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Identification of a Gustatory Receptor for an Aversive High Salt

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Summary

Gustatory taste perception has an important role on evaluating the nutritional value, quality and toxicity of food. Mammalians can detect five basic tastes; sweet, umami, bitter, sour and salty. Among these tastes, sweet, umami and low concentrations of salt are innately attractive, whereas bitter, sour and high concentrations of salt are aversive to animals. Salty is unique that the taste triggers two opposing behavioral responses. Recent studies revealed that the cellular and molecular basis of these two salty tastes (i.e. attractive low salt and aversive high salt tastes) are quite distinct each other. Low salt taste employs dedicated taste receptor cells (TRCs) and epithelial sodium channel (ENaC) is considered as a receptor. While high salt does not have dedicated TRCs and uses bitter and sour cells to detect the aversive taste. Gustatory receptor molecule(s) for the aversive high salt taste are still unknown.

In this study, we found a candidate taste receptor for high salt and examined the function and expression of the gene product. The gustatory behavior of mouse mutant for the candidate receptor was examined by two-bottle preference test widely used for evaluating taste response. The mutant showed reduced aversive responses against high salt, bitter and sour, and showed normal response to sweet, umami, and attractive low salt. The molecular function of the candidate receptor was examined by using Caenorhabditis elegans as an exogenous expression system. In the ASG chemosensory neuron of the transgenic worm harboring mammalian candidate receptor acquired a neuronal response against 300 mM NaCl that elicits no response in the neuron of wild-type worm. Although, we could not detected the expression of the candidate receptor gene in taste tissue by in situ hybridization in this attempt, these results suggested the candidate receptor, which can detect extracellular high salt, might be involved in gustatory aversive taste perception.