myDNA Comprehensive Health Report

myDNA | NutriPATH

Welcome to the future of health and human potential

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TEST METHODOLOGY AND LIMITATIONS

Recommendations in this report apply to all ages, however for any patient under 18 years, a guardian must purchase the test and be present for the report recommendations. The information in this report is not intended to treat, diagnose or cure any medical condition or disease.

Gene By Gene, a wholly owned subsidiary of myDNA, Inc., is a College of American Pathologists (CAP) accredited and Clinical Laboratory Improvement Amendments (CLIA) certified clinical laboratory qualified to perform high-complexity testing. This test was developed and its performance characteristics determined by Gene by Gene. It has not been cleared or approved by the FDA. FDA does not require this test to go through premarket FDA review. This test is used for clinical purposes. It should not be regarded as investigational or for research. Only the genomic regions listed below were tested; there is a possibility that the tested individual is a carrier for additional, undetected mutations. Although molecular tests are highly accurate, rare diagnostic errors may occur that interfere with analysis. Sources of these errors include sample mix-up, trace contamination, and other technical errors. The presence of additional variants nearby may interfere with mutation detection. Genetic counseling is recommended to properly review and explain these results to the tested individual.

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NUTRIENT METABOLISM & DIGESTION

APOE Status: 3/3

You are a Farmer

ApoE-e4 | ApoE-e3 | ApoE-e2

Apolipoprotein E (ApoE) is a lipid-binding protein that transports triglycerides and cholesterol in multiple tissues, including the brain. The e4 allele is common in hunter-gatherer communities, while the e3 and e2 alleles are most common in agricultural communities.

- ApoE 3/3 is the most common ApoE genotype found in agricultural communities and has numerous benefits
- Extended cognitive fitness and enhanced expression of anti-aging sirtuins
- Improved HDL and LDL profile
- Improved ability to repair synapses and neural protection
- Higher viral protection
- Higher response to plant bioactive compounds
- In the brain, e2 and e3 accumulate in neurons 2 to 4-fold higher than e4

Protein Requirements

Protein: AVERAGE | INCREASED | HIGH

Traditional protein intake ranges based on latitude from less than 18% of total calories to approximately 35% in the far northern climates. Recommended protein intake varies based on weight and exercise intensity.

- Genetically, your requirements fall on the average side of the spectrum, approximately 18-20% of total caloric intake

Carbohydrate Requirements

Carbohydrates: VERY LOW | LOW | NORMAL

Your carbohydrate intake range is based on the latitude of your ancestors and whether a hunter-gatherer diet or modern agricultural diet made a larger imprint on your genes.

- Your genotype combination is associated with a slightly lower recommended carbohydrate intake, ranging from 30% to 40% of total calories from carbohydrates
- For a 2,000 calorie diet, this comes to 150-200 grams of carbohydrates per day

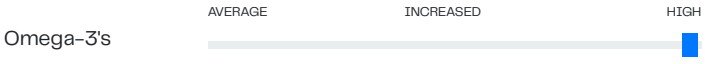
Carbohydrate Requirements

Refined Carbohydrates: LESS RISK | SLIGHT RISK | HIGH RISK

The differences between responses in individuals to refined carbohydrates have been linked to a genetic adaptation occurring during the agricultural age.

- Your genotype will benefit from limiting refined carbohydrates and choosing fiber-rich carbohydrate sources
- Refined carbohydrate sources include cookies, crackers, chips, tortillas, white bread, refined sugar, and high-sugar juices
- Choosing low glycemic foods is recommended

Fat Requirements



The NIH has set the recommended intake of omega-3's from 1.1 to 1.6 grams per day from a combination of ALA, EPA and DHA. Omega-3 fatty acids are essential for brain, eye, and cardiovascular health.

