

# Understanding PTSD: Researchers explore causes, treatment

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Eric Batory, pictured during his time as a special operations medic, assigned to the U.S. Army's 1st Ranger Battalion, 75th Ranger Regiment. Batory went through two years of extensive medical and special forces training to qualify for the position. Credit: Eric Batory

(Medical Xpress)—In 2005, ASU student Eric Batory was a long way from Arizona. He was in Mosul, Iraq on his first deployment as a special operations medic with the U.S. Army's 1st Ranger Battalion, 75th Ranger Regiment.

During a night raid to extract a high-value target, his unit came under fire as they were entering a compound. The squad leader was shot on his right side, where the round glanced off his [body armor](#) and came to rest near his heart. The only medic on the scene, Batory began rendering aid to the Ranger in the midst of a heated firefight, feeling the concussive force of grenades and gunfire all around him.

"That's what really rung my bell," says Batory, who is now a student in ASU's College of Liberal Arts and Sciences. "I'm in a closed room, with an LED light on this guy, all this stuff blowing up, concrete raining down."

Batory's patient survived and Batory was awarded the Bronze Star with Combat 'V' for his actions, the fifth-highest combat decoration. After that, Batory says he started to feel a little bit "off." He became withdrawn from his platoon, obsessing over every possible medical scenario. He distanced himself from his fellow Rangers, afraid he'd lose someone as a result of his actions.

Two years and two deployments later, he left the Army as a sergeant, joining the scores of veterans living with cognitive and psychological wounds from the Global War on Terror.

Six years and a world away from the battlegrounds of Iraq and Afghanistan, Batory still lives with [post-traumatic stress disorder](#) (PTSD) from his time in combat. Any traumatic experience, such as combat, violent assault or natural disaster, can cause PTSD. Symptoms can include flashbacks to the event, nightmares, avoiding triggering situations, numbness and withdrawal, fear and increased emotional arousal.

Why do these kinds of experiences create such a painful and long-lasting effect? The answer lies in very old structures in the human brain, called

the amygdala and the hippocampus. These are nestled within the temporal lobe, which manages sensory input, speech and language, and memory formation and association. Memories are formed, stored and contextualized by the hippocampus. The amygdala is tied to our emotions, particularly those felt in fearful, life-or-death situations.

"The hippocampus' job is to remember the context of the situation and the amygdala ensures the longevity of that memory, especially the emotional memory," says Harold Burke, a faculty associate in ASU's College of Health Solutions. "It's not just the context of the visual and audio cues, but the emotional experience of fear."

In addition to branding these memories in the brain, the amygdala also regulates part of the sympathetic nervous system, commonly known as the fight or flight system.

"It's a very old part of brains from an evolutionary standpoint," says Burke, who teaches courses in ASU's Doctor of Behavioral Health program. "It's been designed over millions of years of evolution to trigger in an emergency situation to save our lives."

In these emergency situations, like the heated combat Batory experienced, the sympathetic nervous system pumps out norepinephrine. Norepinephrine increases heart rate as well as oxygen supply to the brain, allows us to breathe faster and deeper, dilates pupils to take in more visual information and triggers the release of glucose stores for extra energy.

"It also activates the upper part of the brain, namely the cerebral cortex, so you can be very alert and make quick decisions," says Burke.

A secondary system, which takes longer to kick in, lasts longer and aids the body's recovery. The hypothalamic-pituitary-adrenal axis, or HPA

axis, is a conglomerate of structures throughout the body that responds to highly stressful situations by releasing the hormone cortisol.

Cortisol is incredibly beneficial to both the body and mind in small, measured doses. But with chronically stressful situations, cortisol becomes more of a problem than a solution.

Back in the hippocampus, there are neurons that act as a thermostat that regulates cortisol production. But prolonged or repeated release of cortisol kills the very neurons that help inhibit it, resulting in a negative feedback loop of more cortisol and fewer neurons to stop its release.

"It's like smashing the thermostat," Burke explains.

Furthermore, repeated exposure to similar high-stress trauma not only kills neurons and can inhibit cognition, but can also result in the strengthening of the memories being encoded in the hippocampus and amygdala.

"Here's the issue: with PTSD, the activation of the amygdala and HPA axis is so intense that the synapses, the various connections between the neurons, how well they communicate, are strengthened as a product of that intensity and it can last a very, very long time," says Burke.

It's like tracing a picture over and over again. The more you go over those lines, the clearer and more distinct an image becomes, just as repeated exposure to trauma enhances the emotional memory and deeply encodes a fear response.

To make matters worse, the job of the hippocampus and amygdala together is to not just remember that exact, specific situation, but to remember things that are similar to it.

"The brain generalizes the stimuli, so that if anything else is even somewhat similar it will trigger the same response," says Burke. "And that's actually a good thing. We want to be able to generalize our learning to different contexts, but the catch with PTSD is that then other things that are pretty innocent actually trigger the same kind of memories or re-experiencing."

For instance, some veterans who spent time on convoys have difficulty driving if there's trash or debris in the road, as hiding improvised explosive devices in garbage is a common insurgent tactic. In the case of Batory, there's a gamut of different stimuli that trigger an intense fear response for him back in the civilian world.

"Dogs barking, alarms or phones ringing. Anything beeping or with a high pitch," says Batory, listing the things that send his heart racing. "Noise in the dark, or a lot of light at night ... I don't like bright lights at night, I feel like you're exposed."

The sound and concussive force of fireworks has sent him diving to the ground before.

"Even at Fourth of July, knowing what it was, just feeling the concussions or hearing the blasts gets my heart rate up," says Batory.

