

## Ask A Biologist Vol 061 (Guest: Bruce Hammock)

### **Biology Business**

Have you ever thought of biology as career path to running a multi-million-dollar project? Biologist Bruce Hammock talks about life as a biologist, being a businessman and mountain climbing. Listen in as Dr. Biology learns how biology, being a businessman and mountain climbing all fit together?

### **Transcript**

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**Dr. Biology:** This is Ask a Biologist, a program about the living world and I am Dr. Biology. OK. It's time for true confessions. In the past year, we have been busy working on new features and content for our companion website. This is the one that askabiologist.asu.edu. We've also been visiting a lot of guests on Ask A Biologist program. What we haven't been doing is keeping up with the editing and releasing with the shows. On the coming months, we will be releasing these previously recorded shows along with current programs. Up next is an interview with biologist, businessman and mountain climber Bruce Hammock to show where biology meets business.

It could have been called Business Life or Life in Business. Either way, the story is about biology, basic research and how it can turn into a multimillion-dollar project that could one day lead to a new drug to treat pain, blood pressure, diabetes as well as heart disease.

Welcome to Ask A Biologist, Professor Hammock.

**Bruce Hammock:** Thank you, Dr. Biology.

**Dr. Biology:** You probably don't know it but I've talked about you and your research group on this program in an earlier show.

**Bruce:** Was it about scorpions?

**Dr. Biology:** You've got it. It all had to do with scorpions, which are very common in the dessert here and their very interesting venom. What I described as having a weapon that could be set to stun or another one that could be set to kill. Now, you call them a pre-toxin venom light and the real toxin that kills. Have you learned anything more about the pre-toxin and toxin in scorpions?

**Bruce:** Well, it's pretty much the same story. We use a very large scorpion, *Androctonus*, from South Africa as well as the *Centruroides* that I actually collected pretty close to your university. This large scorpion, *Androctonus*, is a lot easy to see because it is actually a large animal. It is an attack scorpion. It doesn't hide. It is four inches, five inches, even six inches long. Most scorpions are very secretive like your bark scorpion but this attack scorpion, if it sees a potential predator will attack the predator and actually spray it's pre-venom into the eyes of the predator.

**Dr. Biology:** Ouch! Well, I was also wondering, did they use this in some cases to scare things away? That they are not really trying to kill but say, "Hey, you stay away rather than try to kill them?"

**Bruce:** I would expect that... Although, biology doesn't work like this, that the scorpion, "I have this very expensive venom and I have a very cheap venom." I'm willing to use the cheap venom to scare something away. But if I'm really terrified that this bird is going to eat me, I am going to use a real venom and kill it.

**Dr. Biology:** OK. Well, I introduced you as a biochemist but you can also be called an entomologist because your work has been with insects. What do you describe yourself as?

**Bruce:** Well, it depends. If I'm around a chemist, I'm a biologist. If I'm around a biologist, well, then I'm a chemist. That way I get away with a lot. [laughter]

**Dr. Biology:** I like that. I like it. I think I do the same thing. Well, your work, you started out in basic research.

**Bruce:** Yes.

**Dr. Biology:** Basic research to me is really critical. You don't think about it but it's pretty much the building blocks of what a lot of other research is based on.

**Bruce:** Yes.

**Dr. Biology:** If we don't have that, we lose a lot of the materials we need to build these drugs or create these drugs or design these drugs, whatever term you want to use or in some cases, pesticides. What I want to know is how did you move from pest control to pain control?

**Bruce:** I think it has been really fun although it was hard to see from the beginning. That we were working on a green pesticide many years ago that affects insect development. Actually, the compound is still used. You can buy it at the drug store that we worked on 30-35 years ago. But the enzymes, some of the enzyme systems, we were looking at the insects that let caterpillars turn into butterflies. We asked do they occur in mice and rats? Surprising the answer was yes.

It also occurs in tomatoes and potatoes. We just began to wonder what they do. We still don't know what they do in plants but in mammals, they control blood pressure, pain, and inflammation.

**Dr. Biology:** OK. Now, you brought up a really good point. We are talking about insects which a lot of people say why on earth are you working on insects. Because as a species, humans, we are pretty egocentric. We always want to know how is this going to help me? What is the good part for humans? You are showing right now, you are working with insects and it actually moved right into humans.

