

Brain circuitry for both positive and negative 'valence' affected by trauma

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For many people, a traumatic experience can leave an indelible impression on the brain in the form of post-traumatic stress disorder (PTSD). PTSD is characterized by hyperarousal and avoidance of risky, potentially aversive behaviors.

Research has revealed that the brain employs distinct circuitries that mediate positive, or rewarding, behaviors and negative, or aversive, ones. PTSD has long been thought to arise from overactivity in the negative valence system, however a new study shows that people with PTSD also displayed a deficit in activation of positive valence processing soon after the trauma, suggesting it plays a role in resilience to PTSD.

The work appears in *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*.

Led by Talma Hendler, MD, Ph.D., and Ziv Ben-Zion, Ph.D., both at Tel Aviv University, Israel, the researchers identified 171 people who had been treated in a hospital emergency department for a trauma (such as a car accident) and who, within two weeks of the traumatic event, were

experiencing symptoms of PTSD. One month after the trauma, survivors were assessed in the lab by a trained clinical interviewer in more detail, and underwent brain scans by functional magnetic resonance imaging (fMRI). The same assessments were made at six months and 14 months post-trauma.

While undergoing fMRI, participants played a competitive electronic gambling game designed to test participants' sensitivity to risk, reward and punishment. Not surprisingly, participants with more severe PTSD symptoms at the start of the study made fewer risky choices in the game, and fMRI scans showed that they had greater activation in the amygdala—a brain region associated with fear processing and a key part of the negative valence system. But decreased activity at one month in the ventral striatum, a mesolimbic brain region involved in processing positive valence like rewards, predicted more severe PTSD symptoms at 14 months.

Dr. Ben-Zion said the work "provides insights on roles of both the positive and negative valence processing systems in the early development of post-traumatic psychopathology. While most of the research to date on stress and trauma has focused on the hyper-active negative valence system (e.g., increased fear and threat responses), our findings also suggest a critical role for hypo-active positive valence system (e.g., less neural activation towards rewards) in PTSD development and point to its role in resilience to traumatic stress and /or adaptive recovery from it."

Cameron Carter, MD, Editor of *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, said that "this work provides new insights into the fundamental changes in brain function that follow traumatic experiences and underlie the development of PTSD. The study shows us that these changes go beyond dysregulated threat processing and include brain

systems related to reward and motivation that are likely to underlie changes in mood and motivated behavior in PTSD."

The work could have implications for therapeutic strategies to treat stress- and anxiety-related disorders, Professor Hendler said, adding that "novel therapeutic approaches should address both positive and negative valence systems, as these two are intrinsically linked and both affect the symptom development after experiencing traumatic stress.

"Furthermore, we suggest that specific deficits in each valence system are associated with specific symptoms of PTSD, possibly pointing to distinct underlying mental processes that could guide a more personalized approach in psychiatric treatment."

More information: Ziv Ben-Zion et al, Neural Responsivity to Reward versus Punishment Shortly after Trauma Predicts Long-term Development of Post-Traumatic Stress Symptoms, *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging* (2021). [DOI: 10.1016/j.bpsc.2021.09.001](https://doi.org/10.1016/j.bpsc.2021.09.001)

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