

 SENSORY SYSTEMS

## Sniffing out neural processing

A good sense of smell and olfactory memory are important to many animals for prey and predator recognition, and so are vital for survival. Through variable expression of a glutamate receptor subunit, Shimshek and colleagues have further elucidated where and how the processes responsible for these faculties occur.

AMPA ( $\alpha$ -amino-3-hydroxy-5-methyl-4-isoxazole propionic acid) receptors (AMPA) are crucial for

learning and memory. At the neuronal level, both odour discrimination and olfactory memory depend on fast excitatory neurotransmission mediated by these receptors. Shimshek and co-workers investigated the involvement of the principal AMPAR subunit, GluRB (GluR2), in these processes by depleting it or expressing a mutant form in mice. Both groups of mice showed specific increases in olfactory discrimination, but, surprisingly, a strong impairment in olfactory memory.

The  $\text{Ca}^{2+}$  permeability of AMPARs was increased both in mice with reduced normal GluRB subunit expression and in those expressing the mutant form, and the authors propose that this might account for their enhanced olfactory discrimination. The enhancement itself, they suggest, is the result of some alteration in olfactory information processing, not odour detection, because due to the spatial restriction

of the genetic modification, GluRB subunit expression was not altered in the olfactory epithelium.

Olfactory memory, meanwhile, seems to be linked to the level of GluRB subunit expression in the forebrain, with lower levels correlating with increased memory impairment. Through restricted transgenic GluRB subunit expression, this effect on olfactory memory was further localized to the piriform cortex and hippocampus.

These findings take us a step closer to understanding the neural control of olfactory behaviour using a well thought-out combination of techniques, which could be used to unravel the neural mechanisms underlying various behaviours in olfactory and other systems.

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**ORIGINAL RESEARCH PAPER** Shimshek, D. R. *et al.* Enhanced odor discrimination and impaired olfactory memory by spatially controlled switch of AMPA receptors. *PLoS Biol.* **3**, e354 (2005)

