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Neuro researchers sharpen our understanding of memories

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Scientists now have a better understanding of how precise memories are formed thanks to research led by Prof. Jean-Claude Lacaille of the University of Montreal's Department of Physiology. "In terms of human applications, these findings could help us to better understand memory impairments in neurodegenerative disorders like Alzheimer's disease," Lacaille said.

The study looks at the cells in our brains, or neurons, and how they work together as a group to form memories. Chemical receptors at neuron interconnections called synapses enable these cells to form electrical networks that encode memories, and neurons are classified into two groups according to the type of chemical they produce: excitatory, who produce chemicals that increase communication between neurons, and inhibitory, who have the opposite effect, decreasing communication. "Scientists knew that inhibitory cells enable us to refine our memories, to make them specific to a precise set of information," Lacaille explained. "Our findings explain for the first time how this happens at the molecular and cell levels."

Many studies have been undertaken on excitatory neurons, but very little research has been done on inhibitory neurons, partly because they are very difficult to study. The scientists found that a factor called "CREB" plays a key role in adjusting gene expression and the strength of synapses in inhibitory neurons. Proteins are biochemical compounds encoded in our genes that enable cells to perform their various functions, and new proteins are necessary for memory formation. "We were able to study

how synapses of inhibitory neurons taken from rats are modified in the 24 hours following the formation of a memory," Lacaille said. "In the laboratory, we simulated the formation of a new memory by using chemicals. We then measured the electrical activity within the network of cells. In cells where we had removed CREB, we saw that the strength of the electrical connections was much weaker. Conversely, when we increased the presence of CREB, the connections were stronger."

This new understanding of the chemical functioning of the brain may one day lead to new treatments for disorders like Alzheimer's, as researchers will be able to look at these synaptic mechanisms and design drugs that target the chemicals involved. "We knew that problems with synapse modifications are amongst the roots of the cognitive symptoms suffered by the victims of neurodegenerative diseases," Lacaille said. "These findings shine light on the neurobiological basis of their memory problems. However, we are unfortunately many years away from developing new treatments from this information."

The findings were published in the *Journal of Neuroscience* on May 2, 2012. The researchers received funding from the Canadian Institutes of Health Research and the Fonds de recherche du Québec – Santé. Jean-Claude Lacaille is the Canada Research Chair in Cellular and Molecular Neurophysiology. Israeli Ran, recipient of a Fellowship of the Savoy Foundation, and Isabel Laplante contributed to this research. All three researchers were affiliated with the Department of Physiology and the Groupe de Recherche sur le Système Nerveux Central of the University of Montreal when the research was undertaken. The University of Montreal is officially known as Université de Montréal.

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