Ask a Biologist vol 040 Topic: Desert Plants - Guest: Tina Wilson

Secrets of Desert Plants -

On a hot summer day in the desert, temperatures are often hotter than 110 degrees F (43 degrees C). If the heat is not bad enough, there can be weeks and months without a drop of rain. How do desert plants like the Saguaro Cactus survive in such difficult conditions? Dr. Biology talks with Tina Wilson from the Desert Botanical Garden in Phoenix Arizona to get the story behind plants that keep their cool in the desert

Transcript

Dr. Biology: This is Ask-A-Biologist, a program about the living world, and I'm Dr. Biology. Wow! I have to say it's been really hot around here. Not that it's any different from any other summer months in the desert, but today, you know, it just seems to be a lot hotter than usual.

And just the thought of not having air conditioning makes me want to melt. But, there are a lot of things that live in the desert that don't have air conditioning. In fact, they sometimes go weeks and even months without a good drink of water.

If you consider the daytime temperatures can reach well over 110 degrees Fahrenheit, which is more than 43 degrees Celsius that is hot. And one of the amazing that lives in these hot and dry conditions is the Saguaro cactus. You know that really tall columnar thing with those arms that reach out.

You see them in the movies, or if you live in the desert, you've driven by them. This amazing plant, along with many other succulent plants - yeah, we're going to learn about succulents - make the desert their home. Just how these plants live in these conditions is the topic of today's show.

My guest is Tina Wilson from the Desert Botanical Garden. She is the school's program and curriculum manager, but better yet, she's a former biologist. Well, I can't even say former biologist, because once you go biologist, you're always a biologist. She's over here; she's smiling at me [laughter], going "I'm always going to be a biologist."

Today we get to work together and learn about these desert plants, how they survive in these really, really difficult conditions, and find out if it's true that some of these plants can go without water for years. Now how is that possible? Welcome to the show, Tina.

Tina Wilson: Thank you. I'm glad to be here.

Dr. Biology: Before we start talking about these really cool plants, I want to talk about the Desert Botanical Garden. Can you tell us a little bit about it?

Tina: Sure. The Garden has an extensive collection of just beautiful desert plants, and we really focus on a lot of the plants that we find here in the Sonora Desert. So, when you

come to the garden, you just get exposed to all kinds of wonderful plants that are just unique and just unexpected.

Dr. Biology: Right, and I used the word succulent, and I'm assuming you have a bunch of succulent plants.

Tina: We have lots of succulent plants, and it's really great because we have two new galleries that really showcase our cacti and our succulents. They're called the Cactus and the Succulent Gallery, and as you go through, you really get the story of what succulence is about, what it can do for the plants, and all the different forms you can see it in.

Dr. Biology: What are these succulent plants and how are they different from, say a leafy green tree or say, the daisy that you might see growing outside in the flower bed?

Tina: Sure. Succulent is a term that we use to describe a plant that can store water in one of its structures. A succulent plant can store water in its root, it can store water in its stem, or it can store water in its leaf. So, a plant that can do that we describe it as a succulent.

Dr. Biology: Oh, OK. So, you're giving me a little bit of a hint, but how are cacti and other succulent plants able to live in this real extreme heat of the desert then? Is it because they can store all this water?

Tina: It's one of their survival strategies, or we like to call that an adaptation. Because saguaro cactus and other plants in the Sonoran desert live under these extreme conditions, they need a way to have water available to them.

Because you know, if you notice, it doesn't rain a lot in the desert.

Dr. Biology: Yes, I have noticed.

[laughter]

Tina: And when it does rain, it doesn't stick around very long. It evaporates very fast. So, when it does rain, those saguaro cactus have to figure out how to get a big drink of water and how to keep it. So, it's almost like when you sit down to dinner and you just keep drinking and drinking, and your tummy keeps getting bigger and bigger, that's a lot like a saguaro. It's got a resource. It's got water. And it'll just keep sucking up water through its roots to store and to keep. So, when we go through periods of drought, it's got enough water stored inside to keep going.

Dr. Biology: OK. It's able to take big drinks of water.

Tina: Yes.

Dr. Biology: And it's able to keep that water.

Tina: -hmm.

Dr. Biology: How does it keep it from evaporating?

