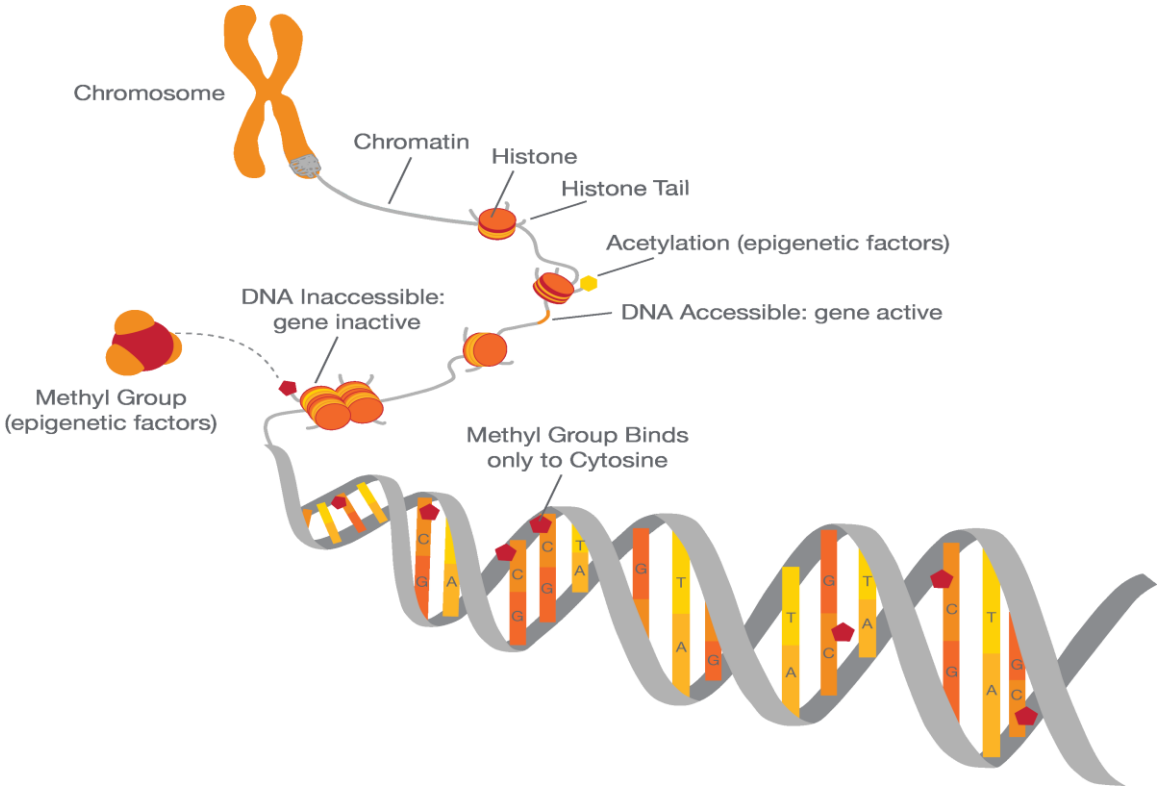
Australian Childhood Foundation

Epigenetics



A Snapshot of How Epigenetics' Works

Our DNA is identical in sequence for every cell within our body. It is very long, too long in fact, so it condenses itself by wrapping around proteins called histones. Whilst the DNA sequence doesn't change, the way in which the information is read does, and this is thanks to the process of epigenetics. Epigenetics influences if a gene is activated or deactivated through chemical deposits that sit above the gene therefore altering how the overall DNA sequence is interpreted. There are two main ways in which the genes are tagged or influenced: One is called DNA Methylation that adds methyl group molecules directly to cytosine deposits on the DNA. The more methylated a gene is, the more it is desensitised. The second is called Histone Modification which is where acetyl and methyl groups are added to the histone tails modifying gene expression[1]. It is the changes to gene expression that can be passed down to the next generation. The variations of gene activation is why in the case of identical twins who share identical DNA, have differing attributes, as their gene expression is different.

Historical Adversity

In the case of trauma, the adverse experiences impact an individual on a cellular level, and therefore these epigenetic changes are passed onto the next generation. The gene expression conducive to the environment of adversity, may now be maladaptive to the

1 Accelerate Discovery through Innovative Life Science <www.amsbio.com/epigenetics.aspx>; Clark, S, Patterson, K & Hasudungan 2015 An introduction to Epigenetics, Garvan Insititue, <garvan.org.au>

future generations as the adversity has passed. This has been evidenced from studies in adults who were exposed to the 1944 Dutch Famine whilst in gestation. These adults were found to share epigenetic sequences that increased their susceptibility to stress and health conditions such as gluten intolerance, obesity, diabetes and schizophrenia [2]. Similar detriment was found among studies on generations following holocaust survivors[3].

Furthermore, the mental health implications for survivors of trauma have the potential to extend to their children. Studies on Cambodian refugee children accredit that children who have parents' diagnosis with Post Traumatic Stress disorder are five times more likely to develop PTSD following a trauma [4].

Positive Experiences Influence Genetic Expression

A common theme within Epigenetic research is the overwhelming importance of gestational health. However, whilst gestational health is important, environmental influences post gestation have been found to influence our genetic expression. The quality of one's lifestyle can impact both positively and negatively on what is passed down through their genetic composition. Diet, exercise, social interactions, psychological state, exposure to drugs, and above all stress are just a few influencing factors. The choices we make for a healthier and balanced lifestyle can have long-lasting affects for the next generation.

Facilitating Positive Genetic Expression within Children

The ability to provide positive nurturing experiences may directly impact on children's future resilience down to a cellular level. In the example of a study conducted on rats

"Young rats who are licked often and nursed in a certain position show a different pattern of gene expression in their hippocampus, prefrontal cortex and amygdala than pups who don't get as much of this 'enriched stimulation. These differences in gene expression enable well cared for rats to be more social, less fearful and faster to approach and explore new things than their less well cared for peers" (Baylin, 2013)[5].

Furthermore reparative relational connection is essential to the development of positive development and growth. Epigenetic research has accredited that play and 'Novel experiences with caregivers can trigger the process of tagging brain cells for further gene expression' (Baylin, 2013,p75).

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[2]Roseboom T, de Rooij S, Painter R. The Dutch famine and its long-term consequences for adult health. Early Hum Dev 2006; 82: 485–491.

[3] Serpeloni, F., Radtke, K., de Assis, S. *et al.* Grandmaternal stress during pregnancy and DNA methylation of the third generation: an epigenome-wide association study. *Transl Psychiatry* **7,** e1202 (2017). https://doi.org/10.1038/tp.2017.153

[4] Koenen, K.C., Nugent, N.R. & Amstadter, A.B. Gene-environment interaction in posttraumatic stress disorder. Eur Arch Psychiatry Clin Neurosc 258, 82–96 (2008). https://doi.org/10.1007/s00406-007-0787-2

[5] Baylin, J 2013, Behavioural Epigenetics and Attachment, Vol 3, The Neuropsychotherapist, <www.neuropsychotherapist.com>