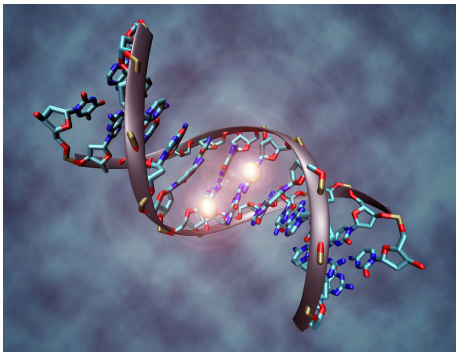
Methylation: The Molecule That Unlocks The Body's Healing Response

A Key To: Detoxification, Cell Repair, Graceful Aging, Weight Loss, Neurotransmitter Balance, Healthy Immunity, Disease Prevention, Nerve Protection, and so much more.

By Dr. Jack Tips, N.D., Ph.D., C.Hom., C.C.N.

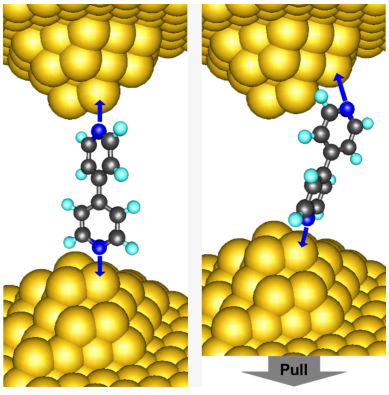
A molecular biologist could write a million pages on methylation and only touch on a small fraction of the subject. Methyl groups are largely ignored in nutritional healing, much to the detriment of a therapeutic program's ultimate success. Here, in this 2-part discourse, discover how providing the body with nutritional methyl donors can be the dividing line between success and failure. Even more importantly, methylation holds an answer to the chemical toxicity and electromagnetic field damage that causes inflammation, mitochondrial dysfunction, and DNA breakage. Natural health clinicians today are quickly realizing that methyl donors are a new solution to environmentally caused maladies.



Graphic of DNA methylation. Methyl groups switch genes on and off and help repair damaged DNA.

Our bodies conduct over a billion methylation[1] processes every moment of our lives! More than any other molecule, methyl groups[2] (CH_3) are involved in the healthy function of the body's life processes, and more than any other molecule, the lack of methyl groups for methylation is involved in chronic, degenerative developments, autoimmune concerns, hormonal processes, and neurotransmitter imbalances. In fact, healthy methylation processes are synonymous with good health and an inability to methylate is synonymous with symptom expressions and poor health. For many people, improving methylation provides new hope for depression, anxiety, autism, and the myriad symptoms that come from exposure to environmental toxins that interfere with the body's genetic expression of optimal health.

On/Off Switches. Methyl groups are the on/off switches of the cells' activities—turn on a genetic expression, turn off an enzyme reaction, turn on serotonin (and feel good), turn off inflammation (and prevent chronic degenerative and auto-immune concerns), turn on melatonin (and sleep), turn off delusional thoughts (and survive), turn on the detoxification of a phenol (and stop food allergies), turn on neurotransmitters (and not be depressed), turn off neurotransmitters (avoid anxious excitability), turn on the tissue repair mechanism (and heal), turn off the stress response before it damages healthy cells.



These are but a few of the many important switches that methyl groups facilitate, and thus here is a critically important topic. If our patients are short a few methyl groups, their bodies cannot respond to the healing directive of our natural therapies. If vitamins, minerals, nutriments, coenzymes, herbs, and homeopathic remedies are to help the body, methylation processes must be available and able to perform. Hence, methylation takes us deep into the heart of healing,

[1] **Methylation** – the adding, and in some cases the subtracting (demethylation), of a methyl molecule to a chromosome, toxin, enzyme, molecule, etc.

[2] **Methyl Groups** – a molecule with one Carbon atom and three Hydrogen atoms, thus CH_3. It is often abbreviated *Me.* Methyl groups can be found in 3 forms: anion, cation and radical. The anion has 8 valence electrons, the radical 7 and the cation 6. All three are highly reactive and perform many of the wonders of life.

into the very core of the individual cells where all lasting healing occurs.

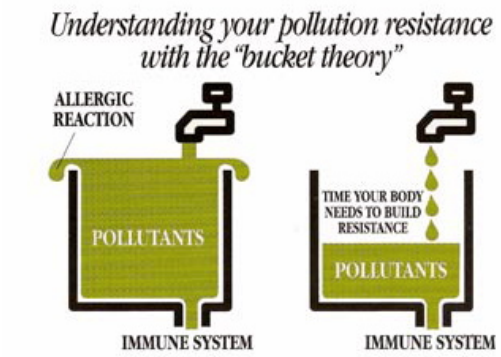
A Growing Problem. A New Solution!

As a seminar teacher for natural health professionals around the world, I have been hearing a consistent concern throughout all the disciplines (doctors, chiropractors, acupuncturists, naturopaths, and clinical nutritionists) that's only getting more noticeable each year. Natural health clinicians are not getting the results that they used to get, and results are more hard won than ever before.

The times have changed and our natural health therapeutic approaches must evolve, or there is a diminishing return in results and patient referrals.

Not too long ago, a chiropractor could give an adjustment, restore full nerve energy, and the body would quickly correct a wide variety of symptoms including hypoglycemia, migraines, and asthma. Not so today. Years ago, food-based supplements worked quick miracles for people needing tissue supports. Not so today. Years ago, a single dose constitutional homeopathic remedy often quickly restored vital health. Not so today as homeopaths must become experts in "case management" and even deviate from the founding principles of the *Organon of Medicine*[3] (*e.g.* repeating the dose) to more effectively address what the body must do to restore health in the 21st Century.

If the instruction manual (DNA) is damaged or flawed, or the transcriber of the manual (RNA) misinterprets the information, then the job won't get done correctly. The "job" is proper cellular function upon which our health depends.



Bucket Theory? Simply put, clinicians are not getting the positive results today that they were getting ten years ago. The "bucket theory" proposes that the thousands of modern-day toxins (chemicals, pesticides, water pollutants, cosmetics, dental fillings, vaccinations, industrial wastes, etc.) gradually accumulate in the body's 70 trillion cells and then, when there is a tipping point such as too much accumulation or a stressful phase of life, then the body's self-regulatory processes break down and chronic degenerative diseases result.

