Diet and Epigenetics:

Support a Healthy Biochemistry and Positively Impact Gene Expression Through Nutrition

By Nadia S. Hughes (Ghost Writer: Stephanie Pelczar)

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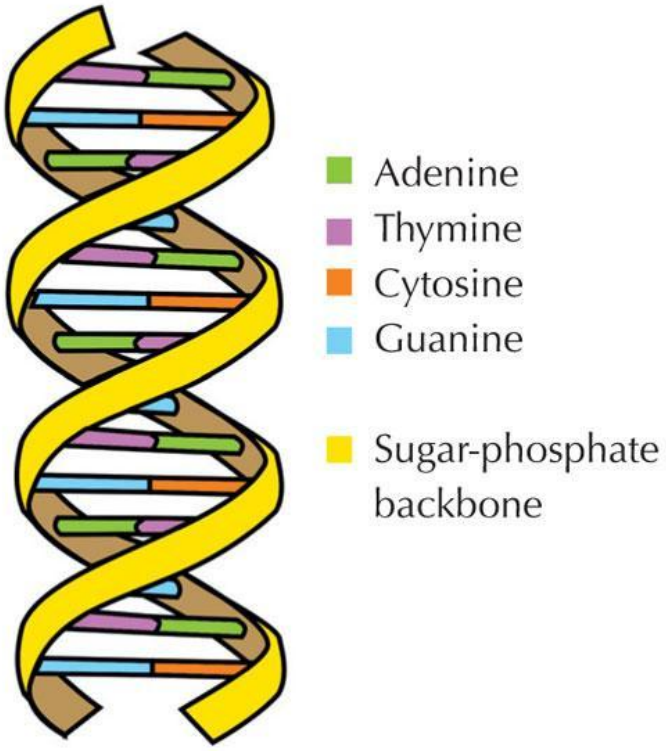
What is Epigenetics?

Epigenetics is the study of heritable **chemical marks** on specific parts of DNA that adjust the expression of our genes without affecting the actual underlying genetic sequence - the string of A, C, T, G bases. ‘Epi’ literally means ‘above’ or ‘on top of’ genetics.

Epigenetics show that your lifestyle affects how your genes are expressed , and epigenetics has shown that our DNA is affected by the nutrients and chemicals in our food, as well as the cortisol levels from of stress, and the endorphins from exercise.

Epigenetics also refers to changes in gene expression from outside forces. Different from a mutation, epigenetic changes lie not in the DNA itself but rather in its surroundings -the enzymes and other chemicals that actually surround the DNA that orchestrate how a DNA molecule unwinds its various sections to make proteins or new cells. Basically, epigenetics is the interaction of your genes and your environment.



Your Environment Affects Your Health

Your “environment” can be described as the arena in which you live your life. This includes what you eat, drink, breathe, how you think, how you handle external stressors, and how much physical activity you give yourself.

Metabolic disorders, diabetes, heart and lung diseases, cancers and other diseases have been associated with several environmental factors.

Environmental pollution can-induce epigenomic defects.

Air pollution can place a negative impact on our health and can also adjust important chemical tags on our DNA. It has been shown to alter tags on DNA that can increase our risk for neurodegenerative diseases. Exposure to particulate matter has been connected to stroke, Alzheimer’s disease, Parkinson’s disease, cognitive impairments, and neurodevelopmental disorders (1)

Air pollution has also been shown to disturb DNA methylation profiles, which could worsen inflammatory and oxidative responses.

Pollutants are not only in the air, but they are also in the foods we eat.

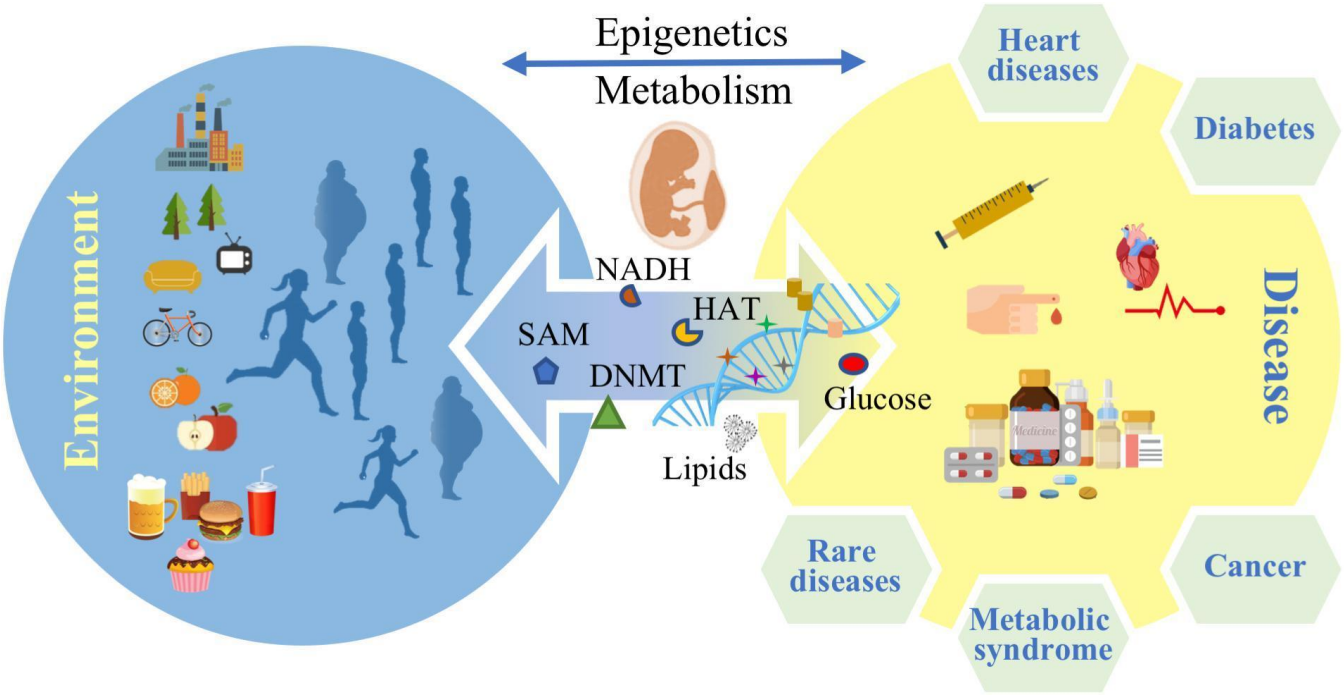
There are environmental toxins and chemicals in certain foods such as:

- pesticides in fruits (strawberry) and leafy greens (spinach)
- bisphenol A in plastic containers of foods and beverages
- dioxins in fatty foods
- polycyclic aromatic hydrocarbons when meat is grilled or smoked at high temperatures
- mercury in certain seafoods (king mackerel and swordfish)

Certain environmental pollutions, including ambient air pollution (particulate matter, smoking, polycyclic aromatic hydrocarbons), hormone-disrupting chemicals (bisphenol A, vinclozolin, persistent organic pollutants) and heavy metals (arsenic, cadmium, lead) can also seriously affect human health through epigenetic mechanisms.

Epigenetic marks are sensitive to environmental exposure. Nutrients, toxins, pollutants, pesticides, and other environmental factors can either directly or indirectly impact the levels and turnover of epigenetic marks. This, in turn results in transformed gene expression patterns, that could facilitate the formation of disease.

Marks on genes that shouldn't be there, or marks that are removed when they should stay put, have been connected to devastating effects on our bodies, such as the growth of tumors, the development of obesity or cardiovascular disease, and inflammation (2).



Look at the four leading health issues affecting us today; all can be influenced by how we choose to live our life (and thus by epigenetics):

- **Cancer:** There's close to a 40% chance of getting cancer, but only 5-10% of cancers are from an inherited genetic mutation.
- **Alzheimer's:** About 10% of people over the age of 65, and 30% of those over 85 get Alzheimer's, yet only 1% of Alzheimer's patients get the disease from a deterministic gene.
- **Diabetes:** 4% of the population lives with diabetes. Type 1 and 2 are known to be both genetic and environmental, and diet can overrule the genetic, especially with type 2.
- **Heart Disease:** Almost 50% of people have some type of heart disease, which has several genetic implications.

