BEHAVIOURAL NEUROSCIENCE

Aggression on cue

The nucleus accumbens is thought to be important in mediating emotional and motivational behaviour, including aggression. Ferrari *et al.*, writing in the *European Journal of Neuroscience*, have shown that changes in the nucleus accumbens can occur in anticipation of an aggressive encounter, even in the absence of an external stimulus.

The authors used chronically inserted microdialysis probes to measure the levels of extracellular dopamine and serotonin in the nucleus accumbens in rats. Both dopamine and serotonin have been implicated in modulating aggressive behaviour. When a rat is placed into the home cage of another rat, the 'resident' rat will attack the intruder. This bout of aggression is accompanied by an increase in heart rate and also by a rise in dopamine in the nucleus accumbens.

To investigate the effects of anticipated aggression, Ferrari *et al.* conditioned rats by placing intruder rats in their cages at the same time every day, for ten days. Each day, the resident rats would attack the intruders. On the 11th day, the levels of dopamine and serotonin in the nucleus accumbens were measured but no intruder rat was introduced, so there was no external cue for aggression.

The rats that had been aggressive on previous days showed a marked increase in dopamine in the nucleus accumbens that started about 20 minutes before the time at which the intruder was normally introduced into their cage. The rise in dopamine lasted for more than an hour. There was also a decrease in serotonin levels in the nucleus accumbens, which began at the time when the intruder was expected.

The increase in dopamine is proposed to represent a 'conditioned stress response', in which a rise in dopamine in the nucleus accumbens might help to prepare the rat for an anticipated stressful or aggressive event. By contrast, the authors suggest that the fall in serotonin levels is associated with the termination of this response when the anticipated event fails to occur. The challenge now is to link these acute monoaminergic changes with the proposal that underlying trait differences in monoaminergic transmission are linked to levels of aggression.

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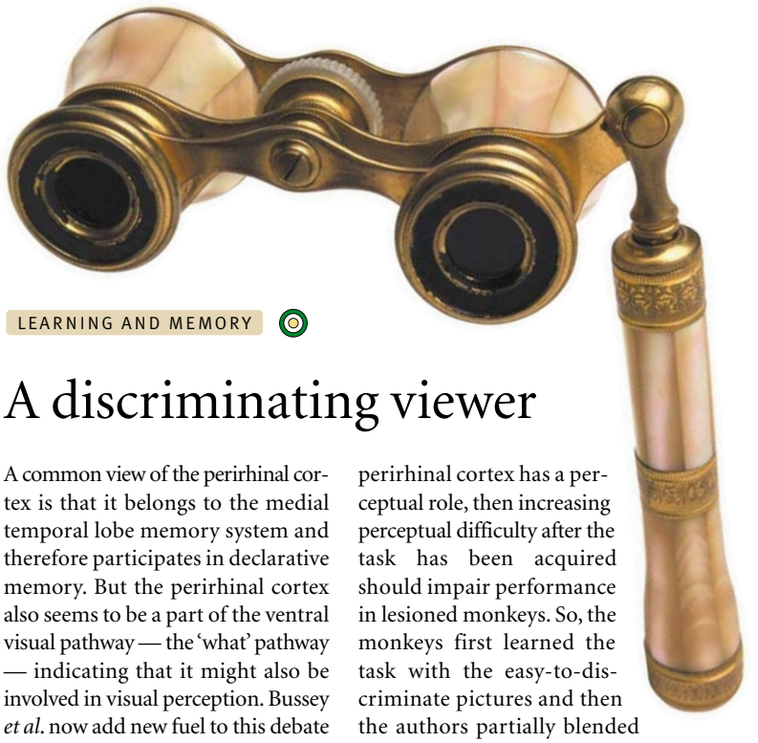
References and links

ORIGINAL RESEARCH PAPER Ferrari, P. F. *et al*. Accumbal dopamine and serotonin in anticipation of the next aggressive episode in rats. *Eur. J. Neurosci.* **17**, 371–378 (2003)



LEARNING AND MEMORY

A discriminating viewer

A common view of the perirhinal cortex is that it belongs to the medial temporal lobe memory system and therefore participates in declarative memory. But the perirhinal cortex also seems to be a part of the ventral visual pathway — the 'what' pathway — indicating that it might also be involved in visual perception. Bussey *et al*. now add new fuel to this debate by showing that perirhinal lesions affect learning and performance of a visual discrimination task, and that this impairment is related to certain perceptual factors. These observations support a perceptual–mnemonic view of perirhinal function.

Rapid acquisition is a hallmark of declarative memory — information is acquired after one or a few trials. If the perirhinal cortex is part of this memory system, then its destruction should impair learning of rapidly acquired discrimination tasks. By contrast, if the perirhinal cortex has a role in perception, then increasing the perceptual difficulty of the task might affect learning in the absence of this cortical region. The authors tested these predictions in monkeys with perirhinal lesions, and found that learning was affected only when the task was made perceptually difficult. When the monkeys were presented with two greyscale photographs that were easy to discriminate and were rewarded for choosing one of them, they quickly learned to choose the correct picture. But if the discrimination was made more challenging by partially blending the photographs, then the lesioned monkeys showed impaired learning.

In a second experiment, Bussey *et al*. tested another prediction of the perceptual–mnemonic view: if the perirhinal cortex has a perceptual role, then increasing perceptual difficulty after the task has been acquired should impair performance in lesioned monkeys. So, the monkeys first learned the task with the easy-to-discriminate pictures and then the authors partially blended the pictures. This manipulation led to a marked drop in performance, satisfying the prediction.

A remarkable aspect of this study is that it was guided by theoretical work grounded on a rigorous connectionist model, the predictions of which were satisfied by the experiments. Although these results support a role for the perirhinal cortex in perception, this role is rather specific. Bussey *et al*. did not find any effect of the perirhinal lesions in learning or performing perceptually challenging discrimination tasks that involved differences in colour or size. The authors concluded that the perirhinal cortex is important for visual discriminations with a high degree of 'feature ambiguity' — a property that can emerge when features of an object are rewarded when they are part of one object, but not when they are part of another. But independently of this functional specificity, these data favour a perceptual–mnemonic function of the perirhinal cortex, as opposed to a strictly declarative role.

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References and links

ORIGINAL RESEARCH PAPER Bussey, T. J. *et al*. Impairments in visual discrimination after perirhinal cortex lesions: testing 'declarative' vs. 'perceptual-mnemonic' views of perirhinal function. *Eur. J. Neurosci.* 31 January 2003 (doi:10.1046/j.1460-9568.2003.02475.x)