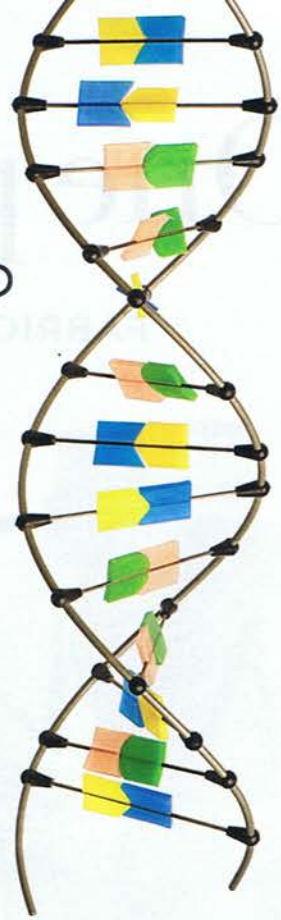
Is Your DNA Your Destiny?

According to new research, it may not be. Scientists have discovered that the way you live your life can alter your GENETIC BLUEPRINT.



WHILE IT'S TRUE that your genes are passed down from your ancestors, the old thinking—that your DNA is fixed—no longer seems to hold true. New studies indicate that genes are mutable, and that simple things, such as what you eat, could actually modify them. In other words, nurture really can trump nature.

LIFE'S PROGRAMMING BUGS

You might think, "Why bother with lifestyle modifications?" says Randy Jirtle, a geneticist in the department of radiation oncology at Duke University. The answer lies in the relatively new science of epigenetics. While genetics is the study of genomes (chromosomes and the DNA they contain, inherited from your parents), epigenetics is the study of epigenomes, the cellular material that rests on top of genomes, which can be changed over a lifetime.

"Your genomes are like the hardware of your computer; the epigenome is the software that tells your computer what to do," Jirtle says. Lifestyle factors, including nutrition and exercise, can in turn "program" that software. So even if you inherit mutated genes that predispose you to a certain type of cancer, for example, developing the disease isn't necessarily inevitable. Epigenetic programming appears to switch those genes on or off, without fundamentally altering the underlying DNA.

EARLY INFLUENCES

The biggest opportunity for epigenetic changes occurs before birth. "DNA expression can be altered at any age, but the fetus is especially susceptible because these pathways are very active as tissues grow and differentiate," says David Williams, principal investigator for the Linus Pauling Institute at Oregon State University.

Therefore, a mother's eating habits (as well as her stress levels, exercise regimen, and environment) actually have the power to shape the genes that are passed down and "are thought to impact the susceptibility of her child to leukemia, lymphoma, and neurological cancers, and possibly adult-onset cancers," Williams says.

In his studies on mice, the compounds found in cruciferous vegetables, such as broccoli, cabbage, and cauliflower, did the best job of protecting offspring from gene mutation. These foods contain sulforaphane, a compound that has been shown in animal models to be effective in preventing and perhaps even treating cancers, Williams says.

There can also be negative effects. Experiments on mice in Jirtle's lab have found that exposure in utero to the chemical bisphenol A (BPA), used widely in plastic products, had consequences for the animals' progeny. Mice that were exposed to BPA gave birth to mutated offspring that were at a greater risk for diabetes, obesity, and cancer as adults. But when the pregnant mice were fed vitamin B_{12} and folic acid, the epigenetic effect of the BPA was counteracted.

YOU ARE WHAT YOU EAT

Though you can't change what happened before you were born, choosing the right foods now could affect genes associated with the risk of developing cancer, heart disease, and other ailments. The biggest promise, based on research so far, again points to the consumption of cruciferous vegetables, as well as leafy greens. All are good sources of antioxidants and folate, which seem to help tumor-suppressing genes stay active.

In a 2010 study that looked at lung-cancer risk in smokers, 12 servings of leafy greens per month reduced methylation—a process by which cells can inadvertently silence genes that protect against cancer—by 20 percent. Taking a daily multivitamin reduced methylation by nearly 50 percent.

"Epigenetic changes occur even in the precancer state, so this [research] is a good target for early dietary intervention," says Steven Belinsky, director of the lung-cancer program at the Lovelace Respiratory Research Institute, in Albuquerque, where the study was conducted.

REWRITING THE STORY

Since epigenomes have been studied only for the past decade, more research is needed to understand the extent to which environmental factors can influence gene expression in humans. But if it turns out that it's possible to nudge genes in certain directions—or, like a choose-your-own-adventure book, influence how epigenetic plotlines proceed—then good living could increase the odds that the story turns out well.

pass the broccoli (and its relatives)

Here are a few easy ways to sneak more vegetables into your diet.

BROCCOLI Keep florets on hand in the refrigerator. They cook quickly, so you can throw them into pasta water a couple of minutes before the noodles are done.

CABBAGE Thin slices can be added to salads for color and texture. Or pile it on a cracker with a little goat cheese or hummus for a snack.

CAULIFLOWER Use puréed cooked cauliflower in soups or sauces to add body with very few calories.

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