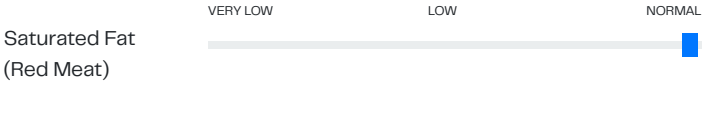
- Your genotype combinations are associated with a higher requirement of EPA and DHA
- ApoE e2 and e3 carriers can benefit from non-phospholipid fish oil intake, however, e4 carriers should use phospholipid-based EPA and DHA as found in fish and fish roe
- For ApoE e4 carriers, fish oil supplements do not appear as effective as phospholipid-based EPA and DHA as found in fish and fish roe
- E4 carriers may have impaired transport of free DHA and require phospholipids for successful transport

Fat Requirements

Traditional total fat intake ranges based on latitude, with as low at 25% consumed in countries closer to the equator, and up to 55% of total calories from fat being consumed in northern latitudes.

- Genetic testing can show which fats to focus on, but total fat will range based on your climate and health goals
- Your genotypes are associated with an average requirement for monounsaturated and polyunsaturated fats from olive oil, avocados, poultry, nuts and seeds

Fat Requirements



The 2020 Dietary Guidelines in the U.S. recommends limiting calories from saturated fats to less than 10% of the total calories you eat and drink each day. That's about 200 calories for a 2,000 calorie diet. Traditionally, saturated fat intake from animal foods ranged based on the season and the geographical location, with higher latitudes and more mountainous regions consuming more.

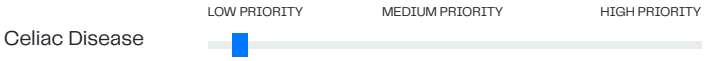
- Your genotype combinations are associated with improved metabolism of saturated fat from red meat

Fat Requirements

The 2020 Dietary Guidelines in the U.S. recommends limiting calories from saturated fats to less than 10% of the total calories you eat and drink each day. That's 200 calories for a 2,000 calorie diet.

- Your genotype combinations are associated with benefiting from getting less than 22 grams of saturated fat in your diet, especially from dairy

Celiac Disease



Celiac disease is an immune reaction to eating gluten, a protein found in wheat, barley and rye. Published research shows that approximately 30 percent of the general population have variants in the celiac disease risk genes HLA-DQA1 through HLA-DQB, yet only 3% of these individuals develop celiac disease.

- Your genotype combination is associated with a low genetic risk for celiac disease
- On a global level, the rates of celiac disease are not related either to the amount of wheat consumed by each country or to the prevalence of the HLA DR3-DQ2 and DR4-DQ8 genotypes worldwide
- First-degree relatives of people with celiac disease including parents, siblings and children have a 1 in 10 risk compared to 1 in 100 in the general population, which may be increased by existing autoimmune disorders

Micronutrient Requirements

B1 (Thiamine)

The recommended daily allowance (RDA) for thiamine is 1.2mg. Thiamine requirements are analyzed based on ethanol metabolism, however, chronic intake of alcohol depletes thiamine.

- Your genotype is associated with an average need for B1

Micronutrient Requirements

B2 (Riboflavin)

The recommended daily allowance (RDA) for riboflavin is 1.3mg. Riboflavin is used as a co-factor for numerous reactions associated with protein, fat, and carbohydrate metabolism. Riboflavin requirements are analyzed based on MTHFR gene function.

- Your genotype is associated with a higher than average need for B2
- B2 is high in liver (2.8mg), lamb (0.4mg), salmon (0.8mg), yogurt (0.6mg) and oyster mushrooms (0.3mg)

Micronutrient Requirements

B3 (Niacin)

The recommended daily allowance (RDA) for niacin is 16mg. Niacin targets genes associated with cardiovascular and skin health, while also balancing methylation levels.

- Your genotype is associated with a higher sensitivity to low niacin intake
- Niacin in high in yellowfin tuna (37.5mg), canned tuna (21.9mg), wild salmon (17mg), ground turkey (20mg), chicken breast (16mg), liver (14.2mg), skirt steak (9.5mg), white button mushrooms (6.8mg), and brown rice (5.2mg)

Micronutrient Requirements

B6 (Pyridoxine)

The recommended daily allowance (RDA) for B6 is 1.7mg. B6 deficiency can manifest as anorexia, irritability, anxiety, depression, muscle pain, bad PMS/low progesterone, nausea, seizures, migraines, dermatitis, age related macular degeneration (with low folate and B12) and lethargy.

