

Ask-a-Biologist Vol 018 (Guests: Conrad Storad, Michael Quinlan)

Stinging Mystery -

It's a mystery, at least until you try to guess what animal children book author Conrad Storad is describing at the beginning of this episode. Joining Conrad is physiologist Michael Quinlan. Together they give us all the gory details behind this desert dwelling animal.

Transcript

Dr. Biology: This is Ask-a-Biologist, a program about the living world, and I'm Dr. Biology. We have a special show today on an animal that will remain nameless until one of our two guests reads from a book he has written about the animal. In the studio, we have Conrad Storad, who's the editor of ASU Research Magazine and a great children's magazine called "Chain Reaction." He's also a well-known children's book author. Our other guest is researcher, Michael Quinlan, who's an adjunct professor in the School of Life Sciences, and also a professor of Physiology at Midwestern University in Glendale, Arizona. Thank you both for joining me today.

Conrad Storad: Thank you, Dr. Biology.

Michael Quinlan: Well, thanks for having us.

Dr. Biology: To begin, I thought it'd be fun to have Conrad read from one of his books where he writes about the animal that's a mystery at the moment, and what I want everyone to do is to try and guess what animal he has written about. Now, we've modified this a little bit because otherwise, we would give away what the animal is. Conrad, let me turn it over to you...

Conrad: All right, we call this chapter, "Sticky Stew." "These animals are fierce hunters. They will attack anybody, including their brothers and sisters. In fact, other than insects, this animal's favorite food is one of its own species. When they are hungry, they will find a place on the ground or a tree to sit. Then they wait. The animal stays perfectly still. It might wait for hours, until an animal like a cricket comes close enough to touch. Then, faster than you can blink your eye, it grabs the cricket with its strong pincers. It holds on, while its tail swoops down like a whip."

"The telson stings the unlucky cricket again and again and again. The cricket can't move. Now, the animal can take its time tearing the cricket into small pieces. It breaks each piece into tiny bits with its pincers and jaws. When the pile of bits is big enough, it spits strong juices from its mouth onto the pieces. The juices melt the pieces into a sticky stew. When the stew is gooey enough, it drinks until all of the cricket is gone."

Dr. Biology: Whoa! Man! Now, that sounds like quite a concoction. That has put a lot of images in my head. Okay, anyone have some guesses out there? Anyone figured out that Conrad was describing a scorpion? By the way, the title of the book is "Scorpions." And

because we have so many questions that come in to Ask-a-Biologist, the website, we thought it'd be a great subject for a podcast.

In fact, Mike you are someone who knows a lot about the questions and these animals because you are the volunteer, I think, that answers more of these questions than anybody else. Do you have a favorite question that you like to answer?

Michael: I suppose the question I get asked most often, and I have the most satisfaction in digging the answers out, concerns identification of scorpions. Sometimes, that's an easy thing to do, based on the description that's sent to the email. Sometimes, it's not. I received an email from a young woman who lives in West Virginia, and I did quite a bit of research to try and determine what scorpion she had found in her house. And it turns out there aren't many scorpions in West Virginia, but she was living in one of the few areas that actually did have some identified scorpion species.

Dr. Biology: Well, that's actually quite an art in itself because from what I know, there's around 2,000 species of scorpions. So, when you write an email in... It is quite an art to try to figure out what they're describing.

Michael: Very mercifully, I have most of the emails coming from individuals that live locally in the Phoenix area, so it's easier for me if they can describe where they found it. Again, sometimes it's an easy thing to do, and sometimes it isn't.

Dr. Biology: When I first met you, you had a pet scorpion. It was very large and looked to be very dangerous. In fact, you were, I think, were putting it in your hand at the time, and I thought, "Oh my gosh!" But, not all scorpions are dangerous. What species of scorpion did you have?

Michael: Well, first of all, let me just say I don't recommend holding scorpions, of any species. The scorpion that you're talking about was an emperor scorpion from Africa. At the time, they were fairly hard to get. And now, they're fairly common in the pet trade.

I've had a number of species of scorpions as pets and for display purposes, including many of the local species. But the emperor scorpion is especially dramatic. It is a very large... It's a black scorpion. Some individuals can be kind of handled, if you're very careful about it. They're not particularly venomous. They can inflict a fairly significant pinch though, if they're sufficiently irritated. But that's quite a spectacular specimen of the scorpions in Africa.

