Ask a Biologist Vol 011 (Guest John Alcock))

Biology Net -

Dr. Biology catches up with animal behavior biologist, John Alcock, and talks about his work, his research, and writing about animals and animal behavior. Hey I thought all bees lived in hives and what about these other animals called tarantula hawks? They're not tarantulas or a hawks.

Transcript

Dr. Biology: This is Ask-A-Biologist, a program about the living world, and I am Dr. Biology. What you are hearing in the background is an Australian musical instrument called the didgeridoo. This instrument is commonly used by the aboriginal people in Australia. We're playing it in order to introduce our guest scientist, John Alcock, whose research has taken him from his own backyard, to the deserts of Arizona, and as far away as Australia, where he has been studying animal behavior. In particular he studies Dawson's burrowing bees in Western Australia, and when he's closer to home, here in Arizona, he studies Tarantula Hawks. Can you imagine what a Tarantula Hawk looks like? Well we'll get to find out, later in the show.

Dr. Alcock, who is also a regent's professor in the School of Life Sciences at Arizona State University, will help us learn about these animals and animal behavior. In fact, he's going to be really good for this, because he has written a book on that very topic, animal behavior. What do you think the title is? What do you expect? "Animal Behavior: An Evolutionary Approach." He has also written many other popular science books involving animal behavior, and a more recent one that's about a really cool plant called an orchid.

Right now, let's greet our guest scientist. Welcome, Professor Alcock.

Professor John Alcock: Glad to be here, Dr. Biology.

Dr. Biology: Animal behavior, hmm. Seems like a straightforward topic even though it covers an awful lot of information, whether we are talking about the world of insects like your Dawson's burrowing bee, or larger animals like, say, the polar bear in the Arctic. There are some basic behaviors that we can study in all of them. What would you say are the most common and maybe the most important things we can learn from studying animals?

John: Well animal behavior is a very, very diverse field, and I think that what the beauty of animal behavior is, is that it enables the researcher to explore any of a wide variety of aspects of biology. So you can study the genetics of behavior if you want, you could study the physiology-- how nerve cells make behavior possible--and of course in so doing we may learn something about how our own brain and nervous system works; or we can study the so-called "ecology of behavior," looking at how animals interact with their

environment, how their adaptations enable them to do the things that they do so well; and we can study the evolution of behavior if we choose. So it's a very diverse and intriguing collection of sub-disciplines that make up the field of animal behavior.

Dr. Biology: When you're doing your animal behavior research, just what part interests you the most?

John: Well I happen to be a person who loves bugs, and so I study, primarily, insect behavior. The focus, as you mentioned, about Dawson's burrowing bee, is I look at the mating behavior of these animals to figure out how the species goes about finding mates, and competing with each other for access to mates, and thus passing on their genes to the next generation.

Dr. Biology: When I first read about these burrowing bees, of course it immediately piqued my interested because every bee I think of is up in a hive. How are these a little different?

John: Well that's a great question, because when people hear the word "bee" they automatically think of the honeybee, and this bee is extremely important and extremely widespread, but it's only one of literally tens of thousands of the species in the world, and each one of those species is different from the honeybee, and each one has its own special story to tell, and each researcher is out there to document their behavior. That's where I come in.

Dr. Biology: That actually just brought up something in my mind. Recently I have been seeing more and more of these black bees, and I have had a lot of people comment about them. One of the things is, they always seem to be solitary. Is that their way?

John: Well yes, I think that's one of the key differences between the honeybee and most other bees, not all other bees. But the honeybee, of course lives in colonies, and there is a queen bee, and a host of worker bees that are unable to reproduce, they are simply helping their mom out, and they help their mother produce a new brood of reproductive bees--those who will be the founders of the next generation. But that kind of social system is very, very different from those black bees that you have been seeing. That particular species is almost certainly a carpenter bee, and these carpenter bees, the females nest on their own, without assistance from a host of workers. The mama bee goes out and collects pollen and nectar, and brings it back, and produces a beautiful little packet of pollen and nectar, lays an egg on it, puts a partition of plywood between its cells, which are bored into wood--so it's a nice little tunnel into wood, which is divvied up by a series of partitions--and each one of those little cubicles contains an offspring of that bee that she has produced on her own, without assistance from any workers.