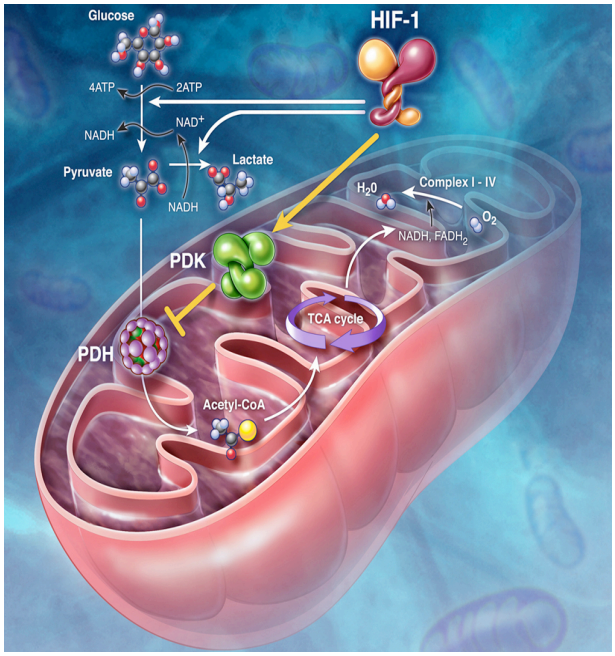
This break down is often called "cellular inflammation" and Time Magazine[4], featured this information as the "Secret Killer" and demonstrated the link between inflammation and the degenerative maladies that afflict humanity.

The bucket theory, often rejected by the medical model that prefers to link one cause with one effect as a non-individualized occurrence, is still considered to be part of the reason that there are so *many "no-known-cause, no-known cure"* diseases. It's not the sole cause because nutritional depletion is an equal factor. Nutrition provides fuel for the chemical energy of life (ATP – Adenosine TriPhosphate), anti-oxidants to reduce inflammatory and free radical processes, fatty acids for cell membrane integrity, detoxification support, and methyl groups for proper genetic expression and cellular function.

The onslaught of cellular damage has only increased in the past ten years despite the heroic efforts of green, organic, and environmentalist movements. The toxic environment damages cellular function deep

[3] *Organon of Medicine* – by Dr. Samuel Hahnemann. The founding philosophy of classical homeopathy and presentation on the laws of health, disease and cure.
[4] *Time Magazine*, 2/23/2004, *Inflammation: The Secret Killer.*

within the cell's epigenetics[5], ionizing (X-rays, mammograms) and non-ionizing (cell phones, airport scanners) radiations damage DNA, and genetically modified foods damage DNA more and more every day as "Round Up® Ready[6]" genetically modified (GMO) toxins are being incorporated into infants DNA around the world[7]. No one who eats, drinks, or breathes is immune or safe from the onslaught of health damaging environmental influences, and the accumulation and effects of these negative influences become *"obstacles to cure"* that block the body's efforts to correct errant processes that result in disease.



Mitochondrial Dysfunction. Recently we've seen where Science's attention has turned to "mitochondrial[8] dysfunction" as a catch-all for all the *no know cause, no know cure* diseases. This is the realm of the mitochondria organelle and its functions known as the Krebs Cycle[9], beta-oxidation [10], and mitochondrial mDNA damage from free radicals and inflammation. Blessedly, once again, our natural therapies are able to rise to this old but newly named challenge and deliver effective solutions despite humanity raising the ante on Mother Nature.

The one key area of cellular function that has been overlooked (until now) is methylation. Based on my clinical experience and the experience of hundreds of practitioners who are embracing healing at the cellular level as necessary for clinical results, nutritional methyl donors are restoring the vibrancy to our patients and practices because they unlock the aforementioned resistance to healing by supporting the cells with the nutrition required for them to health themselves.

Cellular Healing. All genuine healing is within the cell. As we master nutritional support of the cells, the cells respond by healing themselves and thus restoring their optimal function. When cells function optimally, then tissues function properly. When tissues function optimally, then organs and glands function properly, and when that occurs, the body can live in excellent health. Seems simple enough.

Today, the cells are blocked from their optimal function as man made chemicals and radiations damage the DNA, cause membrane inflammation, and damage the very energy processes within the cells. This means that our healing therapies must be able to address the cell, its organelles, and life processes which

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[5] **Epigenetics**— In biology, and specifically genetics, **epigenetics** is the study of heritable changes in phenotype (appearance) or gene expression caused by mechanisms other than changes in the underlying DNA sequence, hence the name *epi-* (Greek: *επί-* over, above) *-genetics*. For example, DNA methylation or histone acetylation, serve to suppress gene expression without altering the sequence of the silenced genes.

[6] **Round Up Ready** – trademark by the Monsanto Corporation. Denotes genetically modified crops that are resistant to death by the neurotoxic herbicide, Round Up® that are now infiltrating the global food supply including soy, corn, beet, and alfalfa.

[7] *"GM Food Toxins Found In The Blood Of 93% Of Unborn Babies,"* The Daily Mail, 6/08/2011: Department of Obstetrics and Gynaecology, at the University of Sherbrooke Hospital Centre, Quebec, Canada.

[8] **Mitochondria** – the organelles with a eukaryote cell that produce the body's miracle of chemical life energy (ATP).

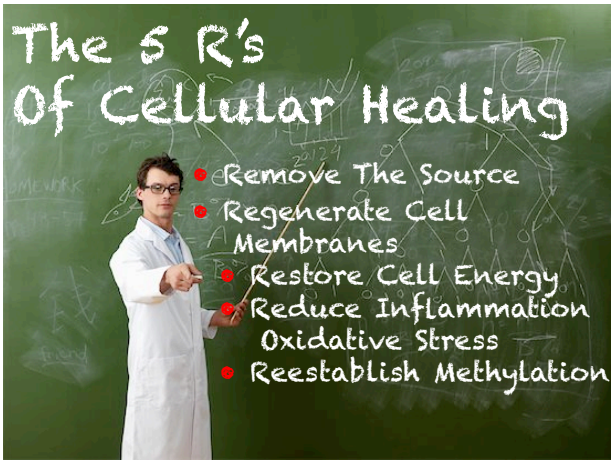
[9] **Krebs Cycle** – also called the citric acid cycle, is part of a metabolic pathway involved in the chemical conversion of carbohydrates, fats and proteins into carbon dioxide and water to generate a form of usable energy. This occurs in the mitochondria.

