Traumatizing your DNA: Researcher warns that it isn't 'all in the genes'

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When the Human Genome Project ended a decade ago, scientists thought that they'd closed the lid on all that's to be known about our genes. But what they really did was open a Pandora's Box, says theoretical evolutionary biologist Prof. Eva Jablonka of Tel Aviv University's Cohn Institute for the History and Philosophy of Science and Ideas.

After sifting through hundreds of scientific studies concerned with epigenetics, Prof. Jablonka concludes that some of the effects of stress, cancer, and other chronic diseases we suffer from may be passed on to our offspring through deep and complicated underlying cellular mechanisms that we are just now beginning to understand.

Prof. Jablonka will discuss her findings at an epigenetics conference in North Carolina later this month.

The invisible threat

Epigenetic research suggests that the effects of stress and environmental pollution can be passed on to future generations without any obvious change or mutation in our DNA. The problem, Prof. Jablonka points out, is that we have no idea of the extent these effects will have on the human genome of the future.

"I am a story teller. I read a lot of information and develop theories about evolution. For the last 25 years, before it became a fad, I was interested in the transmission of information not dependent on DNA variations," Dr. Jablonka says. "Epigenetic inheritance is information about us that is not explicitly encoded in our genes. Two individuals may have identical genes, but the genes present very different characteristics. They can be genetically identical but different epigenetically."

In a 2009 paper for the Quarterly Review of Biology, Prof. Jablonka wrote about cellular epigenetic inheritance and explored some of the consequences of such inheritance for the study of evolution, also pointing to the importance of recognizing and understanding epigenetic inheritance for practical and theoretical issues in biology. She has since concluded that individuals can influence their heredity.

After reviewing the literature, she has found more than 100 examples of living organisms, from bacteria to human beings, demonstrating how our genes' expression can be altered and inherited.

"Stress is enormously important," Prof. Jablonka says. "It can affect the development of cancer and other chronic diseases, and may also have long term impacts on ecology." At the conclusion of the Human Genome

Project, researchers hoped that the findings would provide relief from several diseases. "What they weren't prepared for," she continues, "is that genes really do so many things, and that gene expression patterns can be heritable. We can learn some things about diseases from our DNA, but it doesn't tell the whole story."

Is environmental pollution irreversible?

Stress can create near invisible effects on gene expression, effects that can be passed from mother or father to child. Some of this operates through microRNA, tiny RNA discovered about a decade ago which work as cellular "micro-managers." In addition, a process called DNA methylation alters gene function. Various processes "hidden" in chromosomes within the cells appear to be influenced by lifestyle and disease.

As a result, Prof. Jablonka advises that it might be prudent to reconsider all the environmental pollutants being introduced into the planet's ecosystems. Some pesticides and fungicides are androgen suppressors and have many effects on gene expression — and these effects can be inherited. Whether and how future generations can endure with these altered gene functions are still open questions, she says.

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