

Planning may start in brain's amygdala, study says

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Location of the amygdala in the human brain. Image: Wikipedia.

Thinking of a new career? Buying a home? Have you consulted your amygdala?

These almond-shaped clusters of neurons deep in the brain may play a vital part in long-term planning, said a study published Monday.

Experiments conducted on lab monkey [amygdala](#) may also help the search for new treatments for depression, [drug addiction](#), binge eating and other [behavioural problems](#) in humans, its authors hope.

Until now, planning was thought to be a task generally for the brain's frontal lobe, where "higher order" skills such as weighing the consequences of one's actions and distinguishing between good and bad are located.

But scientists led by Fabian Grabenhorst at Britain's University of Cambridge wanted to see how the amygdala—the organ comprising two cell clusters, one in each [temporal lobe](#) located at either side of the brain—contributes to long-term planning.

The amygdala has long been associated with primal and short-term drivers like fear and aggression, but also, more distantly, with behaviour that is linked to reward.

Two male rhesus monkeys were put through an experiment in which they were trained to choose between accepting an immediate fruit juice reward, or wait and receive a bigger dose later.

The more they restrained themselves, the bigger the reward grew—and like shrewd investors, both monkeys generally tended to save up.

Once the animals were trained, the team implanted electrodes in the monkeys' brains to observe the decision-making sequence.

Early in the process, neurons in the amygdala were activated in a pattern that reflected "several trials ahead" whether the monkey would save up towards specific goals, according to the study.

"These activity patterns could be used by the [frontal lobe](#) to translate goal signals into concrete action plans," Grabenhorst told AFP by email.

The monkeys were humanely killed after the experiment, the scientists said, and their brains dissected to verify the electrodes had been

implanted in exactly the right spot.

"The different types of planning activity we observed were encoded by different amygdala neurons that were closely intermingled," the scientist said.

They "could not have been distinguished" by a non-invasive brain scan, he said.

The amygdala is an ancient brain structure shared by primates, so what happened in the monkeys very likely happens in our brains, too.

The findings, reported in the journal *Nature Neuroscience*, "may open up new avenues" for treating a range of psychiatric problems, including severe depression, substance addiction and eating disorders, Grabenhorst said.

"Amygdala dysfunction is known to underlie a variety of psychiatric disorders," he said.

"Some of these disorders are characterised by a lack of motivation to make plans for the future or by a dysfunctional pursuit of rewards."

More information: *Nature Neuroscience*, [DOI: 10.1038/nn.3925](https://doi.org/10.1038/nn.3925)
target="_blank">nature.com/articles/[DOI: 10.1038/nn.3925](https://doi.org/10.1038/nn.3925)

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