**Bruce:** Yes. Working with insects was fun just because how caterpillars turn to butterflies is one of the things almost every kid in the world, including me since I have never grown up, is interested in. But insects are also those creatures that eat about 60 percent of the world's food supply. They also transmit malaria, encephalitis and really terrible diseases. So there's a very practical reason to work on insects in addition to learning how caterpillars turn into butterflies. But also, this very basic work then begins to have many practical applications down the line. In this case, the insect work has led directly to drugs that may help reduce pain and inflammation.

**Dr. Biology:** That's pretty amazing. You were talking today in your lecture. You mentioned you spent at least 20 years a drug company or at least a research group has done this basic research to bring a new drug for control of this particular areas.

**Bruce:** Yes. That's true that we have a lot of drugs that have a new name. But they are slightly different structure. But the new mechanism of action is really attractive because the position then could tailor that drug to an individual person who has a particular ailment. They also could combine this drug with older drugs to reduce blood pressure or reduce inflammation in a more sophisticated way with few side effects.

**Dr. Biology:** So from butterflies to blood pressure?

**Bruce:** Yes.

**Dr. Biology:** OK. Can you explain how this drug works?

**Bruce:** We have a group of fats. We don't think of fats like this. We have a group of fats that actually are what we call chemical mediators. They are controlling child birth. These fats are controlling blood pressure. They are controlling pain. They are controlling an awful lot of biology. So the compounds that we have made control the fats that control the biology.

**Dr. Biology:** OK. Now, do the fats have a name?

**Bruce:** The name is really long. They are derivatives of arachidonic acid and are called eicosanoids. But if you look on the label of the new baby food bottles, eicosanoids are there. They are called arachidonic acids.

**Dr. Biology:** OK. You can see it on local store shelves. So biology is right in your local store. All right, you have not only been doing this basic research. You have not only gone from butterflies to blood pressure. You also learned a lot along the way.

**Bruce:** It's been really fun because when you find a compound that could be a new drug; you are also finding a probe to ask how does biology work. And so, we have been really interested and very surprised, for instance, to find these compounds dramatically reduce pain. Not only the pain that comes from an inflammation like you cut your finger, but really terrible pain that can come from diabetes or from a burn or bone cancer.

**Dr. Biology:** In this process, you're a scientist. Scientist, we consider ourselves kind of purists a lot of time. It's for the good of science. It's a part of learning. Well, you are mountaineer. Why do you do it? Because it's there. You want to climb that mountain. You actually created a company and it's called Arete, which is A-R-E-T-E which is French?

**Bruce:** Yes.

**Dr. Biology:** It is a mountaineering term?

**Bruce:** It is also is dead fish back bone.

**Dr. Biology:** Oh.

**Bruce:** But mountaineers noticed the sharp ridges kind of look like the dead fish back bone.

**Dr. Biology:** OK.

**Bruce:** That is not very aesthetic.

**Dr. Biology:** OK. To be clear it is term that says sharp or steep ridge. I was curious. Why did you pick this name for your company?

**Bruce:** My kids and I were coming down from the mountain called Bear Creek Spire, which is one of my favorite mountains. We were talking about what would be a good name if I started a company. We looked back at what we climbed which was the northeast around Bear Creek's Spire. We thought Arete. That's a nice name. I think no one used it before.

**Dr. Biology:** It wasn't so much as this has been a sharp and steep learning curve or sharp and steep climb in the world of business?

**Bruce:** We did that afterwards, of course. You can make all sorts of analogies like that. But no, it actually was just a really good day climbing a really nice mountain.

**Dr. Biology:** When doing my research, I was looking at what you estimated it cost to bring a drug to the market which means so the doctor can prescribe, or you can find it at a local drug store. The number was amazing to me because it went from 700 million to 1.2 billion dollars. Even though we talked about billions of dollars in the news these days as if it's commonplace, this is real money. I mean really a lot of money. How do you get that kind money to bring that drug to market?

**Bruce:** Got me. [laughter]

**Bruce:** We've been able to raise about 50 million dollars to get the drug to what's called phase two chemical trials. But it will have to be a big pharmaceutical company that then takes it from there. It's extraordinarily expensive to move to all of the human safety tests needed to move the drug to market. Most never make it. Most of these materials will in fact fail along the way.

**Dr. Biology:** It's not necessarily for the money. It's because they find a side effect or something else.

**Bruce:** They find a side effect or the big company decides that the patient population at the end will not be able to pay enough for the drug to be able to pay back the research cost.