[10] **Beta-oxidation** is the process by which fatty acids, in the form of Acyl-CoA molecules, are broken down in mitochondria and/or in peroxisomes to generate Acetyl-CoA, the entry molecule for the Citric Acid cycle.

include the production of ATP energy, RNA transcription of healthy DNA, and of course, methylation is right in the middle of it all.

The 5 R's of Cellular Healing[11]

There are five critical functions every eukaryotic[12] cell must perform to be healthy, function optimally, and prevent cancer and avoid apoptosis (self-induced death).



They are:

1. **R**emove the Source (address the cause)
2. **R**egenerate the Cell Membrane
3. **R**estore ATP Energy
4. **R**educe Inflammation & Free Radical Damage
5. **R**eestablish Methylation

When practitioners master these five interdependent processes, and help their patients restore healthy cell function, their practices flourish, just as they should, with new patients based on success and referrals.

Methylation used to be taken for granted, something with which we did not have to concern ourselves clinically, any more than we'd offer a glass of water to a fish. In days past, most of our patients had plenty of methyl groups to conduct the body's myriad life processes and help receive the healing directives that natural health practitioners provide through food and herbal nutrition, remedies, supplements, and therapies. Today, however, we find that people's methylation processes are impaired, and adding methyl donors to a nutritional therapy is often required for the therapy to work well.

Once we understand that the body uses methyl groups to heal and restore healthy functions, and once we understand that many of our patients are depleted in methyl groups, we come to the realization that supporting methylation is in the same category as providing water to a thirsty, dehydrated person—absolutely essential.

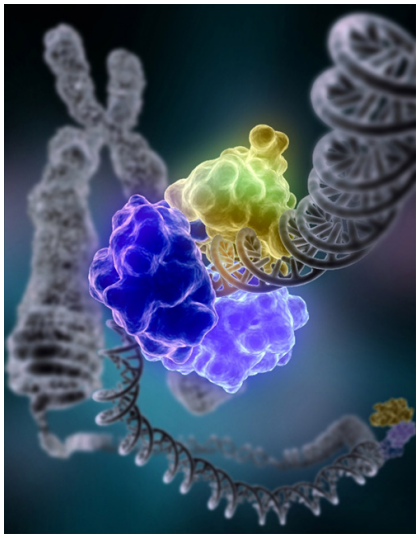
Stress, Revisited. Further, the body has an inherent hierarchy or priority list about what it does with methyl groups. This means that if methyl groups are in short supply, the body innately determines what functions get the molecules and what functions suffer without. The top priority for methyl donors goes to the stress response. Now we see why so many people are methyl group depleted. The busy, multi-tasking, high anxiety, stressful workaday world we live in causes an unprecedented amount of stress and voraciously uses up methyl groups.

The body uses millions of methyl groups to turn on the stress response according to the laws of nature. Reciprocally the body uses millions of methyl groups to turn off the stress response. If a person does not have a full compliment of methyl donors, that person can turn on the stress response and then not be able to turn it off. When we examine the high level of stress in which modern day humanity dwells, we can better understand that stress and episodes of traumatic stress can not only lock people into a chronic

[11] **5 R's.** Note of credit. I first heard of the 5 R's of Cellular Healing at Dr. Daniel Pompa's *Health Centers of the Future Seminars.* Dr. Pompa applied these 5 R's to completely correct his personal environmental illness and to correct an autism-spectrum concern with one of his children.

[12] **Eukaryote** – a cell classification denoting cells that have various other organelles (nucleus, mitochondria, Golgi apparatus, lysosomes, etc.) within their membranes; as opposed to prokaryotic cells that lack a nucleus.

inner cellular inflammatory cycle (called the no/onoo cycle[13]), it can literally occupy the lion's share of the body's methyl groups. The areas of the body that have shortages are those that develop symptoms and diseases. A shortage in the brain results in depression or anxiety, depending on where the shortage exists. A shortage in the thyroid will result in poor manufacture of thyroxin hormone. This shortage-symptom syndrome can affect any and every tissue in the body.



A methyl group added to a chromosome prevents its expression. The removal of the methyl group allows the gene to express and influence the body's life processes.

Methylation Mechanics. Methylation is simply the addition of a methyl group (CH_3) to another molecule (enzyme, RNA, chromosome (DNA), toxin, protein, etc.) Methylation is mostly the addition of a methyl molecule to something. The removal of a methyl group is called *demethylation*. The adding or subtracting of a methyl group causes profound changes to occur as they activate or deactivate the body's life code and thus affect core life processes. Some people will use the word, *methylation*, to describe either the addition or subtraction of a methyl group from a molecule. Either way, this is the body's secret alchemical process of converting one molecule to another, such as converting a fat-soluble toxin into a water-soluble toxin that can more easily be eliminated from the body. A shortage of methyl groups inevitably means poor detoxification, and poor detoxification inevitably means diseases will develop.

So *methylation* is the body using a specific molecule (CH_3), to work countless wonders. In fact, methylation is a process that is an important dividing line between health and disease.

Ubiquitous Molecules? In biology and chemistry, human beings are referred to as "carbon-based units of life" and thus we know that Organic Chemistry is a carbon-based science. Our world, our bodies, and thus our lives, are based on the element, carbon (C)—the very backbone of all life on Earth. Carbon is the fourth most abundant element in the universe. Hydrogen is the most abundant element in the universe and it readily reacts with other elements. So two of our most basic, essential, and abundant elements—carbon and hydrogen, easily join together as one carbon and three hydrogen atoms, and together they become a critically important molecule called a "methyl group"(CH_3) which can appear in three forms: *anion* with 8 electrons, a *radical* with 7 electrons, and a *cation* with 6 electrons. In these three forms, methyl groups serve billions of chemical functions throughout our bodies.

