Editorial

Epigenetics- New thinking at present era

What is epigenetics? Epigenetics (epi- is Greek for above) involves changes in the genes that do not involve changes to the sequence of DNA that makes up those genes. Rather, epigenetic changes involve a host of chemical modifications that serve to “mark” certain genes. Modifications include adding molecules, like methyl groups to the DNA. This changes the appearance and the structure of DNA this allows how that gene can interact with the transcribing molecules in the cell’s structure.

Epigenetics refers to changes in gene function that do not alter its underlying structure of DNA but result in genes being switched on or off in a reversible way. Environmental exposures that occur throughout a person’s lifetime (from fetal life through old age) can not only cause somatic mutations within DNA but also affect how genes function and whether they are turned on and off without changing the DNA sequence. Although the field of epigenetics may seem a matter for biochemists and basic scientists, there are many clinically relevant aspects that require an understanding by all physicians, especially pediatricians. Epigenetic principles are currently used for diagnosis and treatment of some childhood diseases and will likely be used in the near future for predicting and preventing disease. Adverse maternal exposures during pregnancy are thought to be especially important for later disease development because establishment of epigenetic markers occurs during fetal development. The field of epigenetics includes any mitotically or meiotically heritable change that does not change the actual DNA sequence. Adverse maternal exposures during pregnancy are thought to be especially important for later disease development because establishment of epigenetic markers occurs during fetal development. Epigenetic mechanisms regulate gene expression, making it possible for genes to function differently in various tissues. This system also allows a more flexible way to respond to each individual’s to environment. Because of this adaptability, epigenetic mechanisms have been suspected or identified in most diseases, including cancer, diabetes, obesity, asthma, and cardiovascular disease. Exposures throughout life, including toxins, diet, and stress, can influence epigenetic processes.

Pediatric pulmonologist Pamela Zeitlin observed two young boys who happen to have the same exact mutation in the gene responsible for cystic fibrosis, the inherited disease that causes severe mucous buildup in the lungs. Yet even a quick glimpse might reveal the two do not share the same severity of symptoms, for while one patient seems relatively healthy, the other clearly struggles to take a breath. So, why do two young boys of similar age and background born with the identical genetic defect show such a disparity in their health? Why has the identity of the CFTR (cystic fibrosis transmembrane conductance regulator) gene as the underlying cause of the disease not been the cure-all that many researchers had hoped for? Rather than in the gene, the answer may lie quite literally above the gene, and involves an emerging field of science that pediatricians. The answer could be found in epigenetics.

Smoking and overeating can make the genes for obesity overexpress themselves and the genes for the longevity under-express themselves. Men who smoke before puberty tent to have sons who can’t have higher body mass index and shorter life expectancies. Pregnant Women with high maternal anxiety are known to have children with asthma. Good news is that the scientists are learning to manipulate epigenetic marks and are trying to find out the drugs that will treat sickness by turning off the bad gene and by turning on the good gene. Scientists are now hoping to develop epigenetic drugs to help people with diabetes, cancer, Alzheimer’s disease, schizophrenia and autism. Epigenetic mechanisms are external modifications of DNA that cause changes in gene function and are involved in many diseases. Specific examples of pediatric diseases with a known or suspected epigenetic component include Beckwith-Wiedemann syndrome, childhood leukemia, allergies, asthma, fetal alcohol spectrum disorders, childhood obesity, and type 2 diabetes mellitus. Currently, epigenetically active treatments are being used to treat childhood leukemia. Potential epigenetically active treatments and preventive regimens are under study for other diseases. Pediatricians need to be aware of the epigenetic basis of disease to help inform clinical decision making in the future.

Prof. Dr. Mahmuda Hasan
Professor of Paediatrics
Ad-din Women’s Medical College. Dhaka