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The Neurobiology of Sexual Assault

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The Neurobiology of Sexual Assault

Advances in neuroscience continue to shape our understanding of the brain and its seemingly infinite processes. In recent years, through the use of brain imaging techniques like functional magnetic resonance imaging (fMRI), researchers have accumulated knowledge on how the brain responds to stimuli in its external environment, particularly harmful stimuli.

Responding to threat

Evidence shows that perceived threats stimulate four distinct regions of the brain: the hypothalamus, the pituitary gland, the hippocampus and the amygdala.

If someone or something threatens our wellbeing, the hypothalamus signals the pituitary gland, or master gland, to trigger the release of a “hormonal soup”¹ consisting of catecholamines, corticosteroids and opioids. As these hormones enter the bloodstream, their individual functions are apparent. Catecholamines, which include dopamine, epinephrine and norepinephrine, provide the body with the necessary energy to fight or flee. Cortisol, a corticosteroid hormone, conserves the body’s energy by suppressing energy-dependent bodily systems, including the digestive and immune systems. And in the event that the threat turns violent, opioids, combined with the hormone oxytocin, attempt to numb the body from the associated physical and/or emotional pain.

Simultaneously, the hippocampus and the amygdala work together to process and store incoming information from our surroundings as memories. The hippocampus’ role is to actively tag and organize external sensory cues such as sounds and images. This is called encoding. Once the sensory cues have been encoded, the hippocampus then groups similar cues together and stores them as memories throughout the brain. This is called consolidation. The amygdala, which acts like a filter, captures and stores emotionally charged, or fearful, information as memories.

However, the hippocampus and amygdala are extremely sensitive to the fluctuation of hormones released during a threatening event. High levels of catecholamines impair the brain’s mechanisms that control rational thought, while an increased output of opioids and oxytocin can compromise one’s ability to effectively express emotion. Similarly, a high concentration of corticosteroids can zap the body of its stored energy, causing it to shut down or freeze. This is known as tonic immobility.

What does this mean for a woman who is sexually assaulted?

Tonic immobility, or sexual assault-induced paralysis, is an autonomic response, which means it is impossible to control. It typically happens when fighting or fleeing a threat are no longer options, and it is often characterized by pronounced muscle rigidity, numbness and insensitivity to painful stimulation. Tonic immobility is not uncommon among victims/survivors of sexual assault; in fact, 41%-52% of women experience this type of response during an assault (Bovin et al. 2008). Research also suggests that tonic immobility is more common in women who have been assaulted more than once.

¹ Term used by Dr. Rebecca Campbell during an NIJ Research for the Real World Seminar; December 3, 2012

Recalling the details of a sexual assault can be profoundly difficult for women who have been assaulted. Sometimes, their recollection of the event is sparse or seems “almost made up.” The latter phenomenon may be linked to the surge of hormones released during the assault as a result of the interaction between the hypothalamus and the pituitary gland. This surge of hormones compromises the brain’s ability to encode and consolidate vivid memories of the event. Alcohol can exacerbate difficulties in the encoding and consolidation process.

Implications for front-line responders

In many cases, the initial interaction between front-line responders, such as police and healthcare providers, and victims/survivors of sexual assaults is strained by personal beliefs, attitudes or preconceived notions on the part of the worker and/or the woman who has been assaulted. Further, the nature of a victim/survivor’s demeanor and her memories of the assault may be misconstrued when she is reporting or testifying in court because officials do not understand the impact of trauma on the brain’s ability to encode and consolidate vivid memories. Often, victims/survivors of sexual assault experience the questions and subsequent reactions from front-line responders, especially police, as insensitive, leaving victims/survivors feeling guilty, depressed or further violated. Women say this exacerbates the trauma, making them feel victimized for a second time. This is known as secondary victimization.

To improve the societal response to women who have been assaulted and effectively address their post-assault needs, it is essential to educate front-line responders on the varied reactions or behaviours victims/survivors may exhibit and the potential reasons for such reactions (e.g., the neurobiology of sexual assault). Similarly, training front-line responders on how to provide the necessary emotional support and sensitivity when speaking with women who experienced sexual assault, especially when the assault has just taken place, is paramount in reducing the rate of secondary victimization. Prevention is critical, including purging our communities of the stereotypes and misconceptions associated with sexual assault. This is possible through the implementation of community-based sexual assault awareness programs and active collaboration with reputable media outlets to disseminate accurate messages and promote healthy social norms.

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