

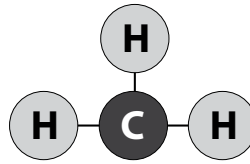


# How Are You Methylating?

**Methylation is a Key to Healthy Gene Function, Liver Detoxification, Brain and Mood Management and More**

Inside every cell of your body there are biochemical processes happening thousands of times every second. One of these is methylation. This simple, but critical process is involved in hundreds of biological functions.

Methylation is the process of transferring a methyl group from one molecule to another. A methyl group (CH<sub>3</sub>) is a carbon atom (C) with three hydrogen molecules (H) attached to it (see illustration). As we explain in this newsletter, problems with this simple process can be a contributing factor in numerous health problems.



## Methylation, Mind and Mood

To begin with, methylation is a very important process in regulating brain function and mood. Folate, also known as folic acid or vitamin B<sub>9</sub>, is required for the synthesis of serotonin, melatonin, dopamine, norepinephrine, and epinephrine, but it must be methylated to create methylfolate in order to work. If methylation is deficient, lower levels of these chemical messengers can result in mood disorders like depression and insomnia.

Methylation also keeps levels of chemical messengers from becoming too high. It is a major pathway in cellular and liver detoxification and is used to get rid of excess hormones and neurotransmitters, including estrogen, epinephrine, norepinephrine, dopamine, melatonin, histamine and serotonin. Higher levels of dopamine, serotonin and epinephrine are associated with anxiety, aggression and insomnia.

The role of methylation in the synthesis and breakdown of neurotransmitters explains why disturbed methylation may be involved in problems like schizophrenia, bipolar disorder, depression, anxiety and behavior disorders. In fact, orthomolecular psychologists (doctors who use nutrients to treat mental disorders) have suggested that over or under methylation may be involved in more than half of all mental health issues.

## Methylation, Estrogen and Reproductive Problems

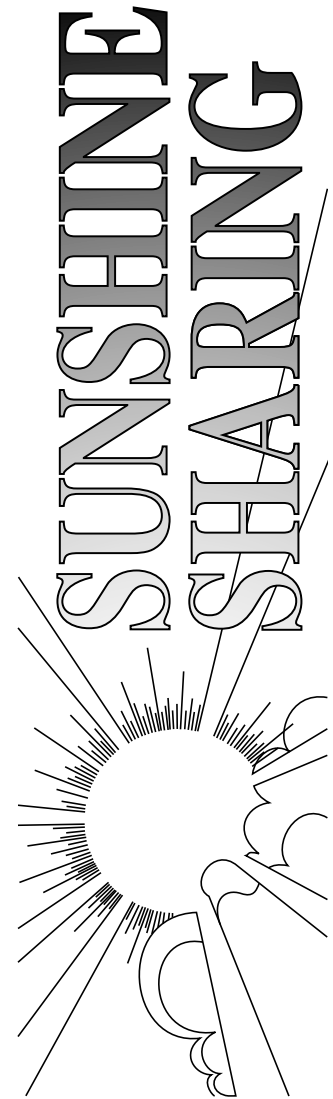
Methylation's role in regulating estrogen is important because high levels of natural estrogens or xenoestrogens (chemicals that mimic estrogen) cause many reproductive health problems. High levels of estrogens are associated with PMS Type A, which is characterized by irritability and anxiety prior to the period. Excess estrogen stimulates the development of uterine fibroids and is a critical risk factor in developing estrogen-dependent cancers such as breast, prostate and uterine cancer. Xenoestrogens also cause prostate enlargement (BPH) in men. Enhancing the methylation detoxification pathway helps to eliminate excess estrogens, reducing the risk of all of these health concerns.

## Methylation, Detoxification and Inflammation

Another important role of methylation is the elimination of homocysteine. Homocysteine is a pro-inflammatory chemical. High levels of homocysteine are a major risk factor for coronary artery disease and increased general inflammation.

A variety of other chemicals (amines, phenols, etc.) are also eliminated through methylation, so if you aren't methylating efficiently your body can't eliminate many environmental toxins.

