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Neural mechanism for salt-intake behaviours

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Summary

Na_x is an atypical sodium channel that is assumed to be a descendant of the voltage-gated sodium channel family. Our recent studies on the Na_x-gene-targeting mouse revealed that Na_x channel is localized to the circumventricular organs (CVOs), the central loci for the salt and water homeostasis in mammals, where the Na_x channel serves as a sodium-level sensor of the body fluid. To understand the cellular mechanism by which the information sensed by Na_x channels is transferred to the activity of the organs, we dissected the subcellular localization of Na_x in the present study. Double-immunostaining and immunoelectron microscopic analyses revealed that Na_x is exclusively localized to perineuronal lamellate processes extended from ependymal cells and astrocytes in the organs. In addition, glial cells isolated from the subfornical organ, one of the CVOs, were sensitive to an increase in the extracellular sodium level, as analyzed by an ion-imaging method. These results suggest that glial cells bearing the Na_x channel are the first to sense a physiological increase in the level of sodium in the body fluid, and they regulate the neural activity of the CVOs by enveloping neurons. Close communication between inexcitable glial cells and excitable neural cells thus appears to be the basis of the central control of the salt homeostasis.