Epigenetics: Why We Need To Decrease Exposure And Increase Protection

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In this article I wanted to review some of the research on "epigenetics." This is the study of chemical compounds that "mark" our DNA - telling it what to do, where to do it and when to do it.

Scientists have discovered that our DNA is opened more when exposed to chemical compounds with more -acetyl groups and closed more when exposed to compounds with more -methyl groups. Acetyl and methyl are just names for specific parts of many common molecules found in naturally occurring foods and vitamins, as well as synthetic drugs and other compounds. They are neither good nor bad. Methyl groups attach to DNA and keep it tightly bound - unable to be copied. Acetyl groups open up the normally tightly wound up DNA and allow it to unravel for copying. When DNA is copied, proteins are made for the process of living. This is an ongoing process and vital to our health. But DNA is very vulnerable and opening it can also expose it to free radicals, other toxins, and messages to copy inappropriately. As in all other aspects of our health, balance is the key – the DNA should open and copy only under tightly controlled circumstances. We have developed intricate mechanisms to keep our DNA safe from opening up inappropriately.

We have long believed that DNA is stable and that changes in our DNA occur over long periods of time, as many generations acclimate to new environments. This is a process called evolution. In a groundbreaking article (Discover, 2000), a researcher from Duke University showed that food can change the expression of genes AND that these changes can be inherited by the offspring in one generation. This researcher knew that folate and its family of B vitamins are methylating compounds. He suspected that by giving pregnant mice more methylating compounds, he could prevent some of the mothers' DNA from being "turned on" and copied. He wanted to see if the offspring would inherit this new DNA. The study used Agouti mice – mice who were bred to be fat, yellow, with a tendency for cancer or diabetes and dying young. The mice were placed on a methyl-rich diet just prior to conception. The hypothesis was that this diet would cause the mother mice to "turn off" some of her potentially health risky genes. That is exactly what occurred – most of the offspring mice were slender and brown, had no tendency for cancer or diabetes and lived to old age.

Conversely, a low folate diet might allow the DNA to open too much allowing exposure to potentially harmful substances. Another recent study showed that lab animals on a folate deprived diet had an increased incidence of cancer when exposed to carcinogens compared to animals similarly exposed and not deprived of folate.

So, you wonder if you should take more folate? We can now check for some common genetic variations that indicate when more or less of specific nutrients are needed. For example, the MTHFR gene is one of many genes producing proteins responsible for methylating DNA. This gene exists in a number of variations – in some people it works 60 – 70% less effectively. These people are like the Agouti mice – their health will be much improved on a folate rich diet. For others, too much folate may be problematic.

New research tells us there is a way to optimize our health without knowing the exact variations in our genes. Dr Dean Ornish, head of the Preventive Medicine Research Institute in Sausalito, California recently published a small study on the effects of lifestyle changes on genes. Study participants were men with low risk prostate cancer who opted out of medical treatment. Instead they chose 3 months of lifestyle medicine – a diet rich in fruits, vegetables, whole grains, legumes and soy products. They included one half hour of moderate exercise (walking) and one hour of stress reduction (meditation) each day. At the end of the study the participants had their DNA evaluated. Amazingly, the activity of around 500 genes showed changes. Many disease-promoting genes (including cancer genes) were turned off and many disease-preventing genes were turned on. Blood levels of the enzyme, telomerase, also increased by almost 30%. This enzyme is known to positively affect longevity and immune status.

It appears that our 21st century nutrient-poor diets and exposures to the many ubiquitous toxins in our environment can cause rapid and lasting changes to our DNA. Our epidemic of chronic disease is only one of the current consequences. If your DNA could talk, perhaps it would say, "Decrease Exposure" to toxins, pollutants, artificial ingredients in foods, stress and the like. It would say "Increase Protection" with the abundant phytochemicals in a balanced assortment of fruits and vegetables, moderate exercise, community, laughter and joy!

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