What is methylation?

Methylation is one of the most important series of chemical reactions in the body. It is involved in repairing our DNA and protecting it against toxic damage. It helps control hormones and reduces homocysteine levels, a compound that damages blood vessels. Methylation supports detoxification, aids the nervous system, helps keep inflammation low and aids many other important body reactions. The methylation cycle starts with the amino acid, Methionine, derived from dietary protein and is found in foods such as animal protein, broccoli, turnips, sesame seeds and asparagus. Methionine is converted to S-Adenosyl Methionine, (SAMe) and requires the mineral magnesium to do this. SAMe is an anti-inflammatory amino acid which helps support the immune system by allowing the body to produce three important hormones; dopamine, serotonin and melatonin. Dopamine is important for focus, concentration, short term memory, emotional stability, organization, vestibulo-visual interaction, and coordination. It affects the levels of the stress hormones, epinephrine and nor-epinephrine. Serotonin is supportive of mood and is known as our happy hormone and is also required for the contractions of the gut. Melatonin is important for sleep.

SAMe in the methylation cycle produces homocysteine using vitamin B6. If levels of homocysteine (a protein that is damaging to our
body) become too high, it is converted back to methionine which requires vitamin B9 or folate to be broken down to 5-methyl-THF controlled by the MTHFR gene and involves Vitamin B12. If the MTHFR gene is defective, conversion of folate to 5-methyl THF will not occur and methylation will be impaired leading to high homocysteine levels in the blood system and increased damage from free radicals and toxins.

It is estimated that approximately 40% of Americans have a defective MTHFR gene (heterozygous meaning 1 copy of the mutation or homozygous meaning 2 copies of the mutation). This mutation can be either inherited or the result of toxic damage or epigenetic changes to the MTHFR gene causing it to switch off. This may be a very useful genetic test for Moms2B as folate is recommended to prevent pregnancy loss, spina bifida and other neural tube defects developing in the baby. If the mother has a defective MTHFR gene, folate is not processed and must be provided as 5-methyl THF. The good news is that this gene may be switched back on with appropriate nutrient interventions including vitamin B9 or folate as 5 –methyl THF, vitamin B12 (as Methylcobalamin), Magnesium and betaine as TriMethylGlycine (TMG). It is also important to remember that in order to produce glutathione, homocysteine must go through a series of reactions known as transulfuration. The transulfuration process is commonly impaired in individuals with autism, ADHD and ADD and may require additional vitamin B6 (as P5P), Betaine (as TMG), the amino acids cysteine, glutamine and glycine plus magnesium and potassium.

**How to test for MTHFR gene mutation?**

A simple genetic blood test will identify a heterozygous or homozygous C677T MTHFR or A1298C gene mutation. It is advised that homocysteine levels are also checked.

What are the conditions and symptoms associated with impaired methylation, reduced SAMe and excessive homocysteine?

- Autism
- ADD/ADHD
- Heart attack
- Stroke
- Dementia
- Alzheimer’s disease
- ALS (Lou Gehrig’s disease)
- Parkinson’s disease
- Chronic Fatigue Syndrome/fibromyalgia
- Mitochondrial disease (as methylation is necessary for the production of CoQ10)
- Systemic lupus erythematosus
- Neural tube defects
- Bipolar disorder
- Schizophrenia
- Premature aging
- Miscarriages
• Cardiovascular disease
• Certain cancers
• Diabetes
• Osteoporosis
• Cervical dysplasia
• Depression
• Mood and behavioral disorders

Studies have shown that individuals with autism may have impaired methylation, and this may be due to defective methylation genes such as the MTHFR which disables their ability to use folate or vitamin B9 effectively and results in reduced production of glutathione. Glutathione is one of our body's most potent antioxidants and protects body cells against damage caused by free radicals and helps the body neutralize toxins such as pesticides and heavy metals. Methylation is required to support many common biomedical problems associated with children with autism, ADHD and ADD. Some of these are listed below:

• Degradation of the myelin sheath surrounding nerve cells (commonly diminished in some individuals with autism)
• Dysfunctional immune T helper cell activity against pathogens (bad bugs) and an increased T helper cell response against food and environmental allergens
• The production of CoQ10 required in optimizing mitochondrial energy production
• The production of hormones and neurotransmitters such as dopamine, serotonin, melatonin, nor epinephrine and epinephrine (which are commonly unbalanced in autism, ADHD and ADD)
• The production of glutathione and metalloproteins (proteins that carry heavy metals out of the body)

Low glutathione levels and elevated oxidative damage is common in individuals with autism, ADHD and ADD.
If a C677T or A1298C MTHFR mutation is present, limit folic acid rich foods in the diet (please see Vitamin B9 nutrient description for a list of foods high in folate) and foods high in or fortified with folate, since this form of folate cannot be utilized by the body. Also, do not take supplements with folic acid as processing of folic acid to 5-Methyl THF is impaired.

Nutrient recommendations for supporting methylation and C677T MTHFR mutations are: Please seek guidance from your healthcare professional.

- Methylfolate as 5-MTHF
- Vitamin B12 as Methylcobalamin
- Betaine in the form of TMG
- Magnesium
- Amino acid complex containing methionine, cysteine, glutamine, glycine
- SaMe (may be supportive if homocysteine levels are low)

In addition to the above the following nutrients are involved in transulfuration which reduces homocysteine to make glutathione:

- Vitamin B6 as Pyridoxal-5-phosphate (P5P)
- Potassium
- N-Acetyl Cysteine (not to be used in individuals with autism with a Candida sp. overgrowth as it may encourage the proliferation of Candida)
Methylation Transulfuration Package

Recommended Products

**ProThera Methylbalance**
Inc 5-Methyl THF, B12 as methylcobalamin, B6 as P5P and betaine as TriMethylGlycine.

**Premier Research Labs Coral Legend Plus**
Providing a natural source of calcium and magnesium at the correct ratio.
Please note: IF CANDIDA is present please use the following amino acid supplement without cysteine which may increase the growth of Candida.

**ProThera SAMe 200**
An important amino acid in supporting methylation and converting homecysteine back to methionine.

Recommended Amino Acid Products

Please include ONE amino acid product. Practitioner Select recommends Amino NR, containing cysteine, as the preferred product. If Candida overgrowth is suspected or confirmed please use Amino Replete without cysteine.

**Pure Encapsulations Amino NR**
A blend of amino acids with cysteine.

**Pure Encapsulations Amino Replete**
A blend of required amino acids without cysteine.

*These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure or prevent any disease.*