- Your genotype is associated with a higher than average need for B6
- Women of reproductive age, especially current and former users of oral contraceptives, teenagers, male smokers, non-Hispanic African-American men, and men and women over age 65 are most at risk of B6 deficiency
- B6 is high in yellowfin tuna (6 oz., 1.8mg), wild salmon (6 oz., 1.2mg), liver (3oz., 0.8mg), chicken breast (6 oz., 1mg), unfiltered fermented drinks (16oz., 0.8mg), pistachios (1 oz., 0.5mg), avocado (1 whole, 0.5mg), sweet potatoes (1 whole, 0.3mg), and spinach (1/2 cup, 0.1mg)

Micronutrient Requirements

B9 (Folate)

The recommended daily allowance (RDA) for folate is 400mcg. Folate is one of the – if not most – influential nutrigenomic micronutrient. It has a powerful influence on genes related to pregnancy, homocysteine, and cancer prevention.

- Your genotype is associated with a higher than average need for folate
- Folate is depleted by proton pump inhibitors, oral contraceptives, NSAIDs, anticonvulsants, antivirals, antibiotics, and antacids
- Folate is high in liver (3 oz., 215mcg), collard greens (1 cup cooked, 177mcg), beets (1 cup raw, 148mcg), black-eyed peas (1/2 cup, 105mcg), raw spinach (1 cup 58mcg), asparagus (4 spears, 89mcg), hummus (1/2 cup, 83mcg), broccoli (1/2 cup cooked, 52mcg), romaine lettuce (1 cup, 64mcg), strawberries (1 cup, 40mcg), orange (1 whole, 39mcg), sprouted lentils (1/2 cup, 38mcg), and parsley (1 sprig, 15.2mcg)

Micronutrient Requirements

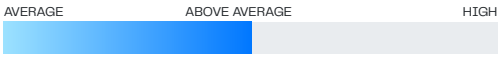
B12 (Cobalamin)

The recommended daily allowance (RDA) for B12 is 2.4mcg. B12 influences genes related to homocysteine, brain health, pregnancy, and energy. B12 requirements are based on serum levels associated with the FUT2 gene.

- Your genotype is associated with an average requirement for B12

Micronutrient Requirements

Boron

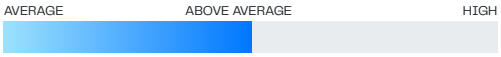


The recommended daily allowance (RDA) for boron has not been set, but 1–3mg is considered adequate. Boron is connected to bone health, hormone health and healthy SAMe levels for brain health. Men with low testosterone and women with osteoporosis or osteopenia will benefit from more boron.

- Your genotype is associated with a higher sensitivity to low boron intake
- Boron is highest in prunes (10 prunes, 1.18mg) avocados (1/2 cup, 1.07mg), raisins (1.5 oz, 0.95mg), peach (1 whole, .80mg), apple (1 whole, .66mg), pear (1 whole .50mg), and peanut butter (2 tablespoons, 0.46mg)

Micronutrient Requirements

Choline & Betaine



The recommended daily allowance (RDA) for choline is 550mg, while betaine hasn't been set. The more betaine you consume, the less choline you require. Choline is crucial for pregnancy, lowers anxiety, prevents fatty liver, assists detoxification, and improves memory.