Factors That Can Influence Gene Expression

- Genetic Background
- Micronutrient Levels (vitamins, minerals)
- Dietary Components (fats, proteins, carbs)
- Toxins (chemicals, metals, drugs)
- Physical exercise and activity
- Lifestyle (sleep, work, stress)
- Sunlight exposure and vitamin D levels
- Interactions with bacteria and viruses

Foods (and beverages) That Have Shown to Have a Positive Effect on the Epigenetic Environment

Fruits (Organic, non-GMO)

Guava, tomatoes, watermelon, grapefruit, papaya, sweet red peppers, persimmons, mangoes, strawberries, goji berries, raspberry (black, red), grapes (purple, red), apples, blackberries, citrus fruits, cherries, passion fruit, kiwi, pears, black currants, black plums, mulberries, cranberries, cantaloupe, avocado

Vegetables (Organic, non-GMO)

Leeks, dark leafy lettuce, kale, spinach, yellow carrots, garlic, onion, chives, olives, olive leaf, asparagus, red cabbage, artichoke, beets, sweet potatoes, purple potatoes, broccoli, (+broccoli sprouts), kale, watercress, bok choy, Brussels sprouts, cauliflower, horseradish, kohlrabi, mustard, radish, rutabaga, turnips, capers, corn, red radish, sugar beet, winter squash, green peas

Meats/fish/cheese (Wild-caught, free range, without antibiotics or hormones)

Beef, sardines, salmon, oysters, mackerel, tuna steak, wild rainbow trout, shark steak, albacore tuna, herring, beef liver, eggs, cheese (cheddar), shellfish (shrimp, crab, oyster, mussel), chicken, pork

Nuts/seeds/grains (Organic, non-GMO)

Cashews, walnuts, pecans, flax, chia, rice bran, oats, hemp seed, pine nuts, almonds, whole wheat, quinoa, brown rice, pumpkin seed, squash seed, sesame seed

Beans/legumes (Organic, non-GMO)

Soybeans, pinto beans, fava beans, chickpeas, kudzu beans, peanuts

Beverages (Organic, non-GMO)

Green tea, white tea, black tea, oolong tea. **In moderation**: coffee, red wine, soy milk, cow milk (whole or low-fat), bone broth

Herbs/spices/Misc. (Organic, non-GMO)

Turmeric, rosemary, milk thistle, parsley, ginger, raw honey

Oils (Organic, non-GMO, cold-pressed, unrefined)

Flaxseed, krill, fish, fish liver (cod), olive, evening primrose, safflower, soybean, corn, black currant seed, borage seed.

The Seven Pillars of Health

There are several factors that help determine a person's overall level of health. This includes whether they get a certain disease or experience a specific health condition during their lifetime. They have been separated into seven pillars, albeit they all play off one another, as the occurrence/lack of one can be the deficiency/abundance of another:

1) DNA Methylation
2) Body Inflammation
3) Cellular Oxidative stress
4) Body Detoxification
5) Immunity
6) Lipid Metabolism
7) Mineral Metabolism

Methylation

What is Methylation?

Methylation is a biochemical process that involves the transfer of one carbon atom and three hydrogen atoms (CH_3, methyl) from one substance to another.

When optimal methylation occurs, it has a positive impact on many biochemical reactions in the body, especially with DNA, as DNA methylation is one of the most commonly occurring epigenetic events in mammals.

DNA methylation plays an essential role in normal biological processes and is an epigenetic mechanism used by cells to control gene expression, determining which genes are turned on or off. Gene expression can be significantly modulated by alterations in DNA methylation patterns.

(Distinct and abnormal patterns of DNA methylation have been observed in cancers (3).

Recent studies have shown that methylation of the regulatory (promoter) regions of several genes, including known tumor suppressor genes, results in the failure to express their functional proteins, while methylation within the gene itself can induce mutational events. (Tumor suppression over or hypermethylated= OFF; tumor production under or hypomethylated= ON)

Researchers have linked abnormal DNA methylation to several adverse outcomes, including many human diseases (4).

For most other genes, less methylation = ON; more methylation = OFF. These methylation patterns can be passed on and may influence the gene expression of future generations. They can also be influenced by diet and environmental factors. Methylation is one example of how genes can be directly affected by the environment, as the environment can alter how many methyl groups are placed on the DNA.

Epigenetic Protocol:

To help improve the methylation cycle in your body, eat a healthy, whole-food, non-processed food diet, to include (unless you are allergic/sensitive to): Organic asparagus, avocado, beets, broccoli, Brussels sprouts, and mushrooms.

Deficiencies of folate (vitamin B9) and cobalamin (vitamin B12), two essential micronutrients, can affect proper DNA methylation**.**

Increase folic acid by eating organic leafy green vegetables, sunflower seeds, citrus fruits, beans, rice, and whole grains.

Increase B12 by eating organic shellfish, fish, chicken, eggs, meats, and drinking nonfat milk such as soy or oat.

Inflammation

What is inflammation?

Inflammation is the result of the immune system's natural response to an injury or illness. When inflammation occurs in the body, many different immune cells are involved (leukocytes, mast cells, basophils, platelets), and they release substances called inflammatory mediators. An inflammatory mediator is a messenger (cytokines, histamines, serotonin, bradykinin), that act on blood vessels and/or cells to promote and intensify an inflammatory response. Inflammation doesn't always help the body. In some cases, such as in psoriasis, the immune system fights against the body's own cells by mistake, causing harm.

Types of Inflammation:

1) Acute- A protective inflammatory response to an injury or infection, which normally resolves after the threat has been eliminated. The immune response lasts for only a short duration, usually no more than a few days. Tissue injury and fibrosis are generally only mild.
2) Chronic- Incomplete resolution of acute inflammation due to repeated attempts to neutralize (non-existing/autoimmune) threats can lead to chronic inflammation. This is a prolonged inflammatory response that involves a progressive change in the type of cells

present at the site of inflammation (macrophages and T-lymphocytes). These cells produce cytokines and enzymes that cause lasting damage (fibrosis) to cells by simultaneously destroying and repairing the tissue involved in the inflammatory process. Also, prolonged blood vessel dilation, skin rashes (eczema, psoriasis), and even excessive mucus production can occur in chronic inflammation.

3) Destructive- Autoimmunity; the immune system attacks and eventually destroys healthy tissues that are targeted as harmful to the body. (Such as in rheumatoid arthritis where the joint is destroyed.)
4) Catabolic- Catabolism is a sequence of enzyme-catalyzed reactions where relatively large molecules in living cells are broken down. The production/release of the systemic inflammatory biomarker C-Reactive Protein (CRP) is part of the acute-phase response to most forms of inflammation, infection, and tissue damage, and its production/release is affected by both genetic and environmental factors (5).

Stress Responses and Inflammation.

Repeated activation of the stress response takes a toll on the body. Chronic conditions can be intensified by the stress response activating too often, with too much intensity, or for too long. A stress response causes physiological and behavioral changes that include various body systems such as the nervous, endocrine, and immune system. A stress response also causes the release of adrenaline and cortisol hormones, as well as inflammatory mediators such as cytokines and oxygen-free radicals. Cortisol has various physiological effects on the body to include the suppression of insulin, suppression of the immune-inflammatory response, and delayed wound healing (6).

Epigenetic Protocol:

Eat green leafy vegetables, beets, bok choy, broccoli, nuts, seeds, berries (especially blueberries), garlic, ginger, avocados, almonds, walnuts, coconut oil, and plain popcorn. Taking anti-inflammatory supplements, such as turmeric, quercetin, and omega 3 fish oil may help.

Optimal Stress Management Zone: Relaxing the mind and body daily (even for brief periods) can help decrease stress responses and its effects. Breathing and relaxation exercises, aromatherapy, along with minimizing stressful thought patterns can help your body's natural relaxation system be more effective.

Oxidative Stress

What is oxidative stress?

Oxidative stress is a disturbance in the balance between the production of reactive oxygen species (ROS, free radicals) and the body's antioxidant defenses. Free radicals play important roles in many physiological and pathological conditions, as they produce oxidative damage to lipids, proteins, and nucleic bases (DNA).

Oxidative stress can induce an alteration in the methylation status of DNA by affecting the function and activity of the enzymes responsible for maintaining the epigenetic status, such as DNA methyltransferases (DNMTs), histone methylase, and histone deacetylase (HDAC).

Oxidative stress (oxidation) occurs when a person is "stressed out", has inflammation due to illness or injury, and naturally occurs during the body's detoxifying process. Studies have shown that a diet rich in polyunsaturated fatty acids could generate mutagenic free radicals and oxidative stress (7).

Epigenetic Protocol:

Eat a balanced diet that includes an abundance of organic fruits and vegetables and avoid sugary and processed foods. Glutathione is a very powerful antioxidant, and foods such as spinach, asparagus, peaches, walnuts, garlic, onion, avocado, beets, broccoli, kale can help the body produce glutathione.

Consume cinnamon, ginger, and turmeric.

