



# Meditation and Epigenetics

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The genome is an aggregate of genes in a cell. We have around twenty-five thousand genes in each cell, which builds our body. However, the expression of genes varies causing cells to perform specific functions. Cells such as those of the liver, brain, and muscles look different and perform different functions. Some studies suggest that we can do a lot to regulate the expression of our genes, to suppress the inimical ones and activate the friendly ones. We can influence the expression of genes by our behaviour and environmental exposure. The food we eat, the air we breathe, the water we drink, sleep patterns, exercises, various stresses in our life, our choices and experiences shape our lives by creating chemical environments inside the cells that influence genetic expressions.

“Epigenetics is the study of how our behaviour and environment can cause changes that affect the way our genes work. Unlike genetic changes, epigenetic changes are reversible and do not change our DNA sequence, but they can change how our body reads a DNA sequence.” – Centre for Disease Control (CDC) (1)

“Many studies have consistently demonstrated an epigenetic link between environmental stimuli and physiological as well as cognitive responses. Epigenetic mechanisms represent a way to regulate gene activity in real-time without modifying the DNA sequence, thus allowing the genome to adapt its functions to changing environmental contexts. Factors such as lifestyle, behavior, and the practice of sitting and moving mindful activities have been shown to be important means of environmental enrichment.” – Vendetti et al., 2020 (2)

The epigenome mediates a lifelong dialogue between the environment and genes. Lifestyle and behaviour influence the chemical tags that turn the gene on and off. Parental lifestyles before and during pregnancy are thought to be linked to long-term health consequences for their offspring. For instance, paternal or maternal tobacco smoking has been correlated with offspring asthma [Chih-Chiang Wu et al., 2019 (3)].

Cells are specialized in doing specific functions. Thinking is also an important activity. In fact, whatever we do begins with a thought. Certain urges and emotions like anger, fear, and attention hinder one’s focus during meditation. Meditation is concentrated thinking involving specialized nerve cells. Regular practice of methodical meditation stimulates these cells strongly, which serves the dual purpose of command and demand. The specialized cells, called cakras in Yogic tradition, located at specific nerve plexuses are stimulated by a mantra to regulate their hormonal secretions. This brings about chemical changes to synthesize proteins in a specialized manner gradually bringing about genome-wide epigenetic change. Visible improvements in dendrites - the receiving ends of brain cells, insulation cover of neuron fiber, neurotransmitter profile, and overall neural functioning take place. Growth

in the pre-frontal cortex and hippocampus has also been observed.

Generally, when we age, thinning of the frontal part of the brain occurs. Thinning causes loss of cognitive ability. Meditation tempers this loss. The range of perception expands. New realms of reality open up. Surprising changes take place in synaptic connections as well. With re-established synaptic connections as well as new ones in place, perceptual abilities improve. [Andrew Newberg & Mark Waldman (4)]. Neurotransmitters are the chemicals that make the brain and bodywork. It is responsible for the transmission and reception of neural messages to different parts of the body. Meditation interrupts the habitual pattern of thinking by changing neurotransmitter profile and neuroplasticity. It changes the level of different neurotransmitters such as dopamine, serotonin, GABA, epinephrine, and norepinephrine. Enhanced levels of dopamine generate pleasurable feeling, stimulate positive thoughts, and induce a sense of well-being and security. During deep meditation, serotonin levels in the blood might alter. Serotonin soothes our mood, brings about feelings of well-being and joy. Higher levels of GABA lower stress, anxiety, and depression. Meditation lowers the concentration of stress molecules such as epinephrine (adrenalin) and norepinephrine (noradrenaline), making us feel relaxed. By altering the neurochemistry of the brain, meditation bestows a sense of peace, happiness, and security, while decreasing symptoms of anxiety, depression, and stress. Meditation thus is a positive epigenetic change factor.

Sara Lazar and her team at Harvard (5) found that mindfulness meditation can change the structure of the brain. Stress is associated with the release of glucocorticoid hormones by adrenal glands. These hormones have been shown to reduce the levels of antioxidant proteins and may therefore cause increased oxidative damage to DNA and accelerated telomere shortening. Antioxidants can potentially protect telomeric DNA from oxidative damage caused by extrinsic and intrinsic DNA damaging agents. Dietary restrictions reduce telomere shortening by reducing oxidative stress. Exercise can reduce harmful fats and help mobilize waste products for faster eliminations leading to reduced oxidative stress and preservation of DNA and telomeres. Lifestyle factors such as smoking, lack of physical activity, obesity, stress, exposure to pollution, etc can potentially increase the rate of Telomere shortening, cancer risk, and pace of aging. Harvard study also found mindfulness meditation increases cortical thickness in the hippocampus that governs learning and memory, emotion Regulations, and self-referential processing. There was also a decrease in brain cell volume in the amygdala, which is responsible for fear, anxiety, and stress and these changes matched participants’ self-report of their stress levels, indicating that meditation not only changes the brain but it changes our subjective perception and feelings as well.

References:

1. CDC on Epigenetics:  
<https://www.cdc.gov/genomics/disease/epigenetics.htm>
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4. Andrew Newberg, MD and Mark Robert Waldman, Authors of “How God Changes Your Brain”
5. Jonathan Greenberg, Britta K. Hölzel, Tim Gard, Thomas Calahan, Vincent Brunsch, Javeria A. Hashmi, Mark Vangel, Scott P. Orr, Mohammed R. Milad, Sara W. Lazar; Hippocampal circuits underlie improvements in self-reported anxiety following mindfulness training; <https://doi.org/10.1002/brb3.1766>