

Intelligent? Brainless slime can 'learn': study

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Physarum polycephalum. Credit: frankenstoen/Wikipedia

What is intelligence? The definitions vary, but all infer the use of grey matter, whether in a cat or a human, to learn from experience.



On Wednesday, scientists announced a discovery that turns this basic assumption on its head.

A slime made up of independent, <u>single cells</u>, they found, can "learn" to avoid irritants despite having no central nervous system.

"Tantalizing results suggest that the hallmarks for learning can occur at the level of single cells," the team wrote in a paper published in the journal *Proceedings of the Royal Society B*.

For the study, researchers from Belgium and France sought to demonstrate "habituation learning" in a brainless organism.

Habituation learning is when original behaviour changes in response to repeated stimulus—think of a human losing their fear of needles after being repeatedly exposed to them in phobia therapy.

The team wanted to see whether an organism without a nervous system could similarly "learn" from experience and change its behaviour accordingly.

They chose a very humble life form indeed—Physarum polycephalum, also known as "many-headed slime".





A handout picture released by the French National Centre for Scientific Research on April 27, 2016 shows a single-celled protist Physarum polycephalum

Single P. polycephalum cells meld into a single, yellow blob—specimens of which can be found on decaying leaves and tree trunks in cool, moist spots.

The slime moves from place to place, albeit very slowly, by extending



finger-like protrusions called pseudopods.

The scientists grew slime samples in petri dishes containing a gel made of agar, a jelly-like substance derived from algae.

They then placed each sample near another <u>petri dish</u> containing a meal of oats, also in agar gel.

The two dishes were separated by an agar gel "bridge" for the slime to "crawl" across, which it generally did within about two hours.

For the experiment, the team then polluted a part of the "bridge" with quinine or caffeine in concentrations that were bitter, but not harmful, to the slime.



Scientists have found that a slime made up of independent, single cells can "learn" to avoid irritants despite having no central nervous system



The slime "showed a clear aversive behaviour" at first, they observed. It hesitated, then took more than three times as long to cross the bridge by a very narrow path as it sought to avoid touching the offensive substance.

In the days that followed, the crossings became quicker—evidence that the <u>slime</u> became "habituated" to the quinine or caffeine, said the team.

These findings in an organism that preceded humans on Earth by some 500 million years, suggests that "learning" may predate the emergence of nervous systems, said the researchers.

"Our results point to the diversity of organisms lacking neurons," they wrote, "which likely display a hitherto unrecognized capacity for learning."

The discovery may boost understanding of the behaviour of other simple organisms like viruses and bacteria.

More information: Habituation in non-neural organisms: Evidence from slime moulds, *Proceedings of the Royal Society B: Biological Sciences*, <u>rspb.royalsocietypublishing.or</u>1098/rspb.2016.0446

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