Dr. Biology: How long do scorpions live?

Michael: At the very least, I would say they live for several years. Now, some scorpion species have documented lifetimes in excess of 25 years. For example, the giant hairy scorpion, which is found in the Sonora desert of Arizona. There have been specimens kept in captivity for 28 years, I think, is the record. So, in some cases, they can live quite a long time. I don't think that that's the average necessarily, but several years, at the bare minimum.

Dr. Biology: Wow! Hey Conrad, what lead you to write a book about scorpions?

Conrad: Actually, I was asked. The publisher, Learner Publications, out of Minneapolis, Minnesota, does a whole series of books called "Early Bird Nature Books, " that are targeted at young readers in second, third, fourth grade. And I had done a book on Saguaro Cactus for them.

They really liked it and they wanted some more topics. We had just finished a big story about the scorpion anti-venin lab here at ASU. I got to meet the scorpion lady, Marilyn Bloom, who is running that lab at the time. And they just fascinated me, living here in the desert. I wanted to write about creatures that live in the desert. That's kind of how we took off and got in to write the book about scorpions.

Dr. Biology: I enjoyed that reading at the beginning so much. I was hoping that we can get you to read another section from the book.

Conrad: Happy to. This section is called "The World of Scorpions." "Scorpions are scary-looking animals. They have been on earth longer than most animals alive today. The very first scorpions lived more than 450 million years ago. That's before dinosaurs were alive. Exactly how long ago was 450 million years? I'm going to help you get a better idea of how long scorpions have been around."

"Think about this... Pretend you are counting dollar bills, and pretend you count one dollar bill every second. It would take you more than 11 days to count to one million. To reach 450 million, you would have to count one dollar bill every second for more than 14 years. And that's just 450 million seconds. Now, try to think about 450 million years."

Dr. Biology: Wow.

Conrad: A little more?

Dr. Biology: Yeah, let's do a little more.

Conrad: Okay. "Scorpions are related to spiders, ticks, mites and other animals called "arachnids." Scorpions are also related to shrimp and lobsters. In fact, without its curved tail, a scorpion looks a lot like a little lobster. But scorpions live on land, not in the ocean. Long ago, scorpions did live in the ocean. They were some of the very first animals to crawl out of the ocean and live on land. Those old scorpions were three or four feet long, almost as big as your friends at school, if you're a second or a third grader."

Dr. Biology: [laughs] You know, when you were writing this book, did you come across some really interesting stories?

Conrad: Oh, just the facts about scorpions are interesting in themselves. I heard lots of stories from people, all their adventures of being stung. Well, maybe I shouldn't call it an adventure, but all the stories of being stung by a scorpion, which is not very fun. But one of the things I found out, that I really didn't know, was that scorpions glow in the dark.

They glow under ultraviolet light. Of course, our eyes can't see them glowing. But insects

can see in the ultraviolet. Now, if you want to see a scorpion glowing in the dark, you get yourself a black light, an ultraviolet light. You go in your little scorpion hunt. You'll see them light up green. Or the emperor scorpion that Mike was talking about earlier, actually glows bright royal blue. It's fascinating.

Dr. Biology: You know, another thing about scorpions, as you've described them; both eating and what they look like, they look very scary. The word "menacing" might come to mind. In fact, very few people have ever died from a scorpion sting, even though there are thousands of people that are stung by them every year in Arizona alone. Mike, how dangerous is scorpion venom?

Michael: Well, it's not especially dangerous in North American scorpions. The most dangerous scorpion in North America is the bark scorpion, which is found predominantly in Arizona. As you pointed out, there are many thousands of envenomations every year, as reported by the poison control centers. There probably have been a couple of fatalities in the last 30 or 40 years. So, it's not often a serious issue for most people. Individuals that are most at risk will be small children or the elderly. But in general, it's a fairly easily managed medical problem when you get envenomated.

Dr. Biology: I've heard that scorpions actually make two kinds of venom. One that is used to kill their prey, and the other is just to stun or scare the animals away, such as someone trying to eat them, they just want to get rid of them. Is this true? And why make two kinds of venom?

Michael: Well, there has been some recent research that suggests that indeed there are two venoms, at least in one species of scorpion from Africa, which in fact is a fairly dangerous species.