**Continued on page 2**



Your guide to better health the natural way.

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## How Well Do You Methylate?

Continued from page one

Undermethylation will also interfere with another detoxification pathway—glutathione conjugation. Glutathione is the primary antioxidant inside the cells and is essential for the elimination of heavy metals and histamine.

Like homocysteine, histamine is pro-inflammatory. Because under-methylators have a hard time getting rid of both of these chemicals, they are more prone to general inflammation and allergic reactions. This also means that levels of homocysteine and histamine can be used to evaluate how well a person methylates.

### Methylation and Energy Production

Both folate (mentioned earlier) and B12 are inactive until they are methylated. These vitamins are essential for red blood cell production, so when methylation is deficient, it can cause anemia and fatigue. This can happen even when blood levels of these vitamins appear normal.

A lack of methylation causes fatigue by another mechanism as well. Methylation is needed for the synthesis of carnitine and CoQ10. Both of these nutrients are needed inside the mitochondria for cellular energy production. Without them, the body can't produce ATP, the molecule used to power the cell.

### Methylation, Genetics and Cancer

There are many other roles methylation plays in the body, but one of the most critical is regulating DNA. Methylation helps to keep DNA repaired and is involved in epigenetics. The epigenome is responsible for regulating which genes get expressed and which genes get suppressed. In essence, epigenetics is the on/off switch for genes.

It's well documented that supplementation with folic acid (or better yet, methylfolate) during pregnancy helps prevent birth defects. This is because folic acid aids methylation, which helps prevent negative gene expression.

This also means that undermethylation may play a role in allowing cells to become cancerous. There are a number of genes that are normally switched off by the epigenome, which must be switched on in order for a cell to become cancerous. A lack of methylation may be involved in this process, which means that maintaining good methylation may help prevent cancer.

There is another reason why poor methylation may be involved in cancer. Cells have a "kill switch," which the immune system uses to convince defective cells to die, a process called apoptosis. Poor methylation can lead to high levels of homocysteine, which can raise levels of S-adenosylhomocysteine (SAH) inside the cell.



## Determining Methylation Balance

How well you methylate is partially regulated by genetics and partially by nutritional intake. Researchers estimate that 30 to 40 percent of the population has problems with the genes that form the enzyme methyltetrahydrofolate reductase (MTHFR), which methylates folic acid to produce methylfolate (see page three).

You can get tested for this genetic issue, but it is important to understand that this is not the only thing that can affect methylation. Other genes can make a person prone to too much or too little methylation and a person's diet and nutrition also play a role in how well they methylate.

So, it's important to assess how you are methylating to determine what supplements may help you. Here are some indications to consider when determining methylation status.

### Undermethylation

People who are under-methylating tend to have the following indications.

**Physical:** High levels of homocysteine and histamine, a greater tendency to inflammatory diseases, including heart disease, a greater tendency to seasonal allergies, but not food allergies, respond well to antihistamines, sparse

body hair, high fluid production (saliva, tears), frequent headaches

**Mental and Emotional:** Obsessive-compulsive; ritualistic behaviors, high libido, strong willed, competitive in games and sports, perfectionist, tendency to rumination about the past, tendency to phobias and addiction, depression that responds positively to SSRIs

**Nutritional:** Respond well to methyl donors like SAM-e, but don't respond as favorably to folate supplements

### Overmethylation

People who are over-methylating tend to have the following indications.

**Physical:** Lower levels of homocysteine and histamine, food and chemical sensitivities, but don't respond well to antihistamines, sleep disorders, restless legs, dry eyes and mouth, hairy body (hirsutism), low libido

**Mental and Emotional:** Obsessive thoughts without compulsive actions, ADHD, hyperactivity, low motivation in school, non-competitive, talkative; high artistic ability, high anxiety, depression that gets worse with SSRIs

