

## **The Meaning of Methylation**

Methylation is truly a multi-tasking marvel that allows us to be “healthy and human.” Though this highly intricate process occurs within each cell as well as in the fluid supplying the brain and within the liver, it is responsible for the most vital undertakings throughout body chemistry. Methylation determines who we are, what we look like, and how we behave and it is central to our physical, emotional, and mental wellbeing. Without methylation, we could not survive; hence, it is the perfect pathway to focus on for understanding autoimmune and neurological diseases such as multiple sclerosis, seizure disorders, dementia, Lou Gehrig’s, chronic fatigue syndrome, lupus, depression, anxiety, and autism spectrum disorders.

### **What are methyl groups & how do they work?**

Lets get the mind-numbing part out of the way first so we can discuss this in everyday terms. Methylation begins with a methyl group, which is stuck together with a carbon and three hydrogen atoms, although we will simply call these tags. These tags are like passes, or work orders, so that as “methylation” begins within each department, a work tag is passed onto another worker, or molecule. Although we go about our lives completely unaware of this elaborate process, methylation is responsible for making, maintaining, and repairing DNA, which is your genetic code. You don’t need to fully understand genetic code in order to understand the implications here. If you cannot create or mend what makes you distinctively you, there are going to be serious problems. This is analogous to crafting a car without bolts, wiring, or cables—while it might look like a car, be prepared for some surprises when you attempt to drive it off the lot. Just as a highly skilled assembly line manufactures quality automobiles, the methylation community regulates the switching on and off of the genetic codes, thereby creating a high functioning human being. Since many of us have several less desirable genetic variations, this is essential for regulating gene expression, particularly cancer causing genes. This system also silences virus and supports immunity while regulating sulfur metabolism, a major contributor in the body’s detoxification, or filtering, pathway. When functioning optimally, methylation assures that the less desired genes are switched off while the preferred genes are switched on so that the system runs successfully. This is known as gene expression and cancer and birth defects are an excellent example of where this process has gone awry.

### **What are those cycles?**

The methylation community has specific areas, known as cycles. The cycles, designed much like well-run fortune 500 Companies, have very specific duties. Each one has a chief operating officer (CEO), that determines its’ purpose, as well as supervisors, employees, and work orders (tags), known as methyl groups. The CEO establishes protocols and delegates various tasks to each supervisor, who is really just the cycle’s enzyme (Big Motherflipper, COMT, or BHMT). The supervisor then meets with the employees to hand out assignments, via work tags (methyl groups). The employees are often chemicals, proteins, or DNA that need the work tags to function effectively. Still, once the supervisor gives each employee an assignment and hands out the work passes; the jobs should be carried out (methylation). And, just as each corporation has a time-honored system, the methylation pathway has stages for beginning, maintaining, and completing the job. Of course, this also means that problems can arise at any given juncture. Nevertheless, don’t let the chemistry names and processes intimidate you. As you review the “simplified” diagrams, remind yourself that every cycle is merely a factory that operates for a specific purpose. The CEO meets with the supervisors, who in turn, meet with the employees to pass on designated work tags (methylation). Though this is a simplified illustration of the methylation process, it includes the major elements of this biochemical pathway.

### **The Major Tasks of Methylation**

In order to provide a brief overview, the following methylation tasks have been vastly streamlined. In reality, there is an endless array of both direct and indirect Methylation activities within the human body. Even so, this summary should provide greater understanding of this highly complex pathway, as well as the complications that can arise from various defects or toxic exposures. Methylation is responsible for the following:

1. Nervous system function (brain, spinal cord, & nerve cells). It’s critical for the insulation around nerves (myelin), which allows signals to properly transmit via this sheath, or outer layer.

2. Chemical Messengers, or neuro-talkers, that provides the means for communication throughout the community as well as maintaining mood, health, & wellbeing. Methylation yields neurotransmitters such as Dopamine, Serotonin, Melatonin, & Norepinephrine.
3. Regulation of gene expression by subduing the corrupt genes and nurturing those that are beneficial.
4. The creation of new RNA and DNA, our genetic building blocks.
5. Direct communication between the nervous & immune systems so that hazards are addressed, thus thwarting would be attackers.
6. Management of sulfur metabolism, a major contributor within the detoxification system (transsulfuration and glutathione).
7. Mobilizes fat and cholesterol so that they are efficiently removed from the body and/or used appropriately for the production of hormones, myelin sheath (nerve lining), and bile salts.
8. Hormone control and production. Methylation is instrumental in estrogen, testosterone, & insulin concentrations as well as many other hormones throughout the body.
9. The allergic response including: a). Anaphylactic reactions (life threatening), b). Food or seasonal allergies, c). Eczema & hives, & d). Asthma. This is accomplished through histamine regulation.
10. The production and repair of proteins throughout the body: Four examples include a). Amino acids (building blocks of protein), b). Hemoglobin (carries oxygen to body), & c). Antibody defense such as IgA, IgE, IgG, & IgM (immune factors that defend us from invaders), and d). Collagen or Elastin, which offer structural function and support within the body via Collagen's role in connective tissue, (tendons & ligaments), while elastin is found in the intestines, blood vessels (arteries), and lungs.
11. RNA Methylation, as it permits for more accurate instruction to DNA in cell replication & identity.
12. DNA Methylation, which allows cells to operate, as they should whether skin, hair, liver, or brain cells.
13. Cell membrane fluidity, which impacts what goes in or comes out of each cell through its' outer coating. This allows cells to fine-tune their own mineral levels, allowing elements to move in & out as needed.
14. Processing and filtering of heavy metals & environmental toxins as well as phenols, glutamates, pesticides, additives, sulfites, ammonia, drugs, herbs/supplements, adjuvants, etc.
15. Oversees the removal of free radicals as well as the formation of new cells to take their place.
16. Regulates histones, the proteins that are tightly wound within the DNA. These are one of the specific proteins involved in cell division and cancer.
17. Homocysteine (HCY) regulation in order to provide adequate work tags while preventing HCY's more harmful effects (inflammation within blood vessels, brain, and heart tissue).
18. The conversion of many nutrients (i.e., folate or HCY) into more active forms (5 MTHF or Methionine) for more work tags, leading to innumerable actions throughout the community.
19. Production, maintenance, and repair of cells, which leads to peak performance within the nerve, tissue, and organ as well as healing.
20. BH4 production, which is critical for neurotalkers, waste & toxin cleanup, and nitric oxide production. The latter is used for maintaining open & clean blood vessels as well as protecting the heart & brain.

