School Shooting Study Shows Genetic Links to PTSD

Genes May Have Role in Determining Who Bounces Back, Who Struggles After Trauma

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Sept. 6, 2011 -- A study of college students before and after a campus shooting has helped to pinpoint genes that may influence whether or not a person will develop lasting psychological problems after trauma.

In 2008, Holly Orcutt, PhD, an associate professor of psychology at Northern Illinois University, in DeKalb, was collecting information on more than 1,000 undergraduates for a study on trauma after sexual abuse when her plans took a dramatic turn.

On Feb. 14, a suicidal gunman walked onto the stage that fronted a campus lecture hall and opened fire on students and teachers attending an ocean sciences class there. He killed five students and wounded 21 others.

Violence and Opportunity

Many of the women in Orcutt’s trauma study were freshman and sophomores and were on campus the day of the shooting. A few were in the lecture hall where it happened.

“And I said ‘wait a minute, I’m sitting on a gold mine in terms of trauma research,’” she says. “What I can do to make a difference in this tragic situation is to try to make the most of what I have to help people.”

Within days, she had secured funding and permission from the University to reinterview the students in her study to capture details about how they were coping.

Life became laboratory -- a rare opportunity in trauma studies.

“You can hardly randomly assign people to trauma in real life,” says Avshalom Caspi, PhD, a professor of psychology, neuroscience psychiatry, and behavioral science at Duke University’s Institute for Genome Sciences and Policy in Durham, N.C.

“That makes trying to identify the genes involved in sensitivity to stress very difficult because we can’t randomly assign people to stress. We have to observe what happens in nature,” he says.

Observing natural trauma usually means asking people to remember what happened to them. Memory can distort actual events.

And one person’s definition of child abuse may be different from someone else’s.

The campus shooting allowed scientists to see what happened after a shared, independently verified event.

“‘That these very clever scientists have done is they have essentially carried out what is tantamount to a natural experiment,’” says Caspi, who with his research partner at Duke, Terrie Moffitt, PhD, first showed that genes could influence the development of depression after stressful experiences.

They were not involved in the current study.

“By capitalizing on the fact that they had data before, there’s a terrible event happening, and following up with these people after,” the researchers had produced very “strong and compelling evidence” of a genetic influence on the development of posttraumatic stress disorder (PTSD), he says.

Genes, Environment, and Trauma

Two years later, Orcutt reached out to Kerry Ressler, MD, PhD, an associate professor at Emory University in Atlanta and an investigator at the Howard Hughes Medical Institute in Chevy Chase, Md., who is working to identify genes that predispose people to developing PTSD.

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He analyzed DNA samples from more than 200 women in Orcutt's study who were free of any symptoms of PTSD before the shooting.

He was looking for differences in genes that make a protein that clears the mood chemical serotonin from the spaces between nerve cells in the brain.

This protein, the serotonin transporter protein, and the genes that determine how it works are some of the most important biomarkers in modern psychiatry. Drugs that block the function of the serotonin transporter protein, for example, Prozac and Zoloft, are used to treat depression.

And last year, researchers at the University of Michigan found that incoming medical students with the 5-HTTLPR gene variant, which means they make less serotonin transporter protein, were also more likely to develop depression by the time they were ready to take their exams.

Ressler wanted to see if the same gene variants might be linked to how well the women at Northern Illinois University had coped with their experience.

As expected, those who were closest to the shooting -- they were in the lecture hall during the shooting, heard gunfire, saw the gunman, or were hurt -- were more likely to develop symptoms of PTSD than those who were more removed from the violence.

Close proximity more than doubled the women's risk for psychological problems in the weeks after the shooting.

Ressler then compared the women's genotypes to their PTSD symptoms.

Those who inherited genes, including 5-HTTLPR, that made them slower to clear serotonin were more likely to go on develop symptoms of posttraumatic stress disorder than those who could clear serotonin more quickly.

That relationship remained even after researchers adjusted for the women's exposure to the trauma, and Ressler says, a woman's genes were nearly as powerful a predictor of future mental problems as how close she was to the violence.

"The really important thing about this study is that it shows that potentially, ordinary individuals will be able to take pre-emptive action to stop themselves from getting illnesses like PTSD and depression," which can be chronic and disabling, Moffitt says.

One day, she says, genetic testing may educate people about their ability to withstand stress.

People who know what genes they carry, she says, "have the option to take action and seek support from friends, family, or a mental health professional, as soon as a major stressful life event enters their life."

Other experts agree.

"The genetic factors, which we have always known seem to exist, this study gives some evidence to that," says Alan Manevitz, a clinical psychiatrist at Lenox Hill Hospital in New York City who was has helped to treat survivors of the 9/11 attacks and Hurricane Katrina.

Genes, Environment, and Trauma continued...

"A large number of survivors naturally recover from disasters over time and they seem to move on without having severe, long-lasting health problems," but others don't. This study, he says, helps to show why.

The study is published in the Archives of General Psychiatry.
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