



Asian Journal of
Cell Biology

ISSN 1814-0068



Academic
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Stress Can Enhance Ordinary, Unrelated Memories

Stress can enhance ordinary, unrelated memories, a team of neuroscientists has found in a study of laboratory rats. Their results, which appear in the journal PLoS Biology, may bolster our understanding of Post-traumatic Stress Disorder (PTSD) and could offer a pathway for addressing PTSD and related afflictions.

The study was conducted by researchers at the Czech Republic's Academy of Sciences, the State University of New York (SUNY) Downstate Medical Center, and Rockefeller University.

"Our results show that stress can activate memory, even if that memory is unrelated to the stressful experience," explained André Fenton, the study's lead author and a Professor at New York University's Center for Neural Science.

"Additional investigations into the effects of stress on memories could shed light on PTSD and other stress-related mood disorders," added Fenton, who directed the studies while he was a Research Scientist in the Czech Republic and an Associate Professor of Physiology and Pharmacology at SUNY Downstate.

The study's other authors are: Karel Jeřábek of the Czech Republic's Academy of Sciences; Benjamin Lee and Eduard Kelemen of SUNY Downstate; and Katharine McCarthy and Bruce McEwen of Rockefeller University.

A common feature of PTSD and various mood and anxiety disorders is the formation of negative associations from otherwise innocuous stimuli or the recall of negative memories stimulated by unrelated, neutral circumstances. What's less clear is how stress influences these phenomena.

To explore the impact of stress on these disorders, the researchers conducted several experiments using laboratory rats.

In these experiments, rats learned to make distinctions

between left and right in a T-shaped maze. One day later, the researchers induced stress in the rats through a commonly practiced technique -- placing them in a bucket of water in which they had to swim. Other rats were placed in shallow water, where swimming was not necessary. Subsequent to this procedure, the rats were again tasked with navigating the maze. Their results showed that the rats who had undergone the stressful swim showed better memory for which way to turn in the T-maze than those placed in shallow water.

To test the validity of their findings -- that the memory for navigating the maze was enhanced by the stressful swim and not other forces -- the researchers conducted a series of additional experiments. These procedures ruled out that learning the maze itself was a source of stress and showed a clear link between the stress induced by the swim and changes in the memories of navigating the maze, even though the changed memories were unrelated to the stressful experience.

These results show that stress can reactivate unrelated memories, leading the authors to hypothesize that, in humans, traumatic stress might reactivate non-traumatic memories and link them to the traumatic memory, thereby facilitating the pathological effects seen in post-traumatic stress disorder and other conditions.

Karel Jeřábek, Benjamin B Lee, Eduard Kelemen, Katharine M McCarthy, Bruce S McEwen, André A Fenton. Stress-Induced Out-of-Context Activation of Memory. PLoS Biology, 2010; 8 (12): e1000570 DOI: 10.1371/journal.pbio.1000570