

Stress in adolescence leads to learning and memory difficulties and increased anxiety in adulthood

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Stress experienced around puberty (peripubertal) worsens learning and memory in adulthood, as well as anxiety related behavior, as shown by a study led by Dr Cristina Márquez, from the Neuronal Circuits of Social Behavior laboratory at the Neuroscience Institute in Alicante (Spain).

This work has investigated the long-term consequences of stress experienced at this critical period of life in rodents, in collaboration with the Behavioural Genetics laboratory at the Brain and Mind Institute of the Federal Polytechnic School of Lausanne (Switzerland), led by the Spanish researcher Carmen Sandi.

The study also shows that it is the capacity of recovery of corticosterone basal levels—the equivalent of cortisol in humans—released in response to repeated stress in adolescence, and not the amount of this hormone released, that predicts the degree of learning impairment that will be experienced in adulthood.

"Testing [spatial learning](#) in rats is a way of

assessing cognitive, memory and learning skills in the laboratory," explains Dr. Márquez. This learning goes beyond academic knowledge and extends to all facets of daily life.

Stress regulation

In the study, rats that showed a poorer recovery from stress in the early stages of life had higher levels of PSA-NCAM, suggesting a [neurobiological mechanism](#) by which peripubertal stress would alter the normal maturation of plasticity processes in specific regions of the brain, such as the hippocampus, leading to a deterioration in cognitive performance and the appearance of anxiety-related behaviors later in life.

Overall, the results of this study demonstrate that the peripubertal period would be a critical time window in which stress may lead to long-term changes in the reactivity of the hypothalamus-pituitary-adrenal axis, which would be underlying the difficulties in learning abilities observed in adult life.

"Our results suggest that the degree of stress-induced adaptation of the hypothalamus-pituitary-adrenal axis in the important transition period of puberty is related to the long-term programming of cognition, behavior and endocrine reactivity," says Dr. Stamatina Tzanoulinou, first author of the study.

These findings pave the way for new studies that can identify mechanisms of both vulnerability and resilience to early trauma: "The programming effects of early stress may need an [incubation period](#) that can be reversed in young and more plastic brains, but not during adulthood. Therefore, following early detection of individuals vulnerable to [stress](#), there could be a window of opportunity for therapeutic intervention in adolescence to avoid the

natural course into psychopathology and cognitive impairment," highlights Dr. Marquez.

More information: S. Tzanoulinou et al,
Programming effects of peripubertal stress on
spatial learning, *Neurobiology of Stress* (2020).
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