Tina: Oh, this is really, really cool. If you can imagine a saguaro in your mind, it's very tall and column-shaped. It almost looks like ridges. If you think about a Ruffle potato chip, it's got these ridges. We call those ribs. And what those ribs do, they allow the stem or the saguaro to expand.

So, as it's taking in all this water, the water has to go somewhere. Well, these ribs allow the stem to expand to hold all this water. And what's also really neat is on that very surface on the saguaro, right on top, the skin.

It's got a waxy cuticle. And that wax, it's almost like putting on sunscreen, because as water tries to evaporate from the plant into the air, that wax helps keep moisture inside so it doesn't lose it as fast.

Dr. Biology: Oh, so it's kind of this protective layer.

Tina: Yes.

Dr. Biology: Oh, that's pretty neat. Well, I've actually heard that some saguaro cacti can live for up to two years without water.

Tina: Wow! Well, I don't know if it's absolutely true, because this is a science. So, we never like to say everything is absolutely true.

But I know that when you transplant saguaros - that means you're putting them in a new location - they can go for a very long time before you can really recognize if they're having problems or they have adapted to their new surroundings because they have so many reserves inside, they can go for a very long time.

Dr. Biology: We talked about, real briefly on an earlier show called Wickedly Cool Plants, about the saguaro cactus. And one of the things that we were talking about is how slowly they grow actually.

Tina: -hmm.

Dr. Biology: If someone was to ask you how tall a saguaro cactus would be, and you've got to realize that some of these you see out there are what, 20, 30, 50 feet tall, right?

Tina: Right, right.

Dr. Biology: How tall would a saguaro cactus be after five years of growth?

Tina: Oh, you know that all depends on where it's growing. It depends on the growing conditions and how much rain it's exposed to. But, a general rule of thumb that we like to work with kids at the garden is if you hold up your thumb, and if you find a saguaro that's as big as your thumb, that saguaro is about eight years old.

Dr. Biology: Wow! That's really impressive. And so, when you have a 50-foot tall saguaro, it's been around a long time.

Tina: Well, it's not necessarily because how tall it is. It's also because it's got the ability to grow those arms and also that ability to produce flowers. So, those are definitely marks in its life cycle that we can sometimes determine how old it is or a rough estimate.

Dr. Biology: OK, so give me the rough estimate. So, we start out. We don't have arms.

Tina: We don't have arms. We look just like a column. These are all averages, remember, so it's all different, you know, for each one. So, you start off as a column, and you grow, and then when you get to be, maybe about, I don't know, 30, 35, you might grow your first arm.

And then when you start to flower, you're usually around 50 or 60 or so. So, if you see a saguaro that's got some arms and you know it's flowering, we can have a pretty decent chance of saying it's probably a little over 50 years, 60 years.

Dr. Biology: Let's tackle something a little more complex, and that's photosynthesis. And I always give the real brief explanation, for kids or for anybody that we're basically taking light energy and we're converting it into food that a plant can use. And so, it's light energy to chemical energy that is then used to do work.

Tina: Right.

Dr. Biology: All right, let's go through some of the basics of photosynthesis.

Tina: Because photosynthesis is great. It's cool. It's one of the coolest things plants do. So, what is photosynthesis? Like you said, we're trying to take this light energy and make it into a food. Now, what is light energy?

If you remember photosynthesis or you talk about photosynthesis, you need the light. Everybody said "Oh, yeah, you need the sun, you need the sun!" That's where the light energy comes from.

We're going to take that light energy, we're going to use it inside the plant, and then we're going to make a food or a sugar from it. But, we need some other ingredients.

Dr. Biology: OK.

Tina: All right, so what we also need is some carbon dioxide, which is a gas, and we get that from the atmosphere, and we also need some water. Now the plant already has water inside because the water's been coming up through the root system, it's been sending it up through the stem. The carbon dioxide needs to come through the leaf, through these little small openings, they're almost like little pores on the surface of the leaf, and we call those stomata.

Dr. Biology: Oh, yeah, they look like little mouths.

Tina: Yes, they're little mouths, and the plant is really neat because the plant can dictate when to open or close those, depending on what's going on in its environment. So, when

those stomata are open, the CO2 gas can come in, and then we have all our ingredients for photosynthesis to begin.

Dr. Biology: OK.