Now you might ask, "Why do we need to talk about a molecule whose atoms are abundantly everywhere in the universe? Like a fish in the ocean seeking water, our bodies live in a world of the elements that make methyl groups—carbon and hydrogen. Further, oxygen is the third most abundant element and that's great for breathing and redox reactions such as making the energy of life—ATP which also involves methyl groups. [Helium is the second most abundant element in the universe, probably to ensure some levity in our lives.] So one might think that methylation is a "given," a *no-problemo* basis of life, something we don't have to worry about. But *au contraire*, my friends; methyl groups are something we must understand to help our patients with their most dire concerns.

The fact is, we can and do run short of methyl groups. Further, methyl groups decline with age and thus supplementing with methyl donors is an "anti-aging" therapy that can prevent cognitive decline[14]. When

[13] **NO/ONOO Cycle** – an inner cellular, chronic, self-perpetuating free-radical/inflammation cascade base on Nitric Oxide (NO) metabolizing into peroxynitrite (ONOO) and then peroxynitrite metabolizing back into nitric oxide and starting the process again. Credit to Dr. Martin Pall for this discovery.

[14] *American Journal of Clinical Nutrition*, Vol. 71, No. 2, 614S-620s, February 2000, B vitamins, homocysteine, and neurocognitive function in the elderly, Selhub, Bagley, Miller & Rosenberg, Jean Mayer US Department of Agriculture Human Nutrition Research Center on Aging at Tufts University, Boston, and the University of California at Davis.

our bodies have a dearth of methyl groups, there are dire consequences such as cancer, autism, diabetes, chronic fatigue, Alzheimer's, multiple sclerosis, autoimmune diseases, and well actually—most all diseases and severe metabolic dysfunctions, with a few exceptions for "over-methylation" conditions.

UNDER-METHYLATION
Addictive Tendencies
Aggravate on high doses of B-12/Folate (though much needed)
Allergic skin disorders (Eczema, Hives, Contact Dermatitis)
Allergies, seasonal, airborne
Aging
Anorexia
Anxiety
Asthma
Autism (45% are under-methylators)
Autoimmune disorders (Mitochondrial Diseases)
Bipolar disorder
Bulimia
Chronic Degenerative Diseases (Mitochondrial Diseases)
Chronic Fatigue
Colds, Flu – frequent
Competitive, overly
Delusions, Delusional thinking
Depression
Detoxification, poor
Headaches, frequent
Heat intolerance
Hyperactivity, ADD, ADHD
Hyperchlorhydria (excessive stomach acid)
Insomnia
Joint stiffness, pain, swelling
Lacrimation, eyes water excessively
Libido, excessive
Muscle pains
Nausea, unexplained
Neurotransmitters, low (serotonin, dopamine, melatonin, norepinephrine)
Neurotransmitter, high (histamine)
Obesity
Obsessive Compulsive Disorder
Oppositional Defiant Disorder
Pain, hypersensitive
Perspiration, excessive
Phobias
Psychosis
Puritis, itching
Rhinitis, vasomotor
Salivation, excessive
SAMe, do well on SAMe supplementation
Schizophrenia

Methyl groups:

- Turn on and off genes and their genetic expressions
- Protect telomeres – reduce aging processes
- Support neurotransmitter processes – prevent depression, anxiety, insomnia, and facilitate proper brain function
- Detoxify dangerous chemicals and heavy metals – prevent cell damage and disease, makes glutathione (the body's most important detoxifier)
- Prevent hormone imbalances – that can cause cancer, weight gain, fibrous tissue, endocrine confusion
- Turn the stress response on and off – and if left on, then disease results such as obesity, Syndrome X, and inflammatory conditions
- Repair cellular communication processes – a facet of immune system alerts linked with auto-immune diseases
- Weight Loss – helps solve hormone resistance and toxic hormonal activity (weight loss resistance is actually a cell membrane/hormonal issue—not a calorie and exercise issue)
- Mitochondrial integrity – protects the mitochondrial production of ATP by synthesizing glutathione[15]—one of the antioxidants that protects the cell from free radical damage.

Methylation Flips The Gene Switch (Genes On. Genes Off).

Don't we all wish we could simply turn good health on, and turn diseases off? In a loose sense that's really what happens. To turn on good health and turn off disease requires well functioning cells and methylation is a primary catalyst to elicit good health and prevent disease expressions.

Within the human genome are all the expressions of health and disease. It's easy to understand the "expression of health," but why would we have expressions of diseases? The answer is, from the body's innate *"survival of the species"* perspective, it's better to have a disease than to be dead, so disease expressions are choices: either errant, selected, or acquired. A chronic disease is simply the: 1) best the

[15] **Glutathione** -- An antioxidant that prevents damage to important cellular components caused by reactive oxygen species such as free radicals and peroxides. Glutathione is found almost exclusively in its reduced form. The enzyme that reverts it from its oxidized form, glutathione reductase, is constitutively active and inducible upon oxidative stress. The ratio of reduced glutathione to oxidized glutathione within cells is used as a measure of cellular toxicity.

body can do with what it has to work with under the circumstances, 2) inability of the body to overcome the "nine paradigms of disease[16]" that modern medicine addresses (all of which require ATP and methyl groups to prevent), or 3) direct effect of something that manipulated the DNA processes such as pesticides[17], toxic chemicals[18], radiations (both ionizing and non-ionizing,) and genetically-modified food molecules.

Before we were born, in fact when we were just a single cell called a *zygote*, methylation was there to help determine and express our life experience as a female or male; and if female, then methylation deactivated one of the "X" chromosome's so there would not be genetic conflict (two operating manuals) resulting in abnormal processes. Methylation governs "cell differentiation" which is for example, how some cells become a kidney nephron whereas other cells becomes a brain synapse or a nose hair.

