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Researchers reveal first images of brain changes associated with memory

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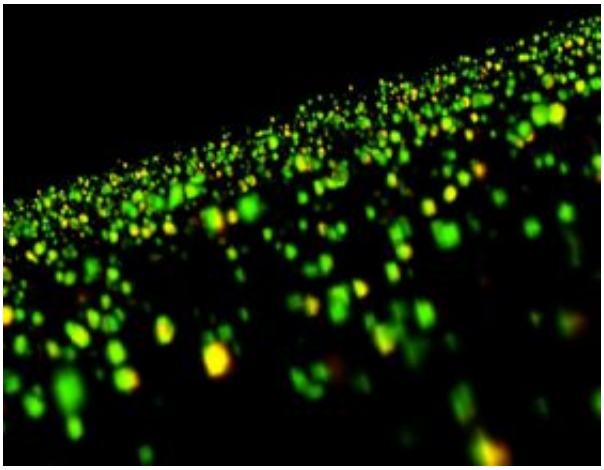

Image of brain cells after LTP. Credit: University of California - Irvine

University of California, Irvine researchers have developed the first images of the physical changes in brain cells thought to underlie memory, a discovery that is already uncovering clues about memory loss linked to cognitive disorders.

Three decades of work by neuroscientists have established that a physiological effect known as long-term potentiation (LTP) encodes everyday forms of memory. In the Journal of Neuroscience today, a UC Irvine research team led by neuroscientists Christine M. Gall and Gary Lynch presents these unique images, which show that the size and shape of synapses that were changed by LTP.

“The way is now open to mapping where in the brain memories are laid down,” said Lynch, a professor of psychiatry and human behavior. “Seeing memory-related physical changes to synapses means that we can at last use mouse models to test if the effects of retardation, aging and various cognitive disorders involve a specific, long-suspected defect in the connections between cortical neurons.”

Brain tissue collected from rats and mice was kept alive in specially constructed equipment. The researchers induced LTP by stimulating synapses with a rhythm known to be critical to memory formation. The brain slices were then sectioned and stained with one antibody that attaches to activated proteins involved with LTP and a second one that labels synapses. Newly developed microscopic methods were used to visualize and measure synapses that had both antibodies attached.

In addition to revealing new information about the formation of memory in the brain, this study and another published last month in the Journal of Neuroscience by the UC Irvine researchers have shown how LTP deficiencies accompany the memory loss seen during the early stages of Huntington’s disease, an incurable neurodegenerative disease characterized by disturbances to memory and learning.

Lynch, Gall and colleagues found that LTP structures encoding memory are defective in mouse models of Huntington’s disease. They discovered that these synaptic defects can be fully reversed through treatment with a brain growth factor released at synapses. Ampakines, a new class of drugs developed by Lynch at UC Irvine that are currently in clinical development for Alzheimer’s disease and ADHD, increase the levels of this growth factor and potentially emerge as therapy for the cognitive problems associated with Huntington’s.

The researchers are now working to see if such LTP defects are present in mouse models of common forms of human mental retardation.

Source: University of California - Irvine