There is what the authors describe as a pre-venom, which is primarily a mixture of salts and some protein, and then the main venom, which is actually used to incapacitate the prey item. And the pre-venom is thought to be a material that's used by the scorpion to either, as you say, stun a potential predator or to drive it off; whereas, obviously, the main venom component is designed to actually incapacitate the prey item.

The reason why a scorpion might have two different types of venom is that the main venom is a very complex mixture of proteins that takes quite a while for the scorpion to make. And I think that the pre-venom may be a way of deriving a benefit from the sting, but not spending any of your valuable venom to simply drive away a potential predator.

Dr. Biology: Hum, I have visions of "Star Trek" and the phasers that they would have. And so here you have this scorpion, and he sets it on "stun," or he sets it on "kill," so to speak.

Michael: Yeah, that works.

Dr. Biology: Well, I want to know something. When we compare the sting of a scorpion to, say, a honeybee or a wasp, is there, on a scale of one to 10--let's just put a bee sting at

a 7, so we can have some room to grow if we have to--where would a scorpion sting be? Anybody know?

Conrad: Oh, I think it'd be closer to the 10.

Dr. Biology: Would it?

Conrad: Yeah.

Michael: In terms of pain or danger?

Dr. Biology: No, pain.

Michael: Pain, yeah. I think that it's painful, absolutely. Honey bees are painful, but obviously I think that Conrad's correct, that a scorpion sting would be much more of a pain issue, if for no other reason than just the fact that the stinger is much, much larger in a scorpion than it is in a bee. The bee has a very efficient venom delivery apparatus, but the stinger itself is quite small.

Dr. Biology: Uh-huh. Just the amount of venom that gets in there...

Michael: And just the size of the needle, so to speak.

Dr. Biology: Where do scorpions live, Conrad?

Conrad: Well, living here in Arizona, everybody thinks scorpions are just desert creatures, but they live almost everywhere. They've found scorpions living in the jungle, in the forests, in the grasslands, in the mountains, in caves. Doing my research for the book, I found out there's actually some tiny little species of scorpions, smaller than ants, that like to live in the cracks of pineapples in the fields in Hawaii.

The only place they haven't actually found living scorpions is in Antarctica. But some scientists tell me that they think they probably could survive there, because they can withstand huge swings in temperature. It's why they've been around for 450 million years.

Michael: [laughs]

Dr. Biology: One of the questions I meant to ask Mike is: are all scorpions equally poisonous? And you've kind of talked about that there is a variation, so...

Michael: Sure.

Dr. Biology: What's the range of poisons out there? And which ones would I want to stay away from, no matter what?

Michael: The most dangerous scorpions are found in Africa and Asia. They are not animals that you're likely to encounter, unless you're on safari or something, or in certain parts of Asia. Although they do occasionally show up in the Petree.

The scorpions that we have in North America are, as a group, very benign, very harmless. The bark scorpion is the most dangerous of the group. There are some scorpions in Central and South America you might want to watch out for that are related, in fact, to the bark scorpion. But by and large, scorpions again, unless you're in Southern Africa, you shouldn't have to worry too much about scorpions in North America.

But there is quite a bit of variation. And the most dangerous of them can be very dangerous indeed. They need to be given a proper respect if you don't know what the scorpion is.

Dr. Biology: It's kind of like a snake; make sure that you treat it as if it is poisonous. Another question that comes into Ask-a-Biologist is if you can tell how dangerous a scorpion is by size. So is there something to that, that a smaller scorpion is more dangerous than a larger scorpion?

Conrad: That's true, and it's not true. It's true only because the bark scorpion is the most dangerous scorpion we have here in Arizona. But it does not grow very big; it only grows about an inch long. So people have put those two things together, equating size with danger. The bark scorpion is dangerous, but it's small. But a small desert hairy scorpion is not going to be any more dangerous than a larger one, is that correct?

Michael: There's two ways to think about that question. One is that is a baby scorpion more venomous than the adult in that same species, versus small versus large scorpions in general. I don't think that the studies necessarily support the idea that a baby scorpion in a given species is any more or less venomous than the adult. Certainly they have a harder time injecting the venom, because they are smaller.