Dr. Biology: Wow, that's pretty amazing. Can they sting?

John: The female carpenter bee certainly can, and if you choose to bother a female carpenter bee, she will get her sting out.

Dr. Biology: That's going to help a lot, because that question has come up several times. Well, besides the Dawson's burrowing bees, you have studied some pretty interesting--if not scary--animals, called tarantula hawks. These animals are neither a tarantula nor a hawk, but instead an insect. Can you tell us about them and what you've learned?

John: Yeah. I love these particular wasps, because they are a wasp, and they are famous because the female wasp, which is really big--three inches long is not unheard-of for a tarantula hawk wasp--and they have a stinger which is about a half-an-inch long, so it does make an impression on people.

But anyway, the tarantula hawk female is a tarantula spider specialist in that she can track down, by odor, the burrow of a female spider, and the female wasp scampers into the burrow where the tarantula is hiding and will flush the tarantula spider out of its hiding place and chase it down, and go right up to it and take that very, very long stinger that the tarantula hawk wasp has, and insert it into the body, the chest, of the spider, immediately paralyzing it.

The tarantula has its own defenses, but they simply don't work against the brave and courageous and strong wasp, and once she has stung the tarantula into submission, she drags it to a burrow--maybe the one that the tarantula was living in originally--hauls it down into the burrow, lays an egg on the spider, and fills in the burrow a bit, and then goes off and tries to do it again. In the meantime, her offspring hatches out of the egg, and the little grub feeds upon the food that its mom so courageously supplied for it.

Dr. Biology: Courageous? Man, it's mean. I'm going to stay away from them. Although if you look at the pictures of them--you can go up on Google and you can actually put in the words "tarantula hawk"--they are really pretty-looking insects.

John: They are excellent-looking animals. There is a lot of iridescence on their body, and frequently it is black with bluish overtones, and they have bright red wings sometimes. They are just elegant animals.

Dr. Biology: I had also read somewhere, in some descriptions and stories about you, that you had talked about them being very flexible, or having flexibility.

John: Well one of the surprising things about insects is that people do think they're sort of robots, and only capable of doing one thing and doing that very, very automatically. But that's not the case at all. There are an awful lot of insects that do things very flexibly.

The tarantula hawk wasps do provide an example of that in that the male wasps around here in the Phoenix area fly up to the tops of the mountains and set up territories on the mountains, defending an entire Palo Verde tree, a little desert tree, for themselves. So these animals divvy up the trees growing along a ridge line, they each have their own territory.

And there are some males that don't have territories; and they can recognize that they are not likely to beat the big boys, and so they do something else. They have the flexibility to either hold a territory or to go patrolling along a ridgeline, trying to be flying along just when a female is coming up to one of the big boys' spot; and if that's the case, the smaller male--because they are usually smaller that are prevented from holding a territory--that male may be in a position to grab the female right out of the air, and they fall to the ground and mate and prevent that female from mating with one of the territorial ones. So they have got flexibility in their behavior, and this is characteristic of, actually, almost all insects.

Dr. Biology: With your travels, in the beginning we talked about, you have done research in your backyard, you spend a lot of time in the Arizona desert, and then as far away as Australia. You have traveled there at least five times doing research. I think you have some interesting stories about animal behavior, and I was hoping you could tell maybe one or two stories.

John: Well I think that the nice thing about being a college professor is this ability to go traveling and go to strange and wonderful places that you wouldn't otherwise go to, and once you're there, yes, Australia is full of wonderful animals which have provided me with a lot of entertainment in terms of my research activities.

One of the, perhaps, most intriguing aspects of my Australian research has been to study the relationship between, again, a wasp--not a tarantula hawk wasp but a different group of wasps--and the little terrestrial orchids of Australia, so that there are these species of orchids that rely upon the wasp to get pollinated, and they do so by fooling the wasp. So the male wasp is out flying around and he sniffs through the air with his antennae and smells the odor coming from an orchid, and if it is a particular species of orchid that happens to mimic his female's smell, he goes rushing towards this orchid, and is so keen to meet the orchid--which he thinks is a female--that he'll pounce upon a flower part of the female and attempt to mate with that flower part and fly away with it; and in so doing he gets tumbled into the pollen sacs of the orchid and carries them away with him when he leaves, disappointed that the encounter hasn't worked out quite the way he hoped.

