# Function of Protein Kinase C-1 in memory in *Caenorhabditis elegans*

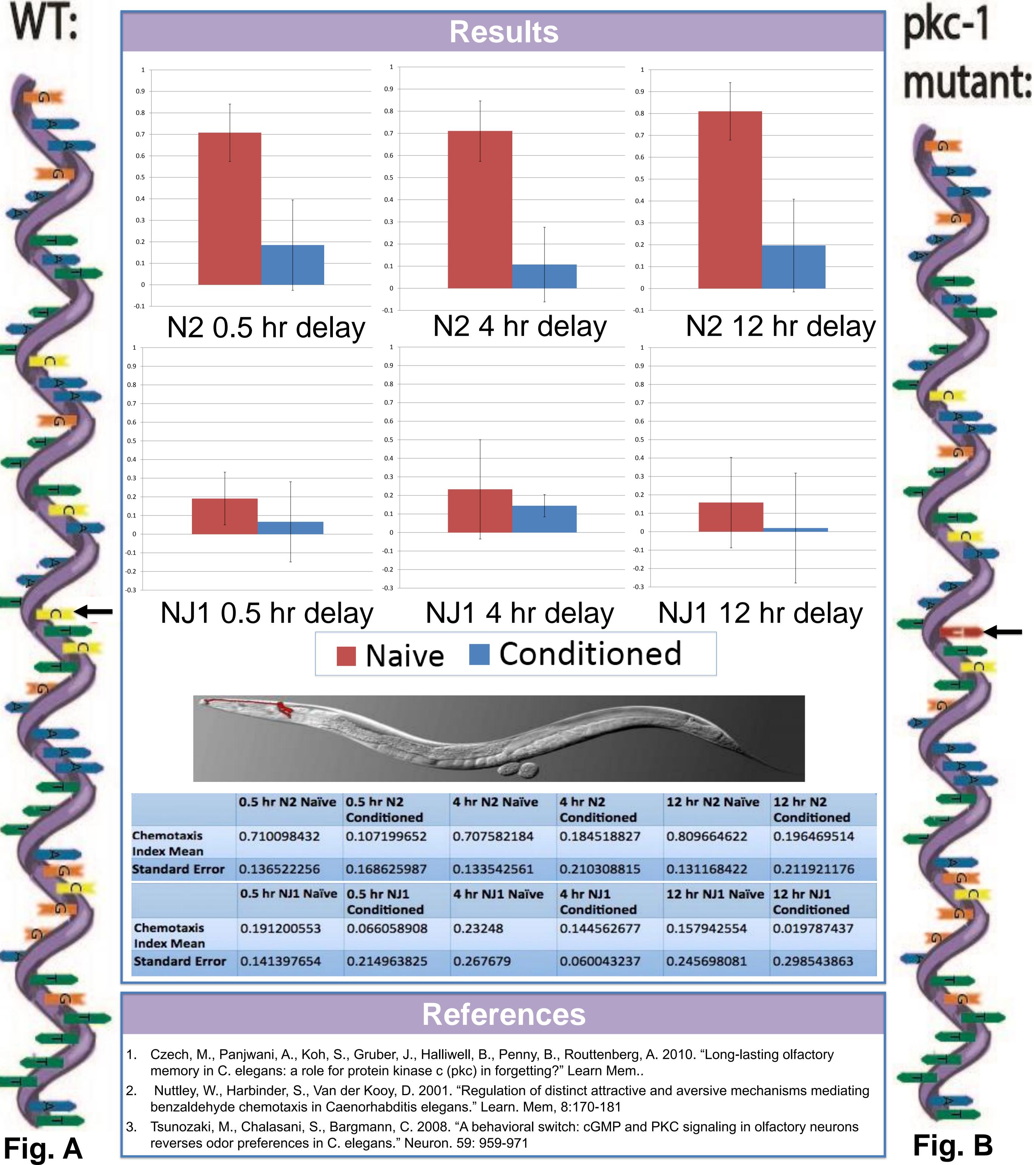
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#### Abstract

To study long lasting olfactory memory in C. elegans, we conditioned the nematodes to form an association between the odorant benzaldehyde and starvation. Assays that utilized their naïve attractive response were performed on N2 wild-type *C. elegans* and the pkc-1 mutant nj1, to determine how long the effects of the associative conditioning to these odors would last. We compared chemotaxis indices following conditioning for delay periods of 30 min, 4 hours, and 12 hours. We found that wild-type *C. elegans* form food-odor associations and retain them for at least 12 hours. Results show that nj1 displays less of a reduction in affinity following conditioning as compared to wild-type, which demonstrates an impairment in memory. Our results also showed a decreased affinity towards benzaldehyde in naïve nj1 nematodes, suggesting an impairment in the olfactory pathway. Thus, nj1 show not only impairments in food-odor associative memory, but potentially impairments in the olfactory pathway as well.

### Background

Caenorhabditis elegans are microscopic soildwelling nematodes that are frequently used in neurobiological research because 83% of their genetic makeup is homologous to that of humans. Moreover, C. *elegans* have the capacity to recognize and remember environmental cues that predict the presence of food, thus allowing for the design and implementation of a wide variety of food association experiments. Mammalian PKC has been known to play a role in intracellular signaling in memory formation processes. The pkc-1 gene found in *C. elegans* is homologous to mammalian gene, pkc-epsilon. The pkc-1 mutant, nj1, has a missense mutation replacing a conserved amino acid in the kinase domain (see figures A and B), making it a prime subject for analysis of the function of pkc-1 in C. elegans.



## Methods

- Three-day-old adult worms were placed onto a circular CTX media plate for pre-exposure to 2 µL of 100% benzaldehyde for 1 hour.
- Animals were deposited on a fresh CTX media plate for a designated delay period
- Animals were then washed with DI water and placed at the center of a square grid CTX plate to conduct a chemotaxis assay.
- Two equidistant test spots had the immobilizing agent sodium azide placed on it followed by the application of 1uL of 1:100 benzaldehyde at one spot and 1uL of 100% ethanol at the other.
- After allowing 1 hr for migration, quantitative measures of the number of *C. elegans* at each test spot were taken.
- Chemotaxis towards the test spots was assessed through a modified chemotaxis index (CI), which is calculated through the equation:

[(# at odorant spot) – (# at ethanol spot)] / [(# at odorant spot) + (# at ethanol spot)]

### Discussion

- The results show that the NJ1 mutants still retain their capacity to remember, even after 12 hours. Further assays need to be conducted at longer delay periods before reaching conclusions about the relationship between pkc-1 and memory. However, the reduction in CI in conditioned NJ1 mutants in comparison to the wild-type may suggest an impairment.
- There is an overall reduction in CI across all naïve NJ1 mutants. This indicates a potential impairment in the olfactory pathway, potentially a reduced sensation by the AWC<sup>ON</sup> and/or AWC<sup>OFF</sup> olfactory neurons, found to sense the odorant benzaldehyde. Further research can assist in pinpointing this location.