Put Me In, Coach! In the very beginning, cells replicate rapidly and they all want to join the team of life as a body. Under the guidance of life's Innate Vitality[19] (our optimal blueprint), methyl groups become the "coaches" that help decide which cell plays what position. Throughout our lives, these methyl coaches tell our cells' DNA to keep working their specific jobs—they activate certain genetic traits and suppress other traits. Just think what would happen if the pancreas' beta cells decided that they were tired of making insulin and decided to express another facet of their genetic pattern—say that they decided to filter urea out of the blood. What would happen? The body would become diabetic and die from a lack of glucose induction into cells for energy; but hey, the blood would be free of urea. So methyl groups keep every cell doing its correct job for the good of the whole according to the body's innate intelligence.

Though rare, people can also be "over-methylators" or have localized over-methylation excitatory processes, so like all things in health, the key is: balance in all things. A major percentage of over-methylation activities seem to be the body's overreaction to a *lack* of methyl groups where the genes overcompensate in a particular area. Statistically, our population is 49% under-methylators, 14% have over-methylation issues, and the remaining 37% are doing okay at the present time.

Intermediate Metabolites. Under-methylation is the big concern, especially since methyl groups decline with the aging processes. The fact that a few people are over-methylators means that supplementation must be balanced to accommodate the seven billion biochemically unique individuals in the world. One of the reasons that over-methylators react to foods and excessive B-Vitamin supplementation is due to intermediate metabolites (transitional molecules) that activate unwanted metabolic pathways.

At the point of the transitional molecule occurring, there can be a lack of methyl groups (because the body is using them elsewhere as an over-methylator) and so they have difficulty controlling the cyclical cellular methylation processes. An example of intermediate molecules becoming temporarily dangerous is the liver's cytochrome p450 enzyme system that renders toxins into a form that can be more easily

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[16] **Nine Paradigms of Disease** – medical expertise addresses nine facets of human disease: infectious disease, genetic disease, nutritional deficiency disease, hormone dysfunction disease, allergies, autoimmune disease, somatic mutation/selection, ischemic cardiovascular disease, amyloid disease.

[17] *Epidemiology***,** Volume 10, Issue 5, 1999. -- Risk of Childhood Leukemia Associated with Exposure to Pesticides and with Gene Polymorphisms.

[18] *Nat Rev Cancer.* 2004 Aug;4(8):630-7. Chemical-induced DNA damage and human cancer risk.

[19] **Innate Vitality** – the body's core vitality, the self-regulatory mechanism, cellular intelligence, the Élan Vital, the Vital Force, the body's metabolic and healing processes.

eliminated. In rendering (transmutating) a toxin to get it ready for removal, the liver can temporarily create an even more toxic molecule before disarming and excreting it.

A well-balanced methylation product often contains ingredients that help prevent damage from intermediate metabolites such as herbs, pyridoxine alpha-ketogluterate (helps prevent glutamine from becoming glutamate), magnesium (helps remove ammonia), and amino acids (helps the body avoid ammonia and hydrogen sulfide), and anti-oxidants so that methylation processes occur without intermediate metabolites causing problems.

Methyl Rationing. How do human beings run short of methyl groups to serve the body's life processes? Stress, free radical damage, poor nutrition, lack of Vitamins B-12 and folic acid, and exposure to environmental toxins all factor into the construction, reconstruction, and use of methyl groups.

If the mitochondria do not make enough ATP (Adenosine TriPhosphate), there is not enough energy to accommodate methylation and its myriad processes. Proper energy production depends upon: 1) nutrition, 2) oxygen, 3) non-inflamed cell membranes, and 4) sufficient antioxidants to protect the mitochondrial mDNA from damage that can occur during the energy creation process. Mitochondrial damage results in a lack of cellular energy—the very energy that's needed for methylation performance. Further, if there is not enough nutrition to support methylation such as B vitamins (B-12, Folic Acid, and others), and their mineral synergists (zinc, selenium, molybdenum, magnesium), there can be a critical shortage of methyl groups to serve the body's trillions of life processes every day.

It is here with methyl groups that we hold a profound nutritional key to helping patients' bodies prevent and correct disease processes, depression, anxiety, adrenal fatigue, and hormone imbalances, as well as restore overall health. This is why methylation is a dividing line between health and disease.

Allergy Insight. Further, methylation establishes how foods and the environment will manipulate a person's genome (allergies, diseases), and this is how people get over or outgrow food and airborne allergies. For example, when a methyl group deactivates the genes that call for an immunological response to gluten, then the person is no longer so sensitive to that molecule and the immune system can relax and work on other projects.

If the Innate Vitality allows an unwanted gene expression such as "react to gluten," then the key to changing that is to instruct the body to place a methyl group on the "react to gluten" gene. Such an instruction can come from numerous healing modalities such as systemic herbology, classical homeopathy, acupuncture, clinical nutrition (and others), because for healing modalities to be truly healing, they must whisper kind instructions to the body's Innate Vitality and then let the cells correct the aberrant life processes.

Thus methylation holds a much more important therapeutic role than desensitization therapies (allergy shots designed to exhaust the immune system) or avoidance practices, neither of which address the "cause." So in a powerful and profound way, methylation exerts a primary influence over a person's

quality of life, and methylation is the body's "implementer." Methyl groups are based on nutrition and this is but one reason why people rightly know that our foods are our medicines.

So what does it mean, genetically, if you run a little short of methyl groups? As explained in our allergy example above, we found that there is a cellular methylation process. It's called *DNA Methylation*. Methyl groups attach to chromosomes and deactivate certain gene sequences so we don't express them. This includes deactivating disease processes, viral genes and other deleterious elements (miasms[20]) that may be introduced to a person's genetics. They prevent the expression of chronic degenerative diseases.

Further they control what is actively embraced for health such as how vigilant our immune systems are. Methyl groups are essential molecules that regulate and help repair our DNA so we do not express diseases and defects, and do express optimal health and adaptability. Having adequate methyl groups keeps the cellular processes running correctly and when we run a little short, then symptoms quickly appear.

Aging & Methylation

Cellularly, aging is all about telomeres[21], those stacks of chromosomes on the ends of your DNA strands. Formerly called "Junk DNA" by the scientists who, at that time, hadn't yet figured out how vitally import all of Nature's components are (including tonsils, appendixes, adenoids, gall bladders, ovaries, prostates, etc.), telomeres hold the DNA strands together so they don't unravel and "forget" their message. When DNA unravels, the cell can no longer reproduce healthy offspring. Such a condition can result in aberrant cell activities such as cancer, cell death, and loss of function due to aging.

