

Talking heads

Larry Sherman brings to the masses a better understanding of PTSD and how, if left untreated, it can get into our genes

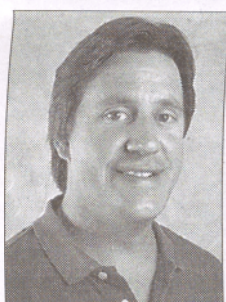
BY AMANDA WALDROUPE
STAFF WRITER

Portlanders are a little nerdy, so it's not all that surprising that Science on Tap, a science lecture series where attendees can also enjoy a beer, regularly sells out.

But Dr. Larry Sherman never expected his talk, "The Neuroscience of Trauma: From Trigger Warnings to PTSD," to sell out three times.

Sherman is a senior scientist in the division of Neuroscience at Oregon Health & Science University (OHSU). He delivered his talk at Vancouver's Kiggins Theater on Veterans Day last year, and in two theaters in Portland to packed audiences.

When he was growing up, Sherman noticed that his father, who served in the Navy during World War II, would startle at the sound of fireworks. He was quiet, stoic, soft-spoken. It was only at the end of his mother's life that Sherman learned his father had once been talkative and effusive.



Larry Sherman

Before he died, Sherman's father told his son about his experiences in the war, and Sherman realized that his father suffered from post-traumatic stress disorder. Startling at fireworks wasn't merely nervous behavior; it was a response to the trigger of a traumatic memory.

PTSD is a mental disorder that develops after a person experiences one or more traumatic events – events that are life-threatening or so dangerous or frightening that the person goes on to suffer from nightmares, anxiety, depression and suicidal tendencies. They have intrusive thoughts and feelings related to the traumatic event. People can become hypervigilant in certain circumstances or avoid situations that trigger their memories altogether.

PTSD is most associated with war veterans, but people who have suffered childhood abuse, sexual abuse or domestic violence are also prone to develop the disorder.

Sherman, who studies the molecular and genetic impacts of neurodegenerative conditions and diseases such as multiple sclerosis, talked about his Science on Tap lecture and research being done that shows PTSD can alter a person's genes – and be passed down through generations.

Amanda Waldroupe: *A lot of people still seem to think, or assume, that the vast majority of people with PTSD are combat veterans. But it's true that many different groups of people – like people who have*

suffered sexual abuse or child abuse – can also get PTSD.

Larry Sherman: People hear the phrase "PTSD" and they immediately think 'soldier' or 'veteran.' It definitely is not something that is just for soldiers. It's true that the first indication that it is a syndrome was from war. We've just learned so much about it from returning veterans. Most of the research has been from veterans.

I think any person who has experienced trauma of any sort is prone to developing PTSD. Recognizing that has been huge. So many people are suffering and it was unclear why they were behaving the way they were after these events. They were self-medicating, developing addiction issues. It includes being in a car crash, surviving a disease that is considered likely fatal, terminal illnesses, cancer survivors who have to go through rounds of chemotherapy and knowing that they may die.

I was talking to a fellow who was a counselor for several of the 9/11 workers who helped the aid workers at the site. A huge proportion of those people developed PTSD. You don't think of someone who is a firefighter having PTSD, but what they see and go through is putting them through trauma on a regular basis.

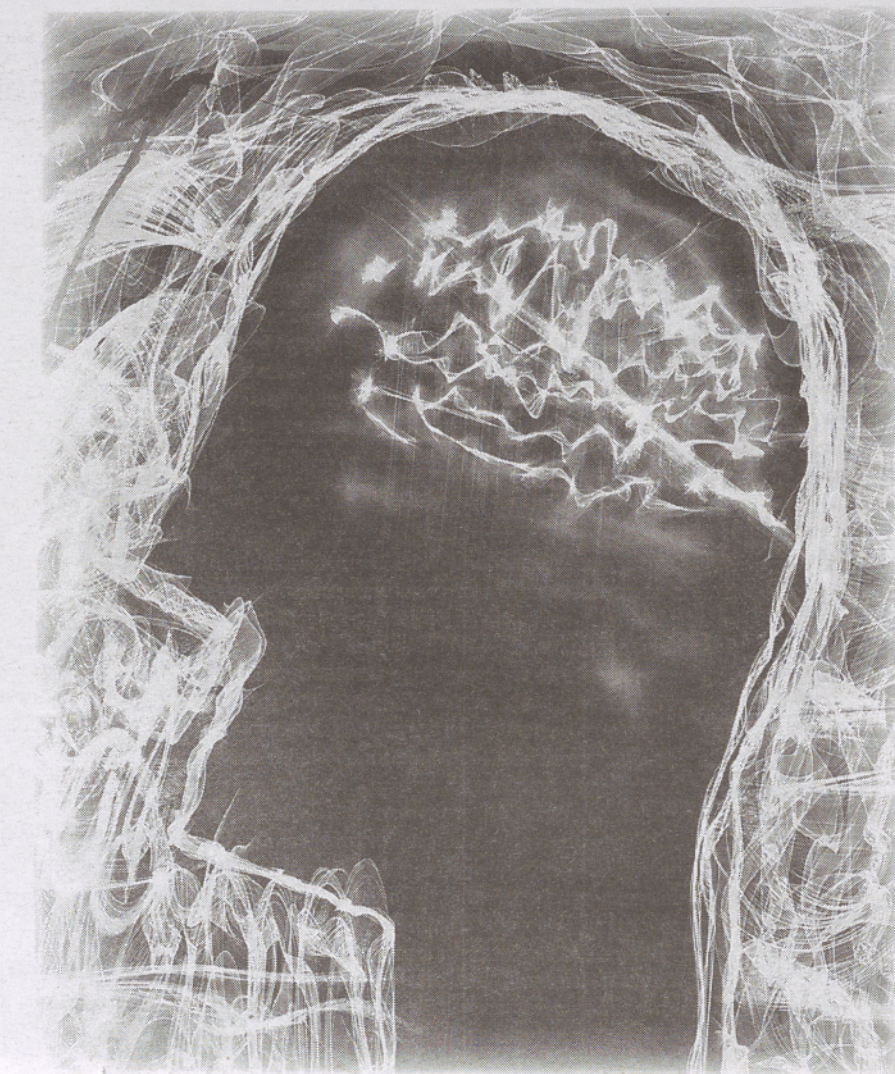
A.W.: *What is the difference between experiencing trauma versus having PTSD?*

