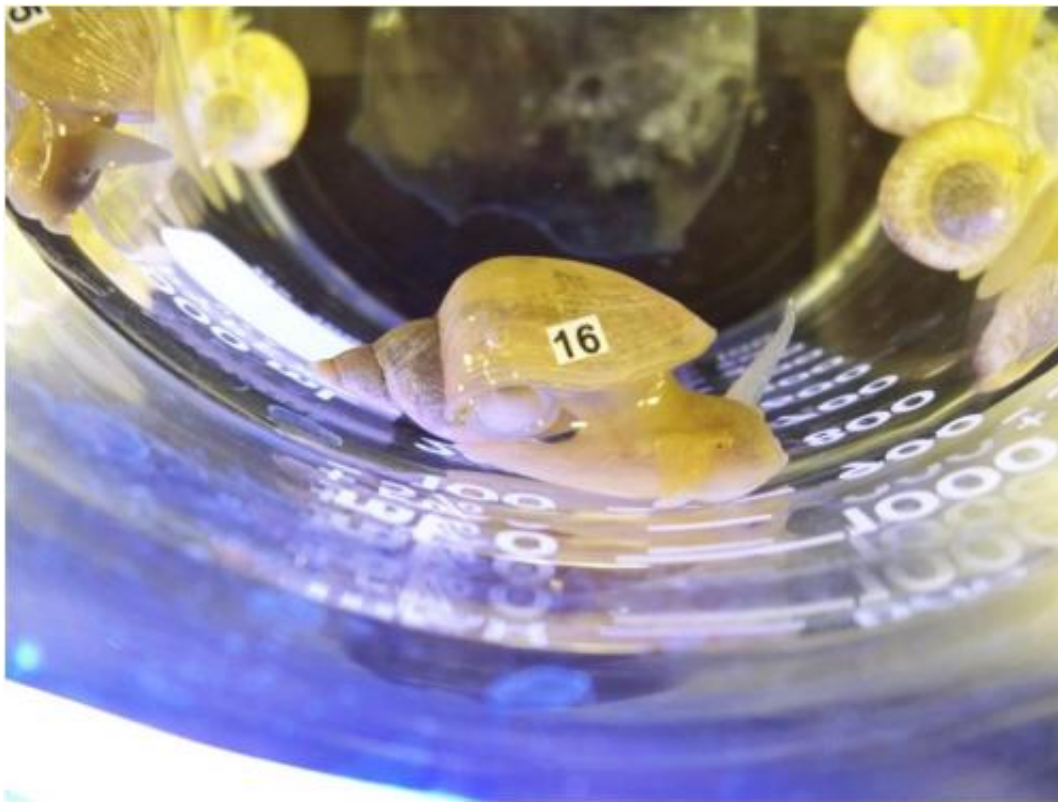


Snail study reveals that stress is bad for memory

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New research on pond snails has revealed that high levels of stress can block memory processes. Credit: Sarah Dalesman, University of Exeter

New research on pond snails has revealed that high levels of stress can block memory processes. Researchers from the University of Exeter and the University of Calgary trained snails and found that when they were exposed to multiple stressful events they were unable remember what

they had learned.

Previous research has shown that stress also affects human ability to remember. This study, published in the journal *PLOS ONE*, found that experiencing multiple [stressful events](#) simultaneously has a cumulative detrimental effect on [memory](#).

Dr Sarah Dalesman, a Leverhulme Trust Early Career Fellow, from the University of Exeter, formally at the University of Calgary, said: "It's really important to study how different forms of stress interact as this is what animals, including people, frequently experience in real life. By training snails, and then observing their behaviour and brain activity following exposure to [stressful situations](#), we found that a single stressful event resulted in some impairment of memory but multiple stressful events prevented any memories from being formed."

The pond snail, *Lymnaea stagnalis*, has easily observable behaviours linked to memory and large neurons in the brain, both useful benefits when studying [memory processes](#). They also respond to stressful events in a similar way to mammals, making them a useful model species to study learning and memory.

In the study, the pond snails were trained to reduce how often they breathed outside water. Usually pond snails breathe underwater and absorb oxygen through their skin. In water with low oxygen levels the snails emerge and inhale air using a basic lung opened to the air via a breathing hole.

To train the snails not to breathe air they were placed in poorly oxygenated water and their breathing holes were gently poked every time they emerged to breathe. Snail memory was tested by observing how many times the snails attempted to breathe air after they had received their training. Memory was considered to be present if there was a

reduction in the number of times they opened their breathing holes. The researchers also assessed memory by monitoring neural activity in the brain.

Immediately before training, the snails were exposed to two different stressful experiences, low calcium - which is stressful as calcium is necessary for healthy shells - and overcrowding by other pond snails.

When faced with the stressors individually, the pond snails had reduced ability to form long term memory, but were still able to learn and form short and intermediate term memory lasting from a few minutes to hours. However, when both stressors were experienced at the same time, results showed that they had additive effects on the [snails'](#) ability to form memory and all learning and memory processes were blocked.

Future work will focus on the effects of stress on different populations of [pond snail](#).

More information: [dx.plos.org/10.1371/journal.pone.0079561](https://doi.org/10.1371/journal.pone.0079561)

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