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Shedding light on the dynamics of memory: Researchers find mechanism that maintains memories

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(PhysOrg.com) -- Why do we remember? What allows our brains to retain bits of information (while forgetting others) for years and years? Why can we remember things that happened decades ago, but forget whether we left the lights on when we left home this morning?

Researchers at McGill University have made strides toward unraveling one of the most fundamental mysteries in neuroscience - how the brain maintains memories over time.

The McGill team, led by Prof. Karim Nader, discovered that the activity of one molecule in the brain, the protein kinase PKM ζ, plays a key role in allowing the brain to retain memories. The molecule prevents the removal of synaptic receptors in the brain that would, if they were destroyed, lead to memory loss. The results will be published in the journal *Nature Neuroscience* on April 11.

"This finding has very important implications for the understanding of the dynamics of memory because it shows that memory persists due to an active counter-balancing process between the mechanisms that keep the memory stored and the mechanisms that will lead to the erasure of the memory." explained Nader, William Dawson Scholar and EWR Steacie Fellow in McGill's Department of Psychology.

This latest finding builds on the work of Todd Sacktor, of SUNY

Downstate Medical Centre, on memory maintenance, and of Yu Tian Wang, of the University of British Columbia, on receptor trafficking. In 2006, Sacktor unraveled the role of the continuous activity of the molecule protein kinase PKMζ, and showed it to be necessary and sufficient for the persistence of memories over time. He showed that established, long-term memories can be erased by deactivating this enzyme. Nader and post-doctoral student Paola Virginia Migues took these findings a step further by discovering that the enzymatic activity of PKMζ is required to prevent the removal of a pool of receptors at the synaptic connections. These receptors are responsible for the strength of the connections between neurons and without these receptors memory cannot be expressed.

The new findings enhance our understanding of memory storage and erasure mechanisms and how the perpetuation of long-term memories relies on a dynamic balance between these two processes.

"These findings are exciting because... until 2006, nothing was known about how memories are maintained over time. With the finds from Sacktor's group they identified the first candidate molecule to mediate memory maintenance. Now we have an idea of how this all works." Nader said.

Provided by McGill University