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Identification of Salt-Responsive Taste Receptor Cells and Analysis of Their Functions

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Summary

Taste signals arise on reception of taste substances by taste receptor cells (TRCs) located in taste buds; these taste signals are transmitted to the gustatory neurons innervating the TRCs. In general, taste qualities are classified into 5 basic tastes: sweetness, umami, bitterness, sourness, and saltiness. Sweet, umami, bitter, and sour tastants are received by different TRCs. Approximately half of the taste bud cells are sweet-, umami-, bitter-, or sour-responsive TRCs. However, the physiological functions of the remaining taste bud cells are unclear. In particular, salt-responsive TRCs have not been identified. Almost all taste bud cells have one of voltage-dependent potassium channels, KCNQ1, indicating that their membrane potentials can be changed. Four basic tastes other than saltiness are received by different TRCs. These suggest that the taste bud cells other than the sweet-, umami-, bitter-, and sour-responsive TRCs could be the salt-responsive TRCs. The purpose of this study is to determine the molecular characteristics of the taste bud cells other than the sweet-, umami-, bitter-, and sour-responsive TRCs, in order to analyze their physiological functions.

Using the DNA microarray data on the isolated taste buds from rat circumvallate papillae and circumvallate papillal epithelia after dissection of taste buds, we obtained approximately 50 genes that are expressed at a higher level in the taste buds than in the epithelia. These included genes that are known to be expressed at a high level in taste buds. *In situ* hybridization analysis was performed to investigate the gene expression patterns in the taste bud cells. The mRNA signals of 17 genes were observed specifically in the taste bud cells. Double-labeled *in situ* hybridization analysis revealed that 2 genes were specifically expressed in taste bud cells other than the sweet-, umami-, bitter-, and sour-responsive TRCs.