

## **Investigating *C. elegans* Learning as a Possible Approach to the Study of Consciousness**

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To study the mechanisms of consciousness, it would be useful to identify a highly manipulable organism that has perception, a key element of consciousness. I define perception to mean the ability to have an inner, qualitative experience of one's environment, beyond simply sensing and responding. Perception is the subjective experience of what something feels like, such as sugar tasting sweet, snow feeling cold, and 700 nm light looking red. One way to determine whether an organism is capable of perception is to determine whether it can be aware of its surroundings. In people, awareness can be measured indirectly by a trace conditioning experiment. In this experiment, a neutral stimulus is presented and removed, and after an appropriate period of time a different, aversive stimulus is presented and removed. Each trial is repeated many times. A person is said to have learned if she starts responding to the neutral stimulus in an aversive way. On average, those who successfully learn are aware, meaning that they verbally report that the neutral stimulus (e.g. sound) predicts the aversive stimulus (e.g. an air puff to the eye or an electric shock). Note that if there is no temporal delay between the stimuli, learning no longer correlates with awareness (Clark & Squire, *Science* 1998; Carter *et al.*, *PNAS* 2003).

Since trace conditioning correlates with awareness, it might be possible to use this type of learning to test whether non-verbal organisms have the ability to perceive. I plan to investigate whether *C. elegans* can perform trace conditioning. Specifically, I plan to pair a neutral odor with carbon dioxide, which causes locomotion reversals (Hallem & Sternberg, *PNAS* 2008). If the presentation of the neutral odor alone is sufficient to induce reversals after the training period, I plan to screen for worms that cannot perform this task. In this way, I hope to identify genes and cells required for trace conditioning in worms. Perhaps these same genes will also be involved in perception and consciousness in worms and other animals.

Poster

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