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# Epigenetics

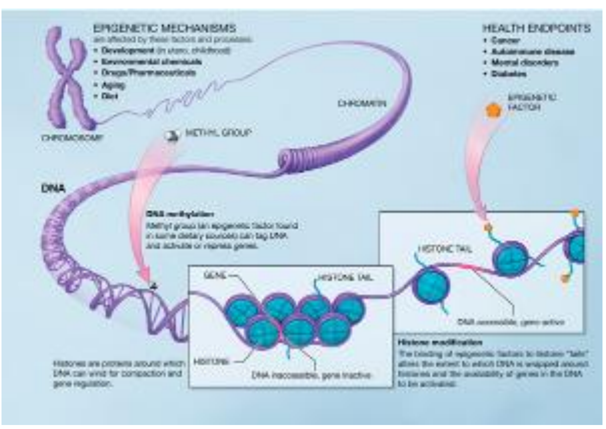
## Overview

Epigenetics – the genes but more

Epiprecaution: When Doing No Harm Is Not Doing Your Best - learn more

Epi, means “upon”, "above", "in addition to". Epigenetics is the study of changes in gene expression caused by mechanisms other than changes in the genetic (DNA) code.

We recognized in 1996 that, with progress in the field of genetics accelerating at a breathtaking pace, we need to ensure that advances in treatment and prevention of disease do not constitute a new basis for discrimination.




The concept of epigenetics, meaning something acting above or in addition to genes, is both old and new. One of the greatest mysteries was how does life replicate, adapt, change, and reproduce. Gregor Johann Mendel (July 20, 1822 – January 6, 1884) an Austrian scientist founded the new science of genetics by demonstrating the inheritance of certain traits in pea plants follows particular patterns. Mendel did not know it but he was describing the functionality of DNA. Decoding the genome and looking for variations in an individual’s DNA was a focus of research to help explain individual variability and susceptibility to disease or toxic effects. We have been accustomed to blaming a lot on “our genes”. But then the story got both more complicated and intriguing with the recognition of the subtle power of epigenetics. (figure at right from the National Institute of Health)

Conrad Hal Waddington (November 8, 1905 – September 26, 1975) postulated that it was not just the genes that shaped development but also the environment that shape the genes. In the late 1930’s he wrote a textbook describing developmental epigenetics, a term that then meant how the environment shaped genetic activity. Understanding a possible mechanism had to wait for a far deep understanding of DNA and its role in development. Epigenetics is now defined as changes in gene expression other than

changing ("above" or "in addition to") the DNA sequence. Typically gene expression is silenced or suppressed by DNA methylation or histone deacetylation, but without altering the sequence of the silenced genes. These ideas were first articulated in 1975. The power and subtlety of epigenetics is these changes can be passed to the next generation.

While we are now well aware of the damage thalidomide, alcohol, lead, mercury, or PCBs can cause to the developing organism more subtle epigenetic changes can also result from environmental exposures. A dramatic example of the power of epigenetic information transfer was demonstrated by research on the endocrine disruptive fungicide vinclozolin. Male offspring of the exposed mother rat transferred disease susceptibility to the next generation. Further research has indicated that epigenetic changes can result from exposure to environmental hazards such as cigarette smoke, arsenic, alcohol, phthalates, BPA, as well as other chemicals. Furthermore, epigenetic changes can occur through nutrition, methyl content of diet, intake of folic acid and vitamins or even social and maternal behavior toward the offspring. This really emphasizes the importance of a loving and supportive environment during development.

Our expanding appreciation of the influence of development for epigenetic changes will have profound effects on risk assessment and really argues for a precautionary approach to chemicals during development. We have an ethical responsibility to ensure that our children have an environment in which they can reach and maintain heir full potential, free of exposure to chemicals that cause adverse epigenetic changes. In addition, we must move beyond just doing no harm to one of creating a positive and supportive environment for our children.

**References**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