Environmental alkalinity sensing mediated by the transmembrane guanylyl cyclase GCY-14 in *C. elegans*

Survival requires that living organisms continuously monitor environmental and tissue pH. Animals sense acidic pH using ion channels and G-protein-coupled receptors (GPCRs), but monitoring of alkaline pH is not well understood. We report here that in the nematode *Caenorhabditis elegans*, a transmembrane receptor-type guanylyl cyclase (RGC), GCY-14, of the ASEI gustatory neuron, plays an essential role in the sensing of extracellular alkalinity. Activation of GCY-14 opens a cGMP-gated cation channel encoded by tax-2 and tax-4 genes, resulting in Ca\(^{2+}\) entry into ASEI. Ectopic expression of GCY-14 in other neurons indicates that it accounts for the alkalinity sensing capability. Domain-swapping and site-directed mutagenesis of GCY-14 reveal that GCY-14 functions as a homodimer, in which histidine of the extracellular domains plays a crucial role in alkalinity detection. The Ca\(^{2+}\) entry into the cilia of ASEI induces depolarization of the ciliary membrane potential, which in turn activates L-type voltage-gated Ca\(^{2+}\) channels containing an EGL-19 a subunit for active propagation of electrical signals in the dendrite. These results argue that in addition to ion channels and GPCRs, RGCs also play a role in pH sensation in neurons.

**Biography**

Ichiro N Maruyama is a Professor at the Okinawa Institute of Science and Technology Graduate University (OIST). He received his PhD from The University of Tokyo, Japan. Subsequently, he was trained as a Post-doctoral fellow in MRC Laboratory of Molecular Biology, Cambridge, UK, where he started to work on the nematode *Caenorhabditis elegans* with an interest in its nervous system. He then moved to The Scripps Research Institute, La Jolla, California, USA, where he started to study molecular mechanisms underlying activation of cell-surface receptors. At OIST, he continues to work on learning, memory and decision-making in *C. elegans* as well as on molecular mechanisms of transmembrane signalling mediated by cell-surface receptors.

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