IDLife®

METHYLATION PANEL

Your genetic blueprint for longevity

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Welcome

[Full Name] [Patient ID],

Welcome to your genetic methylation testing journey! You are about to take an important step in understanding your personal health through genetic testing. This test will examine specific variations in your DNA that affect methylation—a vital process that helps regulate your genes, overall wellness, and longevity, just to name a few.

What Will Your Test Show?

Your genetic test will identify variations in your DNA code (also called single-nucleotide polymorphisms, or SNPs) that affect how well your body performs methylation. Think of these variations as slight differences in your genetic code that make you unique—like subtle spelling changes in an instruction manual. These differences can impact how efficiently your body processes certain nutrients and maintains various health functions.

Why Methylation Matters

Methylation occurs constantly within your cells, where small molecules called "methyl groups" attach to your DNA. This process acts like a switch for your genes, turning them on or off as needed. Ineffective methylation can contribute to elevated risks of conditions such as cancer, heart disease, and chronic illnesses. Proper methylation is crucial for:

- Longevity and vitality
- Cellular repair and maintenance
- Energy production
- Immune system function
- Mood regulation
- Detoxification
- Inflammation control

The Methylation Cycle and Homocysteine

A central theme of the methylation cycle is the conversion of homocysteine, a potentially harmful substance, into methionine, an essential amino acid. The methylation cycle plays a critical role in regulating homocysteine levels, as elevated homocysteine can be linked to various health problems.

How Your Results Will Guide Your Health

Your test results will provide insights into:

- How efficiently your body processes essential nutrients
- Your personal requirements for key vitamins and minerals
- Dietary modifications that may benefit your methylation process
- Lifestyle factors that could impact your genetic expression

Welcome

Supporting Your Methylation Through Diet

Your body needs specific nutrients to maintain healthy methylation, including:

- **Folate:** Found in leafy greens, legumes, and fortified foods—certain gene variants can impact the availability of folate in a usable form.
- **Vitamin B12:** Present in animal products and fortified foods. It is crucial for the proper functioning of the methylation cycle.
- **Vitamin B6:** Available in whole grains, poultry, meat, fish, and potatoes. This vitamin supports several key steps in the methylation process.
- **Choline:** Rich in eggs, liver, and cruciferous vegetables. It is another key nutrient that facilitates methylation as a backup pathway when folate and B12 supply is low due to diet and/or genetics.

Your genetic results will help determine if you need higher amounts of these nutrients.

Beyond Diet: Lifestyle Factors

Several lifestyle factors can affect your methylation:

- **Sleep quality**
- **Exercise habits**
- **Stress management**
- **Environmental exposures**
- **Medication interactions**

Important Considerations

While genetic testing provides valuable insights, it is important to understand that:

- Genes are not destiny—lifestyle choices significantly impact how genes express themselves.
- This test is for wellness purposes and does not diagnose medical conditions.
- Regular consultation with your healthcare provider ensures the best use of this information.

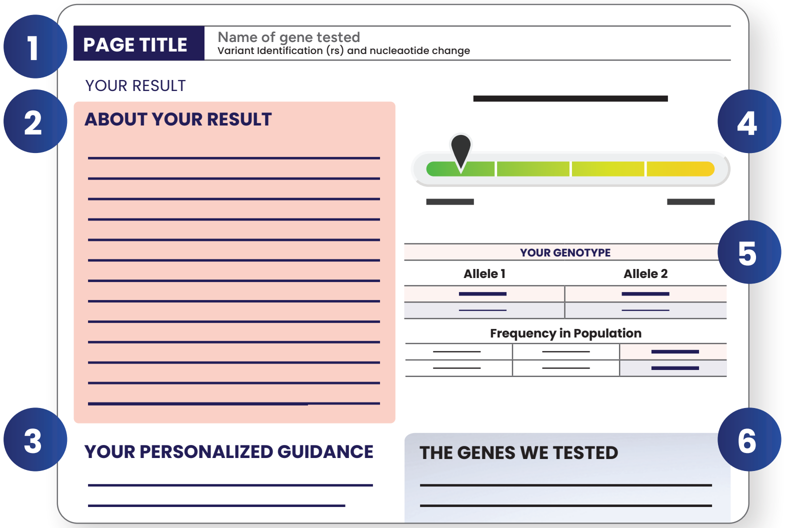
We hope this report offers valuable insights into your unique genetic makeup and its impact on your methylation cycles. By understanding these details, you and your healthcare providers can make informed decisions to optimize your methylation processes, ultimately enhancing your overall health and well-being. Thank you for letting us be part of your journey.

Yours in good health,

Charles J. Sailey, MD, MS, FCAP, FASCP
Chief Scientific Officer and Medical Director of Laboratories
Molecular Testing Labs

Note: This test provides insights for personal health and should be used in conjunction with professional medical advice. It is not intended to diagnose, treat, cure, or prevent any disease.

How To Use this Report



1. **ANALYSIS NAME | VARIANT IDENTIFICATION:** This methylation report is made up of 14 analyses, testing a total of 16 single nucleotide polymorphisms (SNPs). This tells you what was tested in each analysis.

2. **ABOUT YOUR RESULTS:** This peach box provides personalized information about your results on the genes tested in each analysis. For example, you will find out how effectively your body processes certain nutrients.

3. **YOUR PERSONALIZED GUIDANCE:** In this section, you will learn how to leverage your genetics and overcome risks. You will find personalized, actionable dietary modifications that may benefit your methylation processes and lifestyle factors that could impact your genetic expression.

4. This **linear gauge** displays your result in relation to other possible outcomes. A result in the green zone indicates the lowest level of concern, while a red result suggests caution. Most results will fall within the yellow range, as genetic expression isn't always distinctly categorized as "good" or "bad," and factors like nutrition and lifestyle can influence gene expression. Additionally, gene variants inherited through generations often carry both benefits and risks; if they didn't, they would not remain prevalent in the population.

5. **YOUR GENOTYPE:** This is your result and how commonly it is found in the general population. Reading your DNA methylation report can seem complex, but it is easier when you break it down into key parts. Here is how to understand your results:

Understanding Variants and Polymorphisms

- **Homozygous Variant:** This means you have two identical copies of a specific gene variant, one inherited from each parent. For instance, if both copies of a gene show the same change, it is called a homozygous variant. This can affect how your body functions and may influence your risk for certain health conditions.
- **Heterozygous Variant:** In contrast, a heterozygous variant means you have two different versions of a gene. One copy may have a variant, while the other is normal. This variation can also impact your health, but its effects might be less pronounced than those of a homozygous variant.
- **Wild Type:** When no variants are detected, the result is referred to as "wild type." This means that both copies of the gene are normal and do not show any variants. Having wild type results typically indicates that you may not have the genetic variations that could affect your health in the same way as variants do.

Understanding Polymorphism Nomenclature

Polymorphism nomenclature helps you understand genetic variations. For example, in the polymorphism MTHFR 677C>T, this notation indicates that the cytosine (C) at position 677 is changed to thymine (T). Here, C represents the wild type, while T represents the variant allele.

Understanding Alleles

An allele is a specific version of a gene, and it is composed of a sequence of nucleotides. For every gene, you inherit one allele from each parent. These alleles can be the same, leading to a homozygous variant, or different, resulting in a heterozygous variant. The specific combination of nucleotides in an allele determines its form and function.

The Letters A, C, T, and G:

These letters represent the four nucleotides that make up DNA: A (Adenine), C (Cytosine), T (Thiamine), G (Guanine).
These nucleotides pair up to form the building blocks of your genes. The specific sequence of A, C, T, and G determines your genetic information.

6. **THE GENES WE TESTED:** Learn more about how your genetics impact methylation in this blue section.

HOW TO READ YOUR SUMMARY OF ACTIONABLE RESULTS

In this summary, you'll find actionable guidance to enhance your cellular health, along with page numbers more detailed information. Each analysis features a linear gauge that compares your results to various potential outcomes based on your genetic makeup.

When examining genes that encode enzymes or receptors, results can indicate either increased or decreased activity. For instance, variations in genes like **COMT** can lead to changes in activity levels, while other gene variations may only produce one type of effect. Additionally, some variations can alter function selectively, showing increased activity in certain tissues but not elsewhere, as seen with **FOLR1**.

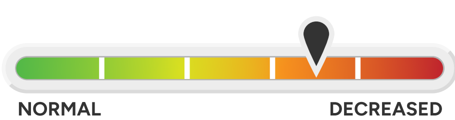
Moreover, not all interpretations center on enzyme or receptor activity. For example, **Methyl Donor Tolerance** may vary based on your genetic predisposition to side effects from supplements that influence neurotransmitter levels. Another analysis, **Vitamin D Requirements**, might be classified as normal or elevated depending on how your **VDR** gene responds to vitamin D.

You will observe a color-coding system ranging from green to yellow and occasionally red. Green indicates the most beneficial result, while red signifies increased caution. Most results fall in the yellow range, as genetic expression is not always easily categorized as "good" or "bad." Gene variants that are inherited through generations often come with both benefits and risks; if they did not, they would not persist in the population at such high frequencies. Additionally, you may notice that sometimes a "normal" result appears in green and other times in yellow. In these instances, the gene variants provide some level of protection compared to the more common result.

YOUR SUMMARY OF ACTIONABLE RESULTS

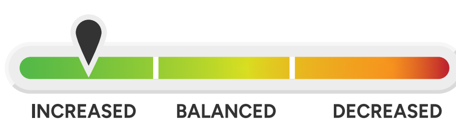
MTHFR
(page 1)

DECREASED MTHFR ACTIVITY
Promote folate activation by consuming more naturally folate-rich foods like asparagus and avocados, while avoiding folic acid from supplements. Support gut health with fermented foods, limit alcohol intake, and prioritize detox through exercise and organic options.



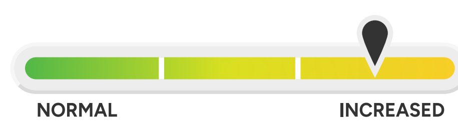
COMT
(page 2)

INCREASED COMT ACTIVITY
Support methylation and neurotransmitter levels with sufficient betaine, choline, magnesium, methionine, and B vitamins from diverse foods. Avoid toxins, enhance dopamine with tyrosine-rich foods, and consider cold exposure.



VDR
(page 3)

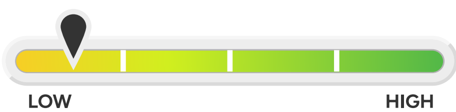
INCREASED VIT D REQUIREMENTS
Ensure sufficient dietary vitamin D from sources like salmon, sardines, and shiitake mushrooms, and get outside daily. Regular exercise and limiting refined carbs will be more important for you. Consult your healthcare provider before taking vitamin D supplements.



SUMMARY OF ACTIONABLE RESULTS

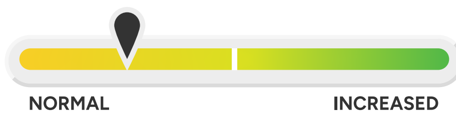
METHYL DONOR TOLERANCE
(pages 4 & 5)

LOWEST TOLERANCE
You may be sensitive to high doses of methyl donor supplements affecting neurotransmitter levels. Support dopamine and methylation through diet, gut health, and stress management. If side effects occur with methyl-B12, hydroxocobalamin may be better tolerated.



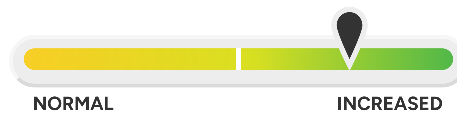
BHMT
(page 6)

NORMAL BHMT ACTIVITY
Reduce stress and inflammation to enhance BHMT function. Increase your dietary intake of betaine (trimethylglycine, TMG) by consuming beets, spinach, and whole grains. Incorporate foods high in zinc, like shellfish and legumes, as well as selenium-rich options such as Brazil nuts and barley.



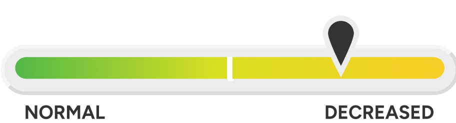
CBS
(page 7)

INCREASED CBS ACTIVITY
Support CBS function and reduce oxidative stress by ensuring sufficient dietary intake of vitamin B6 from foods like salmon and bananas, iron from sources such as red meat and pumpkin seeds, zinc from options like oysters and nuts, and antioxidants from berries and greens.



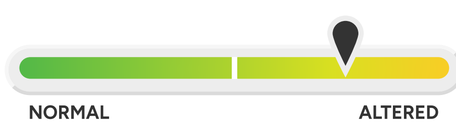
DHFR
(page 8)

DECREASED DHFR ACTIVITY
Optimize DHFR function by obtaining folate (vitamin B9) from natural food sources like asparagus and lentils, avoiding fortified foods and folic acid supplements. If supplements are necessary, consider natural forms like 5-MTHF.



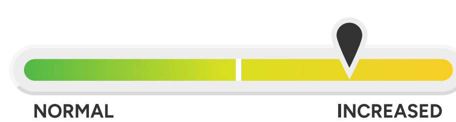
FOLR1
(page 9)

ALTERED FOLATE TRANSPORT
Optimize folate (vitamin B9) availability by ensuring sufficient intake from folate-rich foods like lentils, beans, and spinach. Support liver health with antioxidant-rich foods and healthy fats, and consider supplements during pregnancy to prevent deficiency.



