see this as a real success.

**Ashleigh:** Yeah. It's definitely something I've considered. Right now I have a nonprofit with some faculty here at ASU. We started a nonprofit called TactilEyes.

We have some funding and we're using that to provide the boards to students locally who would like to use them. I've thought about expanding on that and making it a larger nonprofit so that we could really contribute these boards to students who can use them and need them.

**Dr. Biology:** Does TactilEyes have a website?

**Ashleigh:** Yeah. It's [tactileyes.org](http://tactileyes.org). It's T-A-C-T-I-L-E-Y-E-S.org.

**Dr. Biology:** We talk to a lot of scientists that are further along in their career. You're just starting out and I'd say you're starting off in quite a great fashion. It's not always easy, is it?

**Ashleigh:** No, I started out college in general, thinking I wanted to do one thing, and ended up doing this project and really getting a positive experience from it and enjoying it.

Along the way through this project, I've had opportunities to teach blind students and I really enjoyed that as well. It's a complicated thing to figure out where your career's [laughs] going to take you.

Like you said, I've just gotten started, so I'm still in the stages of trying to decide where I want to end up and what I want to pursue. I'm just glad that this project has given me a foothold to drive my future career.

**Dr. Biology:** We'll stay on the topic of challenges. My students, different ones, all have their own challenges. I'm sure you had challenges to overcome when you were both in undergraduate and graduate school. Can you tell me about a few of them?

**Ashleigh:** First I want to say that every student has challenges, just like you said. I feel we perceive others a certain way. For me, I'm perceived a certain way automatically because I'm blind and people notice that right away. My challenges are more apparent and obvious, even though other students have just as many challenges.

One of the biggest challenges I faced as a student pursuing science was not being taken seriously as far as a lot of people thinking "OK, she's blind, how is she going to complete my course or how is she going to participate in this research?" and things like that.

For me, I had to prove myself a lot more than other students would have to. That just made me more willing to put in the effort and try harder.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Dr. Biology:** You've touched on this next question just a little bit. I'll let you go a little bit further. What's the best and what would be the worst thing about being a graduate student?

**Ashleigh:** [giggles] The best thing is feeling like you're contributing to something really important and it's something that you're personally passionate about.

That's the best thing about graduate school in general. It gives you an opportunity to choose something you wanted to research and study and really put all your effort into it. It's going to be something that you really love. That's one of the best parts about graduate school.

At the same time, that's also the most challenging [laughs] part because you care so much about what you're doing and you're so passionate about it. It makes it more difficult to make sure that everything gets done efficiently and in a way that's going to be really productive instead of just what you want it to be.

**Dr. Biology:** The ASU campus, one of the things I've always thought was nice about it, because I've been in a lot of campuses around the country. A lot of them are hilly, roly and all over the place, I would say one of the nice things about our campus is it's flat.

**Ashleigh:** It is definitely flat. [laughs]

**Dr. Biology:** Getting around is easy for everyone in that case. Has it made a difference for you? Has the campus been good for you or bad for you?

**Ashleigh:** I will say this, I did an internship at Purdue a couple summers ago. I did actually get an opportunity to be on another campus for several weeks. The thing I liked about ASU versus that campus was that everything was in one place.

You have your classroom buildings and your memorial union and the book store. It's all pretty centrally located. Whereas, at least at Purdue, everything was very spread out and hard to get to.

ASU does a very good job of having tactile sidewalks. The edges are very well marked. You can tell when you're about to hit grass because the texture of the sidewalk changes. I don't know if you've noticed that anywhere. In a lot of places on campus they border the grass and the rocks with some texture.

**Dr. Biology:** It saved me a few times when I'm walking with my head faced down and I'm looking at my phone.

[laughter]

**Ashleigh:** I'm sure you're not the only one. That's one good thing that I like about ASU campus. I really don't have anything else to compare it to because I haven't been on too many other campuses except for Purdue. I would say that I didn't find it too challenging.

**Dr. Biology:** You have your trusted companion, Dune, that gets you from point A to point B.

**Ashleigh:** Yes, I've been lucky to have had the experience of working with two different dogs and using my cane at different points in my time here at ASU. I can say that there's pluses to both and there's minuses to both.

I definitely love working with my guide dog, Dune, right now. I had a guide dog previously to her, named Classy, who was also a very good guide dog. I enjoy working with them.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Dr. Biology:** When you're in the classroom, what is changed when you're visually impaired? We take it for granted, those of us that can see, what is it that's different for you?

**Ashleigh:** You can't look at the projector, which most teachers are using as a piece of lecture material. They're using PowerPoint and things like that. A lot of times instructors don't realize how much they're leaving out of their actual verbal lecture because they're using a lot of the graphics and images on the PowerPoint.

That has been a little bit difficult for me. I've been able to work with professors and very carefully work together through the semester to make sure I'm getting all the information I need to get.