**Dr. Biology:** Right. If it takes 1.2 billion to bring it to market, probably other costs in there. You've got to make that much money back or it's not worth doing which is bringing me to another important part. In reading about this drug, the type that you are working on. The manufacturing of it seems to be much more compatible with lower cost. In other words it doesn't cost much to make it. In particular, I was interested because I think it was mentioned that developing countries could probably produce this drug as well. Which is a real issue. It is decline for rich countries like United States or Canada or England, and say, to be able to do this. But what happens when you want to get this drug to a developing country. How does that work? Why is it so much better, or have the potential to be so much better?

**Bruce:** The chemistry? Although, I like to think that my work is very sophisticated and I have the most wonderful students in post doc. This is very simple chemistry. The compounds that are being developed in the US are quite good compounds. The cost of the drug will of course, incorporate the development cost. But the actual cost of the drug itself is dirt cheap. There are analogs of this that are basically free to make. They can be made in the country with very, very low technology. They are also very potent in the tiny amounts of the compound will be biologically effective. I am very optimistic that it will only be sociological barriers we have to face in moving these compounds into developing countries.

If we looked a lot of Africa for example, once you get past HIV or AIDS and infant diarrhea, the new problems in many of these countries are the problems of social transition which means obesity, diabetes, high blood pressure. I think we can really help there.

**Dr. Biology:** When I looked at your list of publications. You have over 700 publications. This is phenomenal. But I also want to mention that you have at least 30 people in your laboratory. This isn't a small...

**Bruce:** It's not a small operation.

**Dr. Biology:** No. This is a big lab. What's it like running a big lab? Because if you went to a usual person in the street and said, "Describe a scientist." First of all, they put on some white lab coats and they have us behind a bench and probably not mountaineering. But the other thing they do is they usually think that you are sitting down there doing the experiments day in and day out. You are the only one doing them or maybe have a helper or two. In your lab, there must be a lot of experiments going on.

**Bruce:** Yeah. There are lots of different ways of doing science. Luckily, science is very diverse. You've got people who work by themselves, people who work in small groups. I happen to have a very large group of people. It's a lot of fun because I have all sorts of students and post docs talking to me, asking questions and they teach me an awful lot more than I teach them. But we also work a lot collaboratively with other laboratories at Davis. The idea that we are trying to do science at interface between fields rather than focusing in one discipline is what I found really kind of interesting. But it's critical, Dr. Biology, that we've got different scientists, because there are people that work on one area in a very focused discipline. There are others of us that have never grown up and we like to play in multiple areas. Both kinds of science are very important to society.

**Dr. Biology:** Yeah, I think the best part is to think about it as playing. It could be considered serious play but nonetheless, it is the idea that it really is fun.

**Bruce:** It is delightful.

**Dr. Biology:** What I worry about sometimes is the word finally gets out that the best job you could ever have is a biologist and then it's going to be tougher for me to get a job or someone else coming along. Because everybody will be doing it and it really is amazing.

**Bruce:** But then they'll find out about the pay, Dr. Biology. [laughter]

**Dr. Biology:** Well, actually, you mentioned you have a 50 million dollar company. Well, you have to raise 50 million dollars for this company. But how much money did you actually get out of this development so far?

**Bruce:** Not much. The university paid me a hot new check of \$6,000 for a royalty this year. If you are going to do this as an academic entrepreneur, do it for fun.

**Dr. Biology:** And so, that comes back to the fact that yes, it is not necessarily you are going to get rich although that can happen.

**Bruce:** It can happen.

**Dr. Biology:** I think the best part is if you like or love what you are doing, you can do that every day, you are not really working right?

**Bruce:** Don't get that word get out.

**Dr. Biology:** When you do 700 papers, man! Even if it's 5 pages per paper, that is a lot of writing. Do you do all the writing?

**Bruce:** No. My job with students and post-doctorals in the lab is to teach them. Usually, the first paper is very painful for both of us. But later, they do the writing and I do the editing.

**Dr. Biology:** Right. That red ink. It's interesting, because you and I are old enough to remember red ink before computers. When you saw those things, it is very painful to do the corrections. With the computer today, I absolutely love being able to give my work to someone that is willing to read it and give me their comments, because the corrections aren't that big of a deal. We really learn by doing.