GNMT
(page 10)

INCREASED GNMT ACTIVITY
Increase glycine intake from sources such as muscle meats, fish skin, bone broth, and collagen peptides. Support methylation through dietary changes, and consider taking 3-5 grams of creatine daily to optimize glycine levels while enhancing performance and brain health.



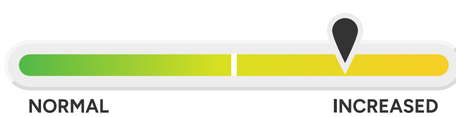
SUMMARY OF ACTIONABLE RESULTS

MAT1A
(page 11)

DECREASED MAT1A ACTIVITY
Increase your antioxidant intake with berries and greens. Obtain magnesium from sources like seeds and legumes, and potassium from foods such as beans and potatoes. Regular exercise and effective stress management—through sleep, mindfulness, and outdoor activities—are essential, as oxidative stress can further hinder enzyme activity.

MTR
(pages 12 & 13)

INCREASED MTR ACTIVITY
Support increased MTR function by boosting your intake of folate-rich foods like lentils and avocados, ensuring adequate B12 from sources such as clams and beef (vegans may need supplementation), and getting zinc from foods like oysters and cashews. Incorporate antioxidant-rich foods, such as berries and leafy greens, while avoiding harmful heavy metals like lead and mercury.



MTRR
(pages 12 & 13)

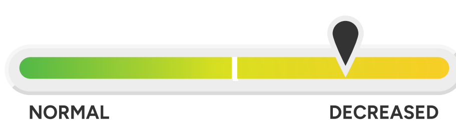
DECREASED MTRR ACTIVITY
Enhance MTRR function by increasing vitamin B12 intake from foods like oysters and salmon (vegans may require supplementation). Support gut health with low-sugar fermented foods and limit alcohol for improved B12 absorption. Additionally, ensure adequate B2 from sources such as yogurt and almonds, and B3 from options like chicken and mushrooms.

PON1
(page 14)

DECREASED PON1 ACTIVITY
Support PON1 function by minimizing pesticide exposure and enhancing detoxification with organic, antioxidant-rich fruits and vegetables for liver health. Avoid plastic containers, exercise regularly, aim for 30 grams of fiber daily, increase omega-3s, and avoid trans fats.

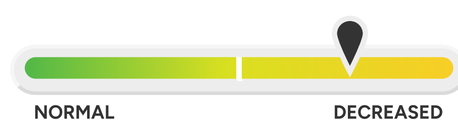
SHMT1
(page 15)

DECREASED SHMT1 ACTIVITY
Optimize SHMT1 function by boosting B9 (folate) and B12 intake along with sufficient B6, iron, and protein. Include a variety of foods like meat, fish, beans, and spinach. Support gut health with low-sugar fermented foods and reduce aluminum exposure.



TCN2
(page 16)

DECREASED TCN2 LEVELS
Improve vitamin B12 transport by increasing B12-rich foods like meat and fish, and consider natural supplements for vegans. Support gut health for optimal absorption by limiting alcohol and adding low-sugar fermented foods.



MTHFR 677 C>T | 1298 A>C

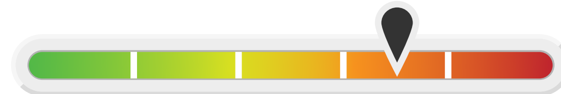
Methylenetetrahydrofolate reductase
rs1801133 677C>T rs1801131 1298A>C

677 C>T	Homozygous Variant
1298 A>C	No Variants Detected

ABOUT YOUR RESULTS

Your MTHFR gene has two copies of the 677 C>T variant and none of the 1298 A>C variant, which may reduce MTHFR enzyme activity by up to 80%. This can result in lower activated folate levels and higher homocysteine levels. Avoid folic acid in foods and supplements, as your body struggles to convert it to 5-methyltetrahydrofolate (5-MTHF). Instead, focus on folate-rich whole foods or supplements with 5-MTHF. MTHFR requires flavin adenine dinucleotide (FAD, from riboflavin) as a cofactor and nicotinamide adenine dinucleotide phosphate (NAD[P]H, from niacin) as an electron donor, so ensure adequate riboflavin (B2) and niacin (B3) in your diet. Supporting detoxification is also essential.

DECREASED MTHFR ACTIVITY



YOUR GENOTYPES

677 C>T		1298 A>C	
Allele 1	**Allele 2**	**Allele 1**	**Allele 2**
T	**T**	**A**	**A**
Variant +	Variant +	Wild Type –	Wild Type –

Frequency in Population (677 C>T)			Frequency in Population (1298 A>C)		
CC	CT	**TT**	**AA**	AC	CC
59.1%	32.7%	**2.8%**	**57.3%**	35.5%	7.2%

YOUR PERSONALIZED GUIDANCE

Ensure adequate intake of:

Vitamin B9 (folate): asparagus, avocados, lentils, beans, and citrus fruits.

Vitamin B2 (riboflavin): organ meat, dairy, almonds, mushrooms, and oats.

Vitamin B3 (niacin): liver, chicken/turkey breast, tuna, mushrooms, and avocados.

Limit folic acid intake from fortified foods and supplements to prevent adverse health effects from accumulation.

Support gut health: Eat at least two servings of low-sugar fermented foods each day and limit alcoholic drinks. Avoid vegetable oils, processed grains, refined sugars, and antibacterial soaps to keep your gut in balance.

Support your body's detox process: Exercise regularly, avoid using plastic plates and containers, eat organic foods when possible, and use natural products when possible to reduce toxin exposure.

THE GENE WE TESTED

The MTHFR gene produces methylenetetrahydrofolate reductase, an enzyme that activates folate (or folic acid). This activated folate is essential for forming methionine, the first amino acid incorporated into newly synthesized proteins, from homocysteine. This step cascades, generating neurotransmitters, supporting immune cells, processing hormones, producing energy, and detoxifying chemicals.

A common variant in the MTHFR gene, called 677C>T, is linked to lower folate and higher homocysteine levels in the blood. Individuals with two copies of T variant are at higher risk of elevated homocysteine, especially with low dietary folate. Increasing folate intake or taking activated folate supplements can help normalize homocysteine levels.

Another MTHFR variant, called 1298A>C, has less impact on folate metabolism and homocysteine levels. However, people with one T allele at 677 and one C allele at 1298 (combined heterozygosity) may experience moderately reduced folate activation.

MTHFR variants are important as they may contribute to certain health conditions. Reduced MTHFR activity indirectly impacts on the tetrahydrobiopterin (BH4) to produce a critical compound for making neurotransmitters, producing nitric oxide, and detoxifying ammonia. If you have two copies of the C allele at 1298, you also may benefit from increasing dietary folate or taking activated folate supplements to support healthy folate metabolism.

No Variants Detected

ABOUT YOUR RESULTS

Variant alleles were not detected on your COMT gene; therefore, you have fast COMT activity. This enables your body to quickly break down stress hormones, neurotransmitters like dopamine, and estrogen metabolites, preventing harmful accumulation. With this increased activity, additional methylation support may be necessary to meet the higher demand for S-adenosylmethionine (SAM). Include plenty of magnesium, B vitamins, methionine, and choline or betaine in your diet. To support COMT health, limit exposure to estrogen-mimicking chemicals, such as plastics and pesticides. Support dopamine production to boost mood and energy with sufficient protein, regular exercise, and early morning sunlight and cold exposure.

YOUR PERSONALIZED GUIDANCE

Ensure adequate intake of:

Betaine: beets, spinach, and whole grains.

Choline: eggs, fish, beans, and cruciferous vegetables; consider taking phosphatidylcholine.

Magnesium: seeds, nuts, and yogurt.

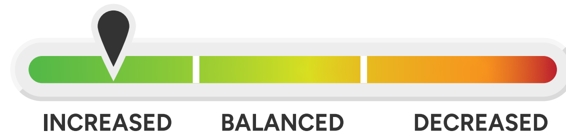
Methionine: eggs, fish, and legumes.

B vitamins: riboflavin (organ meats), B6 (milk, bananas), B9 (beans, spinach), and B12 (seafood).

Avoid toxins: Eat organic, avoid plastics, and use natural household and cosmetic products to help reduce the load on the body.

Support dopamine production: Dopamine helps with mood and focus so you may benefit from increasing foods that support dopamine production. Tyrosine-rich foods (like dairy, nuts, and soy) can help support dopamine synthesis. Consider deliberate cold exposure, such as a cold shower or cold plunge, to increase energy and focus throughout the day.

INCREASED COMT ACTIVITY



YOUR GENOTYPE	
Allele 1	**Allele 2**
G	**G**
Wild Type -	Wild Type -

Frequency in Population

GG	GA	AA
15.1%	43.6%	41.3%

THE GENE WE TESTED

The catechol-O-methyltransferase (COMT) gene encodes the COMT enzyme that helps break down and remove certain compounds from the body by adding a methyl group. These compounds include dopamine, norepinephrine, and epinephrine—key players in the stress response—as well as sex hormones, drugs, and toxins. COMT is essential for balancing neurotransmitters and protecting DNA from damage caused by toxic substances.

One well-known genetic variant in COMT is rs4680 G>A polymorphism, also called COMT Val158Met. This change affects COMT activity. The A allele causes an amino acid change from valine (Val) to methionine (Met), which slows the enzyme activity. People with two G alleles have a fast-working COMT enzyme, while those with two A alleles have a slower one. Most people have one G allele and one A allele, meaning their enzyme activity is somewhere in between.

The COMT gene is associated with dopamine levels, influencing mood and behavior. It also plays a role in estrogen metabolism by inactivating catecholestrogens, helping maintain a healthy balance of estrogen metabolites. Individuals with two A alleles may experience slower estrogen clearance, potentially impacting hormone balance, particularly in those with a family history of hormone-related health issues.

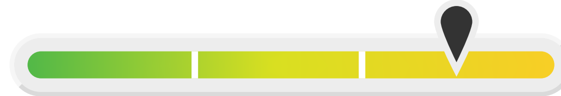
Taq1 No Variants Detected

Fok1 Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the Fok1 variant T allele, with no Taq1 variants detected, potentially increasing your vitamin D requirements. While your Taq1 genotype supports normal VDR protein levels, your Fok1 genotype is linked to a reduced response to dietary and supplemental vitamin D. The longer VDR protein from Fok1 variant may be less effective in activating the vitamin D signal. Individuals with this genotype may also experience blood sugar issues, so regular exercise and limiting refined carbohydrates are important. Without Taq1 variants, you likely have higher dopamine levels, which may lead to poor tolerance to methyl donor supplements; increasing vitamin D can help mitigate these effects.

INCREASED VITAMIN D REQUIREMENTS



YOUR GENOTYPES

Taq1		Fok1	
Allele 1	**Allele 2**	**Allele 1**	**Allele 2**
T	**T**	**T**	**T**
Wild Type **-**	Wild Type **-**	Variant **+**	Variant **+**

Frequency in Population			Frequency in Population		
TT	TC	CC	CC	CT	**TT**
54.4%	36%	9.7%	46.8%	40.8%	**12.5%**

YOUR PERSONALIZED GUIDANCE

Aim for daily sun exposure: Just 15 minutes can help maintain vitamin D levels.

Exercise regularly: Incorporate strength training at least three days a week, alongside cardio activities like running or swimming.

Ensure adequate intake of vitamin D: salmon, sardines, cow's milk, tuna, and shiitake mushrooms.

Test vitamin D levels: Before supplementation, consider taking a vitamin D test as excess intake can raise calcium absorption, increasing risks of heart disease and kidney stones.

Be cautious with methylated vitamins: High doses of methylcobalamin (1000 µg (mcg) or more per day) can cause agitation and sleep issues. Start low and increase gradually, especially since your VDR genotype boosts dopamine production.

GENETICS AND THE ROLE OF VITAMIN D

Vitamin D is an important vitamin that helps control calcium and phosphate levels in the body. These minerals are needed for strong bones, teeth, and muscles. Vitamin D also boosts the immune system, reduces inflammation, and may lower homocysteine levels, which could help with the methylation cycle. High homocysteine is linked to a higher risk of bone fractures, showing that vitamins B12, B6, and folate are important for bone health.

Vitamin D helps make neurotransmitters like dopamine, which are important for mood, energy, and sleep. If you have low vitamin D and poor methylation, you might feel tired, depressed, or unmotivated.

The VDR gene makes the vitamin D receptor, which helps vitamin D work in the body. Some genetic variations in the VDR gene can affect how well vitamin D works. For example, the Taq1 variant has been linked to a higher risk of chronic diseases when vitamin D levels are low. Also, the Fok1 variant changes how vitamin D binds to its receptor and works in the body.

Some people may need more vitamin D supplements depending on their genes. The Taq1 variant can lower dopamine levels, and this can be linked to how well someone responds to supplements that help the methylation cycle.

Methyl Donor Tolerance

COMT rs4680 G>A + VDR TaqI rs731236 T>C

COMT Homozygous Variant

VDR TaqI No Variants Detected

ABOUT YOUR RESULTS

Your genetics suggest a higher risk of side effects from high doses of methylated supplements that affect neurotransmitter levels. This is due to elevated dopamine levels, as your VDR genotype enhances dopamine production while your COMT genotype slows its clearance. To support methylation, focus on a diet rich in folate, B12, B6, and choline or betaine before considering supplements. If supplementation is necessary, start with low doses and gradually increase, monitoring for signs of agitation, anxiety, or sleep disturbances. For high-dose B12 needs, hydroxocobalamin may be a gentler option. If excessive methylation occurs, niacin (vitamin B3) can help regulate it by utilizing extra methyl groups from S-adenosylmethionine (SAM).

