

No, trauma is not inherited

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In the fall of 2015, Rachel Yehuda and her team at the Icahn School of Medicine at Mount Sinai in New York published results of a study looking at the genes of 32 Jewish women and men. All were Holocaust survivors who either had been interned in Nazi concentration camps, forced into hiding during World War II or seen or experience torture. The team also studied the genes of 22 children who were born to Holocaust survivors after the war.

Previous studies had found that [children](#) of Holocaust survivors have a higher risk of developing [post-traumatic stress disorder](#), depression and anxiety, especially if the parents themselves have PTSD. In a 2015 paper in the journal *Biological Psychiatry*, Yehuda wrote she had found a genetic explanation for this apparent inheritance of trauma.

Her team found changes in the DNA of Holocaust survivors, changes which the scientists said were passed on to offspring. "The gene changes in the children could only be attributed to Holocaust exposure in the parents," Yehuda said.

What Yehuda described has come to be known as epigenetic inheritance. It's the idea that traumatic experiences affect DNA in ways that are passed on to children and grandchildren, kind of like molecular scars. The idea has taken off, and New Age guru Deepak Chopra is among those who support the finding.

But Yehuda's study is deeply flawed.

WHAT IS EPIGENETICS?

If DNA contains instructions for making eyes brown and hair curly, epigenetics refers to ways in which those [genes](#) are turned on and off. Genes are the blueprint for creating proteins, while epigenetics is the study of how genes are read.

At least that's the original definition of epigenetics. Nowadays, the term is also used to describe gene modifications that are passed on from parents to children. Some scientists say we transmit more than our genes. We also pass on molecular switches and information about how those genes should be expressed.

One of the most studied epigenetic modifications is DNA methylation, in which small molecules are added to genes, changing the activity of DNA. In a study published in *The American Journal of Psychiatry* in 2014, Yehuda found that male Holocaust survivors who suffered PTSD had children with higher methylation of a gene involved in stress response.

But these changes are exceedingly difficult to interpret. Yehuda's team found that if both of the child's parents were Holocaust survivors with PTSD, the child was more likely to have lower methylation of that gene.

FLAWED STUDY

The problems with Yehuda's 2015 study - which is still generating headlines stating that trauma is inherited - begin with the small study size. Only 32 survivors and 22 of their offspring were studied. That's a very small group on which to base this theory and a major study flaw that many media outlets overlooked.

While the team studied the children of women who lived through the

Holocaust, they would have to study the great-grandchildren of survivors to prove actual epigenetic inheritance from mother to offspring. Why must four generations be studied? Baby girls are born with their lifetime supply of eggs. The eggs that made you were present inside your mother when she was a fetus inside your grandmother. Because a pregnant woman already possesses the DNA of her grandchildren and these genes can be affected by things during her pregnancy, the DNA of the great-grandchildren has to be studied to show that epigenetic changes were passed on across generations.

Another flaw is that researchers looked at only a tiny number of genes. Further, the study didn't account for the influence of social factors. Children born to Holocaust survivors may grow up listening to accounts of the war's horrors. Josie Glausiusz, a participant in Yehuda's 2014 study, raised this point in a recent essay in the Israeli newspaper Haaretz. Glausiusz's father survived the Bergen-Belsen concentration camp. She wrote, "I was troubled by a question: How does one separate the impact of horrific stories heard in childhood from the influence of epigenetics?"

She's not the only one to raise this question. Researchers have also cast doubt on the study's conclusions based on the small changes in DNA methylation that were seen. There's also the issue of reverse causation: If DNA methylation is significant, is that change caused by trauma or does the methylation itself increase the risk of PTSD?

The week after the study was published, the blog of the Center for Epigenomics at the Albert Einstein College of Medicine in New York called it the "over-interpreted epigenetics study of the week."

John Greally, professor of genetics at the college, wrote: "The story being told by the Holocaust study is indeed fascinating as a scientific possibility, and will no doubt prompt others to pursue similar studies. Unfortunately, the story is typical of many in the field of epigenetics,

with conclusions drawn based on uninterpretable studies."

Those who survived the horrors of the Holocaust and other tragedies find themselves asking if they will pass that trauma on to their children. The headlines say, yes but based on a close look at the research, the answer so far is no.

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