Synaptic reformation between salt-sensitive taste cells and axons after denervation of mouse chorda tympani nerve and recovery of behavioral discriminability between sodium and potassium salts

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Summary

Synaptic reformation between taste cells and axons after denervation of the chorda tympani nerve was studied by examining recovery of behavioral discrimination between sodium and potassium salts and taste responses of regenerated chorda tympani nerve to salts and other taste stimuli in mice. In intact control mice, aversion condition to NaCl did not generalize to KCl. This discrimination disappeared when NaCl solution was mixed with amiloride, Na+ channel inhibitor. Single chorda tympani fibers (N-type fibers), specifically sensitive to NaCl, innervate amiloride-sensitive (AS), sodium responsive taste receptor cells, whereas E-type fibers, broadly responsive to various salts, innervate amiloride-insensitive (AI) taste cells. This suggests the importance of AS-N-type fibers for behavioral discrimination between sodium and potassium salts. About two weeks after denervation of the chorda tympani nerve, behavioral discrimination between NaCl and KCl disappered, and no significant responses to taste stimuli were observed in the chorda tympani. At about 3 weeks after denervation responses to salts recovered in both behavioral and neural measurements. However, no AS and the salt discirimination exhibited. At about 4 weeks after denervation, mice became discriminative between NaCl and KCl, and showed AS in NaCl responses of the regenerated nerve, although threshold of NaCl responses for AS was still considerably higher (0.1-0.3M) than control (0.01M). After more than a month, mice showed complete recovery in AS in neural responses and behavioral salt discrimination. These results suggest that behavioral discrimination between NaCl and KCl is parallel with AS in sodium-responsive taste cells. Synaptic reformation between AS taste cells and N-type regenerated axons may start from about 4 weeks and take more than a month for their complete synaptic reformation.