The slime that 'learns' WITHOUT a brain: Cells that change their behaviour could rewrite what we know about evolution

Slime moulds are single celled creatures which join together in one mass
Researchers found the moulds learned to overcome 'fear' of substances
They say that this illustrates a type of learning called habituation
Slime moulds don't have brains or central nervous systems, so scientists said the findings may hint at the earliest evolution of learning

If you go down to the woods today you're sure to get a surprise – in the form of a weird pulsating slime that can dodge harm.

Researchers have found a yellow slime mould that feeds off fungi and bacteria in forests can learn, despite not having a brain or central nervous system.

Made up of individual single-celled organisms which group together to form a 'multi-headed' slime, scientists said the strange yellow slime mould's ability to learn turns evolution on its head.

Researchers have found a yellow slime mould (picture) which feeds off fungi and bacteria in forests can learn, despite not having a brain or central nervous system

Scientists studying the slime mould said it is the first time an organism without a central nervous system has demonstrated it is capable of learning.
Yellow slime moulds (Physarum polycephalum) are part of strange branch of the tree of life called protists, which are distant relatives of plants, animals and fungi.

While they are single-celled organisms, like bacteria, they join together to form a plasmodium, which slowly creeps and pulsates its way around the forest in the search for food.

![Image of yellow slime moulds](image)

The moulds learned to overcome 'fear' of harmless substances after having to face them several times, in a type of learning which scientists call habituation.

When it encounters something it can eat it exudes digestive enzymes and absorbs the nutrients. Over the course of a nine-day experiment, scientists challenged different groups of the mould to bitter substances which they were not keen on, but which wouldn't do them any damage.

Researchers at the University of Toulouse found that the cell learned to overcome its 'fear' of harmless substances after having to face them several times, in a type of learning which scientists call habituation.

In a setup, moulds in one Petri dish moved to another, having to cross an obstacle to reach a food source in the second dish.

The moulds had to cross a 'bridge', which in one of the trials was coated in a bitter substance, either caffeine or quinine.

While initially the slime moulds avoided the bitter bridge, they gradually realised it was harmless, and after just six days acted the same as the control group. However, after two days without contact with the bitter substance, the moulds reverted back to distrust.
What's more, when they taught the moulds to distrust one bitter substance, the researchers found they would automatically distrust another bitter substance.

As the slime moulds are such a primitive part of the tree of life - appearing on Earth some 500 million years before the earliest humans - the findings hint at the earliest beginnings of learning. Researchers add that it also offers an opportunity to study learning in other very simple organisms, such as viruses or bacteria. The findings are published in the journal Proceedings of the Royal Society B.

**EARLIEST ORIGINS OF LEARNING?**

Researchers in France found that the slime moulds learned to overcome its 'fear' of harmless substances after facing them several times.

They say that this illustrates a type of learning called habituation. As slime moulds are such a primitive part of the tree of life, evolving before animals, the findings hint at the earliest beginnings of learning. If this is the case, scientists said it could lead to studying learning in simpler organisms, such as bacteria and viruses. What's more, some groups believe that modelling nanbots on slime moulds could lead to synthetic materials which could be used in a range of applications - such as a robotic slime which searches out damaged surfaces and repairs them, or even which hunts cancer inside the body.