The Disability Resource Center we have here on campus is also very helpful. They provide note takers to any of the students with disabilities who would like one. They could take notes in your class. It's another student in your class who can take notes and provide them to you.

That's definitely been helpful for certain classes, especially the type of classes where all the information is very visual. That's been very helpful. It's a different experience, you don't have the luxury of looking up at the screen and seeing what the professor is talking about or what you might have missed verbally or things like that. You're relying solely on their verbal descriptions.

**Dr. Biology:** What other tools helped you through graduate school?

**Ashleigh:** I'm really lucky to be living in this modern world where we have such wonderful technology. I have a computer with a screen reader on it that reads text to me from the screen so I'm able to do my coursework on Microsoft Word and my emails and all that kind of stuff.

I also have what's called a "Braille Note Taker," which is basically, another version of a computer, but it has a Braille display that changes the Braille on the screen. I like to use that to take notes a lot, because I don't have to be listening to a voice in my ear as I'm typing. I can look at the screen and study in Braille. Those are very useful.

I also have an iPhone, like a lot of you listeners probably do. I have an iPhone with a voice on it, so that I can check my email, my phone and text, and all that kind of stuff as well.

**Dr. Biology:** That is a perfect segue for me, because, fairly soon after I met you, we were talking about the ability of the smart phones and the way that they can speak. You pulled up an email, and I was blown away by how fast you could process it.

We heard about, if you lose one sense, other senses get better, or whether they get better or you just practice them. Ashleigh, I'm going to send you a secret message for the day.

[types]

**Ashleigh:** Did you send it?

**Dr. Biology:** I sent it.

**Ashleigh:** All right.

[iPhone speaks]

**Dr. Biology:** What was it?

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Ashleigh:** It says, "Be sure to tell everyone to subscribe to the iTunes U channel for Ask A Biologist."

[laughter]

**Dr. Biology:** It's like a theme of the Christmas story with Ralphie?

**Ashleigh:** [laughs]

**Dr. Biology:** The Christmas story with...

**Ashleigh:** Yeah, the secret message.

**Dr. Biology:** Yes.

**Ashleigh:** When he does the Ovaltine.

**Dr. Biology:** Yes. That's right.

**Ashleigh:** Decoder pen.

**Dr. Biology:** Drink more Ovaltine.

**Ashleigh:** Yeah.

**Dr. Biology:** Ashleigh, I have a question that you may or may not want to answer.

[laughter]

**Dr. Biology:** It's an interesting one for those of us that have not had to experience being completely visually impaired. Can you describe to others what it's like to be visually impaired?

I don't want you to think about the things that you don't have any more. I'm curious about what you've gained, because I suspect there are a lot of things that you missed before.

**Ashleigh:** I don't want to speak for all visually impaired people, because everyone's different. For me, I think that I definitely gained a better sense of touch, from learning to read Braille and things like that. I'm very aware of my tactile environment, and how things feel.

I'm also very aware, spatially, of where I am in regards to other things. For example, right now, we are sitting at a table. I know that the table is probably about two or three inches away from me. I'm very aware of where things are, related to where I am. I think that definitely is different.

As far as hearing goes, I wouldn't say that my hearing is better. I would say that I'm more aware of what I'm hearing, and that's the difference. A lot of times people think that when you are blind, you hear better. I don't think it's necessarily that you hear better. You are more aware of what you are hearing, and you are paying very close attention to it.

**Dr. Biology:** That's probably a really good point. It's not that you become super human in your hearing, it's just that you can focus on it. In particular, we have a bird aviary -- a virtual one -- on Ask A Biologist. Of course we have the typical pictures and range maps. But we have their songs. Do you go out bird listening?



Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Ashleigh:** I really don't, but I'm sure somebody who is blind probably does really enjoy that. I've never really considered that. But it does sound like it would be an interesting experience.

**Dr. Biology:** Let's get back to the research that's been going on. We have about 50 boards. Is that correct?

**Ashleigh:** Yeah, probably around 50.

**Dr. Biology:** Now that you've gotten through your degree, what are the plans?

**Ashleigh:** Well, I am currently teaching math and science at a nonprofit here in Phoenix, called "Southern Arizona Association for the Visually Impaired." They are a nonprofit that helps blind adults in the community get an education in college, or go back to work in the work field.

I'm tutoring and teaching math, science and technology there. I'm hoping to make a lot more boards and tactile graphics for math. I've done a lot of science related stuff, so I want to try some math stuff and see how those work, and if they help and that kind of thing.

**Dr. Biology:** When we were talking about your professors and your colleagues, I know you mentioned Dr. Baluch. There [are] a few others that have been involved as well, right?