Every time the cell divides to create progeny and perpetuate our lives, telomeres can be lost. Methylation is the process that: 1) extends cell life, thus fewer replications, 2) replaces telomeres via the enzyme, *telomerase*, so the cell doesn't age so quickly by losing telomeric chromosomes and unraveling.

When the zygote starts replication, it has 15,000 telomeres on the DNA strands. By the time a person is born, 5000 of them have been used up in cellular mitosis and cell differentiation processes that create the body. Then another large block of telomeres are used in infancy during the rapid growth and development phase. So by the time a person reaches maturity, there are approximately 5000 telomeres on the ends of their DNA strands. From that point on, the faster telomeres are used up, the faster a person ages.

Some people spend their telomeres faster than others. Some will have the nutritional intake to provide their cells with energy and nutrients they require[22], some won't. Some will encounter environmental factors that damage DNA at a rate higher than others (air travel, mammograms, X-rays, EMF exposure, environmental toxins, etc.) This is assured, as methylation declines, telomeric integrity declines and the body ages more rapidly and expresses aging diseases.

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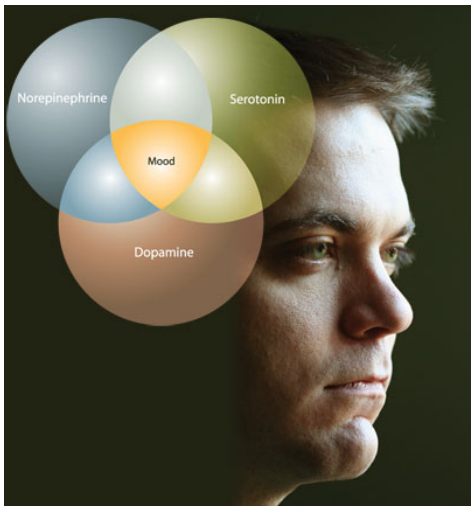
[20] **Miasm** – inherited, innate, constitutional predispositions to acquire and express disease conditions.

[21] **Telomeres** are the physical ends of linear eukaryotic chromosomes. They are specialized nucleoprotein complexes that have important functions, primarily in the protection, replication, and stabilization of the chromosome ends. In most organisms studied, telomeres contain lengthy stretches of tandemly repeated simple DNA sequences composed of a G-rich strand and a C-rich strand (called terminal repeats).

[22] Read: *The Pro-Vita! Plan for Optimal Nutrition*. Available at www.apple-a-day-press.com



Mood (Depression), Neurotransmitters, & Methylation

Neurotransmitters are basically amino acids that have a methyl group attached. Let's understand the methylation cycle that is so fundamental to our life processes.

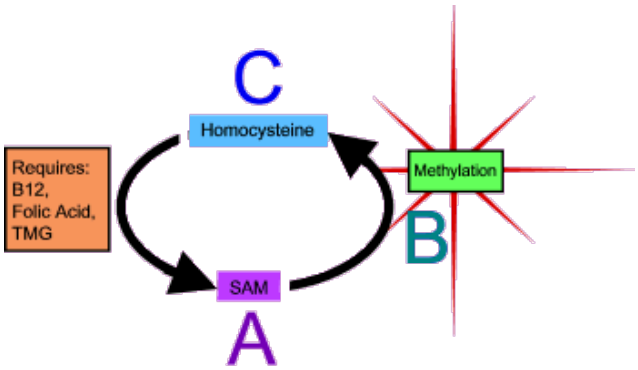
Methionine is an amino acid found in all protein foods. Notice the "meth" part of methionine because it refers to its methyl group. Methionine grabs a packet of energy called ATP and a molecule of magnesium and becomes SAM (S-Adenosyl Methionine). As SAM, the methyl group hitches a ride all around the body making over 400 known chemical reactions occur when and where needed.

Methionine + ATP + Mg = SAM

When SAM delivers a methyl group where needed, it becomes reduced to an amino acid called homocysteine.

SAM – CH3 = Homocysteine

When homocysteine meets up with another methyl group, it receives it and transforms itself back into SAM.



Homocysteine + CH3 = Methionine (SAM)

If homocysteine does not find a methyl group, it becomes a dangerous molecule associated with cardiovascular disease and degenerative conditions. One pathway for homocysteine to gain a methyl group is from vitamins B-12, Folate, B-6, and choline; as well as trimethylglycine (TMG).

Note: The familiar supplement, SAMe, is the form of SAM that can be absorbed nutritionally, and it can help with depression, but it does not help lower homocysteine, thus it's only a Band-Aid helper and does not address the *cause.* The cause is mostly nutritional and B-12/folate supplementation is more effective, often with results in 60 days. Both the safe, nutritional SAMe and the dangerous anti-depressant drugs (require a drug enforcement agency (DEA) license) are only "cover ups" to the real solution of reestablishing the body's methylation.

So what if there are not enough nutrients for all the homocysteine to be converted back to SAM? Sure the body gets big globs of homocysteine associated with cardiovascular disease, but if homocysteine is not converted back to SAM, then there is a shortage of SAM, and that means there is a shortage of methyl groups to make neurotransmitters.

This shortage of methyl groups in the brain is the "chemical imbalance" aspect of depression. Chemical imbalance is only one facet of depression, but it's the one honed in upon by a host of dangerous drugs that cover up the underlying methylation issue. Even worse, the detoxification of those drugs by the liver requires both methyl groups and ATP which further depletes the body of its corrective resources[23]. Other

[23] McKinnon RA, McManus ME. Localization of cytochromes P450 in human tissues: Implications for chemical toxicity. Pathology. 1996;28:148-155.

