

Scientists discover protein's role in human memory and learning functions

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Scientists at A*STAR's Institute of Molecular and Cell Biology (IMCB) have identified the precise role of the protein, SNX27, in the pathway leading to memory and learning impairment. The study broadens the understanding of the brain's memory function and could be used to explain defects in the cognitive development of those with Down's syndrome. The newly established knowledge could potentially facilitate exploration of strategies to improve memory and learning abilities in Down's syndrome.

Down's syndrome is a genetic condition characterized by the presence of an additional copy of chromosome 21. About one in eight hundred newborns is diagnosed with Down's syndrome. It is a condition that leads to impairments in both cognitive ability and physical growth that range from mild to moderate developmental disabilities. Yet, there is still no treatment for it.

In an earlier study published in *Nature Medicine*, an international team of scientists discovered that the additional copy of chromosome 21 in Down's syndrome reduces the production of SNX27 in the brain and results in synaptic dysfunction. Synapse, a structure that permits [nerve cells](#) to pass [chemical signals](#) to each other, is known to have an important role in [memory](#) formation and its dysfunction could result in impairment. By re-introducing SNX27 into the brain, memory could be restored hence suggesting that SNX27 is an essential protein for memory and learning.

The protein's role in the pathway leading to [memory impairment](#), however, remained unclear until scientists from IMCB utilised live-cell imaging techniques to elucidate the mechanism of memory impairment and illustrated how SNX27 attributes to synaptic dysfunction. The scientists observed that transmission of chemical signals between the nerve cells are facilitated by AMPA-receptors and the activity occurs on the brain cell surface. As SNX27 plays an important role in shuttling the AMPA-receptor to the brain cell surface, lower levels of SNX27 means fewer receptors are carried to the surface, which consequently interrupts the signal transmission and impairs memory. This discovery was reported in the 24 January, 2014 issue of the renowned scientific journal, *Nature Communications*.

The correlation established between SNX27 levels and memory could explain why individuals with Down's syndrome encounter memory and learning difficulties. Identifying the target and its role is a crucial first step to therapy – having known the role of SNX27 in memory impairment, future research on Down's syndrome could focus on developing strategies which can effectively re-introduce the protein into the brain to restore memory and learning abilities.

Dr Loo Li Shen was an A*STAR scholar who is now working with Executive Director of IMCB, Prof Wanjin Hong, and is also an adjunct Assistant Professor at LKC medical school of NTU. The lead author of the *Nature Communications* paper and co-author of the Nature Medicine paper said, "Memory and the ability to learn capture the essence of life. Our research goes beyond the lab to make a difference by finding ways to grant these fundamental capabilities to those diagnosed with Down's syndrome. Our ultimate goal is to create a positive impact on the lives of these valuable children."

Prof Hong added, "In IMCB, we conduct research that would contribute to our understanding of mankind. This is a good example where the

study is directed at a human condition - the Down's syndrome. The knowledge established from the findings could potentially translate into treatments for Down's syndrome or even become applicable to other similar human conditions."

More information: Full text of the *Nature Communications* article can be accessed from www.nature.com/ncomms/2014/140...full/ncomms4176.html Full text of the *Nature Medicine* article can be accessed from www.nature.com/nm/journal/v19/n4/full/nm.3117.html

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