**Ashleigh:** Yeah. I was able to get a lot of excitement and enthusiasm from faculty here at ASU. We have a project team that we call 3D IMAGINE. Some key people on that team are, Terri Hedgepeth, who was a former director of the Disability Resource Center, and Dr. Rogier Windhorst, who is a professor here in the School of Earth and Space Exploration.

There has been a few other key people that have been very helpful in the Art and Design school, and in the physics department, and a lot of students in various areas that have been very helpful as well.

**Dr. Biology:** We talked about the different images that your project has done. I recently learned that there are now some baby ultrasounds being produced for visually impaired mothers to be.

**Ashleigh:** Wow! That's really neat.

**Dr. Biology:** I'm always curious if they've learned from you, and are building off your work. That would be something to check on down the road.

**Ashleigh:** That's a really neat project. There is a lot of research going on with 3D printing and things like that, so there are a lot of projects very similar to mine.

But what makes mine different, is that I'm focused on the education aspect, and increasing participation at a younger age, and really getting students involved in science and math at a very young age.

**Dr. Biology:** I can't agree more. It turns out Ashleigh, that on this show, we always have three questions. I will start with the first one, which is, when did you first know that you wanted to be a biologist?

**Ashleigh:** I would have to say, probably in seventh grade when I was 12. I was in middle school, and I was taking, I think they called it life science or something like that. It was basically a very introductory version of biology. I remember very specifically, my teacher bringing up a model of the DNA double helix, and showing it to us, and passing it around.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

I just thought it was the most beautiful thing, and it was so pretty, and fascinating. I couldn't believe that that's what was directing all of the instructions for creating life. I was so fascinated and amazed by that. That's when I think I realized that I really wanted to research that more, and be involved in that, and learn more about that.

**Dr. Biology:** Now for the next question. If you are not able to do any of these things, and I have to take away, not only your biology, but your teaching, because many biologists like to do some type of teaching, which is great, what would you be, or what would do, if you could do anything?

**Ashleigh:** I love to read. I'm an avid reader. I think I would love to write a really great novel. I'm not a very good writer [laughs], so I don't think I could do that now. But, I would love to write a really good novel that gets people's interests and gets them excited and engaged. I really love reading, so I'd like to do that for someone else.

**Dr. Biology:** What are some of your favorite authors?

**Ashleigh:** Probably, like a lot of people, I love all the Harry Potter books. I am a very big fan of Stephen King and all his crazy stories. I like reading his books. I don't know.

I just like reading whatever I come across that sounds interesting to me. I research a lot of times, and go on different websites and see what people are reading, and try to figure what I think would be interesting to me.

**Dr. Biology:** You can start with a short story, right? Rather than thinking the whole novel?

**Ashleigh:** Yeah. That's a good point. [laughs]

**Dr. Biology:** Final question. What advice would you have for a young biologist, thinking of a career in biology? In particular, what advice would you have for students interested in biology, who might be discouraged because of adversity?

**Ashleigh:** In general, I would say that if you are interested in biology or science in general, to find what really makes you passionate and really pursue it. Look for good mentors, teachers, peers, anybody that really drives you, and helps you get to where you want to be, and don't give up on anything.

For students who might have different issues that make things a little harder, I would say that, you are your best judge, and you know what you want, and you know how you can get it.

Work really hard to make sure that you don't let others discourage you. Speak up for yourself and make sure you self-advocate, and do the things that you need to do and get where you want to be. Don't let anyone tell you no.

**Dr. Biology:** One other thing, your accomplishment as an undergraduate student and graduate student is great, in particular, your research project, I was very fascinated with. There's another accomplishment that you have that I would like to mention is that you are a first-generation graduate in your family.

**Ashleigh:** That's true. I'm the first one in my family to pursue a four-year college degree, and then I went on to graduate school. I'm really excited about that. I'm hoping I can encourage my siblings and other family members to pursue their education as well.

Ask A Biologist Vol 073 - Topic: Putting the Touch into Biology - (Guest Ashleigh Gonzales)

**Dr. Biology:** That's exactly what you are likely to do. It shows from research that you have set a trajectory that is going to have a large impact for your family tree. Ashleigh, thank you so much for sitting down with me and talking.

**Ashleigh:** Thank you so much. I really enjoyed it.

**Dr. Biology:** You've been listening to Ask a Biologist. My guest has been Ashleigh Gonzales. Her master's degree work is opening the world of biology to the visually impaired, as well as providing another channel of learning for those without visual impairments.

If you want to learn more about careers in biology, and how to become a biologist, you can pop over to our story, "What's a Biologist." We will include the link to the story from this podcast page on our website.

The Ask a Biologist podcast, is produced on the campus of Arizona State University, and is recorded in the Grass Root Studio, housed in the School of Life Sciences, which is an academic unit, the college of Liberal Arts and Sciences.

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](http://askabiologist.asu.edu), or you can just Google the words, "Ask a Biologist."

I'm Dr. Biology.

Transcription by CastingWords