IN THE NEWS

Shadow play

According to the *Independent* (UK, 15 December 2003), Peter Pan had every reason for being a crazy mixed-up kid: "nothing to do with refusing to grow up, according to scientists at Trento University, but a matter of losing his shadow". New findings reported in *Nature Neuroscience* show that we are rather attached to our shadows, and even perceive them as extensions of our bodies.

As the *Times* (UK, 15 December) reports, "shadows help the brain's visual system to work out how objects are moving, and can influence the sense of touch". The researchers asked their subjects to judge whether an electrical stimulus was being applied to their index finger or thumb. If flashing red lights were placed close to the shadow that was cast by the stimulated hand, the subjects took longer to decide which digit was being stimulated. If the hand did not cast a shadow, or if the shape of the shadow was altered with a glove, the lights proved to be less of a distraction.

This is reminiscent of situations where the brain is tricked into thinking that an object is part of the body. "It was known that people form a mental connection with a false limb or tools if they are trained to associate manipulation of that object with a sensation, for example if their own hidden hand is stroked whenever a visible false hand is touched" (*New Scientist*, 14 December).

These findings might also explain our feelings of unease when someone or something encroaches on our shadow. Vision researcher Margaret Livingstone says, "we all have, as children, experienced a reluctance to have others step on our shadows. I have a graduate student in my lab right now who still feels that way" (*New Scientist*).

Heather Wood

DEVELOPMENT

A projected olfactory map

The olfactory systems of insects and vertebrates are remarkably similar anatomically, so the fruit fly *Drosophila melanogaster* is a valuable model for investigating the underlying organizational principles. As reported in *Development*, Jefferis and colleagues have used the *Drosophila* system to examine how a spatial map is established in an olfactory relay centre in the brain.

In insects and vertebrates, axons from olfactory receptor neurons (ORNs) that express the same olfactory receptor converge on structures known as glomeruli. In *Drosophila*, these structures reside in the antennal lobe. The ORN axons synapse with the dendrites of projection neurons (PNs), which relay information to higher olfactory centres in the brain. The PN dendrites segregate, according to birth order and lineage, into different glomeruli.

How is the glomerular map established during development? Previous findings favoured the idea that the antennal lobe is initially patterned by ORN axons, which then act as targets for the incoming PN dendrites. However, by labelling clones of PNs and tracking the early development of their dendrites, Jefferis *et al.* showed that the PN dendrites in fact segregate into rudimentary patterns resembling future glomeruli before the ORN axons arrive at the antennal lobe.

What is the source of the signals that drive the segregation of PN dendrites? One candidate that the authors considered was the larval olfactory system, which shows a similar glomerular organization to the adult system. However, contact between the adult and larval antennal lobes is minimal during the stage when PN dendrites are invading the adult lobe, so it seems unlikely that residual larval neurons impose a pattern on these dendrites.

The glomeruli also contain the processes of glia and interneurons, and Jefferis *et al.* investigated whether these processes could provide positional information. No glial processes were detectable in the antennal lobe while the prototypic glomerular map was emerging, although glia could still exert a patterning influence outside the lobe. The involvement of interneurons is uncertain, as there are no reliable reagents to detect them. The authors suggest that segregation is at least partly driven by interactions among the PN dendrites themselves; dendrites with the same molecular signature might be induced to cluster through mutual attraction.

So, these findings indicate that PN dendrites establish the initial glomerular map in the antennal lobe. Although this represents a significant shift from previous models that emphasized the role of ORNs, it is not incompatible with the idea that ORN axons are also prepatterned. Also, the map is probably refined through interactions between ORN axons and PN dendrites. The next challenge will be to identify the signals that pattern these two sets of neuronal projections.

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References and links

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WEB SITES

Liqun Luo's laboratory: http://www.stanford.edu/group/luolab/

Encyclopedia of Life Sciences: http://www.els.net/ Olfaction