**Bruce:** Yes, that's true.

**Dr. Biology:** In the writing process and in the science process, do you enjoy writing?

**Bruce:** I do enjoy the writing because I learn from my major professor that it's a trick to go back and re-examine the data again and think about the data very hard. The writing mechanically is a pain sometimes but the intellectual process of thinking about what it means and the fallacies of your thoughts are really valuable and fun.

**Dr. Biology:** Right. You have to tell the story. Even if it's science, you are telling the story. You have to make sure the facts, the information you gather make sense. You have to tell it in a way someone can understand.

**Bruce:** But not only understand, Dr. Biology. They got to find it fun. You hit a key point that if you just present facts, that's your obligation to science but it is boring as hell. But if you tell a story, it is interesting and memorable and it makes you think about your day really hard and ask do they actually support the story you are telling?

**Dr. Biology:** Right. And not only do you get to write, you get to have pictures as well. And sometimes, there are diagrams. In your case, you showed this really beautiful structure of what

you are working on. Whether it is 3D structures of the compound and I actually drew a little sketch, because I can now remember a little green ball, little blue ball for the parts of the structure. This is protein structure and there are two components.

**Bruce:** It's a dimer, which means two parts and it is anti-parallel dimer so one is going this way and one is going this way.

**Dr. Biology:** Right.

**Bruce:** We have a little ball, a big ball, a little ball, and a big ball.

**Dr. Biology:** Right and they line up with each other.

**Bruce:** Yeah.

**Dr. Biology:** But it is really beautiful and its lacy. It is really cool to look at this structure.

**Bruce:** On that, you talked about the picture of an enzyme we are working on. It really points out how many different fields come together. That was an X-ray picture. The ability to take a picture of a single protein that is far too small to ever seen in a microscope can only happen because other scientists were working in the field of X-rays. Still others were working in the field of optics. Still others working in the field of computer science to be able to generate that pretty picture that I showed.

**Dr. Biology:** Right. Not only do your science, but be willing and able to talk to other scientists and learn from each other and use their skills to build our bank of knowledge thinking about business type of term. All right. Well, let's talk a little bit about your hobby here. You like to climb mountains.

**Bruce:** I like to climb mountains. For a number of years, I taught climbing at UC but they decided I was too old. So now, I am teaching water kayaking. [laughter]

**Dr. Biology:** OK. I don't know if that one is better than the other one actually. When you talk about mountain climbing, you showed actually a photo of your son who was actually climbing a rock face. We are not just talking about just back packing in this case right?

**Bruce:** No. That was Mount Humphries in the Eastern Sierra, an absolutely lovely mountain.

**Dr. Biology:** Right. OK, well, this is serious stuff. Now, on Ask A Biologist, I asked three questions of all my scientists. And these are...

**Bruce:** That's scary.

**Dr. Biology:** Yeah, it is, isn't it? It's not like you are in competition, but they usually reveal a little bit about yourself. The first one is pretty simple one. Do you remember when you knew you were going to be a scientist? Was there an 'aha' moment or was there a spark somewhere?

**Bruce:** There were probably lots of moments that from my earliest memories, I like to collect insects. I enjoyed looking at wild flowers. I just absolutely love biology and then that matured to a degree in forestry and working in entomology. But if there was one instant, it was reading a

paper in scientific American by a man name Carol Williams, son of a southern Baptist preacher who thought he could remove all ants from picnics with a magical golden oil. I found his paper really inspiring. In a way, I'm still working in the same area.

**Dr. Biology:** What is your favorite insect species?

**Bruce:** That's a hard question because I don't have one. My favorite yesterday was a turquoise ant that we found in Sedona. I've never seen anything like it and I asked your ant biologist and every one gave me a different answer.

**Dr. Biology:** Really?

**Bruce:** Anyway, it is a really, really interesting metallic turquoise creature. Really fascinating!

**Dr. Biology:** Did you collect it or did you take a picture?

**Bruce:** I should have. But no, I didn't. And last night, I went on a walk in the desert and I was looking at ant lions. These are little creatures that dig the triangle pit in the ground. They are so cute. You can follow their trails across the desert as they move from one pit to another. As a kid, I raised praying mantises, wheel bugs. Maybe my favorite insect pet is a wheel bug. I raised it from an egg. I thought it was my friend. One day, when it was an inch and a half long, it decided I might taste good. And it was no longer my friend.