L.S.: Let's say you're in a car crash. The way most people will react to that is to be in a state of shock. You've just been through this life-threatening event. We'll be disoriented for a while, we'll be a little jumpy, maybe even avoid cars or be nervous about getting in a car.

That is part of a normal fear response. That will only last a short time. Our brains are capable of understanding this isn't going to happen every time we get in a car. We separate (the car crash) from normal life. "Fear extinction" is the process of basically forgetting to be fearful, allowing you to no longer have this fear of this thing that will happen. Your brain is capable of separating the traumatic event from normal daily life.

That's what normally happens. But let's say you have a very intense traumatic event, a bus crash. You saw decapitations, fire and explosions, and you were trapped for some time and someone pulled you out. It's a more intense set of events that happened. All sorts of stimuli are being turned on to the max. That can turn into PTSD.

Because of the intense amount of stress you're going through, your cortisol levels go up. Cortisol is a stress hormone, and chronically high cortisol will impact the way your nervous system responds and forms memories. You will always associate getting in a car or a bus with that accident. The brain is failing to separate patterns. The amount of trauma, the degree and intensity



of the trauma can really push something from a normal traumatic stress response to PTSD.

A.W.: *During your talk, you said, "triggers of these events may not even be associated with the event. Things are indirectly linked." Could you give some examples?*

L.S.: I think the example I used is a room where there is an explosion, and there's a yellow chair. That causes you to relive the entire experience. You've taken in all the details of what you experienced at the time of the trauma. For rape victims, passing by a park where the rape happened could be a triggering event. Or a certain smell, or a song that was on the radio. Even though they are not the event themselves, they're all triggering.

A.W.: *In your talk, you described cortisol as a "fight or flight" hormone that is activated when we are fearful. It's normal to have high cortisol levels sometimes, but what are the impacts of long-term high cortisol levels over time?*

L.S.: If you're constantly reliving your trauma, which is what you do with PTSD, (cortisol levels) will stay high. Cortisol is not meant to stay high. There are many side effects – metabolic diseases, headaches, depression, anxiety. In terms of the PTSD, one thing we know that happens is that it inhibits a process in our brain called neurogenesis.

A.W.: *You talked about that in your lecture – that the brain has neural stem cells, which grow and develop throughout our lifetimes in a process called "neurogenesis." But you said the cells of people with PTSD might develop differently.*

L.S.: Most of the learning and memory involved in neurogenesis happens in the hippocampus (a region of the brain responsible for emotion, learning and memory) and it stays in the Hippocampus. One of the major functions of neurogenesis is to allow pattern separation to occur. If you have normal neurogenesis, your cortisol levels are normal. You start to learn that every time you get in a car, it doesn't explode. But if cortisol remains high, (it) inhibits neurogenesis. That's one of the mechanisms that maintain PTSD. You'll always associate a car with explosions.

A.W.: *There's research that suggests, because of how neurogenesis can become inhibited, that the children of people with PTSD can have a genetic disposition to developing PTSD.*

L.S.: There are people, maybe, who are more prone to PTSD. Those studies are ongoing. There have been a small number of genes that have been identified. The research is in its very early days.

There is also this effect on genes when the environment triggers the methylation of DNA (methylation is a process that typically modifies the function and expression of DNA) or assimilation of histones (a type of protein). "Histone assimilation" is one way to regulate DNA expression. The DNA wraps around histone proteins. You're not changing the structure of the DNA. You're changing the chemical make up in a way that prevents the DNA from being normally expressed. Chronically high cortisol and high levels of stress change DNA methylation. The result of that is that the function of neurons and nerve cells could be