- Your genotype is associated with a higher than average need for choline and betaine
- Choline is depleted by nighttime pain relievers, antihistamines, sleep aids, antidepressants, incontinence drugs and narcotic pain relievers
- Intense endurance exercise depletes choline levels, and increasing phosphatidylcholine has been found to improve exercise capacity during high-intensity cycling and running, as well as reduce muscle soreness
- Choline is highest in liver (3 oz., 356mg), pastured eggs (2 eggs, 294mg), beef round (6 oz., 234mg), heart (3 oz., 194mg), chicken (6 oz., 144mg), wild cod (6 oz., 142mg), bacon (3.5 oz., 125mg), and edamame (1/2 cup, 107mg)
- Betaine is highest in spinach (3.5 oz., 645mg), shrimp (3.5 oz., 218mg), beets (3.5 oz., 200mg) and whole grain sourdough wheat bread (2 slices, 201mg)

Micronutrient Requirements

Vitamin A

The recommended daily allowance (RDA) for vitamin A is 900 mcg for men and 700 mcg per day for women. Vitamin A assists digestive lining repair, oral health, eye health, iron mobilization, mitochondria health, skin health, healthy lung function, and increased immunity.

- Your genotype is associated with a 69% lower conversion rate of beta-carotene to vitamin A, making it important to include more animal-based vitamin A to hit your daily target
- Vitamin A is high in liver (3 oz., 6,600mcg), pastured eggs (1 egg, 75mcg), cod liver oil (378mcg), wild salmon oil (206mcg), pickled herring (219mcg) and sockeye salmon (118mcg)

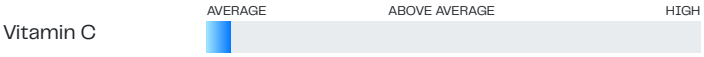
Micronutrient Requirements

Vitamin D

The recommended daily allowance (RDA) for vitamin D is 20mcg. Vitamin D has a wide role in immune function, bone health, cardiovasular health and cancer prevention.

- Your genotype is associated with below average circulating levels of vitamin D
- Vitamin D is depleted by obesity, pesticides, a high fructose intake, anticonvulsants, barbiturates, benzodiazepines, calcium channel blockers, corticosteroids, antidepressants, and bronchodilators
- Vitamin D is highest in sockeye salmon (6 oz., 28.4mcg), cod liver oil (1 tsp., 11mcg), canned tuna (1 can, 6.7mcg), wild herring (3 oz., 5.4mcg), sardines (1 can, 4mcg)

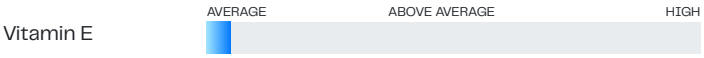
Micronutrient Requirements



The recommended daily allowance (RDA) for vitamin C is 90mg, however, the amount consumed in the Paleolithic era was 400mg per day. Studies show the best results occur with over 500mg per day. Extensive research shows that adequate vitamin C reduces the risk of cancer, heart disease, colds, flu, cataracts, hypertension and even depression.

- Your genotype is associated with average serum vitamin C levels

Micronutrient Requirements



The recommended daily allowance (RDA) for vitamin E is 15mg. Vitamin E is important for antioxidant protection, skin health, fertility, brain health, and cardiovascular health.

- Your genotype is associated with an average need for vitamin E

Micronutrient Requirements

The recommended daily allowance (RDA) for vitamin K2 has not been established, but based on amounts found in food and research, 60–70mcg of MK-4 and MK-7 is a good target. MK-4 targets sex hormones, the brain, possesses anti-cancer and anti-inflammatory activity, and also supports bone health. MK-7 is considered better for reducing arterial calcification, increasing bone density, anti-cancer, improving salivary buffering (minimizes the de-mineralization of enamel and enhances its re-mineralization), and increasing cardiac output (12% increase) in athletes.

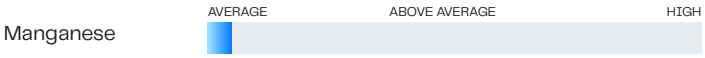
- Your genotype is associated with a higher sensitivity to low vitamin K2 intake
- Vitamin K2 is highest in natto (3.5oz., 108mcg MK-7), Münster cheese (1.7 oz., 50mcg of MK-4 and MK-7), Camembert cheese (1.7 oz., 34mcg of MK-4 and MK-7), dark chicken meat (6 oz., 90mcg MK-4), and pork chops (6 oz. 112mcg MK-4)

Micronutrient Requirements

The recommended daily allowance (RDA) for magnesium is 400mg, however, higher amounts may be required for certain individuals, stress levels and athletes. Magnesium levels vary drastically based on the soil, and therefore in the food. Magnesium is involved in 300 biochemical reactions, and deficiency has widespread effects on every aspect of health. The most common symptoms of low magnesium includes calf cramps at night, headaches, arrhythmia, calcification, and muscle fatigue.

