

Articles to Read for an Introduction to Epigenetics
Carrie Knowles, The Inevitable Past

Hurley, Dan. "Grandma's Experiences Leave a Mark on Your Genes." *Discover* (May, 2013). (<http://discovermagazine.com/2013/may/13-grandmas-experiences-leave-epigenetic-mark-on-your-genes>)

A layperson's introduction to the science of epigenetics. Traces series of experiments with rats, starting in 1990s that demonstrate impact of experiences, especially maternal care, on how genes express or do not express the trait they carry. Explains epigenetics' molecular process through attachment of methyl groups to DNA. Argues that methylation can be inherited.

Dobbs, David. "The Social Life of Genes." *Pacific Standard* (September 3, 2013) (<https://psmag.com/social-justice/the-social-life-of-genes-64616>)

Wide-ranging review of research on insects, fish and humans that have built on initial epigenetic research. Relates environment, biology, and experience.

Liu, Dong, Josie Diorio, Beth Tannenbaum, Christian Caldji, Darlene Francis, Alison Freedman, Shakti Sharma, Deborah Pearson, Paul M. Plotsky, and Michael J. Meaney. "Maternal Care, Hippocampal Glucocorticoid Receptors, and Hypothalamic-Pituitary-Adrenal Responses to Stress." *Science* (September 12, 1997): 1659-1662 (<https://www.ncbi.nlm.nih.gov/pubmed/9287218>).

and

Weaver, Ian C.G., Nadia Cervoni, Frances A. Champagne, Ana C. D'Alessio, Shakti Sharma, Jonathan R. Seckl, Sergiy Dymov, Moshe Szyf, and Michael J Meaney. "Epigenetic programming by maternal behavior." *Nature Neuroscience* 7 (2004): 847-54. (<http://www.nature.com/neuro/journal/v7/n8/abs/nn1276.html>)

Landmark papers demonstrating environmental impact on gene expression. Focus on impact of maternal rat grooming of infants on stress hormones in those infants as adults. Identifies DNA methylation as mechanism for this impact.

Wei, Yanchang, Heide Schatten, and Qing-Yuan Sun. "Environmental Epigenetic Inheritance through Gametes and Implications for Human Reproduction." *Human Reproduction Update* (2015) 21 (2): 194-208 (<https://academic.oup.com/humupd/article-lookup/doi/10.1093/humupd/dmu061>).

Reviews animal and human studies of epigenetic inheritance up to two generations, especially of such chronic diseases as diabetes and obesity. Focus on the molecular-level methylation of sperm.

Dean, Signe. "Scientists Have Observed Epigenetic Memories Being Passed Down For 14 Generations: The Past Lives On." *Science Alert* (April 21, 2017) (<https://www.sciencealert.com/scientists-observe-epigenetic-memories-passed-down-for-14-generations-most-animal>).

Studies of roundworms show environmental effects passed on through males and females for up to 14 generations, the longest epigenetic inheritance yet detected.

Zimmer, Carl. "The Famine Ended 70 Years Ago, but Dutch Genes Still Bear Scars." *New York Times* (January 31, 2018) (<https://www.nytimes.com/2018/01/31/science/dutch-famine-genes.html>).

Reviews research on children born during Dutch "Hunger Winter" during World War II. Tendency for these offspring to be somewhat heavier and have other health problems their siblings do not have. Evidence for methyl group suppression of certain gene expression in these cases. Discussion of alternative explanations instead of in utero impacts of famine.

Veenendaal, M.V., R.C. Painter, S.R. de Rooij, P.M. Bossuyt, J.A. van der Post, P.D. Gluckman, M.A. Hanson, T.J. Roseboom. "Transgenerational Effects of Prenatal Exposure to the 1944-45 Dutch Famine.

BJOG (April, 2013): 120(5): 548-53 (<https://www.ncbi.nlm.nih.gov/pubmed/23346894>).

Study of children born around time of 1944-45 Dutch famine. Father's, but not mother's, malnutrition associated with child's tendency to obesity in adulthood. Grandmother's malnutrition also not associated with grandchild's weight.

Rodriguez, Tori. "Descendants of Holocaust Survivors Have Altered Stress Hormones: Parents' Traumatic Experience May Hamper Their Offspring's Ability to Bounce Back from Trauma." *Scientific American Mind* (March 1, 2015)

(<https://www.scientificamerican.com/article/descendants-of-holocaust-survivors-have-altered-stress-hormones/>).

Study of medical records of holocaust survivors shows reduced levels of cortisol, a stress-coping enzyme, and also of an enzyme that breaks down cortisol. Survivors' descendants echo some of parents' enzyme profile, both preparing them for similar environments to their parents, but also making them more susceptible to PTSD.

Gaisler-Salomon, Inna. "Inheriting Stress." *New York Times* (March 7, 2014)

(<https://www.nytimes.com/2014/03/09/opinion/sunday/can-children-inherit-stress.html>).

Author summarizes her own research with male and female rats subject to stress before mating and consistently finds that offspring show molecular and behavioral inheritance of stress exposure. Effect not due to parenting quality.

Carey, Benedict. "Can We Really Inherit Trauma?" *New York Times*, Dec. 10, 2018

(<https://www.nytimes.com/2018/12/10/health/mind-epigenetics-genes.html>).

Review of main arguments that effects of trauma can and cannot be transmitted epigenetically from one generation to another. Focus on biological mechanisms that might lie behind such transmission.