YOUR PERSONALIZED GUIDANCE

Dopamine support:

Regular exercise is one of the best ways to enhance dopamine production and metabolism. Stress management, adequate sleep, and healthy fats—especially omega-3s found in fish and nuts—are also essential for maintaining balanced dopamine levels.

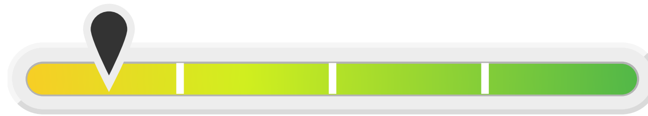
Methylation support:

If you require additional methylation support due to genetic variations (such as MTHFR, MTR, or MTRR), focus on dietary changes before considering supplementation. Foods rich in B vitamins (like leafy greens, eggs, and whole grains), along with magnesium and zinc, can naturally support methylation processes.

Vitamin B12 supplementation:

If you are vegan or have genetic variants in MTR or MTRR, you may need extra B12. However, high doses of methylated B12, such as methylcobalamin, might lead to negative side effects for your genetics. In such cases, hydroxocobalamin, another form of vitamin B12, may be better tolerated and support your B12 needs without overstimulating your system.

LOWEST METHYL DONOR TOLERANCE



COMT G>A

SLOWER DOPAMINE BREAKDOWN

YOUR GENOTYPE	
Allele 1	**Allele 2**
A	**A**
Variant +	Variant +

Frequency in Population

GG	GA	**AA**
15.1%	43.6%	**41.3%**

VDR TaqI T>C

EFFICIENT DOPAMINE SYNTHESIS

YOUR GENOTYPE	
Allele 1	**Allele 2**
T	**T**
Wild Type -	Wild Type -

Frequency in Population

TT	TC	CC
61.3%	31.8%	6.9%

METHYL DONOR TOLERANCE

Your genetics play a role in how your body responds to certain vitamins and supplements, especially those that affect brain chemicals (neurotransmitters). Methylated vitamins such as folate (5-MTHF), vitamin B12 (methylcobalamin), and trimethylglycine (betaine) can influence neurotransmitter levels. For some people, taking these may cause side effects like anxiety, agitation, or sleep disturbances, and certain genetic variations may contribute to these reactions.

Genetic Variants and Neurotransmitter Regulation

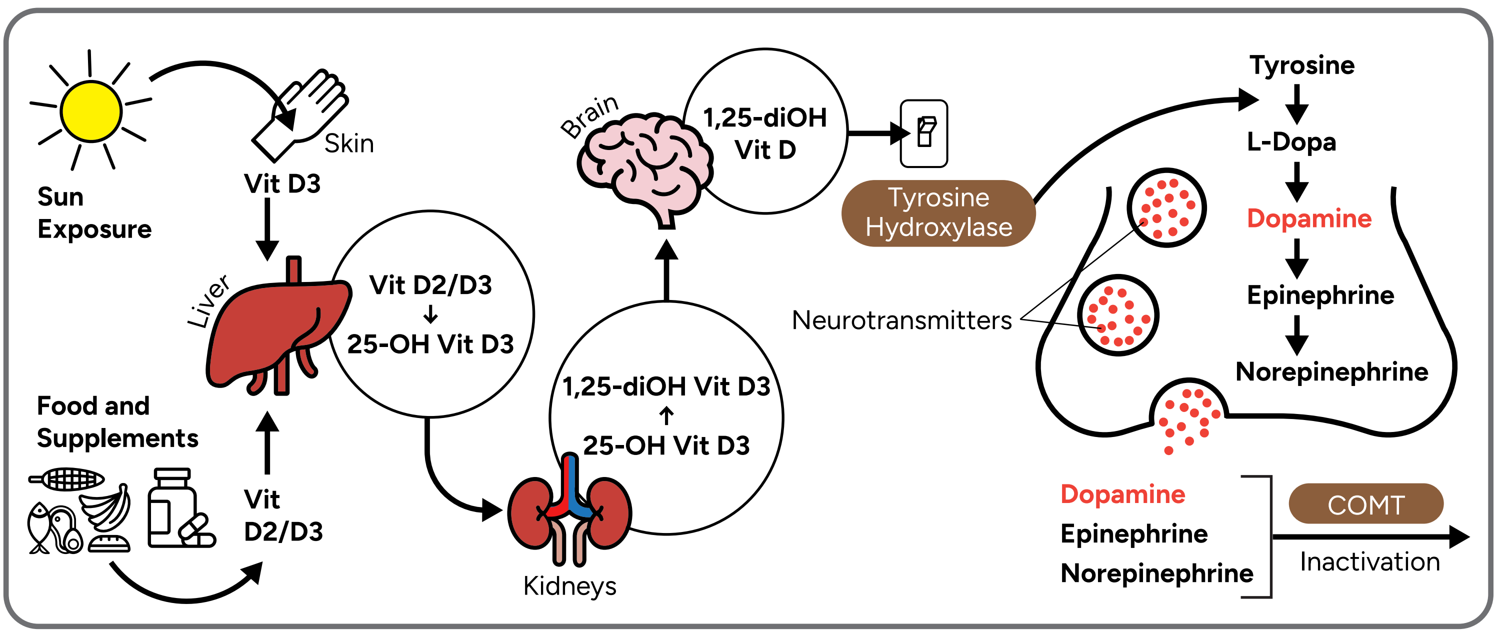
The way your body handles neurotransmitters like dopamine and norepinephrine is influenced by your genes. These chemicals affect your mood, motivation, and focus. Some genetic variations can cause your body to produce too much or too little of them. For example, certain genes can reduce the activity of the COMT enzyme, which helps break down dopamine. If dopamine is not broken down properly, it can build up, leading to feelings of anxiety or trouble sleeping.

VDR Taq1 Variants and Dopamine

The VDR (vitamin D receptor) Taq1 gene variant can also affect dopamine production and regulation. Vitamin D is important for producing dopamine, but if you have a certain version of the VDR gene (like the C allele), you might not produce as much dopamine. This can cause low energy, low motivation, or mood problems, especially if you also have a COMT gene variation.

Interaction of COMT and VDR Taq1 Variants

If you have rs4680 variations that reduce COMT activity, your body may struggle to break down dopamine and other catecholamines effectively. At the same time, if you carry the VDR Taq1 C allele, this could affect the synthesis of dopamine, potentially resulting in lower production of this neurotransmitter. When combined, these genetic variations might lead to a buildup of dopamine and norepinephrine in the nervous system, causing overstimulation. This can manifest as symptoms like anxiety, agitation, or disrupted sleep. Additionally, taking supplements that increase methylation (such as methylated B vitamins) may raise dopamine and norepinephrine levels further, potentially intensifying these effects and exacerbating mood disturbances or sleep issues.



BHMT Betaine-homocysteine methyltransferase

rs3733890 G>A

No Variants Detected

ABOUT YOUR RESULTS

Your BHMT gene does not have the variant alleles that would increase its activity. This means your BHMT activity is lower compared to people who carry the variant A allele. With lower BHMT activity, you might have higher homocysteine levels and rely more on folate and B12 to help with methylation. To support this, try eating foods rich in folate and B12, especially if you have variants like MTHFR that lower active folate. You can also help your body by getting enough zinc, betaine, and/or choline in your diet. Some people with ADHD have seen improvements by supporting this backup pathway to lower homocysteine levels.

BHMT activity is further impaired by inflammation and stress.

YOUR PERSONALIZED GUIDANCE

Ensure adequate intake of:

Betaine: beets, spinach, and whole grains.

Choline: eggs, fish, kidney beans, soybeans, beef, and poultry. Consider phosphatidylcholine supplementation.

Zinc: oysters, beef, poultry, tofu, pumpkin seeds, and dairy.

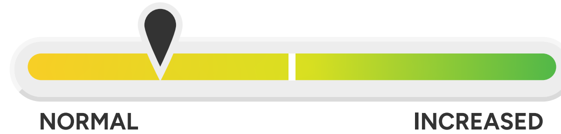
Selenium: brazil nuts, sunflower seeds, poultry, fish, and mushrooms.

Anti-inflammatory foods: salmon, olive oil, cherries, garlic, turmeric, and ginger. Consider omega-3 supplementation.

Minimize copper exposure from cookware and pipes, as copper competes with zinc for intestinal absorption. Run the water for 30 seconds before using it for drinking or cooking, or consider using water filters. Check household plumbing for signs of corrosion.

Manage stress to support BHMT activity by ensuring adequate sleep, exercising early, practicing mindfulness, enjoying fresh air, and engaging in fun, laughter, and relaxation.

NORMAL BHMT ACTIVITY



YOUR GENOTYPE	
Allele 1	**Allele 2**
G	**G**
Wild Type -	Wild Type -

Frequency in Population

GG	GA	AA
51%	39.9%	9.1%

THE GENE WE TESTED

The betaine-homocysteine methyltransferase (BHMT) gene encodes a zinc-dependent enzyme that converts homocysteine to methionine. This conversion is crucial for producing S-adenosylmethionine (SAM), essential for various bodily functions. BHMT provides an alternative pathway for methionine synthesis when folate is unavailable. It requires zinc and betaine (trimethylglycine), derived from choline. Choline is vital for producing acetylcholine, which facilitates cell communication and helps create fats for cell membranes. Dietary sources also provide betaine.

The BHMT enzyme functions optimally with sufficient betaine, allowing the body to produce SAM without depleting choline. However, elevated methionine levels can hinder this enzyme. Stress and inflammation may also disrupt the BHMT process by raising cortisol levels. To manage cortisol, prioritize adequate sleep, regular exercise, and a diet rich in B vitamins, magnesium, omega-3 fatty acids, and fermented foods. Additionally, selenium deficiency can reduce BHMT activity, especially when combined with folate deficiency, so it's essential to ensure adequate selenium intake in your diet.

People with a specific genetic variant (A allele) tend to have increased BHMT activity, which can help lower homocysteine levels. However, it is still important to consume enough betaine to prevent overusing choline, which could lead to other health issues.

CBS

Cystathionine beta-synthase

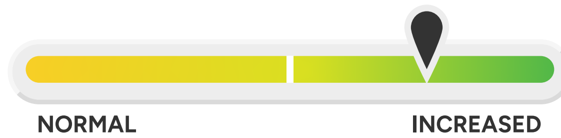
rs234706 C>T

Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the protective T allele on the CBS gene. This genotype may help your body break down homocysteine quickly by speeding up the irreversible process that removes it from the methylation cycle. As a result, your homocysteine levels may be lower, as long as you eat a healthy diet and do not have other genetic risks. Oxidative stress can make the CBS enzyme work harder, so it is important to eat foods rich in antioxidants to support your health.

INCREASED CBS ACTIVITY



YOUR GENOTYPE	
Allele 1	**Allele 2**
T	**T**
Variant +	Variant +

Frequency in Population		
CC	CT	**TT**
65.3%	30.1%	**4.6%**

YOUR PERSONALIZED GUIDANCE

Ensure adequate intake of:

Vitamin B6 (pyridoxine): cow's milk, salmon, eggs, bananas, and avocados.

Iron: chicken liver, red meat (beef, lamb, pork), pumpkin seeds, lentils, and pistachios.

Zinc: oysters, shrimp, unprocessed red meat (beef, lamb, pork), pumpkin seeds, cashews, almonds, dairy (cheese, milk), eggs, potatoes, and green beans. Zinc is required for the body to turn inactive vitamin B6 into the active form, pyridoxal-5-phosphate (P5P), which is essential for CBS functioning.

Antioxidant-rich foods: berries, leafy greens, tomatoes, nuts, seeds, and antioxidants like vitamins C and E. Oxidative stress can cause the CBS enzyme to work harder, which may deplete important methylation metabolites.

THE GENE WE TESTED

The cystathionine beta-synthase (CBS) gene makes the CBS enzyme that helps convert homocysteine into cystathionine, which is then turned into cysteine. Cysteine can be used to make glutathione, an important antioxidant for detox, or taurine and pyruvate, which help with energy. This process, known as the transsulfuration pathway, permanently removes homocysteine from the methylation cycle.

This process depends on vitamin B6 (coenzyme) and is influenced by S-adenosylmethionine (SAM) and betaine. When SAM levels are high, CBS works faster to lower homocysteine levels. Betaine helps by converting homocysteine back into methionine, which reduces the need for CBS to work as much. Also, the CBS enzyme needs iron (a cofactor) to function properly.

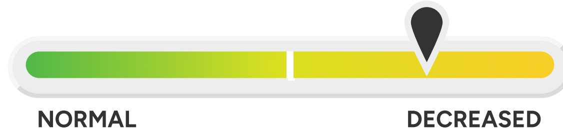
The genetic change known as the CBS 699C>T polymorphism makes the CBS enzyme work faster. People with the T allele usually have lower homocysteine levels, which is good because high homocysteine can cause heart disease, bone issues, and memory problems. However, in people with Down syndrome, who have an extra copy of the CBS gene, this faster enzyme activity can make things more complicated and lead to health challenges.

Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the variant insertion allele on the DHFR gene. This means your body may have trouble processing folic acid from fortified foods and supplements, which can lead to higher levels of UMFA. However, some studies suggest that your genotype may help protect against neural tube defects in fetuses if the mother is taking enough folate while pregnant. It will be especially important for you to avoid folic acid supplements and limit foods with added folic acid to prevent a buildup of UMFA, which can affect your cell health. Folic acid competes with natural folate for the DHFR enzyme, which can make the enzyme work less effectively when there is too much folic acid.