Tina: Where does photosynthesis happen? It needs to happen inside the leaf, most of the time, in most plants. In the leaf, right under the surface, we have this really cool organelle...that's what we call those special structures inside a cell. So, inside the leaf cell we have this thing called a chloroplast, and that's where photosynthesis happens.

So, what happens is, we need to get that light into that chloroplast, so to help it do that, we have a pigment called chlorophyll. And that's when you see the green, that's when all the plants are green; it's because of that pigment chlorophyll.

Dr. Biology: Right. So, paints have pigment, in this case you're talking about chlorophyll, chlorophyll's color is green.

Tina: Green. So, that green really can absorb so much of that light energy, and it attracts it right into that chloroplast. So, we have our light energy, we have CO2 which is the carbon dioxide, and we have our water. And through a series of chemical reactions, what happens is we now have a product, at the end of the chemical reaction, which is a sugar.

And that's the chemical energy that we want. That is the energy that a plant will be able to use for all its different functions...to grow, to develop, all that great stuff. But, the byproduct of those reactions...we not only get sugar, but we get oxygen. Oh, we like oxygen!

Dr. Biology: Yeah, we really like oxygen.

Tina: And that oxygen is then released back into the atmosphere, back through those small openings on the leaf call the stomata.

Dr. Biology: OK, so we could say that sun energy, when plants get a hold of it, is sweet.

Tina: Yes [laughs]

Dr. Biology: OK, and if the plant isn't using that energy or later on, when we harvest the plant, say, whether it's spinach or some other kind of plant, and we eat it, we're going to get that energy from the plant?

Tina: Absolutely.

Dr. Biology: OK, well that's pretty cool stuff. You mentioned that photosynthesis happens inside the leaves, and we've been talking about chloroplasts, and you talked about chlorophyll, you said it's that pigment that's green. So, what light are the plants using? Are they using green light, or what kind of light is it? Because I think, this is one of the things we don't quite understand when we're looking at plants.

What light are they using, because when we look at white light, you know, the sunlight, it has all the different colors in the spectrum. What are the plants using?

Tina: Actually, the plants are absorbing light from the spectrum in the blue and the reds. So, what's left over is the green, and that's what being reflected, and that's what we see as green.

Dr. Biology: Right, so the green light is not being used by the plants. So, if you go out there and you buy a bunch of green lights, try to grow plants, guess what's going to happen. They are going to be really sad.

Tina: [laughs] They will not be happy.

Dr. Biology: OK, you and I live in the desert. As a matter of fact, this is a hot summer day, and if anybody has ever been to desert or they have watched any movies that have to do with the desert, we usually have the famous cactus pictures, you know the giant saguaro.

So, we have been talking about that, you know, they're pretty impressive that they are able to live for such a long time without a drink of water. They are able to carry out photosynthesis in a really unique way. Because most of the time, leaves with the stomata open during the day...wouldn't you lose a lot of water?

Tina: Yes, so when these stomata are open and you are getting in CO2 and you're releasing oxygen, guess what else is going out? Water. Water is evaporating, and that is called transpiration. So, that is one of the ways that a plant can lose a lot of water if those stomata are open during a very hot day, bright sun, it's going to use a lot of water to keep itself cool.

Dr. Biology: OK, so what is the saguaro cactus doing?

Tina: I'll tell you, the cactus has it figured out. A lot of the succulents here in the Sonoran desert have an adaptation to cope with their environmental condition. So, when it's really hot, I need some CO2 to make my food, but I don't want to lose my water, what do I do?

OK. This is really cool. We call this type of photosynthesis CAM.

Dr. Biology: C.A.M.

Tina: C.A.M.

Dr. Biology: And that stands for?

Tina: Crassulacean acid metabolism.

Dr. Biology: Right. Now that's a mouthful. That's why we call it CAM.

Tina: That's why we call it CAM. So, what is CAM? Think about it like this. I like to use food analogies, we're trying to make food for the plant, but it's during the day and it's really hot, and you know what? I don't want to go shopping for my ingredients...the water and the CO2 and all that stuff, it's just too hot. So, you know what I'm going to do? I'm going to wait until it's nighttime because it's much cooler.

So, the saguaro does the same thing. It waits until nighttime, when the sun is down, it's much cooler, and then it opens its stomata to get the CO2 inside. And that way it's not losing as much water as it would during a hot sunny day.

Dr. Biology: Ah, pretty fancy. So, doing photosynthesis at night.

