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Molecular Basis of CO_2 Sensing in the Mouse Olfactory System

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Summary

Carbon dioxide (CO_2) is an important environmental cue for many organisms. In mammal, mouse, rat and guinea pig have a CO_2 sensor in the olfactory epithelium (OE). Mice can detect CO_2 at concentrations around the average atmospheric level by olfaction. In the ventro-lateral region of the mouse OE, there is a unique subset of olfactory sensory neurons (OSNs), termed GC-D OSNs, which express carbonic anhydrase 2 (Car2) and guanylate cyclase-D (GC-D), instead of odorant receptor. In GC-D neurons, Car2 and GC-D function as a sensor for CO_2, urinary peptides and carbon disulfide (CS_2) that mediates food-related social learning. Recently, we found that at least two novel subsets of OSNs, which are not expressing Car2, respond to CO_2 as well. These results suggest that mice sense CO_2 with several subsets of sensory neurons in the OE. On the other hand, mice have the other olfactory organ, vomeronasal epithelium (VNE), which is important for the pheromone sensing. It is uncertain whether the VNE also plays a role in the CO_2 sensing. Interestingly, we recently found the novel CO_2-sensing neurons in the VNE. These results suggest that mice sense CO_2 not only with GC-D OSNs, but also with novel subsets of sensory neurons in the OE and VNE.