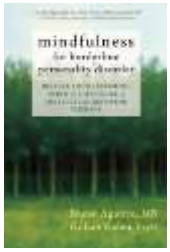
Brain Biology, BPD & Mindfulness



Professional Blog
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In recent years, developments in neuroscience have offered significant breakthroughs in understanding the brain chemistry that contributes to the behaviors and suffering associated with borderline personality disorder. While mindfulness cannot change your genes, research is beginning to show that it can change the way your genes work (Smalley 2010).

The basics: Critical Brain Structures

The adult brain weighs about three pounds. It connects to the spinal cord through the brain stem, which contains bundles of nerve cells, or neurons. In the treatment of borderline personality disorder, the most significant parts of the brain are the amygdala, an almond-shaped group of neurons deep inside each hemisphere of the brain, and the prefrontal cortex (PFC), the part of each of the brain's two hemispheres located right behind the forehead and responsible for controlling executive functions. Executive functions include:

- Mediating conflicting thoughts
- Making choices between right and wrong, or good and bad
- Predicting future events
- Governing social control (ex. suppressing the urge to have sex with your significant other on the bus)

Typically, the PFC regulates the amygdala and the rest of the limbic system. For instance, imagine that you are wearing a light-colored jacket at a family reunion, and your hyperactive brother, who is excited to see you, trips and spills his glass of red wine all over you. Your amygdala processes the information, and you get angry at him. You want to lash out and yell at him, but your PFC steps in and says "I know you want to yell at him, but it would ruin the reunion, and if you yell at him, he will get upset and not talk to you for a week. You can still be mad at him, but go get another jacket and talk to him later." These exchanges among the various parts of your brain happen very quickly, many without your awareness. Because your PFC is in charge of regulating your amygdala, you can see what would happen if your PFC were either not working well or not fully developed. You would have reduced ability to control the impulse to lash out.

People with BPD are often called "impulsive," and it's a fact that the PFC is not as developed in people with BPD as in those without. Conversely, in people who have BPD, the amygdala is very active, almost too active, so emotional responses that arise tend to be big. If you have a big emotional response, the behaviors that arise from that response also tend to be intense. In BPD sufferers, the overactive, under controlled amygdala is to blame for overwhelming power of emotional responses.

Another interesting role of the amygdala is in the making of memories. Memories tied to strong emotions, in particular. For example, imagine that you go up to an unfamiliar dog that's wandering in the park, and the dog growls at you and then bites you. You experience fear, and the memory is registered and locked in, making it less likely that you will go up to strange dogs in the future. From an evolutionary perspective, the amygdala would have helped keep us away from all sorts of dangers, like saber-toothed tigers. In BPD, this response is magnified, and then, rather than their serving simply as a warning system, the memories, paired with strong emotions, play over and over, causing suffering even after the danger has passed.

The most consistent finding in imaging studies of people with BPD, compared to those without BPD, is increased activity in the amygdala, particularly if they also experience suicidal thoughts (Soloff et al. 2012). So finding a way to reduce this activity is critical to reducing the flow of unrelenting emotions in BPD.

Some of the most fascinating tests that investigate the neurobiology of BPD, including brain scans that track the activity of neurotransmitters, have allowed researchers to investigate the neurobiology of BPD by examining

brain chemistry. Studies have shown that having a less active PFC means having a more difficult time with emotion regulation.

Brain scans have shown that people with impulsive aggression, who engage in such behaviors as self-mutilation, physical violence, assault, destruction or property, and drug use—one of the most well-researched areas of BPD—have lower levels of activity in the PFC (Spoont, 1992), and that people with BPD also have less brain activity in the PFC (Goyer et al. 1994).

Most brain-scanning studies reveal that people with BPD show disordered functioning in the PFC, compared to people without BPD, and this is particularly true if the person with BPD also suffers from post-traumatic stress disorder.

Studies on BPD and genetics have shown that you can, in fact, inherit impulsive aggression (Coccaro, Bergeman, and McClearn 1993).

There are three main neurotransmitters, or brain chemicals, that have been studied in BPD.

1. **Opiates** are released (under ordinary circumstances) by the brain to dull pain in response to body-tissue damage. It appears that people with BPD who self-injure have lower levels of natural opiates compared to people with BPD who don't self-injure (Stanley et al. 2010). Many people who take opiate painkillers report a feeling of wellness, so some theorize that people with BPD self-injure to increase their levels of natural opiates in order to feel better. In fact, many people with BPD who self-injure state that they do feel better, even if just for a brief period of time after engaging in the behavior (Simeon et al. 1992). Research shows that if you have BPD and self-injure, you won't perceive pain as much as someone without BPD does (Bohus et al. 2000). This means that self-injury (like cutting) that would typically cause someone without BPD to feel pain might not cause others as much pain. But people with BPD have more pain syndromes, such as headaches and muscle, abdominal, and back pain, than those without BPD (Tragesser, Bruns, and Disorbio 2010).
2. **Serotonin** plays an important role in the regulation of mood, sleep, and learning. It is found throughout the brain and the digestive system, and has been implicated in depression, suicide, anxiety, and appetite regulation. Studies show that people with BPD have low levels of serotonin activity, and that this is associated with impulsive aggression (Goodman and New 2000). Research also shows that low serotonin activity is associated with suicide attempts (Lidberg et al. 2000) and self-injury (New et al. 1997).
3. **Cortisol** is a chemical released during stress that helps to break down carbohydrates and proteins in order to increase the supply of glucose and oxygen in the muscles, heart, and brain. But high levels of cortisol over a prolonged period of time lead to an increase in blood pressure and an increase in sugar levels, both of which lead to unhealthy fat build-up in the abdomen, thinning of bones, and prevention of collagen formation. High cortisol levels also suppress immune-system response and cause the body to age faster. Over time, exposure to high levels of cortisol damages and reduces the number of cells in the hippocampus, which is the brain's memory center. Research shows that not only do people with BPD have high levels of cortisol (Wingfeld et al. 2007), but also that these high levels predict a higher risk of suicide over time (Lester and Bean 1992).

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