Tina: Yeah, well, it's actually collecting the CO2 at night, and then it holds it inside, and then it has to wait until the next day, when the light is out, because we do need light, remember? To do photosynthesis. So, it holds it inside and it keeps the stomata closed so it won't lose any water, but it has everything it needs inside, and it's got the light, and now it can do photosynthesis during the day without losing water.

Dr. Biology: Ah, very cool.

Tina: I know.

Dr. Biology: We've been talking a lot about water. How do plants move the water from the roots all the way up to the top? It may not seem like much, when you're looking at your garden at the little daisies or pansies out there, but if you go to the giant redwoods, or you go to some of the jungles where they have these trees that are literally hundreds of feet tall...how are they getting the water all the way up there?

Tina: How does that water get up there, that's great, and you know it's just not one process, it's a combination of things that get the water moving. So, we're going to talk a little about pressure and forces that help move the water.

Now, where does the plant get the water from, from the soil. So, the water molecules are in the soil, and how the water molecule moves into the root system is through osmosis.

Dr. Biology: OK.

Tina: OK. So, water likes to move from a high concentration to a low concentration. So, you have all these water molecules in the soil, it's getting really crowded, they need somewhere to go where they can kind of have some breathing room. Well guess what, inside that root...oh, there are all kinds of room to move around. So, that's where they go.

So, that starts the flow of water molecules moving into the root system.

Dr. Biology: And the important thing about osmosis is that it doesn't take any energy.

Tina: It's just all pretty much about trying to move from high to low.

Dr. Biology: Right.

Tina: OK. But, guess what? After a while, the roots start filling up with water, and now we're starting to get crowded again, and they're not enjoying this. So, where are they going to move to now? They are going to move further up into the plant. So, that's one way that helps the water move.

Now, inside the plant, we have this really cool highway system. It's kind of like your veins and your arteries or your transport system to move water and food throughout the plant. For water, it's called xylem. It's like these big long rubber tubes. Imagine a rubber tube coming all the way from the bottom of the root all the way up through the stem and out the leaf.

Dr. Biology: And that's xylem with an x-y and not a z, right?

Tina: Right, xylem. Yes. X-y. You know, think about a leaf. If you cut a leaf in half and you see those veins, that's xylem, xylem and phloem. Phloem is the other transport system for the food.

In photosynthesis, we're making all this food and now we have to figure out where to move it to and how to move it. We use phloem.

Dr. Biology: Oh, and I can just think of one way to remember what they do. Phloem begins with what sounds like f, but it's actually ph, right?

Tina: Exactly.

Dr. Biology: But that matches up with food.

Tina: That's exactly right. That's how I do it.

Dr. Biology: Yeah. Oh, good, good. Well, you know, we say great minds.

Tina: Right.

Dr. Biology: Well, how about xylem? Do you have an easy way to remember what xylem does?

Tina: You know what I do? And it might be kind of silly. Xylem is x-y, the first two letters. Water is w, so w-x-y in the alphabet.

[laughter]

Dr. Biology: Oh, I love it. I love it. I think, it's great actually.

Tina: That's how I remember. So, we have the water. We've started with osmosis. We are now in the root system. Now let's think about just the water itself. Water molecules can cling to themselves and hold on to each other by cohesion.

They can just kind of all group together and hang on. So, imagine this rubber tubing with all these water molecules hanging on to each other, but they can also hang on to the sides

of the xylem by a term we call adhesion. OK?

So, the water molecules not only hang on together and form a chain, but then they can also hang onto the sides of the xylem. So, we have the water inside, and now it can start being pushed up by different pressures and forces.

So, we have water moving up through the xylem, up through the plant, and it's going to start traveling through the xylem and up to the leaf surface. On the surface of the leaf, we have these small openings called stomata, and remember that's what we used for the photosynthesis, the oxygen, and the CO2.

Well, when those stomata are open, that also helps release the water molecules or the water evaporating from the plant to help keep it cool.

Dr. Biology: Because they're like a suction mechanism.

Tina: I was going to say, it's just like a vacuum. And remember, up in the air, and we're in the desert so it's very dry air, we don't have a lot of water molecules in our air, so we're going from a high concentration to a low concentration again.

So, all that water in the plant is going to start wanting to move out or be sucked out or pulled out by the transpiration. So, it's almost like you've got an osmosis pushing it in from the bottom.

