IN THE NEWS

Not such a featherbrain

Forget Dolly the sheep; the new darling of the scientific set is Betty the crow. Since the publication in *Science* (9 August) of her tool-making exploits, Betty has hit the headlines in a big way.

We couldn't resist joining the stream of puns about 'featherbrains' and 'birdbrains', but in fact, Betty — a New Caledonian crow (*Corvus moneduloides*) who has lived in an Oxford University aviary for two years — has been showing tool-making skills that put many of our closer primate relatives to shame.

Tool use in an animal is nothing new. Both monkeys and birds have been documented as using natural tools — for example, a finch in the Galapagos Islands uses cactus spines to spear insects. But Betty takes it one step further.

The Oxford zoologists, lead by Alex Kacelnik, were testing whether Betty and her mate, Abel, could use a wire hook to remove a small bucket of food from a tube. But when Abel flew away with the hook, they were amazed to see Betty making herself a replacement hook by bending a straight piece of wire.

According to Kacelnik, "Although many animals use tools, purposeful modification of objects to solve new problems, without training or prior experience, is virtually unknown" (*Independent*, UK, 9 August). Kacelnik also reflects on the behaviour of Abel, who does not make hooks but rather bullies Betty into sharing the fruits of her labour. "It's a matter of judgement as to which is the cleverer strategy", he says.

Rachel Jones

OLFACTORY CODING

Precise timing

New insights into how the olfactory system represents odours — at least in locusts — come from work described by Perez-Orive *et al.* in *Science*. They find that representations become increasingly sparse and specific as they are processed by the early stages of the olfactory system, and that correlations in firing are crucial for this effect.

In insects, odours are detected by receptor neurons that project to the antennal lobe. Here, projection neurons (PNs) carry the signal on to the mushroom body, which has been implicated in olfactory learning in insects. In the mushroom body, PNs form synapses on Kenyon cells (KCs). Each PN contacts hundreds of KCs, and each KC receives inputs from many fewer PNs (an estimated 10–20).

The authors recorded the responses of PNs and KCs to various odours. They found that individual PNs responded strongly to a variety of odours, and that their responses had complex temporal patterns, often outlasting the stimulus, that were odour- and neuron-specific. Odour-evoked PN responses also showed global oscillations at around 20–30 Hz. KC responses, by contrast, were much more selective: each KC responded to very few odours, and their responses were brief (on average, just two action potentials).

What gives rise to the marked sparsening of odour representations between the PNs and the KCs? Recordings from KCs revealed odour-evoked subthreshold potentials with odour-specific timing. Much of this activity was inhibitory, and Perez-Orive *et al.* conclude that the likely source of this inhibition is a group of lateral horn interneurons that contain GABA (γ-aminobutyric acid). The lateral horn receives inputs from PNs and projects directly to the mushroom body. Lateral horn interneurons fire vigorously in response to odours, but their firing is in the opposite half of the PN oscillation cycle from the excitatory PN inputs to the KCs.

Because lateral horn interneurons fire in response to a wide range of odours, it is likely that KCs receive reliable inhibitory inputs from these interneurons during one half of each oscillation cycle, and more selective excitatory inputs from PNs during the other half. The authors propose that KCs act as coincidence detectors, firing only when excited by multiple PNs. Inhibitory potentials antagonize mistimed PN action potentials, so that only time-locked PN spikes at the right point in the oscillation cycle can excite a KC. Direct stimulation of PNs and recording from KCs suggested that KC responses are further sharpened by active conductances.

These results highlight the potential for a combination of oscillatory synchronization and both neuronal and circuit properties to shape and filter neuronal information. Such mechanisms are proposed to be important in other systems, and it is becoming clear that they must be taken into account when interpreting recordings of neuronal activity.

Rachel Jones

References and links

ORIGINAL RESEARCH PAPER Perez-Orive, J. *et al.* Oscillations and sparsening of odor representations in the mushroom body. *Science* **297**, 359–365 (2002)

FURTHER READING Engel, A. K. *et al*. Dynamic predictions: oscillations and synchrony in top–down processing. *Nature Rev. Neurosci.* **2**, 704–716 (2001)