DECREASED DHFR ACTIVITY



YOUR GENOTYPE		
Allele 1		Allele 2
ins		**ins**
Variant +		Variant +
Frequency in Population		
- -	- ins	**ins ins**
50%	33%	**17%**

YOUR PERSONALIZED GUIDANCE

Ensure adequate folate intake from whole food sources, such as asparagus, avocado, lentils, pinto beans, garbanzo beans, black beans, broccoli, spinach, turnip greens, citrus fruits, beets, liver.

Avoid supplements containing folic acid and limit foods fortified with folic acid to prevent an accumulation of UMFA.

View in combination with MTHFR to assess folate requirements; if MTHFR variants are detected and supplementation is indicated, consider natural forms of folate such as 5-MTHF.

THE GENE WE TESTED

The dihydrofolate reductase (DHFR) gene encodes the DHFR enzyme, crucial for folate to help with DNA creation, repair, and methylation. DHFR also helps make tetrahydrobiopterin (BH4), needed to turn tryptophan and tyrosine into serotonin and dopamine. The DHFR enzyme changes dietary folate (folic acid and dihydrofolate) into tetrahydrofolate (THF), the main form of folate in your blood. THF can then be turned into 5,10-methylenetetrahydrofolate (5,10-MTHF), which supports the methylation cycle and DNA production. This process is important for cell growth and division, which is why some cancer treatments, like methotrexate, target DHFR.

Folinic acid is an active form of folate and works regardless of DHFR genotypes because it does not require the DHFR enzyme. On the other hand, excess folic acid (found in many foods and supplements) can reduce DHFR activity and lead to excess unmetabolized folic acid (UMFA), which might cause health issues. Consult with a healthcare provider if you are considering taking folinic acid supplements with a folate-rich diet.

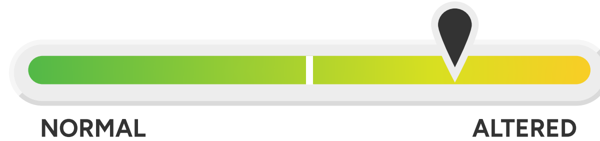
Some people have a DHFR gene change called a 19-basepair insertion (ins). This can lower homocysteine levels, potentially protecting against birth defects like neural tube defects. However, too much folic acid can increase UMFA in people with this gene variant, so it might be more beneficial for them to obtain folate from whole foods rather than from supplements or fortified products.

Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the variant A allele on the FOLR1 gene, which might improve folate absorption in areas like the brain and placenta. This could affect brain health, pregnancy, and overall well-being. Eating a balanced diet should give you enough folate for important functions, like lowering homocysteine levels.

ALTERED FOLATE TRANSPORT



YOUR GENOTYPE	
Allele 1	**Allele 2**
A	**A**
Variant +	Variant +

Frequency in Population

GG	GA	**AA**
15.1%	43.6%	**41.3%**

YOUR PERSONALIZED GUIDANCE

Ensure adequate intake of Vitamin B9 (folate): lentils, pinto beans, garbanzo beans, asparagus, and spinach.

Support liver health and folate processing with nutrient-dense foods. Antioxidant-rich foods like berries and healthy fats from avocados and olive oil enhance folate metabolism and overall wellness.

Pregnancy: Pregnant individuals should eat folate-rich foods and consider taking 5-MTHF (activated folate) or folinic acid supplements to avoid folate deficiency.

THE GENE WE TESTED

The FOLR1 gene produces folate receptor 1 (FRα), which is essential for bringing folate into cells, especially in areas that need it the most. FRα is found in tissues such as the placenta, choroid plexus (where cerebrospinal fluid is made), and kidneys. It has a stronger attraction to 5-MTHF (activated folate) and folinic acid than the main folate receptor, SLC19A1 (reduced folate carrier).

Changes in the FOLR1 gene can affect how folate is transported and used in the brain and placenta. For pregnant individuals, these changes might impact how much folate the placenta absorbs and how the developing fetus receives it. The A allele variant may provide some protective benefits, especially when folic acid is taken as a supplement during pregnancy. FRα also plays a key role in the choroid plexus, helping to keep folate levels in cerebrospinal fluid about 1.5 times higher than in the blood. Having enough folate is crucial for brain development, cognitive function, mood regulation, repairing damage, and promoting healthy aging.

GNMT

Glycine n-methyltransferase
rs10948059 C>T

Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the variant T allele on the GNMT gene. This causes an increase in GNMT activity, which leads to more SAM being turned into SAH, using up glycine in the process. People with your genetic makeup may have higher homocysteine levels, especially if you also have MTHFR gene variations or do not get sufficient folate in your diet. To help support methylation, you need to get folate and methionine from whole foods to avoid depleting glycine. Additionally, increasing your creatine intake can help lower the stress on folate without increasing GNMT activity and losing more glycine.

INCREASED GNMT ACTIVITY

YOUR GENOTYPE	
Allele 1	**Allele 2**
T	**T**
Variant **+**	Variant **+**

Frequency in Population		
CC	CT	**TT**
50%	33%	**17%**

THE GENE WE TESTED

The glycine N-methyltransferase (GNMT) gene produces the GNMT enzyme, which transfers a methyl group from S-adenosylmethionine (SAM) to glycine, creating S-adenosylhomocysteine (SAH) and N-methylglycine (sarcosine). SAM is the body's main source of methyl groups, which are essential for various biological processes. SAH is then converted into homocysteine by an enzyme called S-adenosylhomocysteine hydrolase. Elevated homocysteine levels can increase the risk of heart and brain issues. The GNMT enzyme helps maintain the balance between SAM and SAH, preventing excess SAM that could cause over-methylation, while protecting glycine levels.

Glycine, an amino acid made from other amino acids, is crucial for immune function, heart health, blood sugar control, and reducing inflammation and oxidative stress. It also supports the production of glutathione, the body's most potent antioxidant, and aids in energy use within the brain and nervous system.

The T allele of the GNMT 1298C>T polymorphism increases GNMT activity, leading to more SAM being converted into SAH. This process consumes more glycine. If folate levels are low, it can lead to higher homocysteine levels. The effects of this gene variation are more pronounced in individuals who also have variants in the MTHFR gene.

YOUR PERSONALIZED GUIDANCE

Increase intake of glycine: Muscle meat (beef, pork, poultry, fish), the skin and bones of fish and animals, including collagens, and bone broth.

Support methylation with diet and lifestyle changes: Before using high doses of methylated supplements, diet and lifestyle may need to be adjusted. If you need supplements, aim for less than 400–600 µg (mcg) of 5-MTHF (activated folate) per day to avoid upregulation of GNMT and to save glycine for other important processes.

Creatine: Supplementing with 3-5 grams of creatine daily can enhance muscle strength, improve exercise performance, and support recovery, while also promoting methylation and supporting brain health for overall cognitive function.

Heterozygous Variant

ABOUT YOUR RESULTS

You carry one copy of the variant A allele and one copy of the common G allele on the MAT1A gene, leading to reduced conversion of methionine to S-adenosyl methionine (SAM). This genotype may result in elevated homocysteine levels, particularly if MTHFR variants are present. To support MAT1A enzyme activity, focus on antioxidant-rich foods and limit alcohol, processed foods, and added sugars. Regular exercise boosts antioxidant defenses and reduces inflammation, while quality sleep is crucial for lowering oxidative stress and allowing your body to repair and detoxify itself.

DECREASED MAT1A ACTIVITY

YOUR GENOTYPE	
Allele 1	**Allele 2**
G	**A**
Wild Type **-**	Variant **+**

Frequency in Population		
GG	**GA**	AA
51%	**39.9%**	9.1%

YOUR PERSONALIZED GUIDANCE

Increase intake of:

Antioxidant-rich foods: berries, citrus fruits, cruciferous vegetables, leafy greens, nuts and seeds, herbs and spices (turmeric, ginger, and garlic).

Ensure adequate intake of:

Magnesium: pumpkin seeds, chia seeds, almonds, cashews, bananas, and flaxseed.

Potassium: avocados, potatoes, watermelon, coconut water, beans, and legumes.

Exercise regularly: Aim for at least 150 minutes of moderate-intensity exercise or 75 minutes of vigorous exercise per week, plus muscle-strengthening activities two or more days a week.

Manage stress: Get the right amount of sleep (7-9 hours per night), practice mindfulness and breathing exercises, get fresh air (outdoors), have fun, and laugh.

THE GENE WE TESTED

The methionine adenosyltransferase I (MAT1A) gene encodes an enzyme that helps turn methionine into S-adenosylmethionine (SAM), using magnesium and potassium. SAM is important for many functions in the body, like adding methyl groups to DNA, proteins, and fats. This methylation process helps regulate the function and expression of genes and proteins by controlling their activity. SAM also helps create brain chemicals like serotonin and dopamine, which affect mood and emotions. In short, SAM is essential for health, and MAT1A regulates its production. For the body to stay healthy, the MAT1A enzyme must work properly. If it does not, SAM levels can drop, affecting key functions. Oxidative stress, caused by harmful molecules, can slow the enzyme and reduce SAM production.

A common change in the MAT1A gene is called D1877A. It occurs when adenine (A) replaces guanine (G) at position 2377, leading to less SAM production. People with this change might have higher homocysteine levels, which can harm health. This issue can worsen if the person also has changes in the MTHFR gene. The D1877A variant may also affect mental health, as SAM helps produce neurotransmitters like serotonin, dopamine, and norepinephrine, which control mood.

MTR Homozygous Variant | **MTRR** Homozygous Variant

ABOUT YOUR RESULTS

You have a variant of the MTR gene that increases methionine synthase activity, leading to greater folate use in the methylation cycle and less available for DNA synthesis and repair. This may require you to increase your folate intake, especially if you have changes in the methylenetetrahydrofolate reductase (MTHFR) gene. Focus on eating more folate-rich foods. If you have MTHFR variants, whole food sources or supplements with methylfolate are preferable to folic acid.

Additionally, your MTRR gene variant reduces the activation of vitamin B12, making it harder for your body to convert homocysteine back into methionine due to lower active B12 (methylcobalamin) levels. This means you may need more vitamin B12, ideally from whole foods. Methylcobalamin supplements might help, but check your Methyl Donor Tolerance (page 1) to avoid side effects. If you are sensitive, consider alternatives like hydroxocobalamin or adenosylcobalamin.

MTR requires zinc as a cofactor, so ensure adequate zinc intake. MTRR needs vitamins B2 and B3, along with SAM, to activate vitamin B12. A balanced diet rich in fruits, vegetables, whole grains, and lean proteins will support your overall health and regulate homocysteine levels.

INCREASED MTR ACTIVITY

YOUR GENOTYPE	
Allele 1	**Allele 2**
G	**G**
Variant **+**	Variant **+**

Frequency in Population

AA	AG	**GG**
61.8%	32.8%	**5.4%**

DECREASED MTRR ACTIVITY

YOUR GENOTYPE	
Allele 1	**Allele 2**
G	**G**
Variant **+**	Variant **+**

Frequency in Population

AA	AG	**GG**
42.9%	41.4%	**15.7%**

YOUR PERSONALIZED GUIDANCE

Increase intake of:

Vitamin B12 (cobalamin): salmon, tuna, eggs, beef liver, and cow's milk. You may require vitamin B12 supplementation, especially if you follow a vegan diet.

Vitamin B9 (folate): lentils, spinach, avocados, broccoli, and asparagus.

Antioxidant-rich foods: berries, citrus fruits, cruciferous vegetables, bright-colored vegetables, and nuts.

Ensure adequate intake of:

Vitamin B2 (riboflavin): eggs, beef, dairy, spinach, and chicken.

Vitamin B3 (niacin): chicken breast, tuna, salmon, turkey, and ground beef.

Zinc: oysters, beef, cashews, eggs, and pumpkin seeds.

Avoid exposure to heavy metals: Lead, arsenic, mercury, and aluminum can interfere with the MTR enzyme.

Improve gut health and prevent yeast overgrowth: It is important to limit processed foods and refined sugars, as they can feed harmful bacteria and yeast in the gut. Additionally, avoiding or limiting alcohol is beneficial, as it can disrupt the balance of good bacteria and promote yeast overgrowth. Fermented foods supply beneficial probiotics that support a balanced and healthy gut microbiome.

THE GENES WE TESTED

The MTR and MTRR genes produce the enzymes methionine synthase (MS) and methionine synthase reductase (MTRR), which work together to convert homocysteine into methionine. Methionine is critical for producing S-adenosylmethionine (SAM), the body's primary methyl donor, which is essential for over 100 biological processes.

