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The term epigenetics - fusion of the words epigenesis and genetics - was coined in 1942 by C.H. Waddington to describe 'the interactions of genes with their environment, which bring the phenotype into being'. In its most accepted current definition, an epigenetic trait is a stably heritable phenotype resulting from changes in a chromosome without alterations in the DNA sequence (Berger et al., 2009). The Greek prefix *epi-* in epigenetics implies features that are "on top of" or "in addition to" genetics ; thus epigenetic traits exist on top of or in addition to the traditional molecular basis for inheritance.

What are these epigenetic changes? They are chemical modifications of DNA (such as methylation of specific nucleotides) or modifications of chromatin proteins that are associated with DNA (histones). These modifications very likely play a role in perpetuating the chromatin change in subsequent generations, so that epigenetic modifications can be maintained when cells divide and can sometimes be inherited across sexual generations. For instance, epigenetic changes can be inherited through cellular divisions in differentiated cells, resulting in the restrictive expression of a subset of genes necessary for their own activity. Even though small RNA molecules have been recently implicated in the epigenetic regulation of gene expression, the molecular mechanisms at play are poorly understood. Understanding the mechanisms involved in the initiation, maintenance, and heritability of epigenetic states are important aspects of current research in biology.

Transgenerational epigenetic inheritance phenomena have been reported in a wide range of organisms, including unicellular eukaryotes, plants, and animals. On a multigenerational time scale, epigenetic phenomena offer the possibility of alternative states that will be subject to natural selection. By epigenetic inheritance mechanisms, the selected state will pass on traits in a non-Mendelian fashion, allowing the cross generational inheritance of acquired traits, a subject that has come under increasing study.

Berger SL, Kouzarides T, Shiekhattar R, Shilatifard A. 2009. An operational definition of epigenetics. *Genes Dev.* 23(7):781-3.