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SENSORY SYSTEMS

Smelling trouble

A low level of oxygen (O_2) in the environment is potentially life threatening, and therefore the ability to detect changes in environmental O_2 is an important evolutionary adaptation. How detecting reduced oxygen is achieved in mammals is unknown, but here Bleymehl *et al.* show that, in mice, a subpopulation of sensory neurons of the olfactory system, called type B cells, appears to perform this function.

In addition to detecting conventional odours, certain subpopulations of neurons in the main olfactory epithelium are specialized in detecting environmental cues. One of these subpopulations — type B cells, which uniquely express guanylate cyclase soluble subunit β2 (GUCY1β2) — is poorly understood. To investigate a possible role in O_2 sensing, the authors tested the response of dissociated mouse type B cells exposed to normal or reduced O_2 levels. They found that a reduction in O_2 tension in the perfusate below the equivalent of atmospheric O_2 produced a transient increase in intracellular calcium, which did not occur in cells from *Gucy1b2*$^{-/-}$ mice. In addition, this calcium response was attenuated in the presence of an inhibitor of soluble guanylate cyclases and also by application of an inhibitor of cyclic GMP-activated protein kinase (PKG). Given that GUCY1β2 is probably involved in the generation of cGMP, which can induce neuronal excitation by activating downstream cell signalling pathways, these data suggest that type B cells may transduce reductions in environmental O_2 through GUCY1β2-mediated rises in cGMP.

Therefore, the authors hypothesized that these cells might be part of the 'warning system' for low environmental O_2 and might drive aversive behaviour. To test this hypothesis, the authors then used a conditioned place-aversion model. Mice were trained to associate one chamber with 16% O_2 and another chamber with normal levels of O_2 (20%) and, during the test, were allowed free access to both chambers (at normal O_2 levels). Control mice (but not *Gucy1b2*$^{-/-}$ mice) spent significantly less time in the chamber associated with 16% O_2 than in the other chamber, indicating that they found the 16% O_2 condition aversive. Overall, these findings suggest a new and unanticipated role for type B cells of the mouse olfactory system as sensors for reduced levels of environmental O_2.

Sian Lewis

> “type B cells may transduce reductions in environmental O_2 through GUCY1β2-mediated rises in cGMP”

ORIGINAL ARTICLE Bleymehl, K. *et al.* A sensor for low environmental oxygen in the mouse main olfactory epithelium. *Neuron* http://dx.doi.org/10.1016/j.neuron.2016.11.001 (2016)