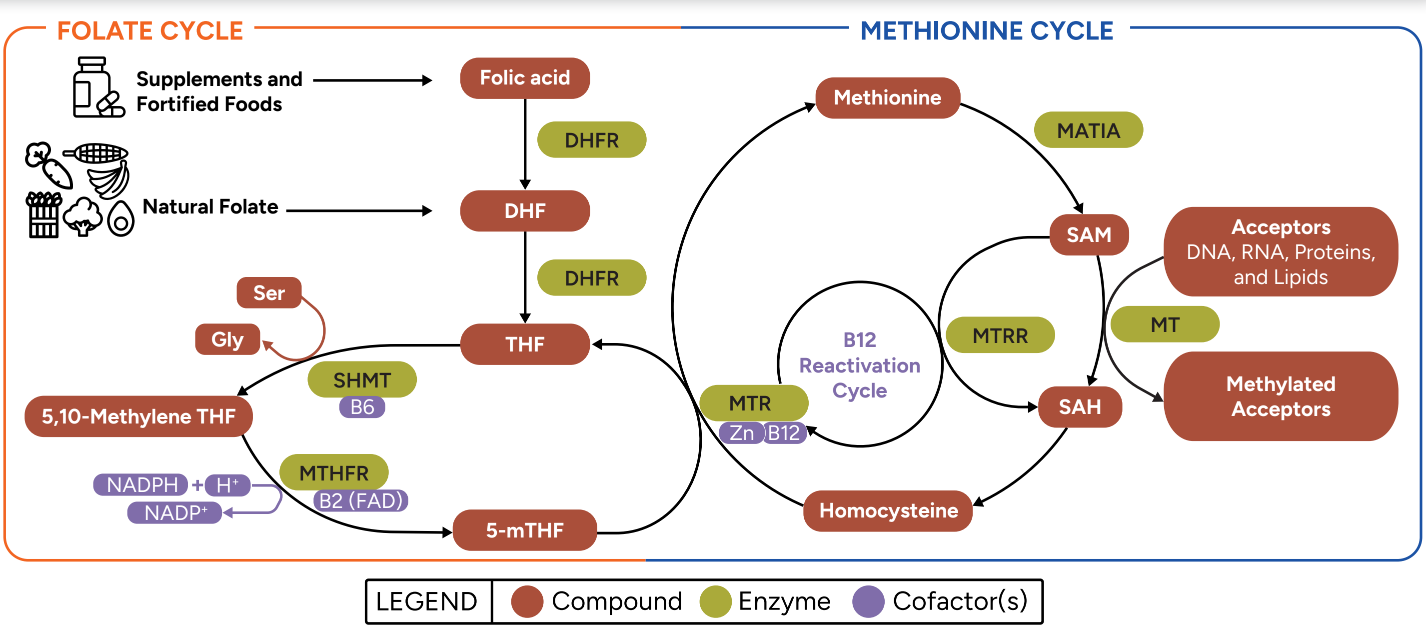
MTR catalyzes the methylation of homocysteine to regenerate methionine, with zinc as a cofactor. It uses 5-methyltetrahydrofolate (5-MTHF, activated folate) as a methyl donor and transfers the methyl group via methylcobalamin (active vitamin B12) from 5-MTHF to homocysteine. MTRR supports this process by regenerating methylcobalamin through a reductive methylation reaction. MTRR uses SAM as the methyl donor and relies on vitamins B2 and B3 as cofactors to recycle oxidized forms of B12 so that MTR can continue converting homocysteine into methionine.

Vitamin B12 deficiency disrupts this pathway by reducing MTR activity, which leads to elevated homocysteine levels and decreases methionine availability for SAM production. Reduced MTRR activity—caused by genetic mutations, oxidative stress, or low vitamin B12 levels—limits the regeneration of methylcobalamin, which is essential for MTR function. Certain medications, including proton pump inhibitors (PPIs), metformin, nitrous oxide anesthesia, epileptic drugs, and colchicine, can interfere with B12 absorption or metabolism, further impairing this cycle.

Alcohol and heavy metals inhibit the MTR/MTRR system by increasing oxidative stress. Alcohol, either from ethanol consumption or yeast overgrowth (common in individuals with impaired methylation), worsens oxidative stress and gut dysbiosis, which in turn limits B12 absorption.

Glutathione, the body's most powerful antioxidant, protects MTR from oxidative damage. Elevated homocysteine, resulting from MTR/MTRR inactivation, can shift toward the transsulfuration pathway to produce more glutathione. Under oxidative stress, homocysteine is diverted away from the methylation cycle and irreversibly converted into glutathione.

If you carry a G allele on the MTR gene, it increases MTR activity, which directs more folate toward the methylation cycle while reducing its availability for DNA synthesis and repair. On the other hand, the G allele on the MTRR gene significantly reduces the ability to convert cobalamin (inactive B12) into methylcobalamin (active B12), limiting MTR's capacity to regenerate methionine.



Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the protective variant A allele on the BHMT gene. This version of the gene helps increase the activity of the BHMT enzyme. As a result, your body may have lower homocysteine levels and need less folate and B12. This gene variation can help protect you from health issues related to high homocysteine and folate deficiency. However, some people with this genotype may have a higher risk of ADHD, possibly due to problems with choline metabolism. To help reduce this risk, make sure you get enough zinc in your diet and increase your intake of betaine (found in foods like beets and spinach) to avoid using too much choline, or ensure adequate choline intake.

YOUR PERSONALIZED GUIDANCE

Eat organic, antioxidant-rich fruits and vegetables to reduce pesticide exposure and **support liver health;** chronic liver disease can lower PON1 levels. Berries, leafy greens, tomatoes, and carrots are rich in vitamins C and E, flavonoids, and carotenoids.

Increase fiber: Aim for 30 grams/day; oats, beans, and fruits can help improve LDLs.

Increase omega-3s from low-mercury fish, plant-based sources, or EPA/DHA (eicosapentaenoic acid/ docosahexaenoic acid) supplementation. See Appendix: Quick Reference Guide to Omega-3s and Mercury in Fish.

Avoid trans fats, found in partially hydrogenated oils, as they raise LDL and lower HDL, increasing heart disease and stroke risk.

Replace saturated fats with monounsaturated fats (MUFAs): MUFAs help lower LDL. Eat nuts, avocados, and olive oil instead of butter, cream, or cheese. Choose lean proteins like chicken breast or lentils over bacon or sausage.

Exercise regularly to improve cholesterol and heart health.

DECREASED PON1 ACTIVITY

YOUR GENOTYPE		
Allele 1		**Allele 2**
G		**G**
Variant +		Variant +
Frequency in Population		
AA	AG	**GG**
32.9%	42.9%	**24.3%**

THE GENE WE TESTED

The PON1 gene encodes the enzyme paraoxonase 1 (PON1), which helps protect your body by breaking down harmful substances, including pesticides, oxidized fats, and excess homocysteine—a substance linked to heart disease. PON1 also works with high-density lipoprotein (HDL, "good" cholesterol) to prevent low-density lipoprotein (LDL, "bad" cholesterol) from oxidizing and becoming harmful.

The G allele of the rs662 SNP can reduce PON1 enzyme activity, potentially leading to higher risk of heart disease, higher levels of harmful LDL cholesterol, and greater sensitivity to pesticides.

In addition to breaking down oxidized fats and pesticides, PON1 helps protect your cells from oxidative stress, which is linked to both heart disease and aging. It also detoxifies homocysteine, reducing cardiovascular risks.

When PON1 is less active, oxidized LDL can accumulate, leading to the buildup of plaque in your arteries and conditions like atherosclerosis. If you carry the T allele, you are more vulnerable to heart disease and environmental toxins. A healthy diet and lifestyle can help support PON1 activity and protect against these risks.

Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the variant T allele, which slightly changes the SHMT1 enzyme activity to favor the folate cycle over methylation. This may lead to lower levels of the activated form of folate, 5-MTHF in your body, and higher homocysteine levels, which can affect DNA repair and methylation.

To help prevent problems, it is important to make sure you are getting enough folate and vitamin B12. You might need more folate, especially if you also have changes in the MTHFR gene, to keep homocysteine levels in check. SHMT1 can also lower B12 levels and may cause an imbalance in gut bacteria. Taking low doses of folinic acid with iron (like lactoferrin) can help balance SHMT1 activity, support methylation, reduce homocysteine, and help your body make SAM from methionine.

YOUR PERSONALIZED GUIDANCE

Increase intake of:

Vitamin B9 (folate): asparagus, avocados, lentils, pinto beans, broccoli, spinach, citrus fruits, and beets. Consider supplementing with low doses of 5-MTHF (less than 600 µg (mcg) per day) if you have MTHFR variants or potentially have high homocysteine levels.

Vitamin B12 (cobalamin): clams, oysters, salmon, tuna, lamb, beef liver, eggs, and cow's milk**.**

Ensure adequate intake of:

Vitamin B6 (pyridoxine): cow's milk, salmon, eggs, bananas, and avocados.

Protein: serine and glycine found in meat, fish, eggs, dairy, legumes, nuts, and seeds.

Iron: chicken liver, red meat (beef, lamb, pork), pumpkin seeds, spirulina, and lentils.

Support gut health: Eat at least two servings of low-sugar fermented foods each day. Consider supplementing with lactoferrin, a protein found in milk with antioxidant properties that help regulate iron absorption and support gut health.

Minimize aluminum exposure by steering clear of aluminum-containing antiperspirants and cookware, as SHMT1 can absorb metals like aluminum, reducing its effectiveness.

DECREASED SHMT1 ACTIVITY

YOUR GENOTYPE		
Allele 1		**Allele 2**
T		**T**
Variant **+**		Variant **+**
Frequency in Population		
CC	CT	**TT**
61.3%	31.8%	**6.9%**

THE GENE WE TESTED

The serine hydroxymethyltransferase 1 (SHMT1) gene encodes an enzyme that plays a crucial role in breaking down amino acids and helping the body make DNA. This enzyme transfers methyl groups between two forms of folate: tetrahydrofolate (THF) and 5,10-methylenetetrahydrofolate (5,10-MTHF). It helps balance the folate supply between the methylation cycle, which is involved in making important compounds like S-adenosylmethionine (SAM), and the folate cycle, which supports DNA synthesis and cell growth.

The SHMT1 enzyme facilitates the transformation of serine and THF into glycine and 5,10-MTHF. This process requires vitamin B6 to function properly. The 5,10-MTHF produced can be used either for DNA synthesis or to support the methylation cycle.

Genetic variations in the SHMT1 gene can cause issues with how the body uses folate, leading to high homocysteine levels, which can be harmful. The T allele of SHMT1 makes the enzyme focus more on the folate cycle and less on methylation, raising homocysteine levels. This shift can also result in a shortage of vitamin B12 and may lead to problems with gut health. Ensuring sufficient intake of B vitamins, particularly B6 and B12, is important for supporting SHMT1 function and overall health.

Homozygous Variant

ABOUT YOUR RESULTS

You have two copies of the variant G allele in the TCN2 gene. This genetic setup can significantly reduce the efficiency of the transcobalamin 2 protein, which is responsible for transporting vitamin B12 into cells. As a result, your body might have lower levels of holotranscobalamin, the form of vitamin B12 that cells can use, which could result in a functional vitamin B12 deficiency. If B12 levels are insufficient, this could contribute to immune or nerve issues. To reduce your risk, it is important to ensure adequate vitamin B12 intake through B12-rich foods or supplements if needed.

DECREASED TCN2 LEVELS

YOUR GENOTYPE	
Allele 1	**Allele 2**
G	**G**
Variant **+**	Variant **+**

Frequency in Population		
CC	CG	**GG**
61.3%	31.8%	**6.9%**

YOUR PERSONALIZED GUIDANCE

Increase intake of:

Vitamin B12 (cobalamin): clams, oysters, salmon, tuna, lamb, beef liver, eggs, cow's milk, and vitamin B12 supplements.

You may benefit from vitamin B12 supplementation if you follow a vegan diet. Natural forms of vitamin B12, including methylcobalamin, adenosylcobalamin, and hydroxycobalamin, will be more effective than synthetic cyanocobalamin.

Support gut health: To aid in vitamin B12 absorption, limit alcohol consumption and include low-sugar fermented foods in your diet.

Consider your methyl donor tolerance: If vitamin B12 supplements are needed, your methyl donor tolerance should be considered. If you have increased sensitivity to methyl donors, consider using hydroxocobalamin via intramuscular injections or sublingual drops/lozenges.

THE GENE WE TESTED

The transcobalamin 2 (TCN2) gene encodes a protein called transcobalamin, which helps move vitamin B12 (cobalamin) from the blood into the body's cells. Vitamin B12 is found in foods like meat, eggs, and shellfish. A lack of vitamin B12 is often due to the body's inability to absorb it, not a lack of food intake. After digestion, vitamin B12 moves into the bloodstream, where it attaches to transcobalamin. Together, they form holotranscobalamin, the active form of vitamin B12 that cells can use. This complex connects to receptors on cell surfaces, allowing B12 to enter the cells. Inside the cells, vitamin B12 helps enzymes important for cell growth, division, and energy production. It is also crucial for making red blood cells and neurotransmitters.

The G allele variant in the TCN2 gene can cause low levels of transcobalamin, making it harder for vitamin B12 to enter cells. This can lead to problems with blood and the nervous system, especially if vitamin B12 intake is low. People with TCN2 gene variants may benefit from eating more vitamin B12-rich foods to maintain healthy levels of vitamin B12 in the blood.