Drink green teas.

Exercise regularly, as per your doctor's approval.

Reduce stress by breathing and relaxing for some time each day.

Detoxification

There are two phases of detoxification that include breaking down and excreting toxins.

- Phase 1- The liver uses enzymes to regulate oxygen and converts toxins into digestible forms.
- Phase 2- After the liver converts these digestible byproducts into water-soluble particles to be excreted, they are eliminated as waste products and cellular debris.

Most people in the United States are exposed to 1 gallon of neurotoxic pesticides and herbicides a year. Toxicity triggers mood changes, depression, aggression, and attention and a decline in mental focusing ability.

Epigenetic Protocol:

Eat organic broccoli, cabbage, garlic, onions, grapes, berries, and drink green and black tea

Practice “Intermittent Fasting” variants (if cleared by your doctor) and increase glutathione. Avoid alcohol, caffeine, and sugar.

Reduce your exposure to harmful chemicals and toxins in skin and hair care products by using organic, all-natural products. Read labels so you know what you are putting on/in your body.

Immunity

Having a balanced immune system is an important part of being healthy.

Types of immunity:

- Hyperactive immunity=The immune system is overactive. People who have allergies, asthma, and autoimmune disease have hyperactive immune systems.
- Hypoactive immunity= The immune system is weakened, allowing colds, flu, and infections to occur.

Epigenetic mechanisms have been shown to regulate many genes involved in the immune response and inflammation. Abnormal DNA methylation profiles and histone modifications have been known to cause several autoimmune diseases, asthma, and some cancers.

Epigenetic Protocol:

Consume adaptogens (herbs that balance, protect, and restore the mind/body), as they have a direct impact on the stabilization of immunity and stress/adaptogenic response.

Consume ginseng, holy basil (Ayurvedic), ashwagandha (Indian ginseng), astragalus root, licorice, Rhodiola, cordyceps mushrooms, goji berries, Rehmannia root, schizandra fruit, and red jujube juice.

Lipid Metabolism

Fats (or triglycerides) are ingested as food or created by adipocytes (fat cells) or hepatocytes (liver cells) in our bodies from carbohydrates.

Lipid metabolism is the oxidation (breakdown) of fatty acids to either generate energy or create new lipids from smaller constituent molecules.

Lipoproteins are important in lipid metabolism, as their job is to transport lipids around the body. They include:

- Very Low-Density Lipoproteins, VLDLs- carry new triglycerides (with cholesterol, a key ingredient in our cell membranes, that it is an important precursor for vitamin D, bile salt, and hormone production) from the liver to the fat cells.
- Intermediate Lipoproteins, IDLs- are general transporters that are essentially VLDLs without triglycerides.
- Low-Density Lipoproteins, LDLs- are also general transporters that carry cholesterol, fat-soluble vitamins, triglycerides, and phospholipids out of the liver to cells around the body.
- High-density Lipoproteins, HDLs- carry triglycerides and cholesterol back to the liver. HDLs are needed to properly respond to the call to get energy out of our fat cells.

Genetic expressions govern optimal lipid metabolism. Fatty-acid sensing and metabolism are integrated by epigenetic events that control gene expression, together with ensuring proper cellular response to metabolites for growth (8).

DNA methylation also plays a role in the regulation of blood lipid levels and lipid metabolism-linked phenotypes and diseases. Epigenetic changes to DNA can be consequences rather than causes of dyslipidemia (elevated blood lipids).

Epigenetic Protocol:

Reduce/eliminate all forms of bad fats, beef, butter, cheese, and all trans-fats in margarine, cookies, pastries, and all refined carbohydrates

Increase monounsaturated fats, nuts, seeds, salmon, avocados, olive oil, and high-quality carbohydrates such as whole grains, cruciferous vegetables broccoli and cauliflower.

Mineral Metabolism

Vitamins (A, Bs, C, D, E, K) and minerals (calcium, magnesium, zinc, iron,) are key components and regulators of many of the body's biochemical processes. For example, B1,2, and 5, are all involved in the various stages of deriving energy from fat, proteins, and carbohydrates. Iron, Niacin, and B6 help metabolize L-carnitine, which is essential for the transport of fatty acid components to energy-producing areas of cells (mitochondria).

If you are deficient in any vitamin or mineral, it can greatly affect normal cellular functioning. For example, having low levels of magnesium can negatively affect your insulin sensitivity. There needs to be a balance of minerals in the blood, as too many or too little can cause issues. Mineral metabolism disorders are sometimes genetically inherited from parents and passed down through generations. Starvation, chronic diarrhea, and alcoholism can also cause mineral metabolism issues for people.

Epigenetically active enzymes require cofactors such as minerals. Essential minerals have direct and indirect effects on the methylation status of the DNA- on epigenetic modifications of histones. The mineral balance in blood mostly affects the epigenome generation during embryonic development, but changes occur throughout life as lifelong epigenome editing can occur.

Epigenetic Protocol:

Take mineral supplements (as approved by your doctor).

Drink water with electrolytes (sodium, potassium, calcium, magnesium) and organic bone broth. Eat organic meats, fruits, vegetables, nuts, and seeds.

Use unrefined sea salt on your food in moderation.

Meditation

There are many physical and mental benefits to daily meditation:

- Increase blood flow and circulation
- Decrease muscle tension
- Reduce tissue damage by lowering free radicals
- Reduce cellular agina
- Reduce PMS
- Lose weight
- Lower blood pressure, enhance heart health
- Reduction in migraines and headaches
- Increase immune response
- Asthma relief
- Enhance cognition and memory
- Decrease nervousness, calm nerves
- Reduce stress
- Reduce depression
- Reduce anxiety attacks
- Increase serotonin and enhance mood
- Increase creativity
- Increase positivity, hapiness, peace of mind

How to meditate

1. **Get comfortable and prepare to sit still for a few minutes.** Find a safe, quiet, calm place**.** Close your eyes.
2. **Focus on your breath.** Simply focus on your own natural inhaling and exhaling. Where do you feel your breath most? In your belly? In your nose? Try to keep your attention on your inhale and exhale.
3. **Follow your breath for two minutes**. Take a deep inhale, expanding your belly, and then exhale slowly, elongating the out-breath as your belly contracts.

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How Your Diet Can Affect Epigenetic Changes

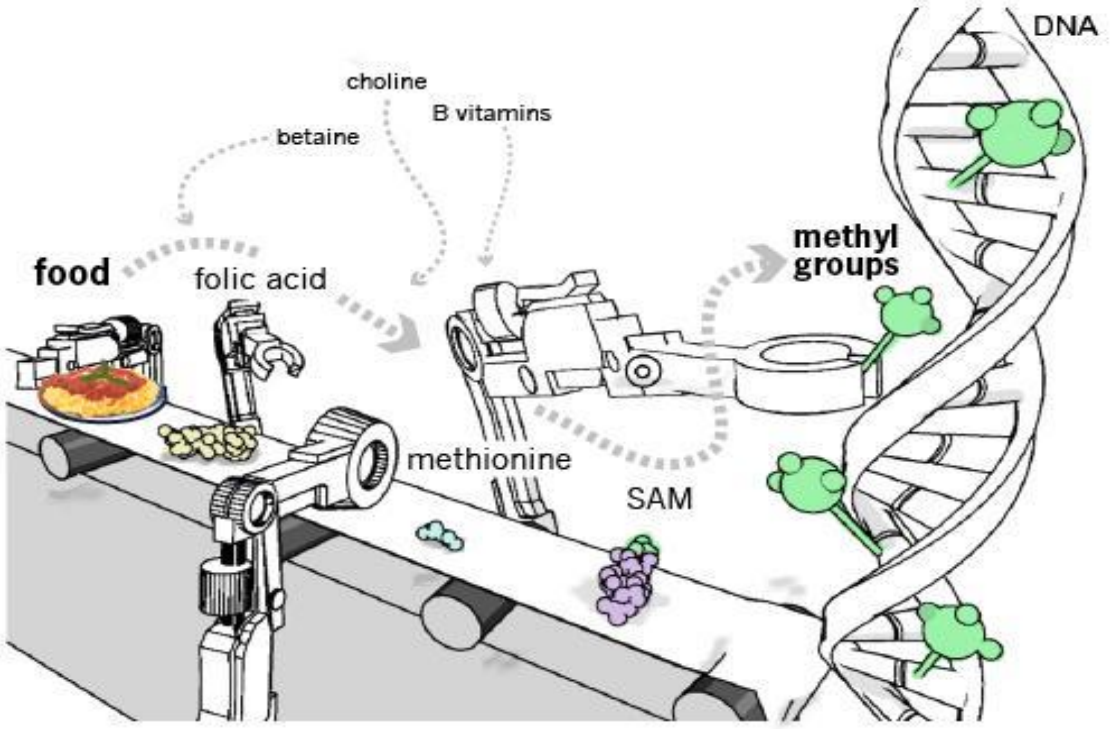
It has become increasingly clear that environmentally induced epigenetic changes can be mediated, in part, by diet (9-11).

