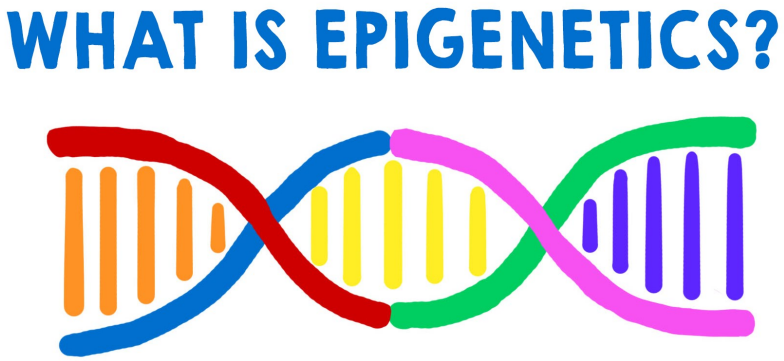
EPIGENETICS – Kristen Hovet

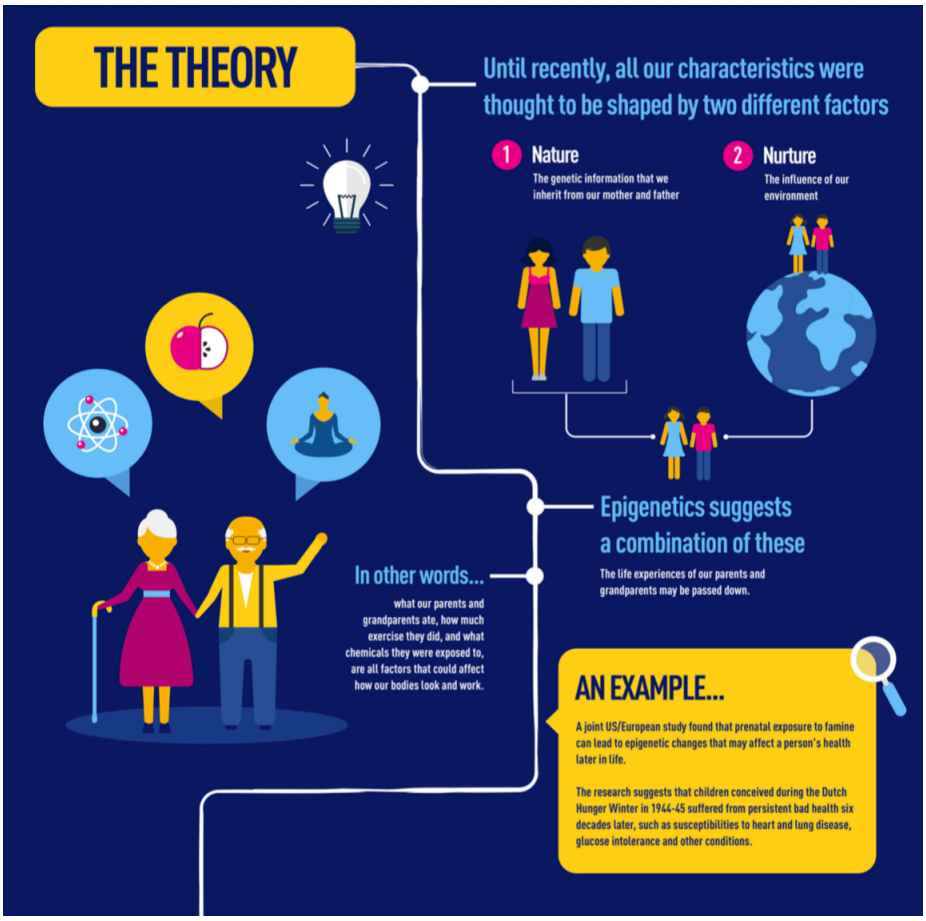
Epigenetics is a term that gets thrown around a lot. It is even used by some public figures and alternative "medicine" practitioners who promote what can only be referred to as pseudoscience. These individuals misrepresent the field of genetics and epigenetics when they carry on as though they understand all there is to know about these subjects, and then twist the details to fit their spiritual or new age ideas. Even worse is when they use these concepts -- now twisted beyond recognition -- to lead vast numbers of individuals astray.



While a lot is understood about epigenetics, there is so much yet to be discovered. Let's start with what we do know.

The term "epigenetics" was coined by Conrad Waddington in 1942, when he defined it as "the branch of biology that studies the causal interactions between genes and their products which bring the phenotype into being." Implied in this definition is Waddington's burgeoning conception of the flexible relationship between genotype (an organism's genetic information) and phenotype (an organism's observable attributes). He clearly understood that certain regulatory processes must determine how a genotype gives rise to a particular phenotype. But the precise nature of these regulatory processes were not yet known in Waddington's time.