Then you have all your cohesion and adhesion of your molecules and your capillary action that wants to pull it up. And then you have this vacuum at the top and the atmosphere on the leaf helping it pull. So, it's pushing and pulling water through the plant.

Dr. Biology: That's wonderful, and I have a really cool way to demonstrate the properties of water.

Tina: OK.

Dr. Biology: I mean anybody can use this. And it's either taking a Kleenex or a paper towel.

Tina: OK.

Dr. Biology: And you have your little drop of water on the counter. And all you do is put the tip of it in that water. Have you ever done that?

Tina: Yes.

Dr. Biology: What happens?

Tina: It travels or goes right into the paper towel and moves right up.

Dr. Biology: Yeah, and it goes straight up. And so, what are we looking at? We're looking at the properties of water. Very easy to see. OK, so now we know how that water gets all the way up at the top.

Tina: Yes.

Dr. Biology: And that's pretty impressive. Hundreds of feet.

Tina: It is.

Dr. Biology: You know how we were talking about photosynthesis and we talked about those beautiful green leaves. When I look at the saguaro cactus, and as a matter of fact, most cacti, I don't see any leaves.

Tina: Wow. I don't either. Or what I think, in my mind a leaf should look like, right?

Dr. Biology: Right. So, what's up with that?

Tina: So, how does that work? Well, actually, when you're looking at a cactus, and we'll say a saguaro, and you see those really sharp, spiny things, those are actually modified leaves.

Dr. Biology: No kidding.

Tina: Yes, but you know what? I don't think they're going to be able to do photosynthesis. You know, that's not a flat surface.

Dr. Biology: And they're not green.

Tina: They're not green, so how are we going to do photosynthesis? Well, when you're looking at a saguaro cactus, that big green column, that's actually the stem.

Dr. Biology: Oh.

Tina: And the stem is green, so it's got chlorophyll in it and it's got the chloroplast, so photosynthesis is actually done in the stem.

Dr. Biology: OK. All right, why?

Tina: Why? Why? Because we don't have any leaves, right? So why are the spines there?

Dr. Biology: Right.

Tina: There are a couple different reasons why the spines are there. To protect the plant or the succulent that's full of water from predators.

Dr. Biology: Oh, yeah, animals that are out there that want a drink of water.

Tina: And they're like, ooh, let me go in there and have a nice, you know, chew on that for a while and get a lot of moisture. That helps protect the plant and to keep a lot of moisture inside.

Dr. Biology: All right. Well, what about the plants that are not the succulents? The ones, oh, the poinsettia for example. It's got red leaves.

Tina: It's got red leaves.

Dr. Biology: Yeah, now how on earth is that working?

Tina: Well, that's pretty good that those leaves. They're not the flowers. So, that's impressive. How does that work? Inside the plant, we have this pigment that we talked about in photosynthesis called chlorophyll. Chlorophyll is green, but guess what? There are other pigments inside the leaf that show other colors.

So, with a green plant, it's got so much of this chlorophyll, it really covers up the other colors. In a plant that you see reds or purples or those yellows, they don't have as much chlorophyll. Their other pigments mask, then, the chlorophyll.

Dr. Biology: Oh.

Tina: So you still have chlorophyll in there, and it'll still do photosynthesis. It's just not as much.

Dr. Biology: OK and I think, maybe you're explaining something that I was going to ask next. When we live in the East or someplace where you have trees that the colors change, the fall colors, the golden, orange, and reds.

Tina: Right.

Dr. Biology: They were green all through the summer and all of a sudden, they're this different color.

Tina: Right.

Dr. Biology: Are you going to tell me that it's just results of the chlorophyll disappearing?

Tina: Yes it is. And, you know, it's the plant getting ready to shut down for winter. It's like, OK, we're done. We do not need to be actively making our food and going through photosynthesis.

So, the chlorophyll does not need to have the amount it does. It starts reducing. And all those other colors were in there to begin with, and then you just get to see them come out because the chlorophyll has been reduced.

Dr. Biology: What is the reason for plants shutting down?

Tina: Well, it's kind of like dormancy, and dormancy means, it's almost like taking a time out. You're still functioning. You're still alive. But, you're just kind of taking a time out and kind of just taking a break.