Nutriepigenomics examines the connection between diet and chemical marks that can be attached to or removed from our DNA, thereby turning genes on or off. Many new studies suggest that certain foods or supplements may be able to adjust the expression of our genes, potentially influencing our health.

A person's diet is an important source of epigenetic signals.

The field of nutrigenomics involves studying how genes and dietary components interact to influence phenotype. It can reveal how one responds to bioactive components based on genetics, nutrient-induced changes in DNA methylation and chromatin alterations, and nutrient-induced changes in gene expression. It involves the lifelong remodeling of our epigenomes by nutritional factors (12, 13).

Consumption of dietary agents can alter normal epigenetic states as well as reverse abnormal gene activation or silencing. Epigenetic modifications induced by bioactive dietary compounds are usually beneficial.



Nutrients in Food Can Support Healthy Biochemistry and Impact Gene Expression

Nutrients in different foods and supplements we consume may be able to adjust or reverse epigenetic mechanisms. In the nutritional field, epigenetics is exceptionally important, because nutrients and bioactive food components can modify epigenetic phenomena and alter the expression of genes.

Epigenetics appears to be the link between environment-associated diseases, nutrition, and health. Nutrients can modify the epigenetic program and influence gene expression- therefore controlling the intake of functional food components through diet can be powerful in preventing age-related and other diseases, to include cancer (13-15).

Methylation is Affected by Diet

One of the most important epigenetic changes is methylation which usually labels genes that are switched off. To consistently maintain the correct patterns of methylation through cell division, new methyl groups are attached to freshly copied DNA. This requires a constant supply of new methyl groups, which can be provided directly from our food, including the trio of molecules methionine, betaine and choline. Alternatively, we can make methyl groups from precursor chemicals such as folic acid.

Other chemicals from food are needed to transport the methyl groups within the body and attach them safely to DNA, such as vitamin B-12 and the mineral zinc. Deficiencies in these essential molecules can have effects on levels of DNA methylation in the body.

Bioactive dietary compounds such as isothiocyanates in broccoli, genistein in soybean, resveratrol in red grapes and other commonly consumed foods have been shown to modify the epigenome leading to beneficial health outcomes. Consuming a diet high in certain compounds can inhibit tumor progression through modulation of epigenetic-modifying enzymes such as DNA methyltransferases and histone deacetylases as well as certain noncoding RNAs.

Specifically, several biological compounds are known to interact with the epigenome. Folic acid, methionine, choline, and other B group vitamins are an important source of one-carbon groups required for methylation of histone proteins and non-histone chromatin remodeling factors. Other compounds like polyphenols, including resveratrol, curcumin and quercetin exert a multitude of biological activities.

Consuming A Methyl-Rich Diet

The nutrients we extract from food enter metabolic pathways where they are manipulated, modified, and molded into molecules the body can use. One such pathway is responsible for making methyl groups - important epigenetic tags that silence genes.

Familiar nutrients like folic acid, B vitamins, and SAM-e (S-Adenosyl methionine) are key components of this methyl-making pathway.

A methyl-deficient diet leads to a decrease in DNA methylation, but the changes are reversible when methyl is added back into the diet- so it is important to consume methyl donor nutrients such as methionine, choline, betaine, vitamin B-12, and zinc.

Some bioactive compounds may counteract or attenuate the damage to the epigenome caused by environmental pollutions. Dietary supplementation with methyl donors(such as vitamin B12, folate, choline, and others) and the isoflavone genistein can reverse epigenome dysregulation induced by bisphenol A, a hormone-disrupting chemical of public health concern.

Zinc is an essential mineral that you must consume in your diet. Zinc is required for the functions of over 300 enzymes and involved in many important processes in the body.

It metabolizes nutrients, maintains your immune system, and grows and repairs body tissues.

Zinc can be found in: Beef, oysters, crab, mussels, chickpeas, legumes, lentils, beans, hemp seed, squash seed, pumpkin seed, sesame seed, pine nuts, peanuts, cashews, almonds, cheddar cheese, whole milk, eggs, wheat, quinoa, brown rice, and oats.

Choline is an organic, water-soluble compound. It is neither a vitamin nor a mineral. However, it is often grouped with the vitamin B complex. After being converted to betaine, choline, a dietary methyl donor, remethylates homocysteine.

Choline-rich foods: fish, chicken, beans, pork, eggs, beef, shrimp, milk, broccoli, and green peas.

Betaine (trimethylglycine) functions very closely with choline, folic acid, vitamin B-12, and a form of the amino acid methionine, known as S-adenosylmethionine (SAMe). All of these compounds function as "methyl donors." They carry and donate methyl molecules to facilitate necessary chemical processes. The donation of methyl groups by betaine is especially important for proper liver function, cellular replication, and detoxification reactions.

Betaine.is found in wheat, shellfish, spinach, and sugar beets.

Methionine is a sulfur-containing amino acid that can be used to build proteins and produce many molecules in the body. These include the antioxidant glutathione and the molecule SAM, which is used to modify DNA and other molecules.

Methionine is found in meat, fish, Brazil nuts, kidney beans, tofu, and dairy products.

Vitamins

Certain vitamins can influence health by interacting with the epigenome.

Vitamin A. Retinoic acid (vitamin A) is required for growth and development. This vitamin interacts with several the Polycomb group proteins, which are responsible for chromatin remodeling and mediating the epigenetic regulation of several genes.

Vitamin a/beta carotene is found in cod liver oil, spinach, fortified milk and breakfast cereals, eggs, orange and yellow fruits and vegetables (winter squash, cantaloupe, grapefruit, sweet potatoes, carrots), fish, meat (liver), and broccoli.

B Vitamins. B vitamins have the potential to epigenetically protect against harmful pollution, which we may meet at different stages of our lives and in various locations around the world (16).

Air pollution has been shown to disturb DNA methylation profiles, which could worsen inflammatory and oxidative responses. Supplementing with B vitamins has been demonstrated to be able to prevent these changes, as B vitamins might avert the loss of DNA methylation induced by air pollution.

Water-soluble B vitamins like biotin, niacin, and pantothenic acid play important roles in histone modifications.

Biotin. Dietary supplementation of biotin is required for biotinylation (the process of covalently attaching biotin to a protein, nucleic acid or other molecule) and a deficiency in biotin may have profound effects on chromatin structure.

Pantothenic acid. Vitamin B5, Pantothenic acid, is a part of CoA to form acetyl-CoA, which is the source of acetyl group in histone acetylation.

Niacin. Niacin impacts chromatin structure and is involved in histone acetylation. Niacin is also vital in the process of cellular metabolism.

Folate. Folic acid/folate is a B vitamin found in many beans, grains, fortified breakfast cereals, pastas, and green vegetables and is essential for the synthesis of DNA, proteins and phospholipids, cell division, and the formation of erythrocytes. Folate is acquired exclusively

from diet, and deficiency in folate affects human development and health. .Folic acid supplementation has been shown to prevent the adverse effects caused by heavy metals.

Folate deficiencies are reported to contribute to the development of several different cancers including breast, cervix, ovary, brain, lung and colorectal (17).

Food sources of B vitamins: Brown rice, barley, millet, red meat, poultry, fish, milk, cheese, beans, lentils, sunflower seeds, almonds, broccoli, spinach, avocado, citrus fruits, bananas, fortified breakfast cereals.

Vitamin D helps reduce inflammation and excessive intracellular oxidative stress. (Vitamin D is one of the key controllers of systemic inflammation, oxidative stress.) Although epigenetic enhancement can occur through methylation and repression by histone-modifications of DNA, vitamin D influences the regulation of cell replication. Primary epigenetic effects of vitamin D are linked to histone modifications, mainly acetylation.

Some metabolic disorders are linked to oxidative stress. These include obesity, insulin resistance, type 2 diabetes, hypertension, pregnancy complications, memory disorders, osteoporosis, autoimmune diseases, certain cancers, and systemic inflammatory diseases. Vitamin D adequacy leads to less oxidative stress and improves mitochondrial and endocrine functions, reducing the risks of certain disorders, such as autoimmunity.

Sources for Vitamin D are the sun, salmon, tuna, mackerel, fish liver oil, beef liver, cheese, egg yolks.

