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Environment and Life Style Related Epigenetics: A Clinical Preview

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Editorial

We quite often ask ourselves as to why do some individuals live a long and healthy life, while others face life-threatening diseases during their life span or have to bear the brunt of being born with postnatal disorders. Well, most of us would explain it in terms of the difference in the genetic makeup of our DNA, the 0.1% that we do not have in common with everyone, else. The small difference in the genetic makeup of the DNA alone is not the only reason that impacts our health. Infact, the genetic variations which are acquired as a consequence of life changing encounters during our evolutionary history, and due to interactions with dietary constituents or exposure to environmental pollutants determine the course of events during the growth and development of a normal healthy individual or an individual manifested with a life-threatening disease. Supporting this assumption is the fact that our cellular metabolism is under epigenetic regulation. Epigenetics, which is defined as a set of chemical changes, that influence the gene expressions without changing the DNA sequence itself, can alter the gene activity of the metabolite regulating genes, thus leading to metabolic and degenerative disorders. So to say, our nutrition and healthy behaviours have a strong influence on our gene expressions by way of epigenetic modifications.

Clinical relevance of epigenetic modifications, has been identified during progression of diseases such as diabetes, heart diseases and cancers wherein numerous genes are switched on and off via epigenetic mechanisms. For instance, in case of colon cancer, transformation of colonocytes to adenocarcinoma cells, takes place due to epigenetic changes that include methylation of cytosines in DNA, chromatin modifications and micro RNA expressions. Further, there can be situations of both hypermethylation as well as of hypomethylation in colorectal cancer, and in the event of hypermethylation, transcriptional silencing of tumor suppressor genes leads to development of colorectal neoplasia [1]. Apart from lifestyle acquired diseases, neurological disorders in humans have been linked with epigenetics. Further, a link has been suggested between epigenetic tags and mental illness in humans where gene-specific changes associated with methylation, were found in the leukocytes of individuals with schizophrenia [2]. Tranylcypromine, an anti-depressant drug, and lithium salts, which are used to treat

bipolar disorders, have been shown to inhibit monoamine oxidase and demethylase and therefore act via epigenetic mechanisms.

Further to say, these epigenetic marks could multiply and be transferred to the next generation, "trans-generational transmission". Therefore, as a step forward to advance personalized medicine, epigenetic biomarkers are emerging as viable tools for the screening and early detection of various diseases; prognostic and treatment monitoring as well as for predicting future risk of disease development.

A few chemical compounds which are regularly introduced into the environment, through our lifestyle, have also been shown to affect the epigenome. For example, bisphenol A, a compound used to make certain plastics, has been shown to decrease the methylation of a specific gene in mice, while a supplement of folic acid was shown to prevent that change [3]. A few other investigations in the past reveal a different and interesting facet of epigenetics which could be relevant for their clinical implications. One such instance is that of grooming of pups within the very early days of life by mother rats that was shown to alter the methylation and acetylation patterns within the hippocampus of the pups and lower circulating levels of stress hormones [4]. While, the significance of such studies remains to be elucidated, however, it would be worthwhile to validate the idea that our environment and lifestyle modulates the epigenome in many different ways.

While concluding, we would like to say that it is easy to get excited about epigenetics, given the promise of new drugs, but by simply modifying our dietary patterns or avoiding exposure to certain chemicals would serve better to exert direct control over our epigenome.

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