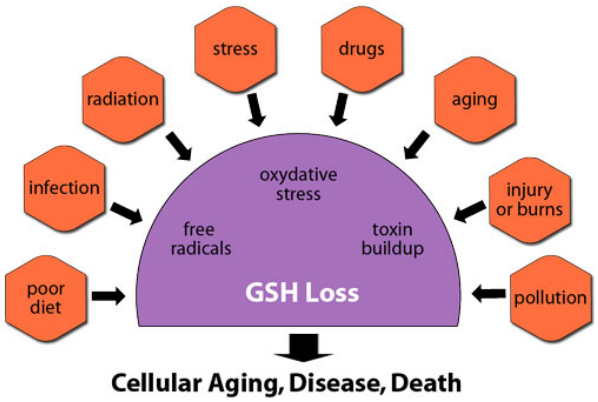
facets of depression include ATP production and the enteric nervous system (gastro-intestinal tract[24]) responses to food and pathogens that can cause chronic inflammation in both the gastro-intestinal tract and brain (known as the *gut/brain connection*[25]).

Fundamentally, depression and anxiety expressions are simple nutritional deficiencies. This is why supporting methyl groups nutritionally is essential for a natural solution to depression and anxiety.

Detoxification and Methylation

Detoxification is the body's great alchemical[26] transmutation process. Methylation helps convert dangerous molecules to ones that the liver, gall bladder, and kidneys can eliminate. The liposome organelle in the cells can take a molecule of mercury or lead and change it to less offensive molecules that can be more easily eliminated. The same holds true for arsenic and hundreds of other chemicals.

One of the key detoxification pathways involves the creation of the body's premier free-radical-quenching molecule, *glutathione*. This is the story of how methylation or the lack thereof involves autism, chronic fatigue syndrome, fibromyalgia, and hundreds of other ailments, provided the patient does not have rare genetic polymorphisms. When rare genetic polymorphisms are present, methylation still holds a critical key to DNA and RNA repair, and the deactivation of errant genetic expressions.



Glutathione (GSH) is a tri-peptide assembled from the amino acids cysteine, l-glutamic acid, glycine plus a glutamate molecule. It is a potent detoxifier and antioxidant that protects the cells (especially the liver and thyroid) from reactive oxygen species (free radical and peroxide damage.) Without glutathione, the cells die because they destroy themselves, or establish errant cellular activities that result in cell-death, or worse, allow abnormal cell proliferations.

The cell's ability to produce its own glutathione is critically important. You can think of glutathione as what the cells use to protect themselves from the effects of toxins as well as the creation of life energy processes that occur at the body's atomic level. Thus glutathione could be likened to the lead rods that keep a nuclear reactor from running out of control, melting down, and destroying life. Glutathione, along with *super oxide dismutase* and *catalase*, protects the mitochondrial mDNA from damage thus preserving the integrity of the cell's life energy production.

Further glutathione protects cells' RNA and DNA, and helps facilitate the necessary life processes of transcription.[27] Its biological activity is that it donates a free proton (proton donor) as well as donates electrons, which at the atomic level, is what makes glutathione serve the body as its perfect antioxidant protector and facilitator of its cellular machinery, as well as the premier detoxification molecule that

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[24] *Journal of Medical Microbiology.* 2005 Oct;54(Pt 10):987-91.Differences between the gut microflora of children with autistic spectrum disorders and that of healthy children. Parracho, Bsingham, Gibson, McCartney.

[25] **Gut/Brain Connection:** *Pfeiffer RF, Quigley EMM. Neurogastroenterology. Semin Neurol 1996;16.*

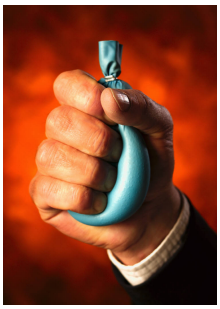
[26] **Alchemy** – 1) The medieval forerunner of chemistry, based on the supposed transformation of matter, esp. that of base metals into gold, 2) A process by which paradoxical results are achieved or incompatible elements combined with no obvious rational explanation.

[27] **Transcription** – the process of creating a complementary RNA copy of a DNA sequence so that the cell can implement the DNA code. It is the first step of gene expression. If the transcription results in a protein, it is called "messenger RNA."

facilitates the tearing down and rearrangement of toxins so they can be excreted.

What this means is that cells make glutathione IF they have available nutrients (peptides), methyl groups, and ATP. Glutathione then protects the cells and facilitates proper function.

People with low glutathione levels suffer from more rapid aging, cellular damage, and liver damage, thus their life processes get choked down with toxins. Inevitably, a lack of methyl groups and low ATP result in low glutathione production and a person becomes a "pathological detoxifier[28]" and their cells choke on metabolic wastes.



Stress and Methyl Groups

Stress is a major issue regarding methyl groups because it requires a massive amount of methyl groups to turn on the stress response, and most importantly, to turn it off. First, let's acknowledge that stress is an important, and even healthy, aspect of life. A little stress keeps the mainsprings of human health and human progress wound up like a precision watch. It is an energizer and motivator.

Too much stress becomes a killer. "Too much" means either excessive stress all at one time, or prolonged stress where the body dwells in its stress response too long. The stress response activates the adrenaline and cortisol hormone cascades. The downside of stress is that it gobbles up methyl groups. In fact, stress is the number one cause of methyl group depletion. Here is a very brief list (just enough to make our point) of conditions associated with intense or prolonged stress.

A FEW SIGNS OF STRESS

•	Agitation, inability to relax	•	Alcohol, cigarettes, or drugs,
•	Autoimmune diseases	•	Chest pain, rapid heartbeat
•	Colds, frequent	•	Concentration, poor
•	Depression or general unhappiness	•	Diarrhea or constipation
•	Digestive problems	•	Eating more or less
•	Feeling overwhelmed	•	Heart disease
•	Irritability or short temper	•	Isolating yourself from others
•	Judgment, poor	•	Loneliness
•	Memory problems	•	Moodiness
•	Nausea, dizziness	•	Nervous habits (e.g. nail biting, pacing)
•	Obesity	•	Pain, aches of any kind
•	Pessimistic	•	Procrastinating, neglecting responsibilities
•	Sex drive, low	•	Skin conditions, eczema
•	Sleep problems	•	Sleeping too much or too little
•	Worry, constant	•	Writing articles under deadline for journals

These symptoms are more than simple expressions of temporary stress. They are symptoms of stress causing methyl group depletion and the body staying in the adrenaline/cortisol metabolic processes to the detriment of its regular, healthy metabolic processes. Thus there is a cascade: stress depletes methyl groups, and depleted methyl groups underlie a host of symptoms and disease. If there are not enough remaining methyl groups to turn off the stress response, the person continues living in a stress response even after the stressful time has passed. This is where we find that some people are "never well since" a stressful episode such as a divorce, bout of the flu, moving, firing from employment, and death of loved ones. Restoring methyl groups is an important component for the body to restore optimal health.