Phytochemicals: Fruits and Vegetables

Phyto means “plant”, and consuming plant flavones has been connected to changes in DNA methylation and the reduction of cancer.

Phytochemicals can be classified in phenolic acids (benzoic acids and cinnamic acids), flavonoids (anthocyanins, flavan-3-ols, flavones, flavanones and flavanols), polyphenolic amides (capsaicinoids and avenanthramides) and other polyphenols (resveratrol, ellagic acid, lignans, curcumin, rosmarinic acid, tannins). Polyphenols exert a wide range of biological activities, including potential effects against cancer, aging, and inflammation. Besides, they have strong antioxidant activity and can influence DNA methylation.

Phytochemicals Fight Cancer. Certain bioactive food components, including tea polyphenols, genistein from soybean, or isothiocyanates from plant foods, might inhibit the development of cancer

Blueberries are incredibly high in antioxidants and it is thought that this “superfood” can epigenetically reduce DNA damage, thereby protecting humans against cancer and possibly even slow aging. Blueberry juice and vitamin C have been shown to be potential methylation inhibitors for the MTHFR gene and the DNMT1 gene in humans (18).

According to recent research, antioxidants may exert their biological effect through epigenetic modulation of DNA methylation and potentially other epigenetic mechanisms.

Compounds found in dietary phytochemical preparations such as teas, garlic, soy products, herbs, grapes and cruciferous vegetables are now generally accepted to defend against the development of many different types of tumors as well as acting as epigenetic modulators that impact not only the initiation, but also the progression of oncogenesis (19-22).

Dietary phytochemicals such as tea polyphenols, genistein, sulforaphane (SFN), resveratrol, curcumin and others have been demonstrated to be effective agents against cancer and to act through epigenetic mechanisms that affect the epigenome (23).

Polyphenols. Polyphenols can act on the epigenome through different mechanisms, including DNA methylation and histone modifications.

Are associated with skin protection, brain function, blood sugar and blood pressure regulation, in addition to antioxidant and anti-inflammatory activity. Plant polyphenols can be divided into at least ten different classes based on their chemical structure. These classes include flavonoids, stilbenes, phenolic acids, benzoquinones, acetophenones, lignins and xanthones (24, 25).

Polyphenols, which are found in foods such as fruits, vegetables, olives, and chocolate, have been shown to be effective in epigenetically reducing stress and depression by modulating inflammatory responses and synaptic plasticity in the brains of those suffering from depression. Polyphenols have strong antioxidant, anti-inflammatory, antimicrobial, and anti-tumorigenic activities that contribute to overall health and wellness.

Dietary polyphenols have a protective role against diseases and have been shown to have a significant impact on cancer prevention (26, 27).

Resveratrol. The dietary polyphenol resveratrol is naturally found in several plants including peanuts, mulberries, blueberries, cranberries, and blueberries, but is most abundant in the skin of grapes. The antioxidant, anti-inflammatory and anti-cancer properties of resveratrol occur through various molecular and biochemical processes. Research proves that resveratrol has epigenetic effects that promote DNA methylation and decrease tumor cell growth.

Curcumin. Curcumin, a diferuloylmethane, is a polyphenolic compound found in turmeric (*Curcuma longa*), and can have multiple effects on gene activation, because it inhibits DNA methylation but also modulates histone acetylation. Curcumin has bioactive components that provide anti-inflammatory, antioxidant, antiangiogenic and anti-cancer properties.

Additionally, curcumin can help prevent diabetes-associated abnormalities in the kidneys.

Catechin. One subcategory of polyphenols, catechins, are strong antioxidants that scavenge reactive oxygen species (ROS). Catechin is the most abundant of the bioactive compounds found in green tea, known as the polyphenol compound epigallocatechin-3-gallate (EGCG). It has many biological activities, including the inhibition of DNA methylation, which can affect epigenetics. EGCG may play a role in protecting the cells from damage and ultimately preventing disease.

There is a correlation between the consumption of the catechin/antioxidant EGCG found in green tea and the inhibition of oral, breast, prostate, gastric, ovarian, esophageal, skin, colorectal, pancreatic, and head and neck cancers (28-33).

The daily consumption of green tea may also help keep a healthy weight by enhancing the loss of abdominal fat and may also reduce triglyceride levels.

Catechins are also found in berries, cocoa, white tea, apples, cherries, guava, pears, fava beans, purple potatoes, sweet potatoes.

Phenolic acids. Phenolic acids are polyphenols that are readily absorbed through intestinal tract walls. They are beneficial to human health due to their antioxidant action that reduces the damage of cells from free-radical oxidation reactions. Phenolic acids are found in a variety of plant-based foods, and the seeds and skins of fruits and the leaves of vegetables contain the highest concentrations.

Phenolic acids are found in berries, cherries, apples, citrus fruits, rice bran, passionfruit, mangoes, coffee, kiwis, teas, wheat, corn, and oat flours.

Isoflavones. Several isoflavones have been investigated and indications are that they have anti-angiogenic (stops tumors from growing their own blood vessels) and other anticancer properties. Isoflavones are produced almost exclusively by the members of the bean family, to include soybeans, fava, and kudzu beans.

> **Genistein.** Soya is a source of the isoflavone genistein, which is thought to decrease DNA methylation in certain genes. It has been described as an angiogenesis inhibitor and a phytoestrogen. It has been used to reduce symptoms of menopause, help control blood glucose, help lower chances of prostate and breast cancer. Foods containing genistein: Soybeans, chickpeas

Flavonoids. Flavonoids are the largest group of phytonutrients. They are powerful antioxidants with anti-inflammatory and immune system benefits. Diets rich in flavonoid-containing foods are sometimes associated with a reduction in the occurrence of cancer, neurodegenerative and cardiovascular disease.

Flavonoids in fruits and vegetables can affect epigenetic processes and are involved in the reactivation of tumor suppressor genes, the initiation of apoptosis, the repression of cancer-related genes, and the activation of cell survival proteins in different cancers (34, 35).

Flavonoids are found in black, green, and oolong teas, citrus fruits, berries, apples, legumes, kale, and grapes.

> **Anthocyanins** are a type of flavonoid that make pigments giving red, purple, and blue plants their rich coloring. Anthocyanins possess antidiabetic, anticancer, anti-inflammatory, antimicrobial, and anti-obesity effects, as well as aid in the prevention of cardiovascular diseases.
>
> Foods high in anthocyanins are black raspberries, black currants, blueberries, blackberries, red cabbage, black plums, red radish, red raspberries.

Quercetin is another flavonoid with a wide range of biological properties. Recent studies have associated quercetin to strong anti-inflammatory, anti-viral and anti-carcinogenic activities along with attenuation of lipid peroxidation. Moreover, this polyphenol was shown to act as mast cell inhibitor to treat allergic and inflammatory diseases.

Foods that contain the flavonoid quercetin: onions, apples, grapes, berries, broccoli, citrus fruits, cherries, tea, and capers.

Isothiocyanates

Isothiocyanates are a category of dietary antioxidants present in cruciferous vegetables. They are known to affect the epigenome as they can increase histone acetylation. They also have vital anti-cancer properties.

Isothiocyanates are found in broccoli, (+ broccoli sprouts) cabbage, kale, watercress, bok choy, Brussels sprouts, cauliflower, horseradish, kohlrabi, mustard, radish, rutabaga, and turnips.

Sulforaphane is a compound within the isothiocyanate group of organosulfur compounds also found in the cruciferous vegetables listed above.

- **It neutralizes toxins.** Phytochemicals like sulforaphane are antioxidants that cancel out free radicals. Free radical are tiny particles that weaken and damage healthy cells. They form in your body because of pollution, UV rays, food additives and preservatives, and even through natural processes like digestion.
- **It reduces inflammation.** Because sulforaphane neutralizes toxins, it also calms inflammation in your body. Inflammation has been linked to several kinds of cancer.
- **It may protect your DNA.** Some studies have shown that sulforaphane blocks mutations in DNA that lead to cancer.
- **It may slow tumor growth.** Sulforaphane has been shown to reduce the ability of cancerous cells to multiply. That means it may slow tumor growth or reduce its ability to spread to other parts of your body.

Other Antioxidant/Anti-inflammatory Compounds

Foods containing antioxidant metabolites counteract reacting oxygen species (ROS) responsible for the oxidative stress influencing DNA demethylation. Excessive formation of ROS and oxidative stress can lead to pathological conditions, including cancer.

Foods high in antioxidants are pecans, strawberries, artichoke, goji berries, raspberries, kale, red cabbage, beans, beets, spinach, purple and red grapes, sweet potatoes.