- Your genotype is associated with a higher than average need for magnesium
- Magnesium is depleted by smoking, sugar, chronic stress, high alcohol intake, coffee, tea, fluoridated water, phosphoric acid, non-fermented grains, intense exercise, high protein diets, high calcium supplementation, high arsenic levels, antacids, proton pump inhibitors, ACE inhibitors, birth control, hormone replacement therapy, Estradiol, Premarin, antibiotics, antivirals, immunosuppressants, methylphenidate, Tamoxifen and corticosteroids
- Magnesium is highest in sprouted pumpkin seeds (2 tablespoons, 156mg), hemp seeds (2 tablespoons, 116mg) chia seeds (2 tablespoons, 111mg), Gerolsteiner mineral water (1 liter, 100mg), spinach (1/2 cup cooked, 78mg), wild salmon (6oz., 52mg), and peanut butter (2 tablespoons, 49mg)

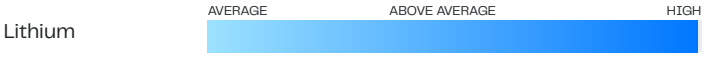
Micronutrient Requirements



The recommended daily allowance (RDA) for manganese has not been set, however, 1.8 to 2.3mg per day is considered adequate. Manganese has a special role in protecting the mitocondria of the cells against toxicity through superoxide dismutase. Manganese is crucial for heart health, blood sugar, male fertility, bone health and protecting the brain against glutamate toxicity.

- Your genotype is associated with an average need for manganese

Micronutrient Requirements

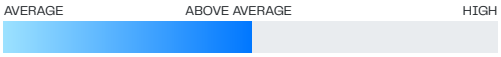


The recommended daily allowance (RDA) for lithium has not been set, with normal intake ranging from 250mcg to 3mg. Studies found an association between higher levels of lithium in local water and "beneficial clinical, behavioral, legal and medical outcomes." In the context of your genetic analysis, we are looking at lithium requirements in regards to B12 transportation.

- Your genotype is associated with a higher than average need for lithium if your B12 levels are high
- Lithium levels in food and water range dramatically around the world
- Concentrations reaching approximately 200 mcg/L have been found in drinking water in selected regions of the USA (Texas), Greece, Japan, England, and Italy
- The mean concentration of lithium in European bottled waters, however, was estimated at 0.94 mcg/L
- In Germany, mineral waters were reported to contain 1.5–1,320 mcg/L of lithium

Micronutrient Requirements

Potassium



The recommended daily allowance (RDA) for potassium is 3,400mg for males and 2,600mg for females. Potassium is an electrolyte that helps maintain normal levels of fluid inside our cells, muscle contraction, and regulates blood pressure. The Paleolithic hunter-gatherers took in about 11,000 milligrams of potassium a day from fruits, vegetables, leaves, flowers, roots, and other plant sources, and under 700 mg of sodium.

- Your genotype is associated with a higher than average requirement for potassium to regulate blood pressure
- Potassium is highest in wild salmon (6 oz., 1,068mg), avocados (1 whole, 975mg), potatoes (1 whole, 926mg), acorn squash (1 cup, 896mg), coconut water (1 cup, 600mg), sweet potato (1 whole, 541mg), spinach (1 cup, 540mg), tomato sauce (1 cup, 523mg) and bananas (1 whole, 422mg)

Micronutrient Requirements

Iron

The Recommended Dietary Allowance (RDA) for all age groups of men and postmenopausal women is 8 mg/day and the RDA for premenopausal women is 18 mg/day.