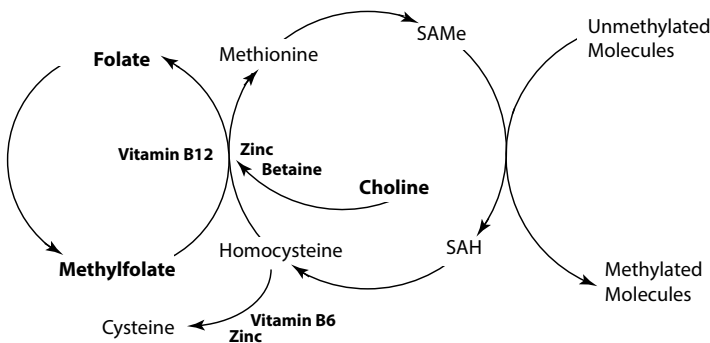
**Nutritional:** Respond poorly to methyl donors like SAM-e, but respond favorably to folate supplements.

SAH inhibits the kill switch, which prevents the immune system from being able to destroy the cancer cells. This suggests that anyone with cancer should evaluate their methylation status, and if they are undermethylating, they should try taking supplements to increase methylation as part of their program.

## Identifying and Correcting Methylation Problems

It should be very clear by now how important methylation is to maintaining good health. It's important to understand that you can have too much methylation, as well as too little. To help determine whether you are under- or over-methylating refer to the previous page. Once you determine your methylation status, the following information can help you balance methylation.

## Nutritional Supplements to Aid and Balance Methylation



To understand how nutrients can help support and balance methylation, let's start by taking a look at the methylation process. As shown in the diagram above, the amino acid methionine is converted into a methyl donor called SAM-e (S-adenosylmethionine) by the addition of the energy molecule ATP.

SAM-e then turns under-methylated molecules (i.e., fats, proteins, neurotransmitters, DNA, toxins) into methylated molecules. After donating its methyl group, it becomes SAH (S-adenosylhomocysteine), which is then converted into homocysteine (HYC).

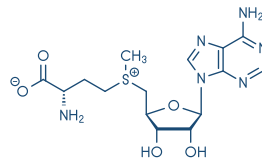
HYC can then be converted back into the amino acid cysteine with the help of vitamin B6 and zinc, or it can be converted back to methionine with the donation of a methyl group from methylfolate or choline. Vitamin B12, zinc and betaine facili-

**Continued on page 4**

### Additional Help and Information

For more information about methylation and how you can balance methylation processes for better health, contact the person who gave you this newsletter. You can also consult the following resources:

- Methyl Magic: Maximize Health through Methylation* by Craig Cooney
- MTHFR: Gene Therapy Demystified* by Dr. Robin Terranella
- Nutrient Power: Heal Your Biochemistry and Heal Your Brain* by William J. Walsh
- Methylation* by Kimberly Hindman, ND, LAc ([healingdragon.net/wp/?p=252](http://healingdragon.net/wp/?p=252))



S-adenosyl methionine

# SAM-e

S-adenosylmethionine (abbreviated as SAM-e or SAME) is a major methyl donor that was discovered in the early 1950s. It is synthesized in the body from the amino acid methionine and adenosine triphosphate (ATP) and most of it is created and used in the liver. First discovered in Europe, and available there by prescription since 1975, SAM-e has a number of potential therapeutic benefits when used as a supplement. Here are some.

### Depression

Studies have suggested that SAM-e can be effective for mild to moderate depression. It helps the body produce more mood-enhancing neurotransmitters such as dopamine and serotonin and is a natural reuptake inhibitor for these neurotransmitters. Unfortunately, the dose required to manage depression is quite high. European studies typically use 800 to 1600 mg. (4-8 tablets) daily, but some people get benefits from taking less. SAM-e can move a person from depression to mania and is therefore contraindicated with bipolar disorder.

### Liver Function

SAM-e helps increase methylation in the liver and other cells of the body. It helps the liver break down excess estrogen, histamine and stress hormones and helps eliminate homocysteine, a compound associated with increased risk of heart disease.

It also helps in liver detoxification through glutathione conjugation. These properties give SAM-e some benefits in situations such as cirrhosis of the liver, chronic viral hepatitis and jaundice related to pregnancy.

