

Dr. Whitlow Au interview on Discovery of Sound in the Sea

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Interview Transcript

Q1

How did you first become interested in science?

"Well, I was always interested in science. I was born that way. As a kid I used to take things apart just to figure out how they work. I was not too successful with putting them together again, but I used to take them apart. And so it's something that was part of me, I think, from as early as I can remember."

Q2

What is the focus of your research and why did you choose this field of study?

"I do mainly echolocation, trying to understand how dolphins use echolocation. Ultimately trying to figure out ways in which we can develop technological sonar that might be modeled after the dolphin, because the dolphin sonar seems to be one of the best, or the optimal sonar for short range, shallow water situations."

Q3

What have been some of the recent discoveries in echolocation by marine mammals?

"We just recently discovered that by looking at echolocation signals from wild dolphins that they have a form of automatic gain control or a form of time varying gain. Now they do it very different than our sonar would do it. In technological sonar, time varying gain usually occurs with the receiver, where the gain of the receiver is increased as a function of time. But with the dolphins, what happens is that they control their level of their emissions so that as they close in on a target, they reduce the amplitude of their signal, so that they try to keep the amplitude of the echo relatively constant."

Q4

How do you study echolocation?

"You study echolocation in many different ways. First of all, one way is to work with captive animals and you do various kinds of echolocation tasks. One simple task might be, you might ask a question, 'how far can a dolphin detect a target?' And so, you begin to put a target in front of the dolphin, then you train the dolphin to respond, first by echolocating and then by touching a paddle, and you reward the animal. Then you take the target and you put it further away from the animal and you continue to do that until the animal says 'I can't see it or I can't detect the target.' That's a very simple way of

studying echolocation. Another way of doing it is to do it in the field. When dolphins are foraging for prey for instance you can measure their echolocation signals and try to get some simultaneous video or maybe some sonar echoes of the dolphin and the prey just to study how they use the echolocation. And so there are different ways, it really depends on how imaginative you are and how well you can instrument, or get the data that you want to get. But it's very difficult in the field."

Q5

What challenges have you faced in studying the echolocation of dolphins?

"The main challenge I think is trying to understand what the dolphin is doing and why the dolphin's doing what it's doing. Often times we'll have a particular hypothesis and we are thinking, 'ah, the animals doing it this way' and the animals goes through the task and does it completely differently. So sometimes it gets frustrating, sometimes it's kind of interesting because it gives you insights in terms of what's going on. So it's really a very interesting field, it's continuously changing and what you do with the animal is something that you have to continually think about."

Q6

What has most surprised you about the echolocating abilities of dolphins?

"To tell you the truth I haven't been surprised by much because everything you do is sort of surprising in a sense, but after awhile you're not surprised at all because you say 'Well, what do you expect?' And, they are able to do so much that you would think wouldn't be possible, so after awhile you just become maybe immune to it and you just get inoculated...by it...and say 'ok, they can do this so let's study it more.'"

Q7

What skills are important in your area of research?

"I think the..., well, it's a multi-discipline field, so what is really important is you have to have someone that understands acoustics. That means someone that understands physics and mathematics. And then you have to have someone that understands electronics because you need electronic techniques to measure signals, measure echoes, measure targets, and things of that sort. And then you need a psychologist that can work with animals that can train an animal to do this or do that, some kind of behaviorist. And then you need a biologist, if you are working in the field in particular, to understand the ecology of the animal and the ecosystem the animal's in. And so it just takes a combination of several different kinds of people with different kinds of discipline and if you can merge the disciplines together then you get the best results."

Q8

What are the opportunities in the studying echolocating abilities of dolphins? Can people without PhD's participate in some way in this type of research?

"I think people without any kind of strong scientific training can still participate because when you work with a dolphin, say in captivity, there is so many things that has to be done. There are things like cleaning the pens, things like thawing the fish, making sure that the fish are weighed, making sure that someone is doing some kind of nutritional check on the fish. There's so many different things that needs to be done just to maintain some kind of operation and this is especially true with captive animals. But then if you are working in the field you have to have someone to drive the boat, someone to maintain the boat, someone to do those kinds of things. So there's so many different things that has to be done and in truth you really need to have trained people. Now, they don't have to be educated in the strict sense that we look how people are educated in academia, but they have to have some kind of skill. The skills might be working on the water, knowing how boats work, how to operate at night in the field, or how to do carpentry or how to do painting, or various kinds of things. There's so many things have has to be done, but it requires skill."

Q9

What is the greatest impact/relevance of your research?

"I think just understanding how dolphins utilize sonar and what kind of signals they use, what kind of capabilities they have. I think that these provide baseline or basic information that eventually, as we get smarter as a society, we'll begin to be able to tap into that informational pool, the knowledge base, and do things better, especially in terms of developing better sonar."

Q10

What continues to inspire you about your work?

"It's fun, and if it wasn't fun then I wouldn't be doing it. And why it's fun is because we are continuously doing something different. It's not something that you just do the same thing from day to day or from week to week. But, we're always thinking about new ways of doing things and trying new techniques and trying new ways of analyzing data, trying new ways of just getting better data. And, so it's a real challenge and it's kind of like a challenge that you wake up in the morning and you just kind of wonder, 'gee, what's next,' and 'what are we going to do today,' and it's really interesting."

Q11

What advice would you give a high school student who expressed an interest in pursuing a career in your field?

"I would say study, study, study. There's no substitute for that. You only can get information if you have some information yourself. You only can get to do research if you know what's happened in the past. So you need to just increase the knowledge base that an individual has, whether it be in math, in physics, in biology, psychology, whatever it is. The more you know, the more you can know, basically, and so that's really important."