VITAMIN B9 (FOLATE) CONTENT IN FOODS

Food Item	Serving Size	Folate Content (mcg DFE)	% RDA (400 mcg DFE)
Asparagus (Cooked)	1/2 cup	90	23%
Avocado	1 medium	163	41%
Beef Liver	3 oz	215	54%
Beets (Cooked)	1/2 cup	68	17%
Black-Eyed Peas (Cooked)	1/2 cup	105	26%
Broccoli (Cooked)	1/2 cup	50	13%
Brussels Sprouts (Cooked)	1/2 cup	80	20%
Cabbage (Cooked)	1/2 cup	20	5%
Cauliflower (Cooked)	1/2 cup	35	9%
Corn (Cooked)	1/2 cup	20	5%
Egg	1 large	25	6%
Lentils (Cooked)	1/2 cup	180	45%
Mustard Greens (Cooked)	1/2 cup	90	23%
Oranges	1 medium	40	10%
Peas (Cooked)	1/2 cup	50	13%
Peppers (Bell, Raw)	1 medium	10	3%
Potatoes (Baked)	1 medium	20	5%
Raspberries (Raw)	1 cup	30	8%
Rice (White, Cooked)	1/2 cup	90	23%
Spinach (Cooked)	1/2 cup	131	33%
Strawberries (Raw)	1 cup	25	6%
Sweet Potatoes (Cooked)	1 medium	25	6%
Tomatoes (Raw)	1 medium	10	3%
Turnip Greens (Cooked)	1/2 cup	85	21%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR FOLATE

- **Adults:** 400 mcg DFE
- **Pregnant Women:** 600 mcg DFE
- **Breastfeeding Women:** 500 mcg DFE

VITAMIN B12 (COBALAMIN) CONTENT IN FOODS

Food Item	Serving Size	Vitamin B12 Content (mcg)	% RDA (2.4 mcg)
Beef (Ground, 85% Lean)	3 oz	2.4	100%
Beef Liver	3 oz	70.7	2,944%
Cheese (Cheddar)	1.5 oz	0.5	19%
Cheese (Swiss)	1.5 oz	0.9	38%
Chicken (Cooked)	3 oz	0.3	12%
Clams (Cooked)	3 oz	17.0	708%
Crab (Cooked)	3 oz	15.4	642%
Duck (Cooked)	3 oz	1.0	42%
Eggs (Whole, Cooked)	1 large	0.5	19%
Goose (Cooked)	3 oz	2.0	83%
Haddock (Cooked)	3 oz	1.8	75%
Herring (Cooked)	3 oz	13.0	542%
Lamb (Cooked)	3 oz	2.0	83%
Mackerel (Cooked)	3 oz	16.0	667%
Milk (2% Fat)	1 cup	1.3	54%
Nutritional Yeast (Fortified)	1/4 cup	8.3 to 24	346 to 1,000%
Oysters (Cooked)	3 oz	14.9	621%
Salmon (Cooked)	3 oz	2.6	108%
Sardines (Canned)	3 oz	8.9	371%
Trout (Cooked)	3 oz	5.4	225%
Tuna (Canned in Water)	3 oz	2.5	104%
Turkey (Breast Meat, Roasted)	3 oz	0.3	14%
Venison (Cooked)	3 oz	2.0	83%
Yogurt (Plain, Fat-Free)	6 oz	1.0	43%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR VITAMIN B12

- **Adults:** 2.4 mcg
- **Pregnant Women:** 2.6 mcg
- **Breastfeeding Women:** 2.8 mcg

VITAMIN B6 (PYRIDOXINE) CONTENT IN FOODS

Food Item	Serving Size	Vitamin B6 Content (mg)	% RDA (1.3 mg)
Avocado	1 medium	0.5	38%
Bananas	1 medium	0.4	31%
Beef (Ground, 85% Lean, Broiled)	3 oz	0.3	23%
Beef Liver (Pan-Fried)	3 oz	0.9	69%
Bulgur (Cooked)	1 cup	0.2	15%
Cheese (Swiss)	1.5 oz	0.9	69%
Chicken Breast (Roasted)	3 oz	0.5	38%
Chickpeas (Canned)	1 cup	1.1	85%
Cottage Cheese (1% Low-Fat)	1 cup	0.2	15%
Eggs (Whole, Cooked)	1 large	0.1	8%
Fortified Nutritional Yeast	1/4 cup	0.5	38%
Nuts (Mixed, Dry-Roasted)	1 oz	0.1	8%
Onions (Chopped)	½ cup	0.1	8%
Potatoes (Boiled)	1 cup	0.4	31%
Raisins (Seedless)	½ cup	0.1	8%
Rice (White, Long-Grain, Cooked)	1 cup	0.1	8%
Salmon (Sockeye, Cooked)	3 oz	0.6	46%
Spinach (Frozen, Boiled)	½ cup	0.1	8%
Sweet Potatoes (Cooked)	1 cup	0.6	46%
Tofu (Raw, Firm)	½ cup	0.1	8%
Tuna (Yellowfin, Cooked)	3 oz	0.9	69%
Turkey (Roasted, Meat Only)	3 oz	0.4	31%
Watermelon (Raw)	1 cup	0.1	8%
Winter Squash (Baked)	½ cup	0.2	15%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR VITAMIN B6

- **Adults:** 1.3 mg
- **Pregnant Women:** 1.9 mg
- **Breastfeeding Women:** 2.0 mg

VITAMIN B2 (RIBOFLAVIN) CONTENT IN FOODS

Food Item	Serving Size	Vitamin B2 Content (mg)	% RDA (1.3 mg)
Almonds (Dry-Roasted)	1 oz	0.3	23%
Apples (with Skin)	1 medium	0.1	8%
Bagel (Plain, Enriched)	1 medium	0.2	15%
Beef (Tenderloin, Grilled)	3 oz	0.4	31%
Beef Liver (Pan-Fried)	3 oz	2.9	223%
Broccoli (Cooked)	1/2 cup	0.1	8%
Carrots (Cooked)	1/2 cup	0.1	8%
Cauliflower (Cooked)	1/2 cup	0.1	8%
Cheese (Swiss)	3 oz	0.3	23%
Clams (Cooked)	3 oz	0.4	31%
Eggs (Whole, Cooked)	1 large	0.2	15%
Fortified Nutritional Yeast	1/4 cup	0.5	38%
Lentils (Cooked)	1/2 cup	0.1	8%
Milk (2% Fat)	1 cup	0.5	38%
Mushrooms (Portabella, Grilled)	½ cup	0.2	15%
Peas (Cooked)	1/2 cup	0.1	8%
Potatoes (Baked)	1 medium	0.1	8%
Quinoa (Cooked)	1 cup	0.2	15%
Rotisserie Chicken (Breast Only)	3 oz	0.2	15%
Salmon (Pink, Canned)	3 oz	0.2	15%
Spinach (Raw)	1 cup	0.1	8%
Tofu (Firm)	1/2 cup	0.1	8%
Yogurt (Plain, Fat-Free)	1 cup	0.6	46%
Zucchini (Cooked)	1/2 cup	0.1	8%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR VITAMIN B2

- **Adults:** 1.3 mg
- **Pregnant Women:** 1.4 mg
- **Breastfeeding Women:** 1.6 mg

METHIONINE CONTENT IN FOODS

Food Item	Serving Size	Methionine Content (mg)	% RDA (728 mg)
Avocado	1 medium	76	10%
Beef (Skirt Steak)	6 oz	1539	211%
Brazil Nuts	1 oz	319	44%
Cheese (Ricotta, Low-Fat)	1/2 cup	352	48%
Chicken Breast	6 oz	1950	268%
Chicken Thighs	6 oz	1150	158%
Clams (Cooked)	3 oz	490	67%
Cottage Cheese (Low-Fat)	1 cup	300	41%
Eggs (Whole, Cooked)	1 large	196	27%
Green Peas (Cooked)	1 cup	130	18%
Lamb (Cooked)	3 oz	1060	145%
Lentils (Cooked)	1 cup	356	49%
Lima Beans (Cooked)	1 cup	116	16%
Milk (Whole)	16 oz	431	59%
Pork (Ground)	3 oz	300	41%
Pork Chops (Lean)	6 oz	1445	198%
Quinoa (Cooked)	1 cup	178	24%
Salmon (Cooked)	6 oz	2000	274%
Shrimp (Cooked)	3 oz	565	78%
Sweet Potatoes (Cooked)	1 cup	125	17%
Tofu (Firm)	1 cup	532	73%
Tuna (Cooked)	6 oz	1505	207%
Turkey (Ground)	6 oz	1583	217%
White Beans	1 cup	261	36%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR METHIONINE

- **Adults:** Approximately 728 mg per day for a person weighing 70 kg (154 lbs)

VITAMIN D CONTENT IN FOODS

Food Item	Serving Size	Vitamin D Content (IU)	% RDA (800 IU)
Beef Liver (Cooked)	3 oz	42	5%
Cheese (Swiss)	1 oz	6	1%
Chicken (Cooked)	3 oz	10	1%
Cod (Cooked)	3 oz	90	11%
Cod Liver Oil	1 tbsp (15 mL)	1,360	170%
Crab (Cooked)	3 oz	20	3%
Egg Yolk	1 large	37	5%
Fortified Almond Milk	1 cup	100	13%
Fortified Milk (Whole)	1 cup	115	14%
Fortified Nutritional Yeast	1/4 cup	120	15%
Fortified Orange Juice	1 cup	140	18%
Fortified Rice Milk	1 cup	100	13%
Fortified Soy Milk	1 cup	120	15%
Fortified Tofu	1/2 cup	80	10%
Halibut (Cooked)	3 oz	190	24%
Herring (Cooked)	3 oz	214	27%
Mackerel (Atlantic, Cooked)	3 oz	360	45%
Mushrooms (UV-Exposed)	1 cup	1,100	138%
Oysters (Cooked)	3 oz	320	40%
Rainbow Trout (Cooked)	3 oz	645	81%
Salmon (Sockeye, Cooked)	3 oz	570	71%
Sardines (Canned in Oil)	3 oz	270	34%
Shrimp (Cooked)	3 oz	20	3%
Tuna (Canned in Oil)	3 oz	230	29%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR VITAMIN D

- **Adults:** 800 IU (20 mcg)

VITAMIN B3 (NIACIN) CONTENT IN FOODS

Food Item	Serving Size	Vitamin B3 Content (mg)	% RDA (16 mg)
Avocado	1 medium	3.5	22%
Beef (Ground, 90% Lean)	3 oz	6.2	39%
Beef Liver	3 oz	14.9	93%
Cauliflower (Cooked)	1 cup	0.6	4%
Chicken Breast (Cooked)	3 oz	10.3	64%
Chicken Liver (Cooked)	3 oz	9.0	56%
Crab (Cooked)	3 oz	2.0	13%
Fortified Nutritional Yeast	1/4 cup	24	150%
Green Peas (Cooked)	1 cup	3.2	20%
Lamb (Cooked)	3 oz	6.0	38%
Marinara Sauce	1 cup	10.3	64%
Mushrooms (White, Cooked)	1 cup	2.0	13%
Oats (Cooked)	1 cup	0.9	6%
Peanuts (Dry Roasted)	1 oz	4.1	25%
Pork Tenderloin (Cooked)	3 oz	6.3	39%
Portabella Mushrooms (Cooked)	1 cup	7.6	47%
Potatoes (Baked)	1 medium	2.0	13%
Rice (Brown, Cooked)	1 cup	5.2	32%
Salmon (Sockeye, Cooked)	3 oz	8.6	54%
Spinach (Cooked)	1 cup	0.8	5%
Sweet Potatoes (Cooked)	1 cup	2.4	15%
Tuna (Light, Canned)	3 oz	8.6	54%
Turkey Breast (Cooked)	3 oz	10.0	63%
Zucchini (Cooked)	1 cup	0.4	3%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR VITAMIN B3

- **Adults:** 16 mg

CHOLINE CONTENT IN FOODS

Food Item	Serving Size	Choline Content (mg)	% RDA (550 mg)
Beef (Ground, 93% Lean)	3 oz	72	13%
Beef Liver	3 oz	356	65%
Beef Top Round (Braised)	3 oz	117	21%
Broccoli (Boiled)	½ cup	31	6%
Brussels Sprouts (Boiled)	½ cup	32	6%
Cabbage (Boiled)	½ cup	15	3%
Cauliflower (Boiled)	½ cup	24	4%
Chicken Breast (Roasted)	3 oz	72	13%
Cod (Atlantic, Cooked)	3 oz	71	13%
Cottage Cheese (Nonfat)	1 cup	26	5%
Eggs (Whole, Cooked)	1 large	147	27%
Green Peas (Boiled)	½ cup	24	4%
Kidney Beans (Canned)	½ cup	45	8%
Milk (1% Fat)	1 cup	43	8%
Peanuts (Dry-Roasted)	¼ cup	24	4%
Quinoa (Cooked)	1 cup	43	8%
Red Potatoes (Baked)	1 large	57	10%
Rice (Brown, Cooked)	1 cup	19	3%
Shiitake Mushrooms (Cooked)	½ cup	27	5%
Soybeans (Roasted)	½ cup	107	19%
Sunflower Seeds (Roasted)	¼ cup	19	3%
Tuna (White, Canned)	3 oz	25	5%
Wheat Germ (Toasted)	1 oz	51	9%
Yogurt (Nonfat)	1 cup	38	7%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR CHOLINE

- **Adults:** 550 mg

MAGNESIUM CONTENT IN FOODS

Food Item	Serving Size	Magnesium Content (mg)	% RDA (420 mg)
Almonds (Roasted)	1 oz	80	19%
Avocado	½ cup	22	5%
Bananas	1 medium	32	8%
Beef (Ground, 90% Lean)	3 oz	20	5%
Black Beans (Cooked)	½ cup	60	14%
Broccoli (Cooked)	½ cup	12	3%
Cashews (Roasted)	1 oz	74	18%
Chia Seeds	1 oz	111	26%
Chicken Breast (Roasted)	3 oz	22	5%
Edamame (Shelled, Cooked)	½ cup	50	12%
Halibut (Cooked)	3 oz	24	6%
Kidney Beans (Canned)	½ cup	35	8%
Milk (Cow's)	1 cup	24–27	6%
Peanuts (Roasted)	¼ cup	63	15%
Peanut Butter	2 tbsp	49	12%
Potato (Baked with Skin)	3.5 oz	43	10%
Pumpkin Seeds (Roasted)	1 oz	156	37%
Raisins	½ cup	23	5%
Rice (Brown, Cooked)	½ cup	42	10%
Rice (White, Cooked)	½ cup	10	2%
Salmon (Atlantic, Cooked)	3 oz	26	6%
Soymilk	1 cup	61	15%
Spinach (Boiled)	½ cup	78	19%
Yogurt (Plain, Low-Fat)	8 oz	42	10%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR MAGNESIUM

