Oral

[3O09m-3]Olfactory System

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*Videos are available throughout the meeting period.

[3O09m-3-01]Encoding of an innate value of odors by dopaminergic neurons

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The activity of dopaminergic neurons (DANs) has been most extensively studied in the context of associative learning. Specifically, DANs have been shown to respond to an unconditioned stimulus and a conditioned stimulus as it becomes predictive of the value of unconditioned stimulus through learning (Schultz et al., 1997; Eshel et al., 2015). However, a conditioned stimulus, especially an odor, is associated with an innate value because it can evoke approaching or avoiding behavior even without learning (Badel et al., 2016). Whether and how DANs represent such innate value of odors remain largely unknown. Here, we addressed these issues using an olfactory system of Drosophila melanogaster as a model. We focused on the DANs innervating the mushroom body (MB) where the olfactory information is modulated by reward or punishment (Aso et al., 2014). The MB comprises 15 compartments, each of which receives input from a distinct type of DANs and provides a place for synaptic modification underlying learning. We performed two-photon Ca2+ imaging to record the responses of DANs in all the 15 compartments to a panel of 27 odors with various values quantified based on the innate approach or avoidance behavior (Badel et al., 2016). We found that DANs differentially respond to attractive and aversive odors; the activity of DANs in specific compartments was correlated positively or negatively with the value of odors. Regression analysis showed that information about the value of odors can be decoded from the activity of DANs, and DANs in each compartment have specific contributions to the encoding of odor values. These results suggest that DANs drive not only associative learning but also moment-to-moment adaptive behaviors in an olfactory environment. In this presentation, we plan to discuss the neural circuit mechanism that gives rise to the odor-evoked activity of DANs.