Conrad is very correct that the bark scorpion in Arizona is a kind of a medium size scorpion. And our really large scorpion is the desert hairy scorpion, which is completely harmless. Worldwide, the scorpions that are truly deadly vary considerably in size, from medium up to kind of biggish scorpions, so there's no real hard and fast rule. But certainly in North America, the dangerous scorpion, the one that we worry about, is a kind of a medium to small scorpion, compared to some of the larger desert ones.

Dr. Biology: So we're not going to equate danger to the size of the scorpion; it could be dangerous either size.

Michael: That's right. A size is very unreliable predictor of the danger, as is the color. When I'm asked, actually, I tell people that, if you live in Arizona, the way that you can tell a dangerous scorpion from a harmless one is whether or not it's in your house, because nine times out of 10, the scorpion that's in your house is actually a bark scorpion. Because, behaviorally, the harmless scorpions are much less likely to end up in your house.

They're much more sedentary. They tend to be "sit and wait" predators. They don't move around a lot, generally. Whereas the bark scorpion, by nature, is an active forager. So it actively moves around the landscape at night looking for insect prey, and in so doing, it oftentimes ends up places where it shouldn't, like in your boot or in your sleeping bag or

in your house.

Most people will automatically destroy a scorpion they find in their house, and rightly so. Scorpions on vertical surfaces are almost always bark scorpions. The harmless forms do not climb; they're not climbers. Whereas the bark scorpion likes to climb. As the name suggests, its natural habitat is in fact the bark of trees.

Dr. Biology: Very good information.

Conrad: If you have a scorpion on your bedroom wall or your ceiling, get rid of it.

Michael: You bet ya.

Dr. Biology: One of the popular questions that comes into Ask-a-Biologist is: who would win between a tarantula and a scorpion if they were in a fight?

Michael: It depends on the size, because I think that tarantulas, as a group, are probably larger than most scorpions. But tarantulas really have to get kind of the jump, so to speak – on ya. The scorpion has got several tools it can use. The big nasty is the centipede. Nobody wins against a centipede--a big scolopendra heros, one of those big jobs.

Dr. Biology: So if we have this animal fight ring, and we put a tarantula in there, a centipede, and a scorpion... [laughs]

Conrad: Put your money on the centipede...

Dr. Biology: Put your money on the centipede. [laughs]

Conrad, at the beginning, you had a really great description of a scorpion stew. What do scorpions eat? We heard brothers and sisters. Do they really eat their brothers and sisters?

Conrad: They actually will eat their family members, if they can't find anything else to eat. They're pretty tough predators. But they're looking for crickets, small insects, spiders, smaller spiders; usually hunting things that are a little bit smaller than them. They'll eat small worms. But if they cannot find insects or small arachnids, they'll go after each other and they will actually eat each other. They're cannibals. When I tell this story to the kids, they're all saying, "Oh my gosh! That's like family abuse!"

Dr. Biology: [laughs]

Conrad: [laughs] Actually, the mother scorpion, if she cannot find enough food to eat, the mother scorpion sometimes will actually eat her own babies.

Dr. Biology: Oh my!

Conrad: So yeah, it's pretty rugged being a scorpion. Think about it. Everything in the desert, everything in the jungle, is trying to eat you--including your own family members.

Dr. Biology: Well, the good news is we're not that size, so we've got a little bit of safety. How do you get rid of these animals if you have them around your home?

Michael: That's a good question, and I do get asked it quite a lot. Scorpions are notoriously resistant to insecticides, and so it can be very difficult to treat a scorpion problem just using insecticides. My recommendation is that if an individual thinks that their home has a scorpion problem, to try and locate the animals, and then destroy them when you find them.

And this might sound like it would be a very difficult thing to do, but in fact it's made much easier by the fact that, as Conrad pointed out earlier, they fluoresce under a black light. All scorpions will show up as kind of a blue-green color under a black light, and they can actually be seen from some distance.

And so you can locate them in your house, or otherwise outside the house, and then destroy them, either by crushing them, or if you have an insecticide formulated for scorpions, you can go ahead and spray them. If you do so, you should pretty much saturate the scorpion, because it will take quite a lot to kill it and you shouldn't expect the scorpion to die immediately.

But the main thing to do with scorpions, at least in Arizona, the primary problem comes from scorpions that live around the house outside that make their way inside the house. And so the key is to find where they are living outside and to try and address the habitat and make it less hospitable for the animals outside. So they will be less likely to show up inside your house.