- **Adults:** 420 mg

ZINC CONTENT IN FOODS

Food Item	Serving Size	Zinc Content (mg)	% RDA (11 mg)
Almonds	1 oz	0.9	8%
Beef (Steak)	5 oz	15	136%
Broccoli (Cooked)	1 cup	1.1	10%
Cashews	1 oz	1.6	15%
Chicken (Leg, Roasted)	1 leg	5	45%
Chickpeas	1 cup	1.5	14%
Crab (Canned)	1 cup	6.5	59%
Dark Chocolate (70-85% Cocoa)	1 oz	3.3	30%
Eggs (Whole, Cooked)	1 large	0.6	5%
Lentils	1 cup	3	27%
Milk (1% Fat)	1 cup	1	9%
Oatmeal	1 cup	2	18%
Oysters	6 medium	52	472%
Pork Chops (Lean)	6 oz	4	36%
Potatoes (Baked with Skin)	1 medium	1	9%
Pumpkin Seeds	1 oz	3	27%
Quinoa (Cooked)	1 cup	2	18%
Sardines (Canned)	3 oz	2.5	23%
Shiitake Mushrooms (Cooked)	1 cup	2	18%
Spinach (Cooked)	1 cup	1.4	13%
Tofu (Firm)	1 cup	4	36%
Turkey (Roasted)	3 oz	2.3	21%
Wheat Germ	1 oz	4.5	41%
Yogurt (Low-Fat)	1 cup	2	18%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR ZINC

- **Adults:** 11 mg

IRON CONTENT IN FOODS

Food Item	Serving Size	Iron Content (mg)	% RDA (18 mg for women, 8 mg for men)
Almonds	1 oz	1.0	6% (women) / 13% (men)
Bananas	1 medium	0.3	2% (women) / 4% (men)
Beef Bottom Round (Braised)	3 oz	2.7	15% (women) / 34% (men)
Beef Liver (Pan-Fried)	3 oz	5	28% (women) / 63% (men)
Broccoli (Cooked)	1 cup	1.0	6% (women) / 13% (men)
Carrots	1 cup	0.6	3% (women) / 8% (men)
Cashews	1 oz	1.9	11% (women) / 24% (men)
Chickpeas (Cooked)	1 cup	4.7	26% (women) / 58% (men)
Dark Chocolate (70-85% Cacao)	1 oz	3.3	18% (women) / 41% (men)
Dried Apricots	1 cup	1.2	7% (women) / 15% (men)
Green Beans (Cooked)	1 cup	1.0	6% (women) / 13% (men)
Lentils (Cooked)	1 cup	6.6	37% (women) / 82% (men)
Mushrooms (Cooked)	1 cup	0.5	3% (women) / 6% (men)
Oysters (Cooked)	3 oz	8	44% (women) / 100% (men)
Peas (Cooked)	1 cup	1.5	8% (women) / 19% (men)
Potatoes (Baked with Skin)	1 medium	1.9	11% (women) / 24% (men)
Pumpkin Seeds	1 oz	2.5	14% (women) / 31% (men)
Quinoa (Cooked)	1 cup	2.8	16% (women) / 35% (men)
Raisins	1 cup	1.2	7% (women) / 15% (men)
Sardines (Canned)	3 oz	2.5	14% (women) / 31% (men)
Spinach (Cooked)	1 cup	6.4	36% (women) / 80% (men)
Tofu (Firm)	1 cup	3.4	19% (women) / 42% (men)
Turkey (Roasted)	3 oz	2.3	13% (women) / 29% (men)
White Beans (Canned)	1 cup	8	44% (women) / 100% (men)

RECOMMENDED DAILY ALLOWANCE (RDA) FOR IRON

- **Women (ages 19–50): 18 mg**
- **Men (ages 19 and older): 8 mg**

POTASSIUM CONTENT IN FOODS

Food Item	Serving Size	Potassium Content (mg)	% RDA (4,700 mg)
Acorn Squash (Baked)	1 cup	896 mg	19%
Artichokes (Cooked)	1 cup	444 mg	9%
Asparagus (Cooked)	1 cup	403 mg	9%
Bok Choy (Cooked)	1 cup	631 mg	13%
Beet Greens (Cooked)	1 cup	1309 mg	28%
Broccoli (Cooked)	1 cup	457 mg	10%
Brussels Sprouts (Cooked)	1 cup	495 mg	11%
Carrots (Cooked)	1 cup	337 mg	7%
Cauliflower (Cooked)	1 cup	303 mg	6%
Celery (Cooked)	1 cup	263 mg	6%
Fennel (Cooked)	1 cup	360 mg	8%
Green Peas (Cooked)	1 cup	434 mg	9%
Kale (Cooked)	1 cup	329 mg	7%
Lima Beans (Cooked)	1 cup	969 mg	21%
Potatoes (Baked, with Skin)	1 medium	926 mg	20%
Rutabaga (Cooked)	1 cup	367 mg	8%
Spinach (Cooked)	1 cup	839 mg	18%
Summer Squash (Cooked)	1 cup	346 mg	7%
Sweet Corn (Cooked)	1 cup	392 mg	8%
Sweet Potatoes (Mashed)	1 cup	536 mg	11%
Swiss Chard (Cooked)	1 cup	961 mg	20%
Tomato (Cooked)	1 cup	523 mg	11%
White Button Mushrooms (Cooked)	1 cup	555 mg	12%
Zucchini (Cooked)	1 cup	475 mg	10%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR POTASSIUM

- **Adults:** 4,700 mg

GLYCINE CONTENT IN FOODS

Food Item	Serving Size	Glycine Content (mg)	% RDA (3 g)
Beef (Ground)	6 oz	3091	103%
Beef (Skirt Steak)	6 oz	2491	83%
Bone Broth	1 cup	1700	57%
Cheese (e.g., Cheddar)	1 oz	150	5%
Chickpeas	1 cup	80	3%
Collagen (Powder)	1 oz	5202	173%
Duck Breast	6 oz	1900	63%
Eggs	2 large	500	17%
Fish (e.g., Cod)	6 oz	1500	50%
Gelatin (Powder)	1 oz	5334	178%
Lamb Shoulder	6 oz	2951	98%
Lentils	1 cup	100	3%
Milk (Whole)	1 cup	100	3%
Peanuts	1 oz	100	3%
Pork Chops	6 oz	2472	82%
Pork Ribs	6 oz	1800	60%
Pork Tenderloin	6 oz	2478	83%
Roast Duck	6 oz	2237	75%
Roast Chicken Leg	6 oz	2038	68%
Salmon (King)	6 oz	2232	75%
Steak (Ribeye)	6 oz	2410	80%
Tofu (Firm)	1 cup	200	7%
Turkey (Ground)	6 oz	2944	98%
Yogurt (Plain)	1 cup	200	7%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR GLYCINE

- **Adults:** Approximately 3 g

TYROSINE CONTENT IN FOODS

Food Item	Serving Size	Tyrosine Content (mg)	% RDA (875 mg)
Almonds	1 oz	100	11%
Beef (Skirt Steak)	6 oz	2174	248%
Cheese (Ricotta, Low-Fat)	1/2 cup	739	84%
Chicken Breast (Lean)	6 oz	1964	224%
Chickpeas (Cooked)	1 cup	80	9%
Egg (Whole, Cooked)	1 large	257	29%
Fish (Salmon)	6 oz	2052	235%
Green Peas (Cooked)	1 cup	179	20%
Lentils (Cooked)	1 cup	100	11%
Milk (Whole)	16 oz	833	95%
Noodles (Somen)	1 cup	185	21%
Oatmeal (Cooked)	1 cup	27	3%
Peanuts	1 oz	80	9%
Pork Chops (Lean)	6 oz	2088	239%
Quinoa (Cooked)	1 cup	118	13%
Rice (Brown, Cooked)	1 cup	19	2%
Rice (Wild)	1 cup	277	32%
Spinach (Cooked)	1 cup	203	23%
Squash and Pumpkin Seeds	1 oz	306	35%
Sweet Potato	1 cup	207	24%
Tofu (Firm)	1 cup	1767	202%
Tuna (Canned)	3 oz	762	87%
Wheat Germ (Toasted)	1 oz	251	29%
White Beans (Large)	1 cup	490	56%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR TYROSINE

- **Adults:** Approximately 875 mg

ANTIOXIDANT CONTENT IN FOODS

Food Item	**Serving Size**	**Antioxidant Content** (mmol/3.5 oz)	**% RDA** (5 mmol)
Artichokes	3.5 oz	4.7	94%
Beans (Various Types)	3.5 oz	2.2	44%
Beets	3.5 oz	1.7	34%
Bell Pepper (Orange)	3.5 oz	1.9	38%
Blackberries	3.5 oz	9.2	184%
Blueberries	3.5 oz	9.2	184%
Cabbage (Red)	3.5 oz	2.2	44%
Cauliflower	3.5 oz	3.5	70%
Chestnuts	1 oz	1.3	27%
Cinnamon (Ground)	1/2 tsp	1.7	34%
Coffee	3.5 oz	2.5	50%
Dark Chocolate	3.5 oz	15.0	300%
Kale	3.5 oz	2.7	54%
Mint (Green)	2 tbsp	4.9	98%
Pecans	1 oz	2.4	48%
Pistachios	1 oz	1.4	28%
Plums	3.5 oz	3.2	64%
Pomegranate	3.5 oz	9.0	180%
Raspberries	3.5 oz	4.0	80%
Spinach	3.5 oz	1.0	20%
Strawberries	3.5 oz	2.1	42%
Tea (Green)	3.5 oz	1.5	30%
Tomato (Sundried)	3.5 oz	1.3	26%
Walnuts	1 oz	6.3	125%

RECOMMENDED DAILY ALLOWANCE (RDA) FOR ANTIOXIDANTS

- **General Recommendation**: Approximately 5 mmol of antioxidants per day.

Appendix QUICK REFERENCE GUIDE TO OMEGA-3S AND MERCURY IN FISH

Consumption of Omega-3 fatty acids are essential for heart health, brain function, and overall well-being. For optimal wellness, adults should aim for a daily intake of approximately 2 grams (2000 mg) of omega-3s. There are three primary types of omega-3 fats:

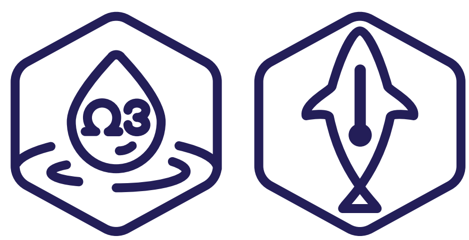
- **Eicosapentaenoic acid (EPA):** Primarily found in fish and seafood.
- **Docosahexaenoic acid (DHA):** Also mainly sourced from fish and seafood.
- **Alpha-linolenic acid (ALA):** Found in plant sources like flaxseeds and walnuts. Although the body can convert ALA to EPA and DHA, this process is slow, so increasing EPA and DHA intake through fish or supplements is often beneficial.

Mercury is a toxic heavy metal that accumulates in fish, especially larger, predator species. High mercury levels can disrupt methylation processes and lead to health issues—particularly for pregnant women and young children—negatively affecting the brain, heart, kidneys, and immune system.

Choose fish wisely as some species contain high mercury levels. This guide helps you determine safe fish consumption for omega-3 needs while minimizing mercury exposure.

Safe Fish Consumption Guidelines

- **Eat 2 servings of fatty fish each week to meet omega-3 needs.**
- **Select lower mercury fish to minimize exposure.**
- **Limit high-mercury fish consumption to once a month or less.**



Recommended Fish Choices

Best Choices:
(low mercury, high omega-3)

- Salmon
- Anchovies
- Mackerel (Atlantic or Pacific not King)
- Herring
- Anchovies

Moderate Choices:
(consume in moderation)

- Tuna (Light, Canned)
- Halibut
- Snapper

Limit Consumption:
(high mercury)

- Tuna (Bluefin and Albacore)
- Swordfish
- Orange Roughy
- Grouper

How to Incorporate Fish into Your Diet

1. **Plan meals:** Aim for two servings of fatty fish each week.
2. **Mix and match:** Enjoy a variety of fish for different flavors and health benefits.
3. **Consider alternatives:** If concerned about mercury, explore omega-3 supplements like fish oil or algal oil, but consult a healthcare provider first.

For personalized advice, consult a healthcare professional or registered dietitian.

