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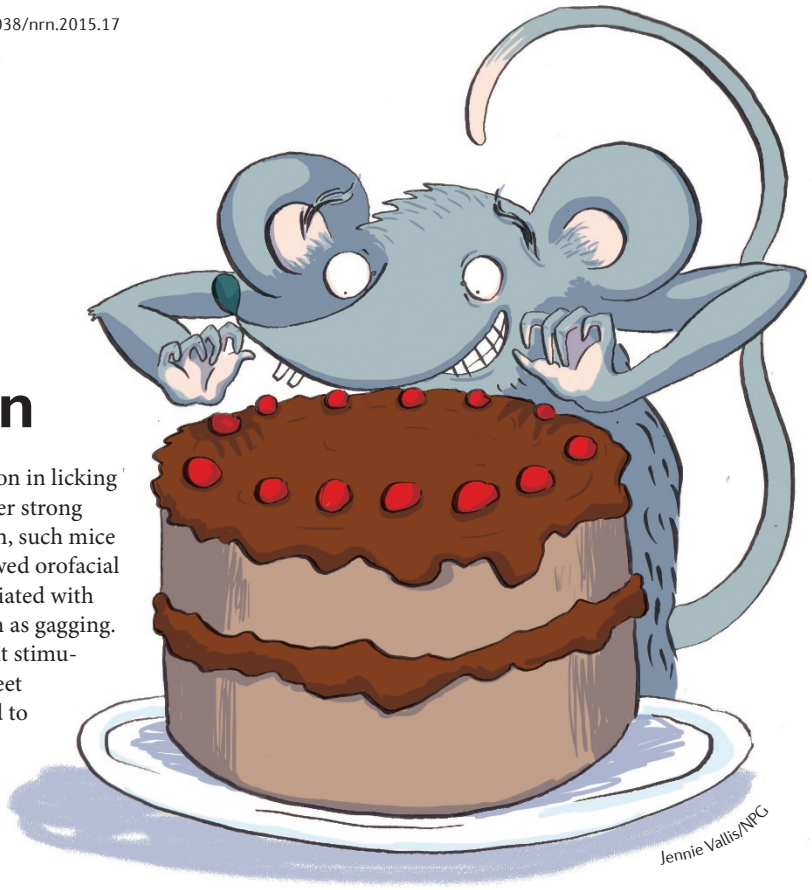

SENSORY SYSTEMS

Tasting in the brain

Imaging studies have indicated that, in the mammalian primary gustatory cortex, separate cortical fields represent sweet and bitter tastes in the brain. Building on those studies, Peng *et al.* now show in mice that the manipulation of neuronal activity in these fields mediates the perception of taste and drives associated behaviours.

The authors examined whether direct optogenetic activation of the cortical fields associated with sweet and bitter tastes elicits taste-like behavioural responses in mice in two tasks. In the first task, they placed mice into a two-chamber arena and delivered a light stimulus to the relevant cortical field only when the animals entered one of the two chambers. Mice expressing channelrhodopsin 2 (ChR2) in the sweet cortical field showed a preference for the chamber associated with light stimulation, whereas mice expressing ChR2 in the bitter cortical field exhibited notable avoidance of that chamber. Thus, activation of the sweet and bitter cortical fields leads, respectively, to attractive and avoidance behavioural responses.

In the second task, mice were trained to lick from a water bottle on presentation of a cue. In some trials, a light stimulus was applied to the relevant cortical field during licking. In thirsty mice, light stimulation of the bitter cortical field led to a marked reduction in licking and, indeed, after strong light stimulation, such mice sometimes showed orofacial responses associated with bitter taste, such as gagging. Conversely, light stimulation of the sweet cortical field led to an increase in licking. These findings provide further evidence that activation of a specific taste cortical field can elicit behaviours that are characteristic of exposure to that taste.

Next, the authors devised a 'go–no-go' task in which mice used learned behaviours to report the taste quality of a stimulus. In this assay, animals were trained to sample a tastant and, depending on its taste identity, report it through licking on go trials or by withholding licking on no-go trials. The authors were able to train mice not only to 'go' to sweet tastants and to 'not go' to bitter tastants but also to do the opposite, going against the innate responses of the animals. Notably, pharmacological inhibition of the sweet or bitter cortical field specifically impaired reporting of the respective tastant, indicating that these fields have an essential role in recognizing sweet and bitter tastes.

Finally, the authors explored what mice perceive when one of the taste-associated cortical fields is activated. To do so, they used a variant of the go–no-go task and found that mice reliably reported activation of the sweet cortical field as 'tasting' sweet and activation of the bitter cortical field as 'tasting' bitter.

Taken together, these data provide evidence that activation of the sweet or bitter cortical field in the primary gustatory cortex, in the absence of orosensory stimuli, elicits an internal representation that is indicative of an orally presented sweet or bitter chemical, respectively, and induces taste-related behaviours.

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ORIGINAL ARTICLE Peng, Y. *et al.* Sweet and bitter taste in the brain of awake behaving animals. *Nature* **527**, 512–515 (2015)

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