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Researchers restore memory process in most common form of mental disability

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University of California, Irvine scientists have discovered how to reverse the learning and memory problems inherent in the most common form of mental impairment.

Neurobiologist Julie Lauterborn and her colleagues identified how a mutated gene linked to fragile X syndrome blocks brain cells from locking new memories into lasting ones. The gene -- called fragile X mental retardation 1 (Fmr1) -- is turned off in people with fragile X syndrome. This genetic mutation disrupts cellular processes that are needed for memory formation.

The researchers found that by adding brain-derived neurotrophic factor (BNDF) proteins to the hippocampus region of fragile X syndrome test mice, memory-forming capacities of the brain cells were completely restored. The findings, which are reported in the Journal of Neuroscience, suggest the possibility of fragile X syndrome therapies that allow for increased learning and memory.

“While this discovery doesn’t identify a cure for fragile X syndrome, it provides the scientific foundation for methods to treat its learning and memory deficits,” Lauterborn said.

In their study, the researchers reported how the loss of a functional Fmr1 gene impaired a process called long-term potentiation (LTP) in the hippocampus region of the brain where memories are created and stored. LTP describes a chemical process that literally strengthens a synapse.

Synapses are the connection points between neurons where single cells are functionally coupled to other cells.

Since memories are believed to be formed and stored within synapses, LTP is widely considered one of the major mechanisms by which the brain learns and maintains memories. This LTP impairment limits the ability of cells in the hippocampus to modify the strength of synapses, thus blocking long-term memory formation.

Earlier this year, a UC Irvine research team led by neurobiologists Gary Lynch and Christine Gall showed the first images of LTP forming memories in brain cells and how neurodegenerative diseases can obstruct the LTP process. These studies were reported in the Journal of Neuroscience.

Fragile X syndrome is the most common inherited cause of mental impairment, according to the National Fragile X Foundation. The syndrome occurs in approximately one in 3,600 males and one in 4,000 to 6,000 females. It is caused by a change or mutation in a gene on the X chromosome.

The majority of males with fragile X syndrome have a significant intellectual disability, ranging from learning disabilities to severe mental retardation, and autism. Females often have milder intellectual disabilities. There is currently no treatment that improves cognitive function in this syndrome. For more information, see: www.fragilex.org .

Source: University of California - Irvine