MedicalXpress

Activity of a single brain cell can predict if we spend or save

January 12 2011

(PhysOrg.com) -- By eavesdropping on the activity of a single brain cell, Yale University researchers can predict the outcome of decisions such as whether you will dip into your retirement account to buy a Porsche.

In a study published online January 12 in the journal *Neuron*, the research team helped identify areas of the brain involved in the choice between taking an immediate reward or deferring for a larger but delayed payoff.

The decision involves a complex network that links multiple areas of the brain in a sort of complex feedback loop.

“But in the instant before the choice is made, we can predict the

outcome of the decision by listening to the firing activity in a single neuron," said Daeyeol Lee, associate professor of neurobiology and psychology at Yale School of Medicine and senior author of the study.

Scientists have described in general terms how the brain responds to potential rewards, such as food, alcohol or sex. However, Lee's team looked at the information processed at the level of both brain regions and individual cells.

They recorded activity in individual neurons of monkeys as they were offered choices between smaller rewards or larger ones, which were delivered after delays. Like humans, monkeys tend to opt for immediate gratification.

They found in hundreds of tests that the activity of a single brain cell differed depending upon whether the monkey sought immediate award or delayed one.

The firing of individual neurons were part of a larger regional pattern of activity. The researchers found that the basal ganglia, an area of the brain best known for controlling motor function, appears to help assess both the magnitude of the reward and the time it takes for the reward to be received. In an earlier study, Lee's team found that the prefrontal cortex, an area of the brain associated with working memory and rational thinking, played a similar function. They also found that two areas of the basal ganglia play quite different roles. One area, the dorsal striatum, helps target the reward and a second, the ventral striatum, helps evaluate the reward already chosen.

This pattern reveals an important piece of the puzzle regarding how the prefrontal cortex and areas closely connected to it, such as the basal ganglia, orchestrate their activity to reach a consensus when different goals create a conflict.

“We don’t know the anatomical basis of lots of the psychiatric disorders, problem gambling or impulsive behavior,” Lee said. “Now we are starting to pinpoint those areas, even down to individual neurons.”

Provided by Yale University