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The Regulatory Mechanisms of Ion Response and Extracellular Ionic Milieu of a Salt-Sensing Neuron that Dictate Taste Preference.

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Summary

Taste preference is determined by dietary habits. However, neural substrate that underlies formation of taste preference, such as synaptic regulation that directs different behavioral preference of food, is not fully understood. Since taste learning is necessary for animals to effectively search for food, such ability is equipped in the animals with a simple nervous system. The soil nematode *Caenorhabditis elegans* migrates toward the salt concentration at which it has been fed, while avoids the concentration at which it experienced starvation.

To understand the molecular mechanisms that regulate synaptic plasticity contributing to the bi-directional, experience-dependent salt chemotaxis behavior, we performed simultaneous monitoring of neural activity and locomotion of animals while delivering salt stimulus using synaptic transmission mutants. We here demonstrate that the synapse between a gustatory neuron to a postsynaptic interneuron shows both excitatory and inhibitory transmission properties depending on previously experienced salt concentrations. This bidirectional neural response is mediated by glutamate released from the gustatory neuron. Glutamate acts through an AMPA-type excitatory glutamate receptor and an inhibitory glutamate-dependent chloride channel, both acting in the interneuron. These findings suggest that experience-dependent synaptic plasticity is generated by altering the excitatory and inhibitory postsynaptic signals from a sensory neuron to interneurons.