We have dormancy here in the desert. It's not so much that the plants shut down for winter, but they shut down because of drought. We call that drought deciduous. Oh, my gosh, what does that mean, drought deciduous? Deciduous is a term that refers to dropping your leaves.

So, if you notice, during the summertime when it's really hot and we haven't had a lot of rain, we have some trees that will drop their leaves because they're kind of going, I don't have enough resources, I don't have enough water. I'm going to kind of take a time out and slow things down so, I don't overdo it.

Dr. Biology: Right, so they don't have to do as much work and they can save their energy.

Tina: Yes. But, if you notice, some of our trees in the desert have green bark?

Dr. Biology: Oh, yes, right. Palo verde for example.

Tina: Yes. Yes. So, why do you think that has a green bark? It's got leaves, right?

Dr. Biology: I'm assuming it has to help out with the photosynthesis somehow.

Tina: Right. If you ever look at a Palo verde or some of the varieties, some of them have such small leaves. I mean like almost the tip of your pencil lead, that's how big those leaves are.

Now that helps keep the plant cooler, but can it really support and make enough food for that tree when those leaves are so small? So that green bark helps make more food for the plant.

Dr. Biology: Well this has really been a fun conversation about plants and in particular these really cool desert plants and succulents. Let's get back to the desert botanical garden; I'd like to learn a little bit more about it. What is a person going to see if they come for a visit?

Tina: Oh they're going to be amazed. When you come to the desert botanical garden, we have a collection of desert plants and so when we're talking about succulents and we're talking about saguaros and we're talking about adaptations for living in the desert you're really going to see beautiful examples of how plants can do this.

We have such a variety of succulents, trees, cacti and they're just all beautiful shapes and sizes so we have just an amazing collection. If you come to the garden make sure you stop and see our cactus and succulent galleries. Inside the galleries we talk about plant evolution or cactus evolution so you can really walk through the story of how a cacti has

adapted to live in this kind of environment. You can talk about the spines and you can talk about succulents, you can talk about the ribs and you guys will know what that is.

Dr. Biology: You mean that they didn't always look like this?

Tina: No, no they didn't. You know we have an evolutionary path for cactus. Further back when cacti were first starting out they actually looked more like a tree.

Dr. Biology: They did?

Tina: Yes, they actually had leaves like the way we think of in our mind you know flat green leaves and a woody branch structure or form. Then if you get really, really close and look at them you can tell and you can see that they have spines and areoles. All cacti have to have areoles so you look at it and you're like wait a minute that has to be a cactus, not a tree.

Dr. Biology: So, is it still considered a succulent?

Tina: No, so not all cacti are succulents.

Dr. Biology: Oh, so give me an example of a cactus that is not a succulent.

Tina: A Pereskia.

Dr. Biology: A Pereskia, what does it look like?

Tina: Like a tree.

Dr. Biology: Just like a tree?

Tina: You could be walking right past it and you would never know it was a cactus.

Dr. Biology: Regular green leaves?

Tina: Yes, with the woody trunk and it's got the flat leaves on it. It's got beautiful flowers and you're just oh, that's another tree. Whoa wait a minute, I see something else on there, I see spines and areoles it must be a cactus.

Dr. Biology: We haven't mentioned areoles yet. That's typically where you find the spines growing out of and I believe flowers also can come out of an areola.

Tina: Yes

Dr. Biology: Now you also have a lot of trails at the botanical garden don't you?

Tina: Yes, there are. We have the plants and people of the Sonoran Desert which is a great trail to really explore the eco botany of the Sonoran Desert so you really get to see how native cultures of this area utilize our native plants to live. It's a wonderful trail to walk through. We also have our new herb garden and we have our wildflower trails so in

the springtime absolutely beautiful, talk about pollination and all kinds of different things going on.

Dr. Biology: You actually have a butterfly garden right?

Tina: We have a butterfly pavilion.

Dr. Biology: Right, pavilion OK.

Tina: In the fall it's all about Monarchs. We tell the story of migration and how Monarchs migrate and that whole pattern in what they do. That whole pattern in what they do, that whole part of their life cycle. When you walk into the pavilion there could be two, three thousand Monarchs flying around, it's absolutely gorgeous.

In the springtime we switch over and we really want to tell you about the life cycle of a butterfly so we could have I don't know, five, ten, twenty different types of butterflies and moths in there at one time too.

