Waiting for a sign? Researchers find potential brain 'switch' for new behavior

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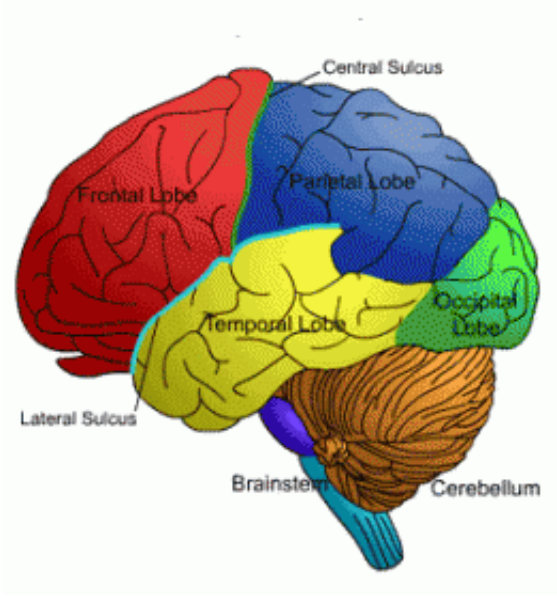

Brain diagram. Credit: dwp.gov.uk

You're standing near an airport luggage carousel and your bag emerges on the conveyor belt, prompting you to spring into action. How does your brain make the shift from passively waiting to taking action when your bag appears?

A new study from investigators at the University of Michigan and Eli Lilly may reveal the brain's "switch" for new behavior. They measured levels of a neurotransmitter called acetylcholine, which is involved in

attention and memory, while rats monitored a screen for a signal. At the end of each trial, the rat had to indicate if a signal had occurred.

Researchers noticed that if a signal occurred after a long period of monitoring or "non-signal" processing, there was a spike in acetylcholine in the rat's right prefrontal cortex. No such spike occurred for another signal occurring shortly afterwards.

"In other words, the increase in acetylcholine seemed to activate or 'switch on' the response to the signal, and to be unnecessary if that response was already activated," said Cindy Lustig, one of the study's senior authors and an associate professor in the U-M Department of Psychology.

The researchers repeated the study in humans using functional magnetic resonance imaging (fMRI), which measures brain activity, and also found a short increase in right prefrontal cortex activity for the first signal in a series.

To connect the findings between rats and humans, they measured changes in oxygen levels, similar to the changes that produce the fMRI signal, in the brains of rats performing the task.

They again found a response in the right prefrontal cortex that only occurred for the first signal in a series. A follow-up experiment showed that direct stimulation of brain tissue using drugs that target acetylcholine receptors could likewise produce these changes in brain oxygen.

Together, the studies' results provide some of the most direct evidence, so far, linking a specific neurotransmitter response to changes in brain activity in humans. The findings could guide the development of better treatments for disorders in which people have difficulty switching out of

current behaviors and activating new ones. Repetitive behaviors associated with obsessive-compulsive disorder and autism are the most obvious examples, and related mechanisms may underlie problems with preservative behavior in schizophrenia, dementia and aging.

The findings appear in the current issue of *Journal of Neuroscience*.

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