Dr. Biology: Now these black lights, where can you get them?

Michael: At one time, they were actually fairly difficult to get. You had to go into psychedelic shops and whatnot to find them. Now you can get small black lights at almost every hardware store. You can get very small fixtures that you can carry around and I actually have several that were fairly inexpensive that I simply purchased at a local hardware store.

Dr. Biology: Hmm. Now, are there any tips for those scorpions that do make it into the household; you know, keeping them out of the bed and out of your shoes?

Michael: If you have a problem with scorpions inside your home, you should address the issue of where they're coming from, locate their habitat outside the house and then try and find the way in which they are getting into your home.

Perhaps the weather stripping under a door may have worn, and they may be coming in under a door. Perhaps there is a crack in the wall they are coming through, and fix that. I think that if you can do those two things, you should be able to manage your scorpion issue at least inside the home.

Conrad: What I've learned living here in Arizona for 25 years is that scorpions are basically nocturnal creatures. They don't like the bright sunlight. They don't like the hot desert sun. They find a nice, cool, shady spot to rest during the day.

So especially if you have desert landscaping or if you live on the outskirts of an urban area, closer to the desert and you do see that you have scorpions, don't leave your shoes outside on the patio at night or on the front porch. If you have a swimming pool, don't leave your shoes by the pool.

Now I've made that mistake before. But I remember that before I put my shoes on in the morning I'll bang them together and shake them out really well so I don't get a nasty surprise.

Dr. Biology: So if we end up getting stung, we forget, leave the shoes out, slide our shoes on, get this really nasty, nasty sting, and we look in the shoe and we find it's a scorpion. Mike, what am I going to do?

Michael: Well, I think the first thing that you should always do in a case where you feel you have been stung by a scorpion is to seek medical attention. You can call poison control centers.

I know that in Arizona our poison control center gets many thousands of calls every year and they are extremely familiar with the signs and symptoms of envenomation and they can just basically talk to you over the phone and find out where you are in terms of your medical condition and make specific recommendations. Generally there is nothing to do but just wait for the venom to wear off. But if you are in contact with a health care provider, you have done really all you can and should do.

Dr. Biology: Is there a particular treatment other than just waiting for the sting to wear off?

Michael: No, there really isn't. I wouldn't recommend doing anything other than just seeking medical advice and take whatever advice they give you, of course. And they probably will just say, "Hang in there and if the symptoms progress to a certain point, then give us a call again or come in."

Dr. Biology: Is there an antivenin for scorpions?

Michael: I don't know that there is anymore. I don't know that there is an antivenin. At one point ASU had a facility for the production of antivenin that was run by Marilyn Bloom. And I think that that has not been in operation for some time now. And I don't think that anybody else is making antivenin specifically for the bark scorpion that we have in Arizona.

Dr. Biology: Hmm.

Conrad: What I have heard on that is that Marilyn Bloom made a five-year supply of antivenin before she retired. And those five years were up last summer, the summer of 2006.

There is an experimental antivenin that comes out of Mexico that a lot of hospitals in Arizona are using. But it's not FDA approved and that has always been the problem. It actually works pretty well from some of the doctors that I have talked to, but it has to go through that whole FDA approval process.

Dr. Biology: Well, it's been great learning about the scorpions and a lot of the mystery and the scary parts and the gross parts: sticky stew. But I want to switch a little bit here.

I always like to find out a little bit more about my guests. Mike, I'm going to ask you, you have been a biologist for quite some time. And what I always like to find out is when did you first know you wanted to be a biologist?

Michael: Well, I think I knew very early. I would go out and collect lizards and snakes and bugs and bring them home and terrorize my family. I suppose it would be, certainly in elementary school, and fairly early in elementary school.

Dr. Biology: Now Conrad, I want to shift gears a little bit because you are a writer, and you are a writer of a lot of different types of books, mainly children's books. We'll talk a little bit about that later. When did you know you want to be a writer?

Conrad: Well I wanted to be a scientist like Mike. I was going to be an entomologist. Growing up in northeastern Ohio, I wanted to be a marine biologist like every other kid growing up in the 70s and there were probably five jobs for marine biologists in the world at that time. Of course, growing up south of Cleveland, the ocean has a huge effect on your life. [laughs]

But I always enjoyed writing. I was able to put both of those likes together. Now I get to write about science. So I have the best of both worlds. My favorite things to write about are bones, bugs and rocks. So if we have got bones, bugs and rocks involved, that's for me.