Dr. Biology: Well I have to put a plug in for the website, we actually have an article called, "Migrating Monarchs" that includes the life cycle of the Monarch butterfly with coloring page.

Tina: Excellent. [laughs]

Dr. Biology: A little quiz and how to recognize a male and female Monarch butterfly.

Tina: Wonderful.

Dr. Biology: We'll have a link on the website about that.

What about the wintertime in the botanical garden, the desert botanical garden? What's special about it at the wintertime?

Tina: It's kind of neat because you really get to see the different seasons of the plants. You get to see the different shapes, their different parts of the life cycle and what they go through. It's very amazing to come in the summer and then in the winter and see how different things can be. Also you can come at nighttime during the summer and do our flashlight tours.

Dr. Biology: Oh flashlight tours.

Tina: Yes, flashlight and it's really nice because you get to see the desert at night. It's a whole new experience because we really become active at night in the desert, our plants and our animals. We have night bloomers and we have animals and you hear and smell different sounds than you normally would during the day.

Dr. Biology: Wow so, if I need to get to the botanical garden, where am I going to go?

Tina: We are off of Galvin Parkway just north of the zoo.

Dr. Biology: And the website?

Tina: www.dbg.org.

Dr. Biology: Well if you live in the Phoenix area you have to go visit, it's great and if you're coming here well, I recommend coming here in the wintertime.

[laughs]

Tina: [laughs]

Dr. Biology: But even if you come in the summertime that's something to do at night you could do these flashlight tours. I didn't know about those.

Tina: Yes.

Dr. Biology: That's marvelous. Well I like to ask three questions of all my guest scientists.

Tina: OK.

Dr. Biology: The first question is when did you first know you wanted to be a scientist or a biologist?

Tina: You know I wanted to be a mad scientist.

Dr. Biology: Well I don't know some of us usually are.

[laughter]

Tina: Actually I was in high school and it was a teacher, my biology teacher who introduced me to genetics and embryology. Of course I just thought it was cool to take a class that was named that. Yes, I'm taking genetics and embryology but after I got in there and really learned some science concepts, some of the really cool things, I just couldn't get enough, I wanted more. I got bit by the science bug.

Dr. Biology: All right, well guess what I'm going to do?

Tina: OK.

Dr. Biology: I'm going to take it all away. No more science for you.

Tina: Ugh. [laughs]

Dr. Biology: Every bit of it, it's gone and since you already have some experience in teaching, I'm not going to let you teach either. What are you going to be? What are you going to do?

Tina: I'll be a chef.

Dr. Biology: You'll be a chef.

Tina: I'll be a chef.

Dr. Biology: What do you like to make?

Tina: You know what, I'm going back to the science a little bit but I love kitchen gardens. I love to grow vegetables and herbs and flowers, an edible garden.

Dr. Biology: An edible garden.

Tina: And I like to take the outside and bring it inside and then create.

Dr. Biology: Do you have a favorite dish you like to make?

Tina: You know it all depends on the time of year.

Dr. Biology: OK, its summer, it's hot what are you going to make?

Tina: [laughs] I'm going to make some cold soup. Some cold vegetable soup.

Dr. Biology: Gazpacho.

Tina: There you go. [laughs]

Dr. Biology: What a great idea. You know I think, I want some of that tonight.

Tina: There you go.

Dr. Biology: All right, what advice would you have for someone who wants to be a scientist? Maybe they want to be a chef that really uses the organic vegetables that they're growing in their garden.

Tina: Right, you know I would explore all areas of science. Every opportunity that you get while you're in school, explore them all because it's such a huge area. You'll have so much fun trying to figure out and narrow down what part of science you want to go into. Try to get as much experience as you can to really know your area and where your passion is.

Dr. Biology: Tina Wilson, thank you again for visiting with us today.

Tina: Thank you very much, I had a good time.

Dr. Biology: You've been listening to ask a biologist and my guest has been Tina Wilson from the Phoenix Desert Botanical Garden.

The ask a biologist podcast is produced on the campus of Arizona State University and is recorded in the Grassroots Studio housed in the School of Life Sciences which is an academic unit of the college of liberal arts and sciences.

Always remember, even though our program is not broadcast live, you can still send us your questions about biology using our companion website. The web address is askabiologist.asu.edu or you can just Google the words ask a biologist.

I'm Dr. Biology.