[laughter]

**Dr. Biology:** Really it bit you?

**Bruce:** It did.

**Dr. Biology:** Oh! Describe a wheel bug. I'm afraid I don't know...

**Bruce:** Well, the technical name is a Reduviidae. A bug, which means it's got a long snout like a drinking straw. It has what looks like a gear on its thorax. They stick their snout into other insects. Inject the fluid that dissolves the prey and then they suck it out.

**Dr. Biology:** Oh!

**Bruce:** I thought that he was really into eating other insects but one day, he decided I was tasty and he left quite a little pit in my arm.

**Dr. Biology:** It wasn't really biting you. It was actually injecting some of that material, in this case, probably an enzyme that was breaking down the cells around there and turning you into a little stew.

**Bruce:** Right and then, he slurp it right back up.

**Dr. Biology:** Well, I would say it is not your friend either.

**Bruce:** That's true. I didn't squash him though. Dr. Biology. It was still a pet.



**Dr. Biology:** That's very commendable. All right. Let's switch to question two. I'm going to take away all your science. You can't be a biologist. You can't be a scientist any type. What would you be and what would you do?

**Bruce:** I would spend my life climbing mountains. But the fact is, if I did, I'll be dead, because I am not a very good mountain climber. Or kayaking but I'll be dead, because I am not a very good kayaker. That's why I am such a good teacher because I remember what it's like to be a beginner. Something at somewhat a different stand point but yet related to what I do is friend and I have been talking about starting a venture capital company where we try to fund very early stage science. Because we have, at least in our area, a really good feel for what can be turned into a real product and what can't in a very limited field.

And so, rather than be a big venture capital company that does thumbs up and thumbs down on a wide range of technologies would be in fact a focus on areas that a few of us really understood and try to help younger scientists move their technology into the private sector.

**Dr. Biology:** Right these venture capitalists that are the ones that are the businessmen that have the money and they go out there and they say, "What am I going to invest in?" When I do this investment, what am I going to get paid in the end? Not always and unfortunately a lot of times, they don't have the science background. This is great. "OK. I'll take that expertise and make use of it. I'll buy that. That works."

**Bruce:** Or would you pay me to climb mountains?

**Dr. Biology:** Well, from reading about you, I think I am going to pay you to be a venture capitalists. But on Sundays, I'll let you climb or on Saturdays. I'll let you climb mountains but be careful please. All right, the last question and this could be very fun. It's probably something you were asked. What advice do you have for someone who wants to become a scientist? Or maybe someone who already knows they are scientist but they need to know what's the path that I should take?

**Bruce:** I think the first thing is to look at the mirror and say, is it fun to be a biologist? If you find it fun, it's what you ought to do because it is if you enjoy it, it is just an absolutely delightful career. You never have to grow up. Scientists, when they get together, always complain about the problems and yet they are still doing it. To really think do I want to be a biologist, do I really love the biology and then it's clear sailing. You can't do anything else.

**Dr. Biology:** I'm going to slip back to the business side. Your focus has always been the world of science but it turns out that you needed to take on a business component just to be able to move this drug further along. What is it like to get into the world of business?

**Bruce:** I found most of the people in the venture field to be very professional, very competent, very profit driven because they are in fact obligated to the people that in a sense loan them the money to invest. I did not find the universities to be particularly altruistic. They seem to be very greedy, very self-centered and in fact, very inefficient. As a society, we need to figure out how do we make universities better able to transfer technology.

**Dr. Biology:** Right. Maybe the universities aren't skilled. Maybe they aren't as educated as they think they are in this area. Maybe they need to go to school. [laughter]

**Bruce:** I think that one can argue that.

**Dr. Biology:** Well, Bruce Hammock, it's been great. I really appreciate you taking the time and I really enjoyed reading about you. It was just amazing.

**Bruce:** Thank you, Dr. Biology.

**Dr. Biology:** You've been listening to Ask A Biologist and my guest has been biochemist. No, maybe we call him an entomologist. How about we just settle on biologist? Bruce Hammock from the University of California Davis.

The Ask A Biologist podcast is produced in the campus of Arizona State University and it is recorded in the Grass Roots Studio, housed in the School of Life Sciences, which is a division of the College of Liberal Arts and Sciences.

And remember, even though our program is not broadcast live. You can still send us your question 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.