# Abstract/Session Information for Program Number 14

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## Abstract Content

Program Nr: **14**

Tyramine Modulates Foraging Behavior and Head Movements. **Mark J. Alkema**, Melissa Hunter-Ensor, Niels Ringstad, Bob Horvitz. HHMI, Dept. Biology, MIT, Cambridge, MA 02139, USA.

Tyramine and octopamine are biogenic amines implicated in several invertebrate behaviors. Tyramine biosynthesis requires the decarboxylation of tyrosine. Octopamine is synthesized by subsequent β-hydroxylation of tyramine. We obtained mutant strains carrying deletions in a putative *C. elegans* amino acid decarboxylase gene (*tdc-1*) (gifts from M. Dong and M. Koelle) and a tyramine-β-hydroxylase gene (*tbh-1*). Using HPLC analysis and radioenzymology we showed that both the *tdc-1* and *tbh-1* deletion mutants lack octopamine, indicating that *tdc-1* and *tbh-1* are required for octopamine biosynthesis. Furthermore, we showed that TDC-1 can decarboxylate tyrosine *in vitro*. TDC-1 and TBH-1 expression overlap in the RIC interneurons and the gonadal sheath cells. TDC-1, but not TBH-1, is expressed in the RIM motor neurons and four UV cells. The co-expression of TDC-1 and TBH-1 suggest that the RIC interneurons and gonadal sheath cells are octopaminergic, whereas the RIM motor neurons and UV cells are tyraminergic.

*C. elegans* foraging behavior consists of forward locomotion interrupted by brief reversals. *tdc-1* mutants, unlike *tbh-1* mutants, have a marked increase in spontaneous reversals, suggesting that *tdc-1* plays a role in the regulation of backward and forward locomotion. Foraging is usually accompanied by oscillatory head movements. In wild-type animals these head movements are suppressed when backward locomotion is induced by anterior touch. *tdc-1* but not *tbh-1* mutants fail to suppress head movements during backward locomotion. We characterized the neural circuit underlying the modulation of foraging behavior and head movements by laser ablation studies. Ablations of the RIMs but not the RICs increased spontaneous reversals. In addition, animals in which the RIMs are ablated fail to suppress head movements upon anterior touch. The RIMs synapse onto the head muscles and the RMD and SMD motor neurons. The RIMs also synapse onto the AVB forward command neurons and are connected by gap junctions to the AVA backward command neurons. Our ablation experiments indicate that the RIMs link suppression of head movements to a backing response mediated by anterior touch. We hypothesize that tyramine controls foraging and head movements by acting as an inhibitory neurotransmitter on the head muscles and interneurons that coordinate backward and forward locomotion. To identify new factors that function in tyraminergic signaling we screened for mutants that fail to suppress head movements upon anterior touch. We have identified over 50 mutants, which we are characterizing and assigning to complementation groups.

## Session Information

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## Abstract Information

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