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## **Drosophila Antennal Lobe Projection Neurons Encode the Acceleration of Time-Varying Odorant Concentrations**

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Motile animals exhibit robust odor-guided behaviors in a spatial odor landscape, and many such behaviors are elicited by a time-varying profile of odorant concentrations. Little is known, however, how such odor experiences lead to a rich repertoire of odor-guided behaviors. We thus studied what time-varying features of olfactory stimuli are represented by olfactory circuits and how such time-varying neural representations are transformed from one brain region to the next in the early olfactory system of *Drosophila melanogaster*.

Using a novel odor delivery system, we obtained in-vivo electrophysiological recordings from olfactory sensory neurons (OSNs) and their post-synaptic projection neurons (PNs) in response to a variety of time-varying odorant waveforms. The data from three odorant-OSN-PN triplets highlights the existence of significant transformations of olfactory information representation in both the OSN and PN layers, with both layers strongly emphasizing the rate-of-change component of their input. Taken together, these transformations lead to the computation of the second time derivative, or acceleration, of odorant concentration waveforms. When coupled with the movement of the animal in space, these transformations may endow an animal with the ability to rapidly detect concentration edges, or odorant boundaries in space.