

Shaken-up bees forgo life's pleasures

By Branwen Morgan for ABC Science Online

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Being stressed has predictable consequences: a pessimistic outlook and a loss of interest in what are normally pleasurable activities.

According to researchers from Newcastle University, England, it is no different for the humble honey bee.

Their research, published online today in the journal [Current Biology](#), shows for the first time that an invertebrate can exhibit similar physiological and behavioural changes to humans who are anxious or depressed.

Lead author Dr Melissa Bateson says when we are feeling anxious or depressed, we make very different decisions from when we are happy, and interpret ambiguous signals as negative.

"For example, if a friend says they are too busy to meet me, I might interpret that they don't like me rather than just that they don't have time," she said.

Dr Bateson had previously shown similar effects in birds and rats.

"When they are in a bad state, they tend to be more pessimistic, just like humans," she said.

"One day we thought, what about insects?"

This led to a collaboration with bee expert Dr Jeri Wright. Dr Bateson's team trained more than 100 worker bees to associate a sugar solution with one particular odour and a bitter solution of quinine with another related odour - both made from a mixture of 1-hexanol and 2-octanone.

They also measured the levels of dopamine, serotonin and octopamine in the bees' haemolymph, a blood-like fluid. In humans, lower levels of the neurotransmitters dopamine and serotonin are associated with a depressed state.

Quick learners

Bees were collected from the hives and cooled, to render them inactive, and then placed into tiny plastic slings made from standard pipette tips. They are then secured with a small piece of gaffer tape and warmed up to begin training.

The bees quickly learnt to discriminate the two odours, sticking out their proboscis (tongue) when they smelt



The bees were much more pessimistic in how they judged ambiguous signals when they were stressed. (flickr.com: Richard Towell)

the odour that was associated with the sugar reward. Following the 15-minute training session each bee was placed into a test environment.

"We split them into two groups, one that was stressed by shaking [for 60 seconds] and the other that was left in peace [controls]," said Dr Bateson.

"They were then tested with five odours, two of which were the original odours used in the training, and another three that were additional blends of the two compounds. We could tell by when the bee stuck its tongue out as to what it thought about these particular novel odours.

"We found that when bees are agitated by being shaken, which we thought would be a bit like having the hive attacked by a predator, they actually became much more pessimistic in how they judged ambiguous signals.

"They were much less likely to stick out their tongue for the odours that were nearer to the negative one that predicted quinine."

Dr Bateson says the results can be interpreted to mean that the "anxious" bees had a greater expectation of being "punished" with the bitter quinine. In addition, these bees had lower levels of dopamine, serotonin and octopamine.

Insects have feelings too

"This is really interesting because it seems that the pessimistic decision making is a hallmark of anxiety that runs across all species," explains Dr Bateson.

Professor Mandyam Srinivasan, of the Queensland Brain Institute agrees.

He says it is a lovely study that further illustrates that the artificial distinction between the feelings of animals with and without a backbone is gradually disappearing.

"The more we look at these creatures, the more we find that they are not that different from the higher order creatures," he said.

"It's very hard to prove any animal is feeling emotion, but what you can do is measure all the behavioural correlates and all the physiological parameters, and, if there are strong parallels, the evidence is very strong that the animal is feeling what we ascribe as emotion."

Dr Bateson says this makes her findings "quite exciting".

"It suggests we could use animals, like a bee, as a model for studying effects of drugs being developed for humans. That's a little way in the future, but it's an obvious use for this research."

The team are now testing whether the bees have the same response during other stressful conditions, such as the presence of alarm pheromones, and whether "happy" or excited bees are more optimistic.

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