

# How does Post Traumatic Stress Disorder Change the Brain?

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Child abuse. Rape. Sexual assault. Brutal physical attack. Being in a war and witnessing violence, bloodshed, and death from close quarters. Near death experiences. These are extremely traumatic events, and some victims bear the scars for life.

The physical scars heal, but some emotional wounds stop the lives of these people dead in their tracks. They are afraid to get close to people or form new relationships. Change terrifies them, and they remain forever hesitant to express their needs or give vent to their creative potential. It may not be always apparent, but post-traumatic stress disorder (PTSD) stifles the life force out of its victims. It is no use telling them to “get over” it because PTSD fundamentally changes the brain’s structure and alters its functionalities.

## What goes on inside the brains of people with PTSD?

PTSD is painful and frightening. The memories of the event linger and victims often have vivid **flashbacks**. Frightened and traumatized, they are almost always on edge and the slightest of cues sends them hurtling back inside their protective shells. Usually victims try to avoid people, objects, and situations that remind them of their hurtful experiences; this behavior is debilitating and prevents them from living their lives meaningfully.

Many victims forget the details of the incident, obviously in an attempt to lessen the blow. But this coping mechanism has negative repercussions as well. Without accepting and reconciling with “reality,” they turn into fragmented souls.

Extensive neuroimaging studies on the brains of PTSD patients show that several regions differ structurally and functionally from those of healthy individuals. The amygdala, the hippocampus, and the ventromedial prefrontal cortex play a role in triggering the typical symptoms of PTSD. These regions collectively impact the stress response mechanism in humans, so the PTSD victim, even long after his experiences, continues to perceive and respond to **stress** differently than someone who is not suffering the aftermaths of trauma.

## Effect of trauma on the hippocampus

The most significant neurological impact of trauma is seen in the hippocampus. PTSD patients show a considerable reduction in the volume of the **hippocampus**. This region of the brain is responsible for memory functions. It helps an individual to record new memories and retrieve them later in response to specific and relevant environmental stimuli. The hippocampus also helps us distinguish between past and present memories.

PTSD patients with reduced hippocampal volumes lose the ability to discriminate between past and present experiences or interpret environmental contexts correctly. Their particular neural mechanisms trigger extreme stress responses when confronted with environmental situations that only remotely resemble something from their traumatic past. This is why a sexual assault victim is terrified of parking lots because she was once

raped in a similar place. A war veteran still cannot watch violent movies because they remind him of his trench days; his hippocampus cannot minimize the interference of past memories.

### **Effect of trauma on the ventromedial prefrontal cortex**

Severe emotional trauma causes lasting changes in the **ventromedial prefrontal cortex** region of the brain that is responsible for regulating emotional responses triggered by the amygdala. Specifically, this region regulates negative emotions like fear that occur when confronted with specific stimuli. PTSD patients show a marked decrease in the volume of ventromedial prefrontal cortex and the functional ability of this region. This explains why people suffering from PTSD tend to exhibit fear, anxiety, and extreme stress responses even when faced with stimuli not connected – or only remotely connected – to their experiences from the past.

### **Effect of trauma on the amygdala**

Trauma appears to increase activity in the **amygdala**. This region of the brain helps us process emotions and is also linked to fear responses. PTSD patients exhibit hyperactivity in the amygdala in response to stimuli that are somehow connected to their traumatic experiences. They exhibit anxiety, panic, and extreme stress when they are shown photographs or presented with narratives of trauma victims whose experiences match theirs; or made to listen to sounds or words related to their traumatic encounters.

What is interesting is that the amygdala in PTSD patients may be so hyperactive that these people exhibit fear and stress responses even when they are confronted with stimuli not associated with their trauma, such as when they are simply shown photographs of people exhibiting fear.

The hippocampus, the ventromedial prefrontal cortex, and the amygdala complete the neural circuitry of stress. The hippocampus facilitates appropriate responses to environmental stimuli, so the amygdala does not go into stress mode. The ventromedial prefrontal cortex regulates emotional responses by controlling the functions of the amygdala. It is thus not surprising that when the hypoactive hippocampus and the functionally-challenged ventromedial prefrontal cortex stop pulling the chains, the amygdala gets into a tizzy.

Hyperactivity of the amygdala is positively related to the severity of PTSD symptoms. The aforementioned developments explain the tell-tale signs of PTSD—startle responses to the most harmless of stimuli and frequent flashbacks or intrusive recollections.

Researchers believe that the brain changes caused by PTSD increase the likelihood of a person developing other psychotic and **mood disorders**. Understanding how PTSD alters brain chemistry is critical to empathize with the condition of the victims and devise treatment methods that will enable them to live fully and fulfill their true potential.

But in the midst of such grim findings, scientists also sound a note of hope for PTSD patients and their loved ones. According to them, by delving into the pathophysiology of

PTSD, they have also realized that the disorder is reversible. The human brain can be re-wired. In fact, drugs and behavioral therapies have been shown to increase the volume of the hippocampus in PTSD patients. The brain is a finely-tuned instrument. It is fragile, but it is heartening to know that the brain also has an amazing capacity to regenerate.

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