Dr. Biology: Very clever. We have talked a little bit, in past shows, we have conservation biology and animal behavior, and those terms probably seem familiar to most people. Conservation biologists, as we learned from a previous guest, Andrew Smith, they look at aspects of the ecosystem including plants and animals, and they want to understand, in many cases, how to protect the environment we all live in. And animal behavior biologists, well, they're interested in animal behavior. However, there is another area of at least word that has been introduced more recently by E.O. Wilson. It's called "sociobiology." I say more recently, I'm saying 25 years, and to some people that might not seem like a very long time, but in reality, if you look at the totality of a lot of the research that has gone on, that's pretty recent.

You actually are an author of a book on this topic, and so, could you tell us a little bit about sociobiology and how it fits in with other areas of biology?

John: Yeah. Sociobiology is a fairly recent discipline in terms of its name, but it is really just part of animal behavior, and that part of animal behavior which involves, specially, the social behavior of animals. So people in the past have studied social behavior--let's say ants and bees and wasps--and they were sociobiologists even though they weren't labeled as such. What Professor Wilson did was to provide a new label for the field of social studies of animals other than humans, primarily, and that new field has gone on to develop a very active research component over the last 25 years or so, but it was existing even before Wilson came online.

Dr. Biology: So what are the basic principles?

John: The basic principle of sociobiology is that animal social behavior evolves. So the idea is that in the past individuals that happened to exhibit certain social tendencies left more copies of their genes to the next generation, and that shaped the evolution of the species and provided the descendants of that species with certain behavioral attributes, certain behavioral characteristics, that make them effective at passing on their genes.

So one of the exciting things that sociobiologists study is the issue of sterility in the workers, because the workers don't reproduce, and you would think that that would be a very tough thing to pass on to your offspring since they don't have any offspring, and yet sterility is a widespread phenomenon in the advanced social insects like the ants, and the question is, how could it evolve? And the answer has been worked out by sociobiologists, and in a nutshell it is that the sterile workers in a colony are actually helping their brothers and sisters, some of which will go on to reproduce, and in so doing will pass on the genes to the next generation, and those genes can, in the bodies of some individuals, cause them to become workers rather than reproducers.

Dr. Biology: Right. When we talk about genes and we talk about DNA, we're talking about the blueprints, we often say. In this case, we have a giant blueprint that isn't just for one type of offspring, it could be for several of them. So it is only how those genes are turned on or turned off that we end up building different animals, right?

John: This is absolutely correct, and in the case of the honeybee, for example, if the grub that is being fed by the workers in the colony receives an awful lot of food, all those materials activate a set of genes which cause that individual to develop into a future queen, or at least a potential future queen. But if the little grub isn't given that much food, then its body is smaller and the result is of its shortage of materials to develop into, it becomes a sterile worker whose ovaries, the egg-producing part of the body, the ovaries simply are not developed adequately to produce eggs, and so that individual doesn't reproduce and instead dedicates her life to the care of sisters.

Dr. Biology: Now do sociobiologists discount--I'm going to use two words, nature versus nurture--and so what we were talking about right now was nature of the code, the

blueprint, the DNA that's being moved from generation to generation, and then nurturing is more or less the environment that they grow up in. There has always been a bit of that debate no matter where you go, as far as how much their influence is, one versus the other. Does sociobiology eliminate nurture?

John: No. I think that one of the real advances in the field of sociobiology and animal behavior generally has been a recognition that any behavioral trait, any behavioral characteristic, like the ability to be a sterile worker, depends upon both genes and environment. These things interact, just like the amount of food that the developing worker bee receives helps it develop into a particular creature with particular abilities. Different amount of food, different amount of nurture, so to speak, and the genes interact with that differently to produce a queen bee. So nature and nurture work together, interact in different ways and contribute different things to development, but both are absolutely required for the development of any organism in nature.

Dr. Biology: Actually, the book that you wrote on this topic is "The Triumph of Sociobiology," and if you would like to read about that, you might want to go to the local library, or if you want to buy it go to Amazon.com.

