LEVEL 1 · FUNDAMENTALS · METHYLATION

What Is Methylation?

It has been turned into a wellness buzzword, usually attached to one gene and one supplement. What it actually is: a routine chemical handoff your cells perform billions of times a second.

By **Shaaf Hussain** · Author & Founder | Level 1 · Fundamentals | Educational — not medical advice

https://longevitydecoded.net/what-is-methylation-article.html

WHAT YOU'LL UNDERSTAND BY THE END

What a methyl group is, what your cells do with one, and why methylation is ordinary chemistry rather than a condition you either have or lack.

Search the word and you will mostly find two things: a gene called MTHFR, and something to buy. Both are downstream of a much simpler idea, and skipping the idea is why so much of the conversation goes wrong.

Methylation is the transfer of a methyl group from one molecule to another. That is the whole of it. Everything else in this school is a consequence.

WHAT IT IS

One carbon, three hydrogens

A methyl group is about as small as chemistry gets: a single carbon atom holding three hydrogens, written **CH_3**. On its own it does nothing interesting. Attached to something else, it changes what that thing does.

Think of it less as an ingredient and more as a *tag*. Attaching one can switch a molecule's behavior, change where it goes, mark it for disposal, or quiet a stretch of DNA. Removing it can reverse that. The tag is small; the consequences are not.

WHY THIS MATTERS MORE THAN IT SOUNDS

A cell has to do thousands of different jobs using one set of instructions. Tagging is how it specializes — the same gene can be busy in a liver cell and silent in a neuron, without either cell changing a letter of its DNA. Methylation is one of the main tagging systems that makes that possible.

THE SCALE OF IT

The same reaction, running everywhere

Methyl transfer is not a specialist pathway tucked away in one organ. It runs continuously, in every cell, across an enormous range of jobs:

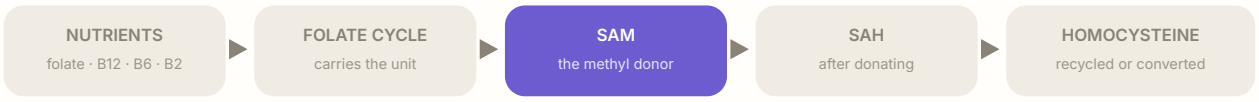
- **Gene regulation** — tagging DNA and the proteins it wraps around, influencing which genes are read and which are left alone.
- **Building molecules** — creatine, phosphatidylcholine for cell membranes, and carnitine are all assembled using donated methyl groups.
- **Neurotransmitter metabolism** — several of the enzymes that build and break down brain chemicals are methyltransferases.
- **Clearance** — tagging certain compounds is part of how the body prepares them for removal.

The demand is genuinely large. Creatine synthesis alone is one of the biggest single consumers of methyl groups in the body — which is a useful thing to know later, when we get to why methyl supply is a budget rather than a switch.

THE SUPPLY CHAIN

Where the methyl groups come from

Methyl groups are not stored in a tank. They are carried, handed over, and regenerated, in a loop that never stops turning. The five stages below are the spine of this entire school, and every later lesson is a closer look at one of them.



The same five stages appear in every lesson in this school.

The methylation cycle, simplified. Nutrients feed it, the folate cycle carries the unit, SAM does the donating, and what is left is either recycled or sent down a different route.

In one sentence: **nutrients supply one-carbon units, the folate cycle carries them, methionine is converted into SAM, SAM hands its methyl group to whatever needs it, and the leftover becomes homocysteine — which is either recycled back to methionine or converted onward into something else entirely.**

You do not need to hold that in your head yet. It is here so you recognize the shape when the next lessons take it apart.

CLEARING THE GROUND

What methylation is not

THREE THINGS THE INTERNET GETS WRONG

It is not a switch that is on or off. It is a continuous process with a rate, and the rate differs by tissue, by reaction and by moment. Nobody is simply a “good methylator” or a “bad” one.

It is not one gene. MTHFR is a single enzyme in a network that includes MTR, MTRR, BHMT, CBS, MAT, AHCY and several more. A variant in one is not a verdict on the whole system.

More is not better. Methylation is regulated in both directions. Over-methylation of the wrong target is not a benefit, and the body spends real effort keeping the rate where it wants it.

That last point is worth sitting with, because it cuts against the entire framing of methylation as something to maximize. A regulated system that is pushed harder does not necessarily do more useful work. It may simply be pushed.

THE HONEST LIMIT

Why you cannot feel it

There is no symptom of methylation. Fatigue, low mood, brain fog and poor sleep are produced by dozens of unrelated processes, and none of them points at this one. Neither does a genetic panel: a variant tells you about a tendency in an enzyme, not about the state of a network that has several ways to route around it.

Even homocysteine — the marker most often used as a proxy — is a junction rather than a verdict. It reflects the balance between two competing routes, and a great many things move it. What it can and cannot establish is a whole lesson of its own, at Level 4.

WHAT THE EVIDENCE ACTUALLY SAYS	
HUMAN EVIDENCE	Methyl transfer is a fundamental, universal cellular reaction, and the folate and methionine cycles are established biochemistry. This is textbook material, not a hypothesis.
HUMAN EVIDENCE	Severe deficiency of folate or vitamin B12 causes well-characterized disease, and correcting the deficiency treats it. This is settled.
MECHANISM	That variation in methyl-group supply within the normal range meaningfully changes everyday health is plausible and widely discussed, but rests largely on mechanism rather than on outcome trials.
UNCERTAIN	How much day-to-day methylation capacity varies between healthy people, and whether that variation matters clinically. Actively researched, not settled.
NOT SUPPORTED	That symptoms, a genetic panel or a single homocysteine reading can establish whether someone's methylation is impaired.

CONNECTED SYSTEMS

Where this connects

MITOCHONDRIAL & CELLULAR ENERGY

Methylation: The Hidden Supply Chain

NUTRITION & GUT HEALTH

The Gut: The Root System

THE WHOLE LESSON IN ONE LINE

Methylation is the transfer of a one-carbon tag from one molecule to another — ordinary, constant chemistry that regulates genes and builds molecules, with a rate rather than an on-off switch, and no symptom you can feel.

Educational content only — not medical advice, diagnosis, or treatment. This lesson explains general biochemistry for a non-specialist audience. It does not diagnose any condition and does not recommend any supplement, dose or protocol for any individual. Methylation cannot be assessed from symptoms, and no article can tell you whether yours is working well. Genetic variants, homocysteine and B-vitamin status should be interpreted by a qualified clinician in the context of your full history. Discuss any changes to your health, medications, or supplements with a licensed professional who knows your situation.

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