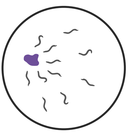
Odor-dependent temporal dynamics in *Caenorhabitis elegans* adaptation and aversive learning behavior

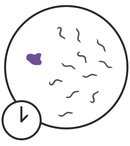
INTRODUCTION

Animals sense an enormous number of cues in their environments, and, over time, can form learned associations and memories to some of these. The nervous system remarkably maintains the specificity of learning and memory to each of the cues.



Attraction

The nematode *Caenorhabditis elegans* is **attracted to many odors**.



Adaptation and Aversive Learning

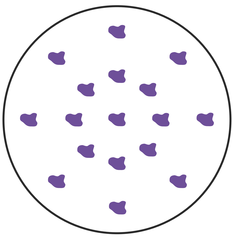
Persistent odor stimulation in the **absence of food results in a decreased attraction** called “adaptation”. An **association between odor and food deprivation forms**, called “aversive learning”. The resulting change in behavior is stable and long-lasting.

Here we asked whether the nematode *Caenorhabditis elegans* adjusts the temporal dynamics of adaptation and aversive learning depending on the specific odor sensed.

METHODOLOGY

C. elegans senses a multitude of odors, and adaptation and learned associations to many of these odors requires **activity of the cGMP-dependent protein kinase EGL-4 in the AWC sensory neuron**.

We identified **a panel of 17 attractive odors**, some of which have not been tested before, and determined that the majority of these odors require the AWC primary sensory neuron for sensation. We then **devised a novel assay to assess odor behavior over time** for a single population of animals.



RESULTS

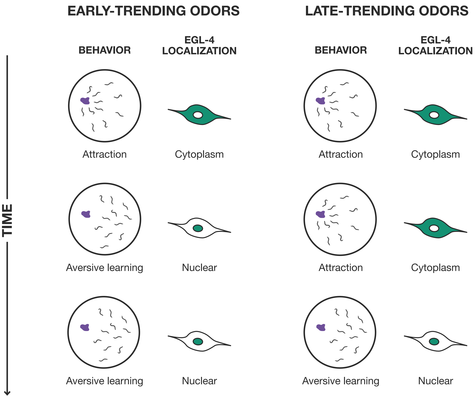
Temporal dynamics

We used the novel assay to evaluate the temporal dynamics of aversive learning to 13 odors and found that **behavior change occurs early in some odors and later in others**.

EGL-4 localization

We then examined EGL-4 localization in early-trending and late-trending odors over time.

We found that the timing of these behavior changes correlated with the timing of nuclear accumulation of EGL-4 in the AWC neuron suggesting that **temporal changes in behavior may be mediated by aversive learning mechanisms**.



CONCLUSION

We demonstrate that temporal dynamics of adaptation and aversive learning in *C. elegans* can be used as a **model to study the timing of memory formation to different sensory cues**.

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