Shifting gears, it's not uncommon for people to think of science and experiments and think of these fancy labs with all sorts of instruments. Words that come out are "technology" and "computers" and a much newer word that is combined, where we say "biotechnology." Because these words are emphasized, you might think you need a lot of special equipment to do research. One of the things that you are able to do is, you don't use a lot of equipment, and I would like to hear your view on the wide range of things you can do scientifically without a lot of tools.

John: Luckily for me, because I am a little bit computer-challenged and so on, but I do like to do fieldwork, and fieldwork can be highly technical and highly technological, but it doesn't have to be. For me, the most important pieces of equipment that I have to do the studies that I have done are an insect net and a set of paints of various sorts.

So I find it incredibly instructive and revealing to go out to, say, my hilltop, in the springtime, where the tarantula hawk males are setting up their territories, sweep them out of the tree with my insect net, reach in the net and grab the male out because he doesn't have a stinger, I'm safe. And I take a little pink pen, and I give him, on the back of his thorax, right behind his head, I give him a set of paint-coded colors, and then I release him. So he might be blue/orange, or yellow-two-dots, or what have you, and once he is marked and released, in most cases these tarantula hawks accept this is just a bad day at the office and immediately return to their work of defending their tree.

So I now know the name, so to speak, of a particular individual wasp, and by returning to the top of the mountain on many, many days over the course of the season, I can see how

long he hangs out, and I get some basic information about the natural history of the species that I'm working with by tracking down individuals as individuals.

Dr. Biology: You keep things very simple. I'm assuming you also use some binoculars, maybe?

John: I do. I also carry binoculars with me because it is very helpful not to have to recapture the animal each time. So yes, that's a bit of high-tech stuff. I also own one of these small portable scales, and I have been able to use it often, very usefully, because what I can do is I can put my captive animal in a little vial, weigh the vial, let the animal escape, weigh the vial again, and then I have got, essentially, the weight of the individual involved, and because male body size is so important in the competition amongst the male insects, knowing the weights of individuals can be extremely helpful. And like I say, I do have my little semi-high-tech scale to play with.

Dr. Biology: Well while we're talking about simple experiments, can you recommend one that someone could do on their own, maybe in their own backyard?

John: Well, if the person listening lives in the Phoenix area, one of the insects which is often found in the yards in the late afternoon, early evenings, in some numbers, is a very small bee. This bee is a species in which the male sleep in clusters on vegetation of various sorts. If you have got a little shrub with little twigs or something sticking out at the top, they will cluster onto the top of the shrub on these twigs; and once they settle down in the evening and dusk comes, they become very quiet. You can take a very fine paint brush and some little paints, and dot the ones that you want to follow, and get to know them as individuals; or you can mark a cluster of males on a particular branch and see if they come back to use that same branch, the same individuals, the next night, and things like that.

Again, marking individuals and getting to know them as individuals can be, actually, very useful and very emotionally satisfying.

Dr. Biology: So they would keep a journal.

John: Yes.

Dr. Biology: The other thing, it sounds to me like a good family project, and quite frankly, I'd send the parents out to do the marking just in case. That way, if you get a bee that hasn't gotten settled down, mom and dad get to get stung.

John: But really, I assure you that the bees that form these clusters, these sleeping clusters--there are quite a few species that do, but in particular this one very abundant bee in this part of the world that does that--but these are all males, and the males are completely safe to work with. They don't sting you, and you don't even actually have to handle the animal. If you're very cautious and careful with your little paint pen, or with a brush with a little dab of paint on it, you can just mark them right on the spot without ever touching them with your hand.

Dr. Biology: OK. Many biologists write. Most of them are writing grants and then they are publishing the research that they have conducted with the funding that they got from the grants. Your writing goes well beyond this. You actually have written many books. Some of them I would call popular science textbooks, and that just means that they are a little bit more accessible and a little more fun to read, actually, than maybe a textbook that you would read in college or in high school. What I'd like to know is, what attracts you to writing, and do you prefer one type of writing over another?

John: Well what attracted me to writing the kinds of books which you're talking about was, I guess, first the experience of writing a textbook, which does require that you sort of explain things, in my case at the level of college freshmen. In thinking about how to explain things, you do have to, I think, write in a somewhat accessible manner; and I had an editor at a university press--universities often have their own publishing units--come to me and say that she thought that I should give a try at writing a popular science book for a general audience. She suggested that I write about the insects and birds and lizards that occurred on this place, Usury Mountain, where I do most of my research. So I wrote a little book that had a series of chapters, each one dedicated to a particular species, and she thought that I had written something that could be published, so she published it, and I felt good about that.