Selenium supplements are often used to help prevent to heart disease, cancer, and vision loss. Selenium has also been shown to help people with asthma, as well as reduce the risk of rheumatoid arthritis and cardiovascular disease.

Selenium (Se) is found naturally in Brazil nuts, chicken, game meats, and beef (36).

Lutein is a xanthophyll and carotenoid (a pigment that gives fruits their red pink, yellow, or orange color). that has been shown to help prevent eye diseases, macular degeneration, and cataracts. It also has anti-inflammatory properties that can help prevent cancer and improve cardiovascular health.

Foods high in lutein are leeks, dark leafy lettuces, kale, spinach, and yellow carrots.

Lycopene is one of the most powerful antioxidants found in food. It is also part of the carotenoid group. It can help lower blood pressure and may reduce the occurrence of certain cancers.

Foods high in lycopene are guava, tomatoes, watermelon, grapefruit, papaya, sweet red peppers, persimmons, asparagus, red cabbage, and mangoes.

Hydroxytyrosol is a phenylethanoid, a type of phenolic phytochemical with antioxidant properties. The consumption of hydroxytyrosol has shown to lower the occurrence of cancer, heart disease, and metabolic diseases. It also defends against the negative effects of reactive oxygen species, ROS, which protects cells against cellular damage.

Hydroxytyrosol is found in olives, olive leaves and olive oil, and in the form of its elenolic acid ester, oleuropein.

Kaempferol is an antioxidant found in pinto beans, and has been linked to many health benefits, such as reduced chronic inflammation and suppressed cancer growth.

Garlic (*Allium sativum*) has been used for the prevention of disease for many years, and is thought to have antibacterial, antiviral, and anti-inflammatory activities (37). Garlic cloves contain several compounds including vitamins A, B-complex, C, E, fiber, free amino acids, sulfur/organosulfur compounds, and proteins.

Garlic's ability to reduce hyperlipidemia, hypertension, sterol synthesis and thrombus formation make it a strong candidate for lowering the risk of heart disease and stroke. (Other allyl compounds such as onions, leeks, and chives also have strong antioxidant capabilities.)

Polyunsaturated fatty acids (PUFAs)

Omega-3. Omega 3 fatty acid can promote brain health and reduce the risk of cardiovascular disease by lowering triglyceride levels. PUFAs may also prevent cancer, macular degeneration, Alzheimer's, and rheumatoid arthritis. Omega 3 is also vital for the integrity of the phospholipid in cellular membranes. Alpha linolenic acid (ALA) and linolenic acid (LA) are omega 3 essential fatty acids that must be obtained through the diet. Sources of Omega 3 are: Chia seeds, Walnuts, flax seed, fish oil, krill oil, sardines, salmon, oysters, mackerel, tuna steak, wild rainbow trout, shark steak, albacore tuna, and herring.

Omega 6. Components of omega-6 fatty acid are mediators of inflammation, vasoconstriction, and platelet aggregation. Sources of omega 6 are: evening primrose oil, safflower oil, soybean oil, corn oil, black currant seed oil, borage seed oil.

*It is important to balance your ratio of omega 3 to omega 6 for optimal health.

Butyrate. Butyrate is a short-chain fatty acid that supports digestive health, helps control inflammation, and can prevent leaky gut. It has also been known to help prevent diseases originating in the intestine to include autoimmunity, obesity, and colon cancer. Certain intestinal bacteria (*Faecalibacterium prausnitzii, Eubacterium rectale)* produce butyrate by the fermentation of nondigestible polysaccharides (fiber). A depletion of butyrate in the gut is typically caused by an absence or depletion of butyrate-producing-bacteria (BPB). These bacteria feed off the oligo- and polysaccharides found in fruits and vegetables.

Adaptogens

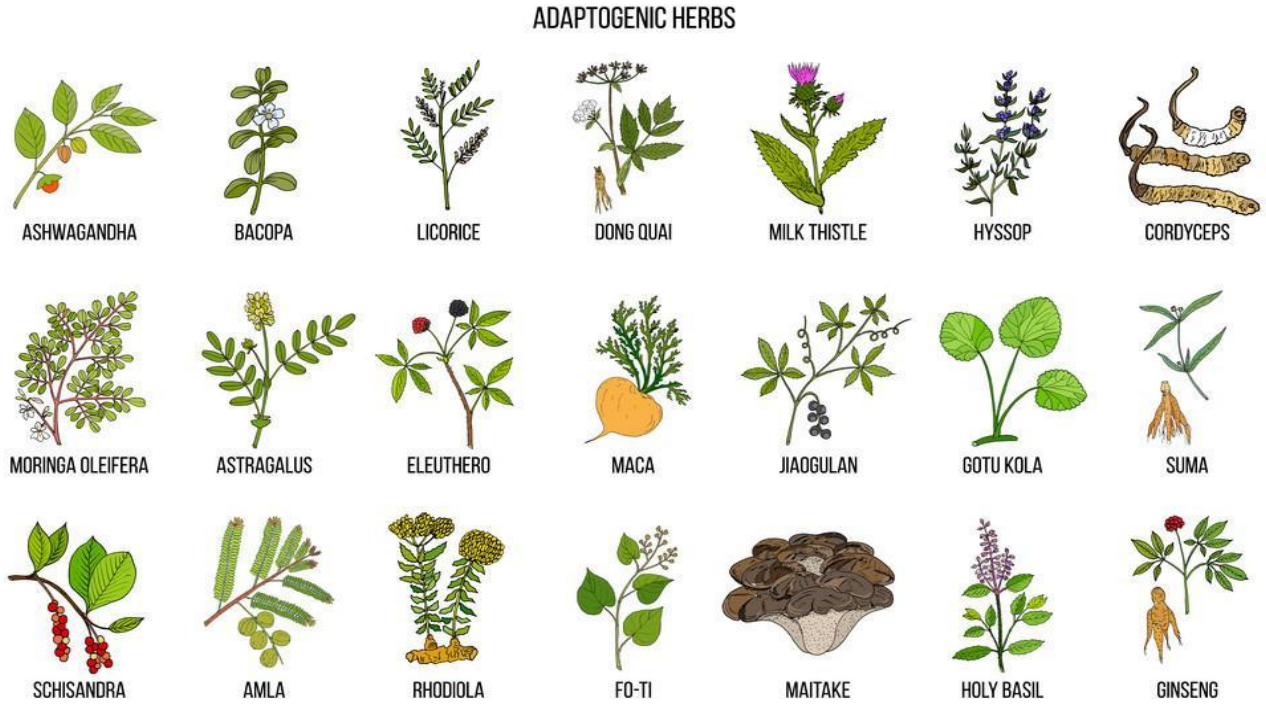
The term adaptogen was first proposed in the 1940s by a Soviet toxicologist named N. V. Lazarev. After the breakup of the Soviet Union, Russian scientists lead the way in adaptogen research, however, news about adaptogens remained a closely guarded secret of the Soviet state. The Russian government took research of adaptogens so seriously that scientists were banned from speaking of their results or publishing their findings outside the country- so until recently, this research never reached Western scientists. Ironically, adaptogens have been used in Eastern, Ayurvedic, and Chinese medicine for generations.

Adaptogens are natural bioregulators, mainly plant-based herbs and fungi/mushrooms, that increase one's ability to adapt to environmental factors (stress) while avoiding the damage caused by those factors. Adaptogens have been shown to correct imbalances within different systems of the body. The major advantage of adaptogens is how they help to minimize the bodily response to stress by reducing the negative reactions during the alarm phase and eliminating, or at least decreasing, the onset of the exhaustion phase that is part of the general adaptation syndrome , GAS (38).

In 1998, the United States Food and Drug Administration (FDA) defined an adaptogen as a new kind of metabolic regulator that has been proven to help in environmental adaptation and to prevent external harms. Many studies have shown that adaptogens can non-specifically enhance the resistance of the human body under a wide range of external stress conditions. They can improve our ability to recognize, respond, recover, and restore or regenerate. Adaptogens can also increase the bodily rates of oxygen, protein, fat, and sugar utilization. Adaptogens are also stress response modifiers that non-specifically increase resistance to various stressors, such as chemicals in the environment, overwork, poor diet, and emotional factors. They work as immune stimulants by increasing the resistance to pathogens, viruses and bacteria, thereby promoting adaptation, survival, and enhancing one's quality of life.

For an herb to be classified as an adaptogen it must:

- Show nonspecific activity
- Have a normalizing influence independent of the nature of the pathological state
- Be innocuous and not influence normal body functions more than required.



