

Hippocampal volume and resilience in posttraumatic stress disorder

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The hippocampus, a brain region implicated in memory and interpreting environmental contexts, has been the focus of a controversy in posttraumatic stress disorder (PTSD).

Early MRI studies suggested that the volume of the hippocampus was reduced in some people with chronic PTSD. This observation was interpreted as suggesting that stress produced atrophy within the hippocampus, consistent with a body of research conducted in animals. Supporting this hypothesis, it appears that the same region of the hippocampus that is most-sensitive to stress effects in animals, the CA3 region, may show the greatest volume reductions in people with PTSD.

More recently, the non-traumatized identical twins of people with PTSD were shown to have smaller hippocampal volumes, suggesting that a small hippocampus might be a risk factor for PTSD. This hypothesis relates to the role that the hippocampus plays in drawing inferences about one's environmental context, such as evaluating the safety of the environment. The hippocampus also provides some inhibitory control of hypothalamic centers that control the levels of the stress hormone cortisol.

Now, a new study in *Biological Psychiatry* has found that larger hippocampal volume is associated with recovery of PTSD. Brigitte Apfel and colleagues used structural magnetic resonance imaging to study hippocampal volume in Gulf War veterans who recovered from PTSD in comparison to veterans with chronic PTSD and to control participants

who never had PTSD. They found that recovered veterans had, on average, larger hippocampal volumes than those with chronic PTSD and similar volumes compared to the control participants.

"These results need to be interpreted with caution because we did not measure brain changes over time. However, the finding suggests that hippocampal damage in PTSD is reversible once the symptoms remit," explained Dr. Apfel. "If our finding can be confirmed, it might suggest that treatment of PTSD could be viewed as brain restoration rather than primarily a way to ease symptoms."

Does this finding help to resolve the conundrum of whether the hippocampus is a target of stress or a contributor to stress response?

This finding would appear to support the hypothesis that a small [hippocampus](#) is a risk factor for the persistence of PTSD, because people with larger hippocampi seemed better able to recover. This finding may be consistent with the observation that some gene variants associated with emotional resilience in response to stress are also associated with larger hippocampal volume. Alternatively, it is possible that smaller hippocampi reflect early life stress or other environmental factors that compromise resilience in adulthood.

A major remaining question is whether treatment-related increases in hippocampal volume mediate aspects of the therapeutic responses to PTSD treatments. A prior study reported that six months of antidepressant treatment increased hippocampal volume in people with PTSD.

"It may be time to view hippocampal volume as both a modulator of stress resilience and as a target for the negative impact of stress and the positive effects of treatments," commented Dr. John Krystal, Editor of [Biological Psychiatry](#). "This more complex view might explain how the

negative effects of stress "feed forward" to worsen outcomes in the face of subsequent stressors, while treatments would similarly cumulatively promote resilience."

More information: "Hippocampal Volume Differences in Gulf War Veterans with Current Versus Lifetime Posttraumatic Stress Disorder Symptoms" by Brigitte A. Apfel, et al. The article appears in *Biological Psychiatry*, Volume 69, Number 6 (March 15, 2011)

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