[28] **Pathological Detoxifier** – the liver's Phase I detox processes are more active than its Phase Two processes resulting in a build up of intermediate toxins that can damage the liver and contribute to diseases.

When people use coffee or other stimulants (sugar, ADHD amphetamines, etc.) to energize their body functions, or use alcohol or drugs to unwind, they are actually getting caught in a stimulation/sedate pattern of forcing tissue functions despite the body's inability to perform. This further depletes methyl groups and soon the person will experience more severe symptoms such as chronic fatigue syndrome, adrenal burn out, and fibromyalgia, and risk losing methyl groups that were inactivating certain genetic expressions and helping with proper gene transcriptions. The effect can be a thousand different symptoms depending upon the individual's genetic operative instructions and weak links in their unique biological processes.

Today, we live in a very stressful world. Because we live in the middle of it all, we often forget just how stressful it is – the pursuit of money, raising children, multitasking, traffic, all add up, but it's the silent stressors such as ionizing and non-ionizing radiation, pesticides, and chemical additives in food, air pollution, and water pollution that contribute and cause the body to stay in a prolonged stress response.

Having adequate methyl donors is a nutritional issue, and many people find that they need to supplement and boost their body's access to methyl groups.

Autoimmune Diseases and Methylation

An autoimmune process occurs when the body's own immune system errantly attacks healthy cells. Why would this happen? Let's find out.

First, maybe those so-called "healthy" cells are not really so healthy. Maybe their cell membranes are inflamed. Maybe their membranes are damaged by free radicals. Maybe those cells have pesticides locked inside. Maybe those cells have damaged chromosomes from airport scanners and cell phones. If the cell is damaged, it can become aberrant and such cells are slated for *apoptosis* (self-imposed destruction), or destruction by the immune system.

Of 155,000 scholarly articles on methylation and autoimmune diseases[29], most cite the lack of methylation to maintain the DNA integrity. Methylation is the process whereby DNA is repaired, telomeres repaired, and it's the process where unwanted gene expressions are deactivated. This makes having ample methyl groups available, particularly as a person ages, essential to a healthy life experience.

Methylation and Weight Loss Resistance

When pesticides, food additives, and chemicals inflame cell membranes, the hormone messengers are unable to deliver their message. When they deliver their messages, they become deactivated so they can't cause trouble. But if they cannot deliver their messages, they become toxic and can cause trouble.

[29] *DNA Methylation in the Pathogenesis of Systemic Lupus Erythematosus,* Amr H. Sawalha1 and Bruce Richardson *Department of Medicine, University of Michigan, Ann Arbor, Michigan, 2US Department of Veterans Affairs Medical Center, Ann Arbor, Michigan, USA*

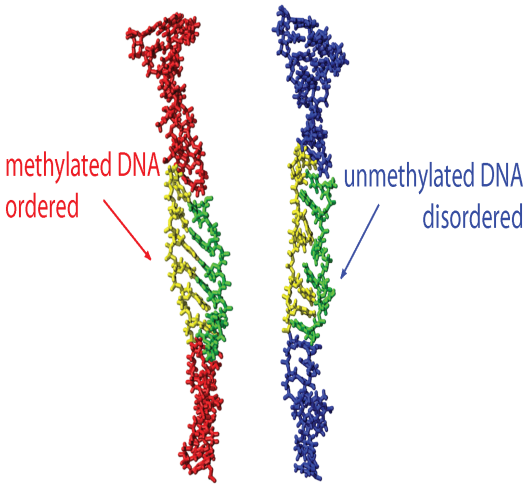
So hormones can become toxic (e.g. reversed thyroxin, unused estrogen, etc.), particularly in an environment that lacks methyl groups. Toxic hormones cause endocrine confusion and can cause other tissues to misbehave and generate fibrous tissues[30]. Both insulin and leptin hormone resistance causes weight gain and the inability to burn fat. Insulin causes food to be stored as fat and leptin regulates the body's ability to burn fat.

Thus in weight loss resistance, the very same toxins that inflame the cell membranes plus the body's own hormones become "obesogens[31]" which are the result of the body's inability to provide methyl groups to serve detoxification. Ultimately excessive weight gain and the inability to lose weight is a cellular issue—one involving inflammation, the cell membrane, anti-oxidants, ATP production, and methylation. Sounds familiar!

Methyl Groups Improve Effective Outcomes of Natural Health Therapies
Consider how methyl donors can activate your nutritional protocols. Further consider how your programs are blocked from working effectively if a person is under-methylated.

Methylation is required to:

- Convert serotonin to melatonin for sleep
- Help the thyroid to make thyroxin
- Turn off the stress response
- Make insulin
- Support the liver's detox
- Heal inflamed joints
- Facilitate neurotransmitters (depression)
- Cycle the heart's ATP and detox cellular wastes
- Make glutathione to protect and detox every cell
- Correct chronic fatigue
- Relieve and correct fibromyalgia
- Help correct aberrant cellular expressions
- Build the immune system
- Assimilate vitamin B-12
- Manage blood pressure
- Optimize male sexual performance
- Support nerve transmissions
- Protect the nerve sheath
- Support neuroendocrine balance
- Heal muscle trauma
- Correct tinnitus
- Eliminate biofilms
- Clean up the extra cellular matrix
- Build bones
- Reduce asthma and respiratory ailments



[30] Oxford Journals, Life Sciences & Medicine MHR: Basic science of reprod. Medicine Volume 8, Issue 8 Pp. 770-775 *Estrogen receptor-α and -β expression in microvascular endothelial cells and smooth muscle cells of myometrium and leiomyoma,* Gargett, B

[31] **Obesogen** – a chemical compound that is foreign to the body or an unwanted intermediate metabolite that can disrupt normal development or homeostasis (usually concerning metabolism and use of lipids, or fat) inducing obesity.