Adaptogens for the immune system

- Reishi mushroom (*Ganoderma lucidum*) is a highly researched adaptogen that supports the bone marrow reserve- which is where the macrophages and all other immune effector cells (t-cells) are produced. Reishi mushroom can increase production of interleukin 1 and 2, increase white cell count, and enhance natural killer (NK) cell activity. Reishi enhances immune function and helps in detoxification, which is especially useful when you've been exposed to allergens or toxins.
- Astragalus, Huáng Qí *(Astragalus propinquus)*, increases the total number of white blood cells, strengthens the activity of macrophages, and promotes cellular immunity.
- Maitake mushroom (*Grifola frondosa*) is a macrophage activator.
- Malaysian ginseng, Longjack (*Eurycoma longifolia)* contains epigallocatechin-gallate (EGCG) which helps prevent the development multidrug resistance when medications are taken for infections .
- Chinese ginseng (*Panax ginseng*) and Siberian ginseng (*Acanthopanax senticosus) both* enhance overall immunity, including antibody response, natural killer (NK) cell activity,

and interferon production (a group of signaling proteins made and released by host cells in response to the presence of several viruses.) Siberian ginseng can also increase t-cell count.

- Huáng Qí, astragalus (*Astragalus propinquus*) helps reduce the inflammatory-causing C-reactive protein (CRPs), a marker for inflammation. Astragalus also has immune-boosting properties and can activate T-cells
- Ashwagandha (*Withania somnifera)* reduces C-reactive proteins (CRPs), which are produced by the liver. CRP levels rise when there is an inflammation in the body; they are linked to an increased risk of heart disease.
- Turkey tail mushroom (*Trametes versicolor)* and Holy basil, Tulsi (*Ocimum tenuiflorum*) improve immune function by activating the immune response.
- Licorice root (*Glycyrrhiza glabra)* helps nourish a weakened and depleted immune system.
- American ginseng (*Panax quinquefolius)*
- Echinacea (*Echinacea purpurea*)
- Thuja (Thuja occidentalis)
- Wild indigo *(Baptisia australis*).

The spices curcumin, turmeric, ginger, and omega-3 oils may also help in counteracting an inflammation imbalance in the body.

Adaptogens for the endocrine system

- Five flavor fruit, magnolia berry (*Schisandra chinensis)* can prevent and resist stress because they activate the secretion of cortisol and nitric oxide, NO, in the plasma and saliva, allowing the body to adapt to heavier stress loads. Exposure to stressful stimuli (such as exercise) has been found to be associated with the activation of nitric oxide synthase and generation of NO, which reacts with spontaneous oxygen species to aid formation of active nitrogen radicals. High concentrations of reactive nitrogen radicals may cause damage to intracellular proteins, in addition to causing impairment to components of the mitochondrial transport chain- leading to cellular energy deficiency.

After the consumption of adaptogens, physical exercises do not increase the level of cortisol and NO in the human body; in fact, the levels decrease and are lower as compared to those present prior to the physical exercise. They have even shown the ability to enhance exercise endurance and provide an easier recovery afterwards.

- Rhodiola (*Rhodiola rosea*) is an estrogen receptor modulator, and it provides thyroid support.
- European black currant *(Ribes nigrum*) is a neuroendocrine adaptogen that has adaptogenic actions on damaged tissues.
- Oak (*Quercus pedunculata*) is an adaptogen with endocrine distributing actions.
- Peruvian ginseng, Maca (*Lepidium meyenii*) encourages overall hormone balance, which can support regulation of a woman's cycle.
- Ashwagandha, Indian ginseng (*Withania somnifera) reduces cortisol levels.*
- *Chinese ginseng (Panax ginseng)*
- Southern ginseng, Jiaogulan (*Gynostemma pentaphyllum)*
- Reishi mushroom (*Ganoderma lucidum)*
- Roseroot stonecrop (*Sedum rosea)*
- *Golden root (Rhodiola rosea)*
- Chinese licorice (*Glycyrhiza uralensis*) is used for treating adrenal gland disorders such as Addison's disease.
- Codonopsis (*Codonopsis pilosula*) reduces the production of adrenaline. In addition, it is used for general physical and mental fatigue.
- *Oak (Quercus pedunculata)* corrects adrenal hormone deficiency.

Adaptogens for the digestive system

- Peptic ulcer was one of the first conditions ever to be associated with an overactive stress response. Licorice root (*Glycyrrhiza glabra)* has demonstrated efficacy against *Helicobacter pylori*, which is believed to cause peptic ulcer, including the clarithromycin-resistant strains. It also helps with healing a leaky gut.
- Passion flower(*Passiflora incarnata)* anti-*Helicobacter pylori, heals gastric ulcers.*

- Gotu kola (*Centella asiatica*) inhibits nitric oxide (NO) and facilitates gastric ulcer healing.
- Long pepper (*Piper longum*) increases permeability and partitioning of the gut lining, promoting rapid absorption and better assimilation of nutrients via the gastrointestinal tract.
- Amla, Indian gooseberry (*Phyllanthus emblica*) aids digestion and helps with metabolic disorders.
- Turmeric (*Curcuma longa*) helps the body maintain healthy levels of body weight.
- Astragalus (*Astragalus propinquus*) helps to soothe intestinal irritation.
- German chamomile *(Matricaria chamomilla*) helps with irritable bowel syndrome, dyspepsia, intestinal cramps, indigestion, and heartburn.
- Common hops *(Humulus lupulus*) aids digestive issues.
- Turkey tail mushroom (*Trametes versicolor)*
- Holy basil, Tulsi (*Ocimum sanctum*)

Adaptogens for the respiratory system

- Siberian ginseng (*Eleutherococcus senticosus*) Studies from Russia involving thousands of people showed as much as 50% reduction in respiratory illnesses by daily use of Siberian ginseng.
- Reishi mushroom (*Ganoderma lucidum*) acts as an expectorant.
- Long pepper (*Piper longum)* contains a constituent known as piperine, which demonstrates stimulant activity that supports poor circulation and shifts congestion within the respiratory and reproductive systems.
- Holy basil, Tulsi (*Ocimum sanctum*) is an expectorant for bronchitis.
- *Passion flower (Passiflora incarnata*) has anti-asthmatic, and anti-cough properties.

Adaptogens for the cardiovascular system

- Golden root *(Rhodiola rosea*) can help with vascular hypotension.
- Maitake mushroom (*Grifola frondosa*) reduces blood pressure and helps to lower LDL cholesterol.
- Holy basil, Tulsi *(Ocimum sanctum)* helps to lower cholesterol and triglycerides, as well as blood pressure.
- Aloe vera (*Aloe barbadensis Miller*) can help alleviate symptoms associated with cardiovascular disease.
- Chaga mushroom (*Inonotus obliquus*) lowers cholesterol and triglycerides.
- Turmeric (*Curcuma longa*) helps the body maintain healthy levels cholesterol.
- Codonopsis (*Codonopsis pilosula*) increases the number of red blood cells and the levels of haemoglobin in them, but it lowers the number of leukocytes. It also lowers blood pressure.