The epigenome is the part of the genome that modifies cell function by silencing or activating specific genes. Where genetics is the study of variation and mutation in the genome, epigenetics is the study of changes in gene expression that occur without changes to the DNA sequence itself. Epigenetic modifications can be detrimental or beneficial to an organism.



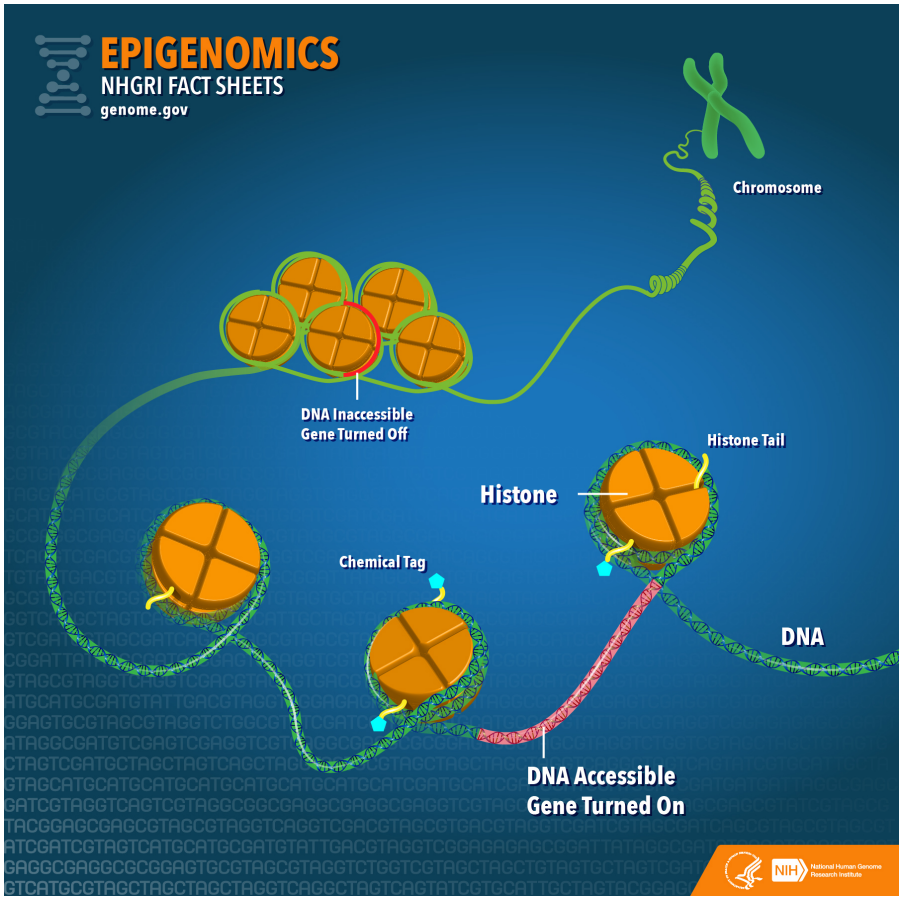
I love the analogy that Adam Rutherford uses to describe the difference between genetics and epigenetics: "Think of DNA as an orchestral score, the notes on the page unchanging. But the annotations on the manuscript will dictate how the music sounds, with crescendo and lento and adagio. The conductor and orchestra play their annotated manuscript, and each performance is unique, even when the original scores are identical."

One intriguing example of epigenetics is a study done by McGowan et al. that looked at hippocampal tissue in people who had been abused as children and who later committed suicide. Compared to controls, the samples of those who had been abused as children showed decreased levels of glucocorticoid receptor proteins. These proteins play a significant role in the stress response and are important in understanding depression and post-traumatic stress disorder (PTSD).

Others have called epigenetics the solution to a problem that once perplexed many: the nature or nurture debate. This debate perpetually pit one thinker against another in determining the origins of particular human behaviours. Does a person behave a certain way because of biology or upbringing? But epigenetics says it's not one or the other, but both. We are who we are due to continual and complex interactions between our biological makeup and our environment. (Environment includes the people and places

around us, the foods we eat, the pathogens and toxins we come in contact with, the stress we experience, the exercise and physical activities we take part in, and so on.)

Also, some epigenetic "marks" can be passed down from one generation to the next -- a fact that has inspired scientists and speculators alike.



To learn more about epigenetics, here are some links:

"What Do You Mean, 'Epigenetic?'" http://www.genetics.org/content/199/4/887

"Epigenetics. You keep using that word. I do not think it means what you think it means." http://scienceblogs.com/insolence/2013/02/11/epigenetics-you-keep-using-that-word-i-do-not-think-it-means-what-you-think-it-means/

"Genotype versus Phenotype" https://evolution.berkeley.edu/evolibrary/article/genovspheno_01

"Beware the pseudo gene genies" https://www.theguardian.com/science/2015/jul/19/epigenetics-dna--darwin-adam-rutherford

"Genetics of Nurture" http://sites.bu.edu/ombs/2010/11/11/licking-rat-pups-the-genetics-of-nurture/

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