Nature Reviews Neuroscience | AOP, published online 28 March 2011; doi:10.1038/nrn3232

SENSORY PROCESSING

Dense scents of nature

The odours we encounter in daily life are composed of many different odorant molecules. Nevertheless, experiments in anaesthetized rodents have shown that natural odours activate just a few glomeruli in the olfactory bulb, and that an individual odorant molecule generally activates just a single glomerulus. This has led to the idea that olfactory coding in the olfactory bulb is sparse. Vincis *et al.* now show that this interpretation is incorrect and that in awake mice, natural odorants — presented at natural concentrations — have dense representations in the olfactory bulb.

The authors used optical imaging and two-photon microscopy in awake mice to assess the response in the dorsal olfactory bulb to 40 different natural products with distinct smells, such as banana, coffee, oregano and lemon. In contrast to findings from previous studies, a 5-second exposure to an odour activated between 10 and 40 glomeruli, and the pattern of activated glomeruli partially overlapped between odours. These natural odours consist of multiple components, but exposure to physiological concentrations of artificial monomolecular odorants (such as amyl acetate, which smells like banana) activated the same glomeruli as the corresponding natural odour. A lower concentration of a monomolecular odorant induced a sparser representation; this could partially explain the sparse odorant representations found in earlier studies, which often used low odorant concentrations.

> “isoflurane gas anaesthesia greatly reduced the pattern of activation in glomeruli in response to natural odours”

In many previous studies, isoflurane was used to anaesthetise animals, and the authors found that this gas influences glomerulus activity. Exposure to a puff of isoflurane activated, like other odorants, a number of glomeruli in awake mice, especially in the posterior-lateral part of the dorsal olfactory bulb. Moreover, continuous isoflurane gas anaesthesia greatly reduced the pattern of activation in glomeruli in response to natural odours, especially in the area that was activated by isoflurane exposure. The pattern of activated glomeruli reversed at the end of the anaesthesia.

These findings show that the olfactory bulb representation of odours at their natural concentration is dense rather than sparse and, importantly, that the effect of anaesthesia on sensory processing should not be underestimated. Future experiments may reveal whether the isoflurane-induced suppression of glomerulus activation is due to a direct effect of the anaesthetic on neural function or to an adaptation or desensitizing effect on olfactory receptors.

Leonie Welberg

ORIGINAL RESEARCH PAPER Vincis, R. *et al.* Dense representation of natural odorants in the mouse olfactory bulb. *Nature Neurosci.* 11 Mar 2012 (doi:10.1038/nn.3057)