It is not unusual for damage or grey matter loss in a particular brain area to cause deficits in a specific aspect of cognition, perception or behaviour. But it is much rarer to find the opposite situation — a relative increase in volume in a part of the brain causing an enhancement in function. Now, the challenge for researchers is to discover how a deletion on one copy of chrom some 7 can produce such a striking and characteristic pattern of anatomical changes. If we can find the answer to this question, it must surely also shed new light on the normal development of the cortical networks that process visuospatial and emotional information.

Rachel Jones

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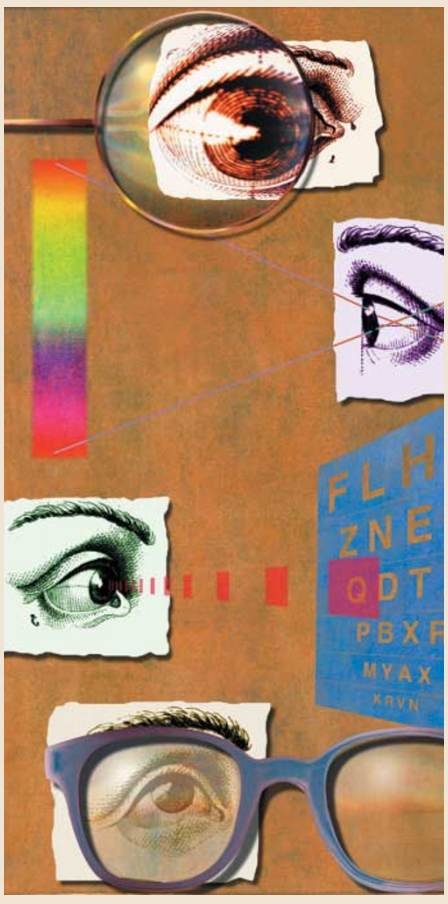


SENSORY SYSTEMS

The importance of staying active

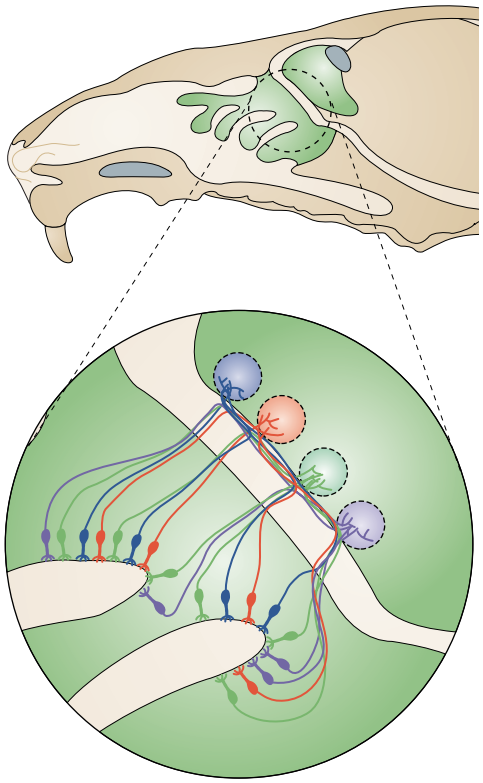
The mammalian olfactory system is organized so that projections from olfactory sensory neurons (OSNs) that express the same odorant receptor converge on structures called glomeruli in the olfactory bulb. Two recent reports highlight the roles of spontaneous and odorant-evoked neuronal activity in the establishment and maintenance of this glomerular map.

In a study reported in *Neuron*, Yu and colleagues inhibited neuronal activity in the developing mouse olfactory system, using constructs that expressed the tetanus toxin light chain or the inwardly rectifying potassium channel Kir2.1. They found that development of the glomerular map seemed to be largely normal if all OSNs were inactivated. However, if activity was blocked only in selected neurons, the phenotype was more severe — although the inactive neurons could initially establish normally targeted synaptic contacts in glomeruli, the contacts were unstable and broke down after around three weeks.

Therefore, spontaneous activity seems to give OSNs an advantage that is manifested only in a competitive environment. Yu *et al.* favour the interpretation that the active neurons have a survival advantage. However, as they used odorant receptor expression to track the fate of the neurons, the possibility remains that the inactive neurons simply switch to expressing a different odorant receptor gene.

Reporting in *Science*, Zou and colleagues show that odorant-evoked activity is required for the refinement of the olfactory map during postnatal development. They tracked the development of glomeruli that are innervated by neurons that express the odorant receptors M71 and M72. The olfactory bulbs of normal young animals (postnatal day (P) 10) contained multiple M71 and M72 glomeruli, whereas in the adult (P60), approximately one glomerulus for each receptor was found in each half-bulb. In addition, in the young mice, the 'M71' and 'M72' glomeruli were often also innervated by neurons that expressed different odorant receptors. These heterogeneous glomeruli usually disappeared by adulthood.

The authors examined the effects of sensory deprivation on glomerulus development by surgically closing one of the nares (nostrils) at birth. They found that the multiple and heterogenous glomeruli that characterize the immature glomerular map persisted into adulthood in the olfactory bulb that was ipsilateral to the closed naris. By varying the time of naris closure, they showed that the M71 and



M72 glomeruli develop with distinct time courses and have different periods of sensitivity to sensory deprivation.

What mechanisms might underlie these observations? The role of spontaneous activity in normal map development remains unclear, and Yu *et al.* suggest that it is likely to be permissive rather than instructive. It could also help to weed out weak synaptic connections, thereby contributing to map refinement and plasticity. Zou *et al.* offer a possible explanation for the effects of sensory deprivation on map refinement — closure of the nares was previously shown to reduce OSN turnover, so the persistence of the immature map might be attributable to an increase in neuronal survival. Clearly, more work will be needed to test these ideas, but these studies undoubtedly provide some important leads.

Heather Wood

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