



Biology: uniformity and diversity

Spiders Academic Commentary

Narrator:

Spiders can exploit all environments and have unique abilities. With eight legs and not six, they shouldn't be confused with insects. As David Robinson, a Zoologist at the Open University explains.

David Robinson:

People often call spiders insects. It offends professionals. Because they are very different. They have different origins. They have very different structures. And it may seem to a member of the general public that the distinction between the number of legs isn't really a very important one. But behind that there are substantial differences in body structure.

Narrator:

And with advances in technology, scientists have gained new and better insights into that body structure. And they way spiders make webs and move.

DR:

New technology has provided us with very interesting ways of looking at spiders and how they move. Freeze frame filming, high speed photography. These all show things that you can't see just by sitting and watching. I think when you watch a spider making a web, you think that this is a very complicated process. And although some of the things look repetitive, you feel that there's a complexity there that might be difficult to understand. And what the work on Theseus of the cyber spider showed, was that you could have just a small number of decisions. It really was quite a short decision tree. And that would generate the majority of the features of the spider's web.

And so there it's new technology allowing you to simulate, when spiders walking and jumping, then I think it's new technology that enables you to visualise.

Narrator:

You can watch a spider running across the surface of a pond, but it's high speed photography that has enabled scientists understand how the spider manages to get a purchase on the pond's slippery surface.

DR:

When they're travelling across the surface of water, they're able to use the tension in the water's surface so that they can of course support themselves and not sink in. But also they can make use of it, to actually jump slightly above the water surface, and then fall back on, and not go under. And then do that again. It's a very impressive. I can try and describe it of course, but it's much better if you look at clips of high speed film, that's then been slowed down to see how they make impressions in the water. And they can do this because the legs are hydrophobic, they reject water. And so they don't get themselves wet. And so the surface film on the water remains intact.

Narrator:

Scientists do focus on spiders legs. They use their legs to make their webs. And spiders are constantly receiving feedback from receptors in those legs.

DR:

And it's the information probably that is coming back from particularly the tip of the leg, and the joints in the leg, which tells the spider, what the legs in contact with. And the angle at which the leg makes with say a water surface or a piece of silk. It's getting feedback all the time about it's environment through the legs.

Narrator:

Scientists are steadily increasing their knowledge of the neurology of the spider.

DR:

We have some hope of getting closer to how the neural system is controlling the way they behave. You're always looking in zoology for models that you can use. Which are relatively simple but which will help you to find out the more fundamental and basic principles. And since all nervous systems operate essentially in the same way, we can get quite a lot of information from spiders, about how in general nervous systems work. How sensory systems work, and how decision making processes occur.

Narrator:

There has always been great interest in spiders' capacity to form silk. Which they use not only to make an extraordinary variety of webs, as safety lines when falling through air or jumping. And to surround and protect their eggs. But now there is an interest in silk for its own sake, as a protein that forms threads with a high tensile strength.

DR:

The people who are interested in its molecular structure, and the way in which it's extruded by spiders. Because it might then be possible to make artificial silk with all the properties of the different spider silks. Because it will be highly flexible, yet very strong. Fritz Vollrath has suggested, I'm not quite sure how seriously, that if you made up something like a bullet proof vest or something like that, the silk might actually stop a bullet. But it would stop it by expanding and flexing and would hold it. But of course it would still have travelled quite a distance.

Narrator:

And our knowledge of spiders will increase it seems as new advances in the electronics industry continue.

DR:

Certainly the miniaturisation that's gone in the electronics industry has transformed certain areas of biology. It's not quite possible yet, but I'm sure it will be possible to mount little radio transmitters on spiders. And to follow them, to tag them effectively. And then further into the future, maybe we can tap into their nervous systems, and with a little transmitter on in the back, actually pick up the signals.

There has been some work done on trying to link in miniature computer into the nervous system of a cockroach. Making a sort of strange hybrid. These sort of experiments will continue. They will get easier.. well not easier to do, but the technology will get smaller which will enable them to be carried out.

Narrator:

So with growing knowledge and new insights about spiders, will we begin to find them more fascinating than fearsome.

DR:

I find spiders fascinating. They're fascinating to watch. And their abilities to move and to use silk are just tremendously impressive. It would be nice to think that people could learn to love spiders and that we could change our culture. And not be at all concerned about the spider in the bath, and the spider in the house. I'm not sure that is going to happen. There is something about spiders that seems to worry us. Whether it's the fact that they can move so fast. Whether it's the fact that of course in some parts of the world, there are venomous spiders. And therefore you are right to be frightened of them. I don't know. But certainly in Britain we shouldn't be scared of spiders at all. We should learn to love them. And I think we should spend a lot of time just watching and learning about them for ourselves, rather than just saying 'Oh dear, there's a spider. How can I get rid of it'.