Batory's struggle with PTSD and its lingering effects aren't limited to barking dogs or fireworks. When he was honorably discharged from the Army in 2007, he was bored. After deploying three times as a special operations medic and working through two years of intensive schooling to qualify for the coveted position, a desk job left him restless.

"I was so dissatisfied with feelings of insignificance and lack of stimulation, compared to what I was used to," says Batory.

Distracted, depressed and disillusioned with civilian life, Batory joined the Army Reserves, which only seemed to exacerbate his symptoms. Batory had trouble sleeping, and when he did, he was sleepwalking. He started to fear social events and public places like movie theatres, malls or sporting events.

"I started to get overwhelming anxiety being around groups of people," says Batory. "Whenever I was around large crowds, I'd want to leave because I'd feel overwhelmed, because there was no structure and no order. That all started to compound until I started having dissociative episodes, getting in car accidents where I would zone out and think about Iraq or Afghanistan. I'd hit a median or rear end someone. Started getting a lot of tickets and got into financial trouble."

Eventually, Batory's car was repossessed and he became homeless, all in the midst of trying to attain his undergraduate degree. He put in a disability claim with the VA and sought additional help there, receiving neuropsychological testing. He found some relief with medication, but he wasn't happy about it.

"It's disheartening to know that you have this pile of pills in front of you and you're dependent on it to feel human," says Batory.

Batory sought out additional resources available to ASU students. Fortunately for him, ASU offers a range of counseling services and has been named a Military Friendly School four years running.

He began therapy with Andrea Hekler, a clinical psychologist at ASU Health Services - NP Healthcare, located near the Downtown Phoenix campus. Hekler provides two types of evidence-based psychotherapies for PTSD patients: cognitive processing therapy and prolonged exposure therapy. Both are a class of therapies called cognitive behavioral therapies.

"Cognitions refer to the thoughts we have and how we perceive life through a certain lens," says Hekler, who has previously worked with the National Center for PTSD. "When individuals experience a trauma – be it combat, Hurricane Sandy, 9/11 in New York or being sexually assaulted – having those traumatic experiences leads us to perceive the world in different ways. People tend to start thinking the world is a much more dangerous place than most people believe and they're not able to handle and cope with the world."

Cognitive processing therapy focuses on the assumptions that PTSD victims have as a result of their trauma. Prolonged exposure therapy homes in on a victim's behavior.

Cognitive processing therapy teaches patients how their thoughts are connected to how they behave and feel.

"It's essentially using logic and rational thinking to help them understand the assumptions they have and challenge those assumptions," says Hekler.

Prolonged exposure therapy can be more challenging as it's based on the premise that PTSD victims haven't processed their trauma or even talked about it, according to Hekler.

This therapy breaks down into four parts: education on what PTSD is and its symptoms, breathing exercises to relax the patient and two types of exposure. In the first, imaginal exposure, patients close their eyes and describe their trauma as if it were happening in the moment, not the past. This process is repeated, recorded and listened to outside of the sessions as well.

"Through this rehearsal, they come to something called habituation," says Hekler. "Essentially, stimuli that once had a very strong intensity,

over time reduces that intensity. Each time, when someone comes back to therapy they recite the event again and typically what happens is they don't become as emotionally distressed or upset about it. Eventually it becomes a memory, not one that you want to revisit all the time, but without the same emotional intensity."

The second type of exposure is in vivo exposure, where patients list all of the situations they avoid and then insert themselves in them. This fosters a similar process of habituation, where the patient learns to manage the crippling fear or anxiety they experience in situations they avoid.

"At the heart of PTSD is avoidance," says Hekler. "Avoidance is really good in the short term because it makes anxiety go away – what it's really doing is telling your brain that this is terrifying and we need to get away."

In other words, it's only serving to strengthen the fear conditioning in the amygdala and hippocampus. The process of habituation doesn't seek to overwrite those incredibly intense emotional memories, but to create a separate set of circuits that associate the same stimuli with a safe emotional response.

"Cognitive behavior therapy literally sets up and strengthens circuits to inhibit fear," says Burke. "You don't get rid of the original trauma, but you overlay it with other behavior."

For Batory, in vivo exposure proved to be a beneficial form of therapy.

"It was effective not because it changed what I feel or think, but because I learned to deal," says Batory. "Even though I feel anxiety, it's not as severe and I know how to keep it in check."



While both therapy and medication can be effective, Burke believes that PTSD demands a holistic approach to treatment in which different health professionals work closely together.

"I think ASU is on the cutting edge of integrated health solutions," says Burke. "We can have Dr. A doing one thing to a person and Dr. B doing something else to the same person across town, especially when Dr. A is just physical medicine and Dr. B is just psychological. Those two groups have not been talking nearly enough over the last decades, and that's got to change. And ASU is right on the cusp of it. The Doctorate of Behavioral Health program is the first of its kind in the whole country."

Batory now lives with a group of other veterans and is on track to graduate with a bachelor's degree in microbiology in December 2013. After spending years of attaching negative associations to his military experience, even when saving lives, he has newfound perspective and direction. He is applying to medical schools in the coming months, saying he wants to get back to helping people.

"I've taken up an interest in medicine again, and I think it's a good measure of the return of myself and my life's purpose," says Batory. "But I really had to rebuild myself to get back to that point."

To others suffering from PTSD, Batory offers pretty straightforward advice: "You're not weak. You're not any less of a person for acknowledging you're struggling, and the sooner you do that, the sooner you'll be on the road to recovering."

Provided by Arizona State University

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