### Arthritis

SAM-e also shows promise with arthritis, particularly osteoarthritis. It has been shown to be as effective as nonsteroidal anti-inflammatories in relieving pain without the side effects. It may also prevent damage to cartilage and may help rebuild cartilage when taken for long periods of time (more than 3 months).

### Other

Several studies have been conducted using SAM-e with fibromyalgia. The results are promising, but not conclusive at this point. Patients taking SAM-e reported improvements in pain, fatigue, morning stiffness and mood. Studies suggest that people with Parkinson's disease have low levels of SAM-e. SAM-e can slow the progression of Parkinson's disease in some cases and reduce some symptoms of Alzheimer's, but more research is needed.

### Usage

For arthritis, liver detoxification and other related uses take one tablet (200 mg.) of SAM-e with breakfast and another with lunch. A third may be added at dinner, but taking SAM-e at night can cause restlessness. Larger doses are needed for depression, 2 tablets (400 mg.) twice daily.

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## Continued from page 3

tate this process of remethylating HCY. Giving up its methyl group transforms methylfolate back into folate, which can also be methylated again to create methylfolate.

With this understanding, let's look at how we can use nutritional supplements to aid and balance the methylation process.

### Methyl Donors

Several nutrients can act as methyl donors, thus aiding the methylation process. The first of these is **SAM-e**, discussed on page three. Available as a supplement since 1975 SAM-e has many potential benefits for people who are under-methylators, but is not helpful for over-methylators.

The amino acid choline is a powerful methyl donor because it contains three methyl groups. It is not only used in methylation, it is also important for the production of the neurotransmitter responsible for memory, acetylcholine. Organ meats, like liver are rich in choline, which is also found in butter, eggs, peanut butter, potatoes and whole wheat bread.

One of its forms, phosphatidylcholine helps transport fats and cholesterol, as well as serve as a precursor for the production of acetylcholine. Phosphatidylcholine is used in **Brain Boosting formulas**, which also contain **ginkgo** and Chinese club moss.

Betaine is a methylated version of the amino acid glycine. It is part of betaine hydrochloric acid which is taken as a nutritional supplement to aid protein digestion. Beets and spinach contain large amounts of betaine if they are grown properly. It's also found in seafood.

Methionine is an essential amino acid that carries a methyl group and is part of the methylation cycle as shown on the previous page. It's plentiful in the diets of people who eat animal protein, but is also found in peanuts, soybeans and other legumes. Supplementation is typically not necessary.

### Methylation Supporting Nutrients

**Folic acid** or folate, is very important in methylation because it's used by enzymes that manufacture methyl groups. It's also a common vitamin deficiency. When taken in the form of methylfolate, it acts as a methyl donor as well. Foliates are better supplements than straight folic acid and green, leafy vegetables are a great source of folates. Taken by itself, folate is a good supplement for over-methylators.

**Vitamin B6** helps convert HCY to cysteine, thus lowering homocysteine. B6 plays many other roles in the body and deficiencies can also cause dermatitis, seizures, inflammation of the tongue, cracked lips, carpal tunnel syndrome and anemia. It's best to take B6 as part of a **B-complex Vitamin supplement** however, and not as a single vitamin. Too much will decrease methylation by converting HCY into cysteine rather than methionine (which could be helpful for over-methylators, however).

**Vitamin B12** plays a role in methylation, too. With the help of methylfolate, it helps to convert HCY back into methionine. So, a **Methylation Supporting formula** containing a combination of methylated B12 (methylcobalamine) and methylfolate is a great supplement for enhancing methylation.

**Zinc** is involved in the proteins that turn genes on and off. In fact, it's a cofactor for a critical enzyme in DNA regulation known as DNA methyltransferase. Along with vitamin B6, zinc also helps lower homocysteine by converting it to cysteine, which means it can be helpful for over-methylators as well as under-methylators. It also aids in the process of methylating homocysteine back into methionine with the aid of betaine.

When experimenting with supplements to balance methylation it's best to start with small doses and see how you react. If you react favorably, you can gradually increase the dose.