

Researchers identify brain's 'eureka' circuitry

Researchers have found the brain region that controls the decision to halt your midnight exploration of the refrigerator and commence enjoyment of that leftover chicken leg.

What's more, they said, such mechanisms governing exploration are among those that malfunction in addiction and mental illness.

Emmanuel Procyk and colleagues published their findings in the January 24, 2008, issue of the journal *Neuron*, published by Cell Press.

In their experiments, the researchers presented monkeys with a choice of touch targets on a computer screen, requiring the monkeys to spend time exploring which target would trigger a juice reward. Once the monkeys discovered the reward target, the researchers then gave the animals a period during which they could repeatedly touch the reward target to obtain more juice.

During the trials, the researchers recorded the electrical activity of hundreds of neurons in the anterior cingulate cortex (ACC), a brain region known to be active in adaptive behaviours such as the shift between exploring and exploiting.

In their analysis, the researchers measured the electrophysiological activity of cells during four different types of feedback - incorrect choices, first reward, repetition of the reward, and the ending of a trial by breaking fixation on the targets.

Analyzing the results, the researchers concluded, "Our data show that ACC discriminates between different types of feedback, allowing appropriate behavioural adaptations."

They wrote, "Thus, the function we attribute to ACC activations is clearly not only to evaluate feedbacks but is also to participate in monitoring the different steps of the task at hand to optimize action adaptation and valuation. A dysfunction of these mechanisms represents the core feature of cognitive alterations observed in addiction and mental illness."

Wrote Procyk and colleagues, "The ACC produces signals that discriminate between various behaviourally relevant positive and negative feedbacks, suggesting a role in triggering appropriate adaptations. Our data reinforce the proposal that ACC is important for establishing action valuations. But they also emphasize a combined role in monitoring events/actions for behavioural regulation when task control is high, underlining the intimate link between control and action valuation."

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