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> *The growth of the memory culture may, indeed, be a symptom of a need for inclusion in a collective membrane forged by a shared inheritance of multiple traumatic histories and the individual and social responsibility we feel toward a persistent and traumatic past … (Hirsch 111)*

What does it mean to "inherit" trauma? On the one hand, there is perhaps an intuitive logic to the idea that profound stress and suffering are transmitted across generations within family lines. On the other, the actual mechanics of this transmission have been the subject of ongoing scientific debate. When children exhibit symptoms of a traumatic inheritance, are they simply demonstrating feelings and behaviors that they have learned from their parents? Or do these symptoms also signal a physiological dimension to the passage of trauma from one generation to the next?

A growing body of research suggests that transgenerational trauma has its roots not only in psychology but also in biology. The seeds for this work were planted in psychiatric studies of the children and grandchildren of Holocaust survivors. Manifesting symptoms of PTSD, both the second and third generations of survivors were believed to have experienced secondary traumatization through exposure to their parents' and grandparents' post-traumatic symptomatology (Fossion et al.). More recently, however, studies in epigenetics have shown that trauma permanently changes genetic expression—so permanently, in fact, that the changes can still be seen in the cellular makeup of trauma survivors' offspring, and even in *their* offspring as well.

Epigenetics is an emerging field of science that examines heritable changes in genetic expression which are the result of phenotypic, rather than genotypic, modifications. An organism's genotype comprises its hereditary code, while the phenotype is an organism's *expression* of that code as informed by environmental factors. Whereas changes in genotype affect DNA sequencing, changes in phenotype affect DNA "packaging," altering the "accessibility of DNA and potentially regulat[ing] gene expression without changing the sequence of DNA itself" (Krippner and Barrett 54).

For example, epigenetics has studied the correlation between DNA methylation, or "attachment of methyl groups to the DNA molecule," and incidence of depression and suicide (Youssef et al. 83). In their discussion of recent work on DNA methylation, Nagy A. Youssef et al. conclude that "accumulating evidence" suggests "the transgenerational transmission of DNA methylation changes from parents to children" as the result of parental trauma:

> *For instance, maternal exposure to intimate partner violence during pregnancy was associated with increased NR3C1 DNA methylation in teenage children. Maternal exposure to war violence or rape during pregnancy was associated with increased methylation in the NR3C1 promoter region in newborns. (83)*

NR3C1 is a glucocorticoid receptor that regulates a number of physiological mechanisms, including the body's hormonal response to stress. Increases in *NR3C1* DNA methylation are associated with higher levels of depression and PTSD (Youssef et al. 83). Accordingly, boosts to DNA methylation are effectively biomarkers of trauma in both survivors and the children who manifest these markers, too.

Of course, it's possible that this phenomenon still has a psychological explanation. As Stanley Krippner and Deirdre Barrett point out, "methylation of DNA in a traumatized parent may result in behaviors around the offspring that cause similar methylation patterns anew in one or more generations" (56). Yet certain experiments have demonstrated epigenetic effects that defy a merely behavioral rationale. Krippner and Barrett summarize a 2014 study of epigenetic transmission in mice that were

> *conditioned to manifest fear when they smelled cherry blossoms. This was accomplished by pairing the odor with a shock to the foot. This fear changed the organization of the animal's nose, leading to more cells that were sensitive to that particular smell. This structural alteration was also found in future generations as was a fear-generated "startle" when the mice were exposed to the odor. The reaction to other odors was not affected. (58)*

This experiment seems to confirm that trauma-induced fear can be inherited through direct alterations to the germ line in mammals; presumably these mice parents were not "teaching" their pups to be frightened of cherry blossoms. In a similar vein, other studies have shown that the offspring of survivors can show biomarkers of trauma even when children haven't been raised by their parents or otherwise exposed to the source of the trauma (Krippner and Barrett 60).

Such findings carry significant implications for extant accounts of genetic transmission and evolution. Biology for years has adhered to the theory that changes in DNA sequence are the fundamental basis for genetic inheritance. Evidence for the apparent heritability of phenotype changes highlights the important role of environment in shaping not only a given generation but the subsequent ones it will produce.

In the light it sheds on transgenerational trauma, epigenetics also has the potential to both complement and deepen work in the humanities on the familial and communal transmission of traumatic inheritance. Marianne Hirsch, professor of English and Women, Gender, and Sexuality Studies at Columbia University, has referred to this ongoing work as "the growth of memory culture" and coined the term "postmemory" to describe the affective imprint of trauma's afterlives. For Hirsch, postmemory is

> *the relationship that the generation after those who witnessed cultural or collective trauma bears to the experiences of those who came before, experiences that they 'remember' only by means of the stories, images, and behaviors among which they grew up. But these experiences were transmitted to them so deeply and affectively as to* ***seem*** *to constitute memories in their own right. Postmemory's connection to the past is thus not actually mediated by recall but by imaginative investment, projection, and creation.*

Granted, what Hirsch is describing at first seems to fall into the category of feelings and behaviors that are intuitively learned from parents, rather than biologically inherited. Yet why should the one necessarily rule out the other? "Postmemory" might well encompass both "the stories, images, and behaviors among which" survivors' children and grandchildren grow up, and the epigenetic effects of one generation's trauma on the physical makeup of others. Indeed, Hirsch's emphasis on the "affective" depth of these shared memories connotes both psychological and physiological facets of traumatic transmission, given that affect is typically understood as a form of embodied knowledge.

There is thus a striking resonance between Hirsch's conception of traumatic inheritance and Krippner and Barrett's definition of epigenetics as "a very specific sort of memory": one that is mediated not by the brain but rather at the level of the body (54). The science of transgenerational trauma suggests that the traumatic experiences of "those who came before" not only "*seem* to constitute memories" for the "generation after," but do in fact *become* an embodied inheritance as "memories in their own right."

The simultaneous swells of interest in both memory culture and epigenetics speak volumes about "the individual and social responsibility we feel toward a persistent and traumatic past" (Hirsch 111). At the same time, the heritability of trauma also invites vital reflection on the painful legacies that our own generation will imprint on those to come.

Works Cited

Fossion, Pierre, et al. "Family Approach with Grandchildren of Holocaust Survivors." *American Journal of Psychotherapy*, vol. 57, no. 4, 2003, pp. 519-527.

Hirsch, Marianne. "The Generation of Postmemory." *Poetics Today* vol. 29, no. 1, Spring 2008, 103-128.

Krippner, Stanley and Barrett, Deirdre. “Transgenerational Trauma: The Role of Epigenetics.” *The Journal of Mind and Behavior,* vol. 40, no. 1, winter 2019, pp. 53-62.

Youssef, Nagy A., et al. “The Effects of Trauma, with or without PTSD, on the Transgenerational DNA Methylation Alterations in Human Offspring.” *Brain Sciences,* vol. 8, no. 5, 8. May 2018, pp. 83. doi:10.3390/brainsci8050083