Dr. Biology: And that seems to be what you have done more and more of, is the popular science writing. When did you first know that you wanted to be a scientist or biologist?

John: I think that the key event that happened in my life was that way back in the 1940s, my father decided that we would move from a city--Wilmington, Delaware--to the countryside, and so we moved out to, really, what at the time was quite a remote countryside, and lived in an old farmhouse by a dirt road and a pond, an old mill pond that was down on the other side of the road. My father said, also, that in addition to making us move, it would be good if we had a family hobby, and that family hobby was bird watching, and I really took to it. I remember, to this day, I was five years old, I remember the absolute thrill of going down to the mill pond and seeing a pair of mallard ducks, and coming back to my mother and saying I had seen my first bird with my father's binoculars. This was such a thrill to me that I kept doing it. I still am a birdwatcher, and I think right from that time I knew that natural history, an interest in observing animals in the field, was going to be what I would do for the rest of my life. And by George, I was lucky enough to be able to do it.

Dr. Biology: What if I said you couldn't be a biologist anymore. What would you be?

John: I think that my love of being outdoors--and again, my father's influence and my grandfather's, they were both excellent gardeners--I believe that I would opt to become a gardener of some sort, particularly if I could find employment in the field of vegetable gardening, which I prefer to the field of flower gardening. So if there was an opportunity, and I admit it's a remote possibility, to become a vegetable gardener, I think I would choose that profession.

Dr. Biology: What advice would you have for young scientists. I say young scientists, often that doesn't mean you're young yourself. It could just mean you're new to becoming a scientist. What advice would you have?

John: Well I think the key is to have, if you do have an interest, a passion, in some aspect of science, that would seem to be critical to develop, and so I would go with the main interest as it has developed. Of course it may change or mature or what have you as you go along, but I think that you have got to be mildly driven, maybe even a bit odd, but with this real driving interest. Then, then you need a mentor, and being able to work with an established scientist, it seems to me, is such a good way to go about learning about a field, learning about what it means to be a scientist and a researcher, and very likely, too, if the relationship between you and your mentor is good, which it often is, very likely to be the foundation for a springboard into a research career.

Dr. Biology: It's interesting, because a lot of those, at least the last three questions I ask every scientist that comes on here, and it seems that there are very similar answers, there are little variations. One of the things I found most curious is that everybody seems to have started out in some kind of a field or observing the animals; and one of the things I always like to remind some of the people that may be in the city: animals are everywhere, even in the city, certainly in the parks and everywhere else. So don't feel like you can't get out and observe these animals just because you might be confined by a big metropolis.

John: I think that's really true, and I think that the opportunity to join with your fellow birdwatchers, for example, if that happens to be your interest--and it's a great entree into field work--that opportunity exists in most places. There are Audubon groups and so on, eager to have new, young members, and it's a great way to get to know about a subject--bird watching--and a great way to meet people, and highly recommended.

Dr. Biology: Well on that note I'd like to thank you, John Alcock. You've been wonderful, and I appreciate you visiting with us.

John: Thank you, Dr. Biology.

Dr. Biology: You've been listening to the Ask-A-Biologist program, and my guest has been Regent's Professor John Alcock, from the ASU School of Life Sciences. You can learn more about animal behavior by reading some of his books. The easiest way to find those is to go to Amazon.com and put in the words "John Alcock." I will let you know, there are a few other authors out there, and there are some people that have the name John Alcock that have been written about, but if you come up with something that deals with animals, I'll guarantee it's going to be "the" John Alcock, and you might even come across an interesting one called "An Enthusiasm for Orchids." It's a little different than the usual book that John has been writing. In case you would like to listen to some more of the didgeridoo, the song is called "Slow Street Mix" from "The Wander Around" by Christopher and the Wolves, which I love the name, because it ties in beautifully with a program on animal behavior. It's available from Magnatune.com.

The Ask-A-Biologist podcast is produced on the campus of Arizona State University. Even though our program is not broadcast live, you can still send us your questions about biology using our companion web site. The address is AskABiologist.ASU.edu, or you can just Google the words "Ask A Biologist." I'm Dr. Biology.