



The Health Nugget

Lick Your Pups

In my mind, rats are one of those animals that only a mother could love. Baby rats, whose mothers spent time licking, grooming and nursing them, grew up to become calm adult rats. On the other hand, rat pups who received very little attention were anxious and nervous. Canadian researchers, Moshe Szyf, McGill University pharmacology professor, and Michael Meaney, Associate Director of the Research Centre at Douglas Hospital, discovered what it was that made the rats different in how they ticked. The part of the brain that controls the level of stress hormone released by the adrenal glands was altered. The abundance or lack of social stimuli influenced the expression of the receptor genes there. Based on their research, Szyf stated, “We’re showing that it’s the maternal behavior that counts, not just the genetic baggage. Behavior can clearly affect the chemistry of DNA.”¹

The adult-life environment of the stressed-out rats was no different from the calm rats. Nor were their traits inherited at birth. The difference between the calm and anxious rats was not genetic. It was epigenetic.

Epigenetics deals with the changes that can occur in gene activity that can be passed down to successive generations, without an actual mutation or change in DNA. It refers to modifications in gene expression that cannot be explained by genetics. Some analogies have made it simpler for me to understand epigenetics. One scientist likened the difference between genetics and epigenetics as the difference between writing and reading a book. The book, the written text, is like the genetic code or DNA. This stored information is the same in all the copies. “However, each individual reader of a given book may interpret the story slightly

differently, with varying emotions and projections as they continue to unfold the chapters.”² Another scientist analogized, “DNA is just a tape carrying information. . . . Epigenetics is about the tape player.”³ The genome, which is the entire hereditary information of an organism, has also been likened to hardware, the computer. The software, like Windows, would be the epigenome, the cellular material that sits outside the genome, responsible for determining cell type, activity and gene expression.

Literally, epigenetics means: around or above the gene, in addition to changes in genetic sequence. Interestingly, around or above the gene are chemical markers or tags that attach themselves to DNA or to the structures surrounding the DNA, collectively called epigenomes. So far it is understood that these chemical tags can silence or activate genes, or modify them as in making them louder or softer. Because these chemical tags are independent of the DNA sequence itself, they are considered epigenetic factors. These chemical tags are influenced by environmental influences.

“Known or suspected drivers behind epigenetic processes include many agents, including heavy metals, pesticides, diesel exhaust, tobacco smoke, polycyclic aromatic hydrocarbons, hormones, radioactivity, viruses, bacteria, and basic nutrients.”⁴

The term epigenetics includes any process that alters gene activity without changing the DNA sequence, and leads to modifications that can be transmitted to daughter cells. David Rakel, MD, director of integrative medicine at the University of Wisconsin School of Medicine and Public Health, describes epigenetics as the soup in which we bathe our genes that is determined by human choice. “We are the cooks of

our soup that influences if our genes are healthy or diseased.”⁵

Biology class was a long time ago. And it may have been a while since you taught your kids about the birds and the bees, so let’s refresh our memories about DNA. Our whole genome was passed down to us. Neither we nor our parents choose the shape of our nose, our skin hue or our basic personality. This information, encoded in the DNA, was stored and transferred as chromosomes. At conception, 23 chromosomes from dad entered into the egg where they united with the 23 chromosomes from mom. As the residence of DNA, these chromosomes contained the blue print for every single protein and cell in our body.

What we inherit is what we transfer. DNA is replicated exactly, unless there is a mutation. These changes to DNA code result in an altered set of instructions. As we age, mutations occur more frequently. According to evolutionary theory, mutations are responsible for the variety and progression of life forms. It is these mutations that Darwin thought explained the diversity of life and allowed the growing of a giraffe’s long neck for example. In reality, the majority of mutations do not result in new and improved features. In fact, various diseases are the result of DNA mutations: diabetes, club-feet, hemophilia, Down’s syndrome, color-blindness, Turner’s syndrome, Klinefelter’s syndrome, Sickle Cell Anemia, Cystic Fibrosis, Phenylketonuria, Albinism and cancer.

Every cell in our body has the exact same genetic code whether it’s a stomach cell or an eye cell. What makes one cell function as a stomach cell and another as an eye cell is that certain genes (portions of the genome) have been turned off or on for that cell to perform its specific task. Cells only activate those genes which are indispensable for their functioning and survival, while the rest of the genes

remain inactive. The resulting specific instructions guide cell growth, when they divide and multiply, how they communicate with surrounding cells and how to be a team player. It is thus programmed to respond to hormones and signals. But it turns out that the cell’s expression of its encoded instructions also responds to environmental factors like nutrition, chemicals and love.

The behavior and atmosphere of loving, licking mommy rat was translated into chemical triggers that impacted her baby’s DNA, which manifested itself in adulthood. An amazing aspect of Szyf’s and Meaney’s research was that once they saw how this took place, they were able to reverse its affect: the brains of calm rats became frazzled. The food we eat, the chemicals we are exposed to, the company we keep, literally becomes the atmosphere in which our genes thrive or depreciate. This is how and why lifestyle impacts the whole man and can prevent or predispose to a myriad of diseases.

No longer can inspired statements regarding the life-impacting significance of mothering be read with a mere sentimental interpretation. “Kind, cheerful, encouraging words will prove more effective than the most healing medicines.”⁶ Literally! The tongue of the wise brings healing (Proverbs 12:18).



- ¹ “Epigenetics” Means What We Eat, How We Live and Love, Alters How Our Genes Behave. Duke Health.org, Oct. 25, 2005. http://www.dukehealth.org/health_library/news/9322.
- ² Jenuwein, Thomas. [What is Epigenetics?](http://epigenome.eu/en/1,1,0) <http://epigenome.eu/en/1,1,0>.
- ³ Turner, Bryan. Ibid.
- ⁴ Weinhold, Bob. [Epigenetics: The Science of Change](http://ehp03.niehs.nih.gov/article/info%3Adoi%2F10.1289%2Fehp.114-a160). Environmental Health Perspectives. March, 2006. <http://ehp03.niehs.nih.gov/article/info%3Adoi%2F10.1289%2Fehp.114-a160>.
- ⁵ [Lifestyle Choices Can Change Your Genes](http://www.uwhealth.org/news/lifestyle-choices-can-change-your-genes/13915). UW Health. Oct. 21, 2008. <http://www.uwhealth.org/news/lifestyle-choices-can-change-your-genes/13915>.
- ⁶ White, Ellen G. *My Life Today*. Pacific Press, p. 152.

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