

A Super Brief and Basic Explanation of Epigenetics for Total Beginners

Epigenetics Simplified

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In simplified terms, epigenetics is the study of biological mechanisms that will switch genes on and off. What does that mean? Well, if you are new to this whole thing, we first need a quick crash course in biochemistry and genetics:

- **Cells** are fundamental working units of every human being. All the instructions required to direct their activities are contained within the chemical deoxyribonucleic acid, also known as DNA.
- **DNA** from humans is made up of approximately 3 billion nucleotide bases. There are four fundamental types of **bases** that comprise DNA – adenine, cytosine, guanine, and thymine, commonly abbreviated as A, C, G, and T, respectively.
- The **sequence**, or the order, of the bases is what determines our life instructions. Interestingly enough, our DNA sequence is mostly similar to that of a chimpanzee. Only a fraction of distinctively different sequences makes us human.
- Within the 3 billion bases, there are about 20,000+ genes. **Genes** are specific sequences of bases that provide instructions on how to make important **proteins** – complex molecules that trigger various biological actions to carry out life functions.

Now that you understand genetics, let's learn about *epigenetics*. Epigenetics, essentially, affects how genes are read by cells, and subsequently how they produce proteins. Here are a few important points about epigenetics:

- **Epigenetics Controls Genes.** Certain circumstances in life can cause genes to be silenced or expressed over time. In other words, they can be turned off (becoming dormant) or turned on (becoming active).
- **Epigenetics Is Everywhere.** What you eat, where you live, who you interact with, when you sleep, how you exercise, even aging – all of these can eventually cause chemical modifications around the genes that will turn those genes on or off over time. Additionally, in certain diseases such as cancer or Alzheimer's, various genes will be switched into the opposite state, away from the normal/healthy state.
- **Epigenetics Makes Us Unique.** Even though we are all human, why do some of us have blonde hair or darker skin? Why do some of us hate the taste of mushrooms or eggplants? Why are some of us more sociable than others? The different combinations of genes that are turned on or off is what makes each one of us unique. Furthermore, there is evidence that some epigenetic changes can be inherited.
- **Epigenetics Is Reversible.** With 20,000+ genes, what will be the result of the different combinations of genes being turned on or off? The possible permutations are enormous! But if we could map every single cause and effect of the different combinations, and if we could reverse the gene's state to keep the good while eliminating the bad... then we could theoretically cure cancer, slow aging, stop obesity, and so much more.