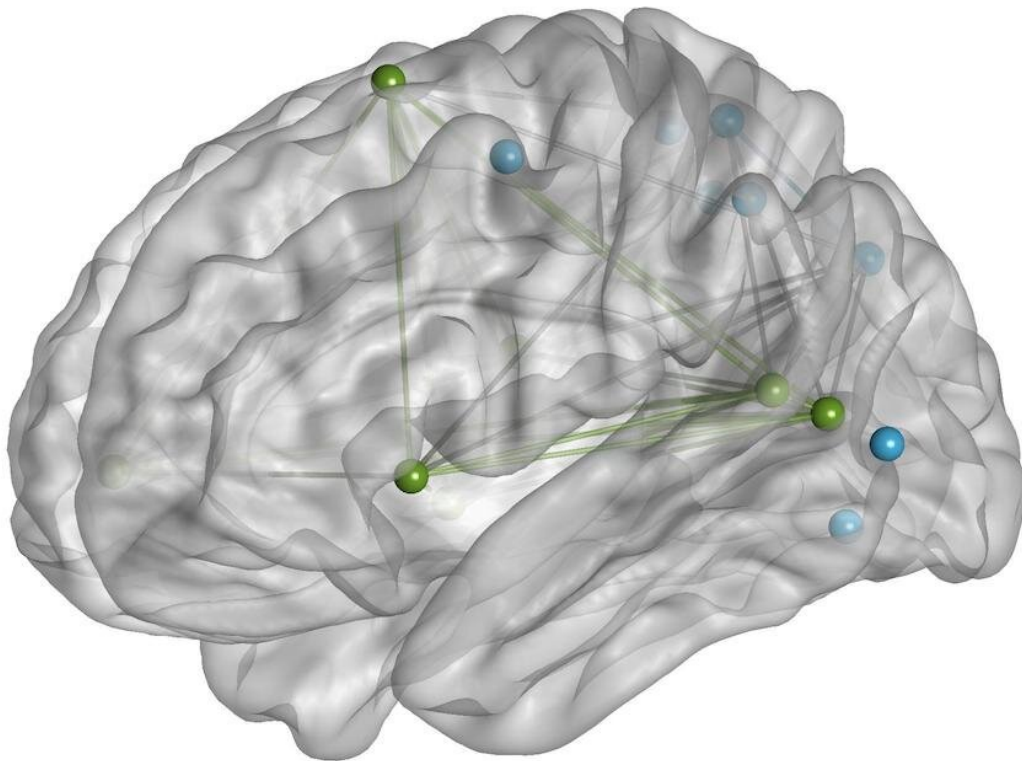


# Brain connectivity is lower in adults with PTSD or a history of sexual abuse

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The VAN-DAN network of the brain. Credit: Dr. Jane Joseph.

A study conducted at MUSC in adults with a history of childhood maltreatment showed that two groups—those with a history of sexual abuse and those with posttraumatic stress disorder (PTSD)—had reduced

brain connectivity in the attention systems known as the ventral and dorsal attention network (VAN-DAN). No such reduction was seen in adults with a history of physical abuse, nor in those who did not develop PTSD. The team, which was led by MUSC neuroscientist Jane Joseph, Ph.D., also showed that connectivity in the VAN-DAN systems increased after treatment with oxytocin, a hormone associated with social affiliations and the stress response. The team's findings are published in *Psychiatry Research: Neuroimaging*.

"We believe that these findings contribute to the field by helping us to understand better how the connection between the [brain](#)'s attention systems may be involved in whether PTSD develops after childhood trauma," explained Kathleen Crum, Ph.D., lead author of the article. Crum, who was at MUSC at the time of the study, has since transitioned to a faculty position in the Department of Psychiatry at the Indiana University School of Medicine.

Abuse during childhood is a major risk factor for PTSD. Indeed, children who experience any form of abuse are 70% more likely to develop PTSD. Sexual abuse during childhood disrupts brain development and is theorized to be associated with betrayal trauma, which occurs when a person's trust in an institution or loved one is violated by abuse.

"Current psychology literature suggests the possibility of something known as betrayal trauma," Crum explained. "People perceive events differently depending on the form of abuse."

For example, study participants with a history of sexual abuse had reduced VAN-DAN connectivity, regardless of whether they went on to develop PTSD, whereas those with a history of physical abuse did not.

VAN and DAN each play a unique role in the regulation of attention,

according to Crum.

"DAN is a network in the brain that is responsible for voluntary attention, while VAN is the process of shifting or reorienting our attention to another event," said Crum. "They act as a push-pull mechanism; while one action occurs, the other cannot."

Joseph and Crum wanted to study the VAN-DAN network because patients with PTSD often find it difficult to reorient their attention.

"Individuals with PTSD have difficulty disengaging attention from threat-related cues, including cues that remind them of their traumatic experiences," explained Crum. "Individuals with PTSD may also tend to interpret neutral cues as threat-related. Collectively, these problems affect their ability to direct their attention to the task at hand in their everyday lives."

It is thought that the "fight or flight" response may be hyperactive in these individuals, which may account for this difficulty with shifting their attention. Crum provided an example to illustrate why it can be difficult for people with PTSD to concentrate on a specific task when their perception of external threat is heightened.

"Imagine a scenario where you are parachuting or skydiving and someone asks you to do a complex math problem—how well would you do on that math problem?" asked Crum. "The focus on survival and staying out of danger can compete with performing everyday tasks, like holding a conversation or doing our work."

The team wanted to measure VAN-DAN connectivity at rest because it enabled them to compare differences in connectivity without the demands of a specific task.

The effect of the hormone oxytocin was also explored in relation to decreased connectivity. Oxytocin is thought to act on the attention network system and is being studied nationally as a potential treatment for PTSD and childhood trauma, including at MUSC.

"Oxytocin is very important for social bonding and stress reduction," explained Joseph. "While PTSD does not always originate from social and personal trauma, oxytocin seems to be beneficial in stressful situations, which is why it is being explored as a treatment for this disorder."

Crum believes the next step for the field would be to examine how trauma exposure itself affects attention network connectivity.

"Existing research suggests that trauma exposure is associated with changes in the brain and its functions, regardless of a PTSD diagnosis," stated Crum. "Future work should analyze the differences between trauma exposure and traumatic stress in groups exposed to trauma who did and did not develop PTSD, as well as a third group who did not experience any trauma whatsoever."

**More information:** Crum KI et al, Oxytocin, PTSD, and sexual abuse are associated with attention network intrinsic functional connectivity. *Psychiatry Res Neuroimaging*. (2021) [DOI: 10.1016/j.psychresns.2021.111345](https://doi.org/10.1016/j.psychresns.2021.111345).

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