Dr. Biology: You're all set. Well what if I took that away from you? What if you couldn't be a writer? And since you already said you would be a scientist, I'm actually going to take that away from you as well. I'm going to make you go out for a completely different career. What would you be?

Conrad: Wow. Probably a pro baseball player.

Dr. Biology: Pro baseball! Is there a particular position you would love to play?

Conrad: Oh, left field.

Dr. Biology: Left field!

Conrad: Oh, yeah.

Dr. Biology: Well Mike, what about you? If you couldn't be a biologist what would you be?

Michael: I would probably still be a teacher I think of some type. I've discovered teaching actually in the last 10 years and I really, really enjoy it a lot. And I'm sure I would gravitate to it at some point.

Dr. Biology: Would there be a topic? If I'm going to take away your biology and you don't get to be the science teacher, what are you going to be?

Michael: Oh goodness. English.

Dr. Biology: English?

Michael: Yeah.

Dr. Biology: Great, great.

Michael: Or history.

Dr. Biology: Or history.

Michael: Mmmhmm.

Dr. Biology: Both, both great topics. What advice would you have for a young scientist? They want to come out and become a scientist or even someone who's going to shift gears. Maybe there is a writer out there that wants to be a scientist.

Michael: Follow your passion. Study the things that interest you. And absolutely do what you want to do. This is I think one of the great advantages of having a career in science is that you are given complete freedom as to what you study and that starts very early.

Dr. Biology: How about for a science writer? What is your advice?

Conrad: Well, my advice to the kids - I do lots of writing workshops for the kids and I tell the kids first if you want to be a writer, you have to be a very good reader first. You have to read all kinds of things. Read as much as you can. And then you have to practice. Just like if you wanted to be a great guitar player -

Dr. Biology: Baseball player.

Conrad: Baseball player, basketball player, dancer, singer. You have to practice. So if you want to be a great writer, you need to practice. You need to write a little bit every day, even if it's just a few sentences.

Dr. Biology: Well, if you'd like to read some of Conrad Storad's books, jump on the Internet, enter his name in the search tool. I would suggest using Amazon.com. His name is C-O-N-R-A-D S-T-O-R-A-D. And that will take you to about; well I found 20 books.

I think my favorite ones that you've written recently are "Lizards for Lunch (A Road Runner's Tale)", "Don't Call Me Pig (A Javalina Story)" and your recent one is really quite amazing - "Desert Night Shift (A Pack Rat Story)".

By the way, I haven't asked, do you have a book in the works and can you tell us about it?

Conrad: I can. In fact, I have six books in the works. My newest book actually just came out yesterday. It's called "Fossil Fuels", written for second and third graders. But my newest animal book will be out probably around Christmas and it's all about Gila Monsters.

Dr. Biology: Oh, I love those! I love Gila Monsters!

Conrad: Fascinating critter.

Dr. Biology: We have actually Dale Dinardo, who works with Gila Monsters in the School of Life Sciences.

Conrad: That's right. He was a major source for this book.

Dr. Biology: Well Conrad Storad and Mike Quinlan, thank you for visiting with me today.

Michael: Thank you for having us.

Conrad: Thank you.

Dr. Biology: We have more information on scorpions on the "Ask A Biologist" website. Just Google the words scorpion, ask, and a biologist and you will end up with the link to our not-so-scary scorpion story with a lot of great pictures about scorpions.

You have been listening to "Ask a Biologist" and my guests have been Conrad Storad, children's book author and editor of ASU Research Magazine and Chain Reaction Magazine.

Along with Conrad, we have adjunct professor Michael Quinlan from the ASU School of Life Sciences. Dr. Quinlan is also a professor at Midwestern University in Glendale, Arizona.

The Ask a Biologist podcast is produced on the campus of Arizona State University and even though our program is not broadcast live, you can still send us your questions about biology using our companion website. If it's about a scorpion, who knows, Dr. Quinlan might be answering it.

The address is askabiologist.asu.edu. Or you can just Google the words "Ask A Biologist." I'm Dr. Biology.