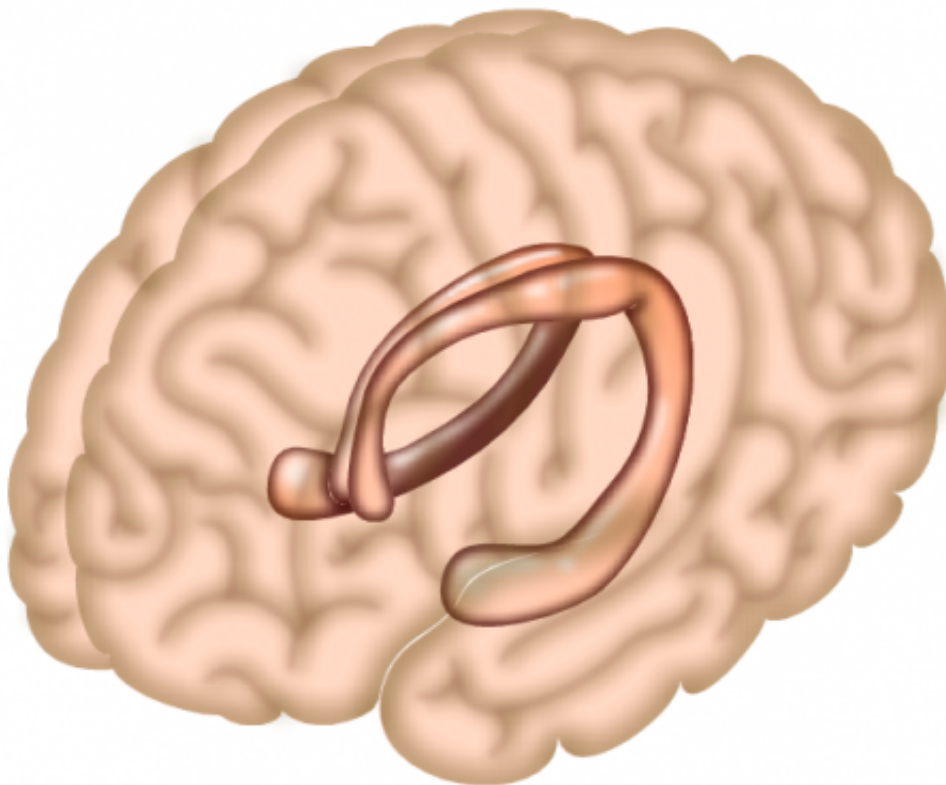


# Researchers study tie between estrogen, memory

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The hippocampus is a region of the brain largely responsible for memory formation. Credit: Salk Institute

A new study by University of Guelph researchers that narrows down where and how estrogens affect the brain may help in understanding how

the hormones affect cognition and memory in women, says psychology professor Elena Choleris.

The team found that adding the hormone to female mouse brains helps boost short-term learning, likely through a 'use-it-or-lose-it' process, said Choleris, who co-authored the paper along with biomedical sciences professor Neil MacLusky.

The paper was published recently in the *Proceedings of the National Academy of Sciences*.

Lead author Anna Phan, a recent PhD graduate who worked with both Guelph professors, is now a post-doc researcher at the Scripps Research Institute in Florida.

Researchers already knew that a region of the brain called the hippocampus responds to estrogens and is involved in cognition and memory.

An earlier study led by Phan showed that mice given systemic injections of the hormone improved their learning.

For this new study, the researchers recorded learning improvements within 40 minutes of injecting an estrogen directly into specific regions of the hippocampus, said Choleris.

The team assessed learning in mice by testing how readily they recognized other mice or objects, or objects moved to unfamiliar locations.

Brain cells communicate by passing signals through long cell extensions called axons to tiny spines located on branches of adjacent neurons. Within minutes of adding more estrogen, the team saw huge numbers of

spine synapses growing on those branches.

The researchers also expected to see greater electrical activity with more spines, but were surprised to find just the opposite in treated brain tissue alone.

Choleris said the scientists believe estrogens increase the number of synapses but that those potential connections remain silent unless they're used for learning. Learning strengthens certain connections while others are pruned away.

"Use it or lose it," said Choleris, adding that more research is needed to understand this mechanism.

She said studies have shown that post-menopausal women or women whose ovaries have been removed for medical reasons report problems with cognition and memory.

This new study suggests that boosting [estrogen levels](#) could help, although Choleris cautions that [estrogen replacement therapy](#) has been linked to greater cancer risk for some women.

"Ideally we would like to identify the [estrogen](#) mechanism to improve [learning](#) and not increase the risk of cancer."

Phan was a student in U of G's neuroscience graduate program, whose members include Choleris and MacLusky.

**More information:** Anna Phan et al. Rapid increases in immature synapses parallel estrogen-induced hippocampal learning enhancements, *Proceedings of the National Academy of Sciences* (2015). [DOI: 10.1073/pnas.1522150112](https://doi.org/10.1073/pnas.1522150112)

Provided by University of Guelph

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