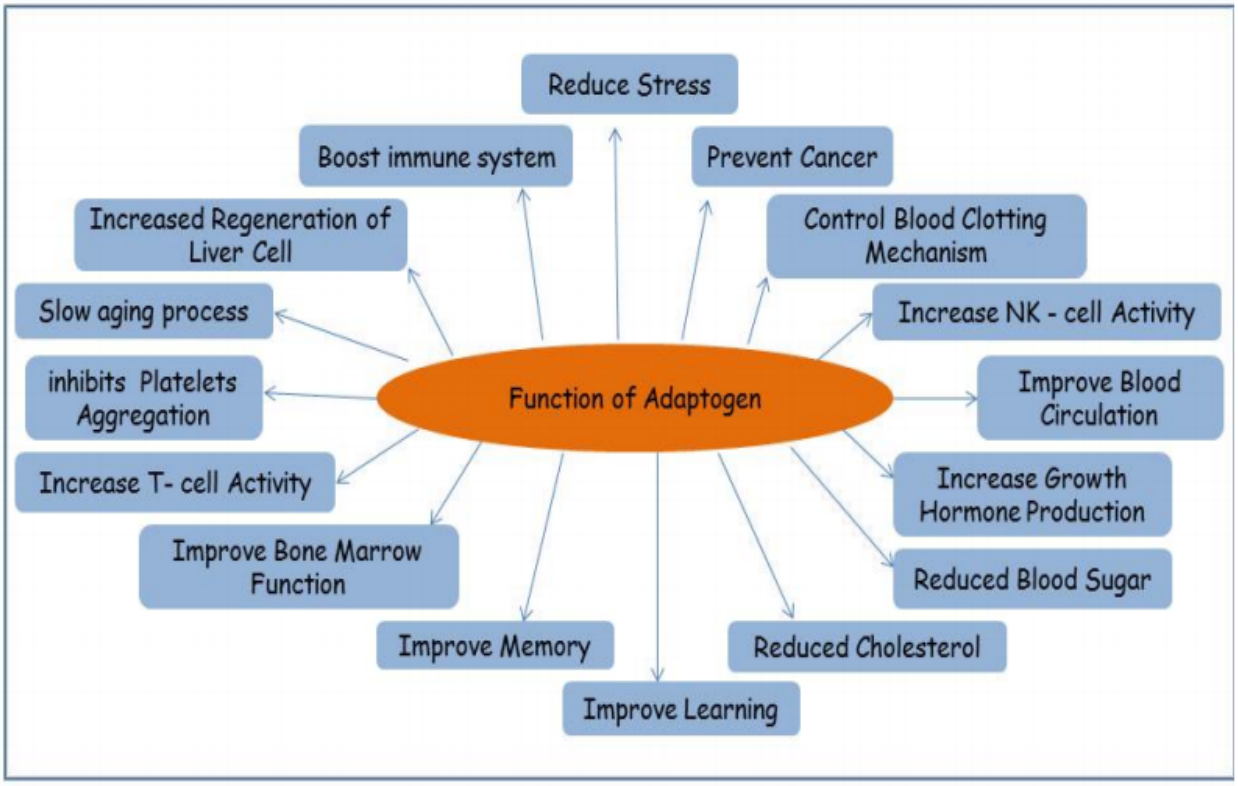
Adaptogens for the skin (integumentary system)

- *Gotu Kola (Centella asiatica) aids in the* treatment of various skin conditions such as leprosy, lupus, varicose ulcers, eczema, and psoriasis. It is rich in amino acids, beta carotene, fatty acids, and numerous potent phytochemicals. Extracts have been found to calm inflammation, speed wound healing, stimulate new cell growth, build collagen, and improve circulation.
- Ashwagandha, Indian ginseng (*Withania somnifera*) is antimicrobial, antioxidant, and has skin-softening abilities. It also helps the skin to retain moisture.
- Golden root *(Rhodiola rosea*)
- Amla, Indian gooseberry (*Phyllanthus emblica*) is high in vitamin C and minerals and supports the immunity of the skin against bacterial infection. It also helps strengthen the digestive system, and aids in detoxifying the liver.

There are many ways to take adaptogens and incorporate them into your daily life. They can easily be taken in the form of teas, drinks, powders, pills, tinctures, glycerites, eaten raw, cooked, sprinkled on food, or topically applied as a salve.

Along with daily meditation, healthier eating, physical activity, sunshine, water, and ample sleep- adaptogens could be an essential part of helping to manage your stress and the associated negative effects of stress on your body and mind- which will ultimately facilitate a healthy epigenetic environment.

Adaptogens should not be considered a quick miracle cure. They should, however, be considered as part of a natural, whole-body, holistic treatment that can help you live a stress-free, happier, and healthier life.



Incorporating healthy Foods into Your Diet

Salads- Lettuce, kale, spinach, colorful vegetables (or fruit), nuts, seeds, and homemade dressing using apple cider vinegar and an oil on the list. The combinations are endless.

Fruits- Cut up fruits and snack on them throughout the day. You can make a beautiful, colorful fruit salad, or just use a single fruit. You can also make a fruit, granola, nut, and yogurt bowl with your favorite fruits.

Juicing- Investing in a good juicer can be a great idea. You can juice fresh fruits and vegetables and drink it right away to get the maximum benefits.

Snacks- You can make your own nut/seed mix, or cut up fruits, vegetables into sticks or bite size pieces. Or you can make a cheese cube and olive plate.

Smoothies- A quick and easy way to get a serving or two of fruits and vegetables is through a smoothie. You can freeze fruits/vegetables and throw them in the blender along with Greek yogurt, chia seeds, and flax seeds. The combinations are endless here too.

Teas- Teas have fantastic benefits, but you can add lemon, honey, orange, hibiscus flower, or any fruit to add extra flavor (and vitamins).

Soups- There are so many ways to make soup. You can add dozens of vegetables, herbs, barley, rice, quinoa, bone broths, and some good oils.

Stir fry/Rice or Quinoa bowls- Using a healthy oil, you can stir fry a variety of vegetables and herbs. Toss in carrots, broccoli, bok choy, cabbage, ginger, and place over steamed brown rice, or quinoa.

Egg omelets- You can add many different vegetables, cheese, lean meats, herbs, and spices to an omelet.

*Enzymes=The maximum benefits generally come from raw (or slightly cooked in the case of broccoli) fruits and vegetables. However, they still provide fiber, vitamins, and minerals, phytochemicals needed for health and intestinal bacteria if they are cooked. (Remember, zinc is essential for the body to process enzymes and reap their benefits.)

Things to Avoid

Alcohol. Alcohol consumption is associated with harmful epigenetic modifications as well as the development/progression of several human cancers. Alcohol can interfere with folic acid in the body, disrupting methylation patterns. Alcohol profoundly affects 1-carbon metabolism by limiting methyl transfer reactions

Cigarettes. Apart from damaging DNA, some chemicals in tobacco smoke can change epigenetic marks.

Sodium Benzoate. Sodium benzoate is an FDA approved preservative, commonly used as an antimicrobial and flavoring agent to prevent canned fruit and fruit beverages from molding. Sodium benzoate-induced histone lysine benzoylation represents an example of an epigenetic mechanism in which metabolic products could directly influence epigenetic modifications that affect gene expression.

Pre-packaged foods, fast food, sugary foods/beverages, and fried foods. You need as much nutrition as possible to stay healthy and these foods/beverages do not always offer much. Once you begin eating a healthy diet, you will most likely begin to lose the cravings for those types of foods. Packaged foods have many unhealthy preservatives in them that can interfere with epigenetics. Read labels! Always try to eat whole, fresh, real foods whenever possible.

In Closing

By being conscious of what you put in and, on your body, you have the ability to affect **your** likelihood of disease outcome later in life. As many of the leading nutritional epigenetics experts say, "Your genes load the gun, but your environment pulls the trigger" on gene expression.

Make your environment one that promotes health and wellness, by remembering that your diet can be used as a pharmacological agent to improve your overall health, quality of life, and life expectancy.

-Nadia S. Hughes

Foods (and beverages) That Have Shown to Have a Positive Effect on the Epigenetic Environment

Fruits (Organic, non-GMO)

Guava, tomatoes, watermelon, grapefruit, papaya, sweet red peppers, persimmons, mangoes, strawberries, goji berries, raspberry (black, red), grapes (purple, red), apples, blackberries, citrus fruits, cherries, passion fruit, kiwi, pears, black currants, black plums, mulberries, cranberries, cantaloupe, avocado

Vegetables (Organic, non-GMO)

Leeks, dark leafy lettuce, kale, spinach, yellow carrots, garlic, onion, chives, olives, olive leaf, asparagus, red cabbage, artichoke, beets, sweet potatoes, purple potatoes, broccoli, (+broccoli sprouts), kale, watercress, bok choy, Brussels sprouts, cauliflower, horseradish, kohlrabi, mustard, radish, rutabaga, turnips, capers, corn, red radish, sugar beet, winter squash, green peas

Meats/fish/cheese (Wild-caught, free range, without antibiotics or hormones)

Beef, sardines, salmon, oysters, mackerel, tuna steak, wild rainbow trout, shark steak, albacore tuna, herring, beef liver, eggs, cheese (cheddar), shellfish (shrimp, crab, oyster, mussel), chicken, pork

Nuts/seeds/grains (Organic, non-GMO)

Cashews, walnuts, pecans, flax, chia, rice bran, oats, hemp seed, pine nuts, almonds, whole wheat, quinoa, brown rice, pumpkin seed, squash seed, sesame seed

Beans/legumes (Organic, non-GMO)

Soybeans, pinto beans, fava beans, chickpeas, kudzu beans, peanuts

Beverages (Organic, non-GMO)

Green tea, white tea, black tea, oolong tea. **In moderation**: coffee, red wine, soy milk, cow milk (whole or low-fat), bone broth

Herbs/spices/Misc. (Organic, non-GMO)

Turmeric, rosemary, milk thistle, parsley, ginger, raw honey

Oils (Organic, non-GMO, cold-pressed, unrefined)

Flaxseed, krill, fish, fish liver (cod), olive, evening primrose, safflower, soybean, corn, black currant seed, borage seed.

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