### **When Methylation Breaks Down**

What does this process look like when it's broken? After reading the following, you will be able to envision the implications of defects or mutations. The following is an example of the health problems that might occur.

1. Poor nerve function leads to muscle twitching, numbness, and weakness yet misfires can cause seizures, fatigue, memory loss, word groping, clumsiness (with falls & injuries), and visual or hearing loss in those with MS, CFS/ME, or Autism Spectrum Disorders.
2. Depending on the neuro-talker, imbalances often lead to a variety of disorders including: depression, anxiety, panic attacks, irritability, mood swings, OCD, ADD/ADHD, Parkinson's, schizophrenia, bipolar, spaciness, insomnia, and poor concentration and focus.
3. Gene expression can lead to many unwanted disease processes such as Malignancy/cancer (melanoma, breast/uterine/ovarian, prostate, MDS, leukemia), Neurological (ALS, MS, Parkinson's), Autoimmune (CFS/ME, Lupus, Ulcerative colitis, mixed connective), Endocrine (diabetes, pituitary, thyroid, adrenal), Gastrointestinal (Pancreatitis, Crohn's, stomach/colon cancer, Hemochromatosis), or Heart/cardiac (blood vessel disorders, high cholesterol, high blood pressure, heart attacks), etc.
4. Deficiencies in RNA & DNA lead to poor growth & development, poor healing, and lack of bowel or brain cell regeneration so that as cells die, they cannot be readily replaced.

5. Poor communication between the brain and the immune system means the difference between successfully fighting off a simple cold vs. allowing the virus to develop into a more severe bacterial infection, such as meningitis or pneumonia.
6. Inability to utilize sulfur leads to toxic sulfites and can substantially reduce glutathione production. As the backbone of the immune system and major antioxidant, glutathione deficiency leads to poor immunity & inability to naturally clean up accumulating toxins, leading to widespread collateral damage.
7. Cholesterol accumulation leads to fat deposits around organs and within blood vessels, which may cause strokes or heart attacks, whereas inability to use cholesterol can lead to Vit D shortages as well as imbalances within testosterone, estrogen, & insulin.
8. Lack of hormone regulation leads to diabetes, as is the case with insulin, or breast & endometrial cancer, as often occurs with high estrogen levels.
9. Too much histamine allows for an overactive allergic response, such as the near fatal reaction to eating peanuts or strawberries, whereas low levels may lead to anxiety disorders.
10. Poor protein repair and production has far-reaching effects including: a). Shortages in amino acids allow for poor detoxification, immunity, healing & growth, b). Lack of oxygen via hemoglobin leads to poor cell & tissue repair and more infection & damage to tiny blood vessels, c). Low antibody formation causes Immune deficiencies due to lack of T & B cells, d). Without sufficient elastin & collagen, there's greater risk for injury & musculoskeletal dysfunction with weakness as well as poor healing.
11. RNA acts as both a translator and chemical messenger to DNA for cell identity so that any interference allows room for error within genetic coding. This contributes to genetic typos or SNPs (snips).
12. DNA methylation allows for accurate cell identity & errors here may impede proper cell function. Diseases include cancer cystic fibrosis, sickle cell anemia, & Hemophilia.
13. When the cell isn't able to regulate its' contents, electrolyte imbalances (potassium, calcium, magnesium, sodium) occur, limiting cell communication. Alzheimer's, Autism, MS, and Crohn's Disease are all cases in which poor cell membrane fluidity plays a significant role.
14. Without filtering, toxic accumulation of heavy metals, ammonia, sulfites, phenols, glutamates, & other substances, leads to toxic threshold. Many feel this is a significant factor behind regressive autism, CFS/ME, MS, ALS, neuropathy, dementia, cancer, and many other chronic diseases and disorders.
15. The inability to govern and repair free radical damage causes widespread cell, tissue, & organ damage and is instrumental in the aging process as well as headaches, lethargy, and symptoms of fatigue or disorders such as Autism, CFS/ME, neuropathy and chronic pain.
16. Improper methylation of histones is a known trigger behind tumors & malignancies such as leukemia and a variety of cancers.
17. High homocysteine (HCY) levels are related to heart disease, strokes, and cancer. Recent studies reveal an association between mothers with high HCY levels & children later developing schizophrenia.
18. The inability to convert nutrients into useable forms is highly associated with heart disease, strokes, clotting disorders, infertility, spina bifida, cancer, and a multitude of diseases and disorders.
19. Poor cell turnover, repair, and maintenance are a prime example of why so many have developed inflammatory bowel disorders, leaky gut syndrome, and yeast overgrowth as well as neurodegenerative disorders such as dementia & autism.
20. Without adequate BH4, we cannot make the neuro-talkers we need to maintain health and happiness, neurological function, waste cleanup, or nitric oxide in order to protect the heart and brain. (See # 2).