Omega-3 and Mercury Levels in Fish

Fish (4 oz cooked)	Omega-3 Fats (EPA + DHA) (mg)	Mercury (PPM)
Anchovies	2300-2400	0.016
Bass (Saltwater, Black, Striped, Rockfish)	900	0.167
Catfish	100-250	0.024
Crab (Blue, King, Snow, Queen, Dungeness)	200-550	0.065
Cod (Atlantic, Pacific)	200	0.111
Haddock	200	0.055
Halibut	200	0.241
Lobster (American)	200	0.107
Mackerel (King)	450	0.730
Mackerel (not King)	1350-2100	0.050
Marlin (Blue)	250	0.485
Marlin (Striped)	1030	0.485
Oysters (Pacific)	1550	0.012
Orange Roughy	42	0.571
Pollock (Atlantic, Walleye)	600	0.031
Salmon (Chinook, Coho)	1200-2400	0.022
Salmon (Sockeye)	700-900	0.022
Sardines	1100-1600	0.013
Scallops (Bay, Sea)	200	0.003
Shark	1250	0.979
Shrimp	100	0.009
Snapper	200	0.166
Squid	750	0.024
Swordfish	1000	0.995
Tilapia	150	0.013
Tuna (Bluefin, Albacore)	1700	0.358
Tuna (Light, Canned)	150-300	0.126
Trout (Freshwater)	1000-1100	0.071

Folate Cycle

Step 1: Dietary Intake
The cycle begins with the intake of folic acid and folate from the diet. Folic acid is converted to dihydrofolate (DHF) and then to tetrahydrofolate (THF) by the enzyme dihydrofolate reductase **(DHFR)**.

Step 2: Conversion to 5,10-Methylene-THF
THF is then converted to 5,10-methylene-THF by the enzyme serine hydroxymethyltransferase **(SHMT)** using serine, which is converted to glycine in the process.

Step 3: Conversion to 5-Methyl-THF
The enzyme methylenetetrahydrofolate reductase **(MTHFR)** reduces 5,10-methylene-THF to 5-methyl-THF.

Methionine Cycle

Step 1: Homocysteine Remethylation
5-Methyl-THF donates a methyl group to homocysteine, converting it to methionine in a reaction catalyzed by methionine synthase **(MTR)**, with its cofactor methionine synthase reductase (MTRR).

Step 2: S-Adenosylmethionine (SAM) Formation
Methionine is then converted to S-adenosylmethionine (SAM) by methionine adenosyltransferase **(MAT1A)**. SAM acts as a universal methyl donor in methylation reactions, including DNA and RNA synthesis.

Step 3: Methylation Reactions
SAM donates its methyl group to various substrates through methyl transferases **(MT)**, forming S-adenosylhomocysteine (SAH).

Step 4: SAH to Homocysteine
SAH is hydrolyzed to homocysteine, which can either be remethylated to methionine (as described) or enter the transsulfuration pathway.

Transsulfuration Pathway

Step 1: Conversion to Cystathionine
Homocysteine is converted to cystathionine by cystathionine beta-synthase **(CBS)** using serine.

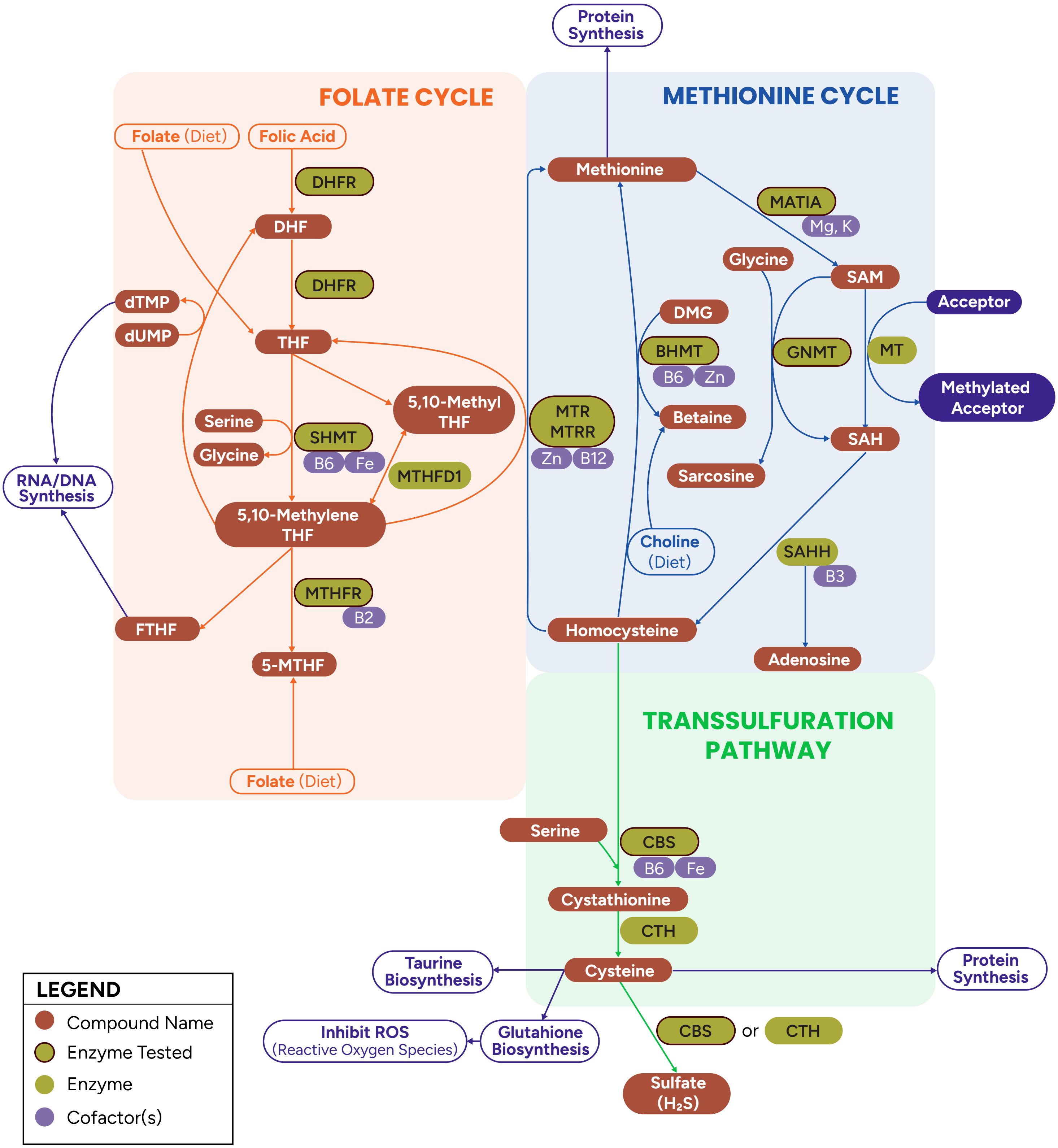
Step 2: Conversion to Cysteine
Cystathionine is further metabolized to cysteine, which can be utilized in protein synthesis, or converted to glutathione and taurine, crucial for cellular antioxidant defense.

Conclusion

The folate and methionine cycles are vital for maintaining cellular function and integrity. These cycles ensure the proper synthesis of nucleic acids and proteins and regulate methylation, influencing gene expression and cellular homoeostasis. The interaction between these pathways and their regulatory enzymes underscores the complexity and precision required for metabolic balance.

The diagram on the next page outlines the key steps in these cycles and the enzymes that facilitate them.

The folate and methionine cycles are interconnected biochemical pathways crucial for numerous cellular functions, including amino acid metabolism, methylation reactions, and the synthesis of nucleotides for RNA and DNA. This diagram outlines the key steps in these cycles and the enzymes that facilitate them.



Scientific Team

Backed by Experts

This methylation test is the result of extensive research and collaboration by a dedicated team of professionals:

- **PharmD (Doctor of Pharmacy):** Our pharmacist brings expertise in medication management, writing the database that holds the analyses for each test result and what dietary and lifestyle elements would help optimize your methylation.
- **MD (Doctor of Medicine):** Our medical doctor ensures that the test is clinically relevant and tailored to your health needs.
- **PhD (Doctor of Philosophy):** Our researchers apply advanced scientific methods to develop and validate the test, ensuring accuracy and reliability.

Why Trust Us?

The development of this test is grounded in rigorous scientific research. Each step, from conception to execution, has been guided by the latest medical knowledge and practices. You can feel confident that the information you receive is not only accurate, but also meaningful for your individual health.

Our goal is to empower you with knowledge about your health. With our clinically backed test, you have the tools to engage in meaningful conversations with your healthcare provider and take charge of your lifelong health journey.

Kelly Chauvin, PharmD Medical Science Liason and Certifying Scientist

Dr. Kelly Chauvin graduated from Samford University with a Doctorate of Pharmacy after obtaining a BS in Biochemistry and Molecular Biology from Penn State University. She has over 10 years of experience at Molecular Testing Labs, educating healthcare providers and promoting the clinical use of precision medicine and gene-guided drug therapy (pharmacogenomics). She authored the Molecular Fitness and Methylation reporting systems and pioneered their database creation. She also plays a critical role in creating and maintaining the pharmacogenomic database and infectious disease antibiotic treatment algorithms. Previously, Dr. Chauvin worked in the pharmaceutical industry after practicing pharmacy in both retail and hospital settings in geographically isolated areas of Wyoming and Oregon.

Dr. Chauvin is a well-known expert in the field of pharmacogenomics with a strong interest in nutrigenomics and genetic effects on athletic performance. She has lectured on Pharmacogenomics and Precision Medicine at Pacific University, School of Pharmacy, and California Northstate University, College of Medicine. She also appeared as the spokesperson for Molecular Fitness on news channels and for professional and collegiate sports teams.

Dr. Chauvin's passion for health and fitness developed as a young athlete and continues to this day. She grew up competing in gymnastics and track before transitioning to snowboarding and mountain bike racing. Once she discovered the transformational benefits of Olympic lifting and metabolic training, she became a CrossFit Level 1 Certified Trainer. She believes knowing one's genetic predispositions can be a strong motivator in developing and maintaining healthier habits.

Scientific Team

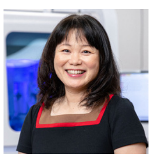
Charles Sailey, MD, MS, FCAP, FASCP Chief Scientific Officer and Medical Director of Laboratories

Dr. Charles Sailey obtained dual graduate degrees in Cell Biology and Biotechnology before earning a medical degree from Ross University School of Medicine. He completed residency training in Anatomic & Clinical Pathology at the University of Maryland, followed by fellowship training in Molecular Genetic Pathology at the University of North Carolina. He is a board-certified clinical and molecular genetic pathologist, and holds medical licenses in several states as well as a certificate of qualification for testing from the state of New York. As medical and scientific director of the Molecular Genetic Pathology, Molecular Microbiology, Metabolic Genetics, and Clinical Chemistry laboratories at Arkansas Children's Hospital, he planned, designed, and coordinated the construction of a human genetics laboratory in 2011.

At Molecular Testing Labs, Dr. Sailey is responsible for monitoring all scientific and technical processes. He is also the primary investigator for several ongoing research projects, including analysis of various collection methods for community and individual-based testing of sexually transmitted infections and several FDA 510(k) submissions.

Dr. Sailey has over 60 peer-reviewed publications, book chapters, and presentations at both national and international conferences, and has served as a professor at several universities. He has held the title of College of American Pathologists Delegate Chair for the state of Oregon for three years and performed over 20 laboratory audits.

Mariko Nakano, PhD Advanced Research Principal Investigator



Dr. Mariko Nakano holds a PhD in Medicinal Chemistry from the University of Washington, a leader in pharmacogenetics and pharmacogenomics. With her strong foundation in molecular biology, protein chemistry, analytical chemistry, drug metabolism, and clinical diagnostic sciences, she specializes in developing diagnostic assays and innovative medical devices.

At Molecular Testing Labs, Dr. Nakano's work is driven by a passion for empowering individuals to take proactive control of their health, advancing wellness through user-initiated health solutions. Her expertise is reflected in her ongoing work in precision diagnostics, including her contributions to this methylation testing and report for user-initiated wellness control.

Dr. Nakano has authored dozens of peer-reviewed articles and holds several pending patents. She is dedicated to advancing the science of personalized health, utilizing genetic profiling to improve health and enable better decision-making in the rapidly evolving field of precision medicine.

Sara Botto, PhD, MS Medical Device Development Scientist

Dr. Sara Botto obtained her master's degree in Biomedical Sciences in 2009 from Turin, Italy, where she worked at the Clinical Virology Laboratory at Ospedale San Giovanni Battista to develop and validate PCR-based assays for the early detection of viral infections in transplant recipients. She earned her PhD in Molecular Microbiology and Immunology from Oregon Health and Science University in 2016, focusing on viral and host gene regulation. Her postdoctoral research further honed her expertise in vaccine development and the innate immune response to viral infections.

Following her post-doc, Dr. Botto worked as a senior scientist for a Clinical Research Organization, where she developed and validated PCR-based assays for clinical trials involving CAR-T therapies and other cell and gene therapies targeting cancer and rare diseases. Among her contributions, she developed molecular assays to detect genetic variations, including SNP genotyping PCR and Sanger Sequencing.

Dr. Botto has authored over 20 peer-reviewed publications, book chapters, and presentations, and has shared her research at national and international conferences.

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Disclaimer

These tests were developed, and their performance characteristics were determined, by Molecular Testing Labs (MTL). These tests have not been cleared or approved by the U.S. Food and Drug Administration as they are validated as Laboratory Developed Tests. MTL is regulated and qualified under the Clinical Laboratory Improvement Amendments (CLIA) of 1988 to perform high-complexity testing. Pursuant to the requirements of CLIA, MTL has established and verified these tests' accuracy and precision. Validation documents may be provided following disclosure requests and upon execution of a non-disclosure agreement.

Empowering
Lives on a
Molecular Level.™