- Your genotype combinations are associated with with lower serum iron levels and a moderate need for dietary iron intake
- Animal-based foods and seafood contains heme iron, while plant foods contain non-heme iron
- Heme iron has a higher absorption rate compared to non-heme iron
- Iron is highest in oysters (3oz, 8mg), beef liver (3 oz., 5mg) beef 6 oz., 4mg), sardines (3 oz., 2mg) white beans (1 cup, 8mg) dark chocolate (3 oz., 7mg), spinach (1/2 cup cooked, 3mg)

Micronutrient Requirements

Selenium

The recommended daily allowance (RDA) for selenium is 55mcg. Selenium levels in plant and animal foods vary drastically based on the soil. Selenium is a crucial mineral linked to numerous genes involved in glutathione (the master antioxidant), detoxification, immunity, thyroid health, skin health, and cancer prevention.

- Your genotype is associated with an average need for selenium

Micronutrient Requirements

Zinc

The recommended daily allowance (RDA) for zinc is 11mg. Zinc is poorly absorbed from plant foods and is highest in animal foods. Zinc plays a special role with numerous genes connected to immunity, cancer prevention, detoxification, skin health, eye health and more.

- Your genotype is associated with lower serum zinc levels
- Zinc is depleted by ACE inhibitors, antibiotics, diuretics, hormone replacement therapy, MAO inhibitors, oral contraceptives, proton pump inhibitors
- Zinc is highest in oysters (3 oz., 74 mg), crab (6 oz., 13 mg), lobster (6 oz., 6.8 mg), ground beef (6 oz., 10.6mg), ground lamb (6 oz. 8.8mg), pork loin (6 oz. 5.8mg), liver (4.2mg) and sprouted pumpkin seeds (1 oz., 2.2mg)

Micronutrient Requirements

Copper

Typical diets meet or exceed the copper RDA and copper deficiency is rare. The RDA for copper is 900mcg. Copper is involved in the regulation of gene expression, brain development, neurotransmitters, cardiovascular health, and immune system functioning.

- Your genotype is associated with low serum levels of copper
- Copper is highest in liver (3 oz. 12,400mcg), oysters (4,850mcg), potatoes (675mcg), shiitake mushrooms (1/2 cup, 650mcg), cashew (1 oz., 629mcg), sunflower seeds (1/4 cup, 615mcg) and dark chocolate (1 oz., 615mcg)

Fiber Requirements

Prebiotic Fiber

The recommended amount of fiber is up to 25 grams per day for women and up to 38 grams per day for men.

- Your genotypes are associated with a slighter higher than average requirement for prebiotic fiber

Phytonutrient Requirements

Phytoestrogens

Phytoestrogens are plant derived compounds found in a wide variety of foods. There are pros and cons to phytoestrogen intake that appears to have a genetic, age, and gut health connection for determining optimal intake.

- Your genotype combinations are associated with a higher than average need for phytoestrogens for healthy hormones
- Phytoestrogens are highest in soy, flax, beans, rye, wheat, hummus, peanuts, tahini sauce, and cruciferous vegetables

Phytonutrient Requirements

Lutein and Zeaxanthin

A recommended daily intake of lutein and zeaxanthin hasn't been established. Lutein and zeaxanthin can help protect your eyes from harmful high-energy light waves like UV sunlight.

- Your genotype is associated with an increased need for foods high in lutein and zeaxanthin to support eye health
- Around 700 carotenoids have been discovered and only lutein and zeaxanthin are found in the eye
- American adults typically consume 1–3 mg/day of lutein and zeaxanthin, the Spanish consume 3.5 mg/day, the Germans consume 5.33 mg/day, and older Australians consume 0.9mg per day
- For reducing the risk of eye disorders, the estimated target is 6mg or more of lutein and zeaxanthin daily
- The foods highest in lutein and zeaxanthin include cooked spinach (1/2 cup, 12.64 mg lutein), raw spinach (1/2 cup, 6.6mg lutein), cooked kale (1/2 cup, 8.88mg lutein), egg yolks (1 egg, 237mcg lutein and 216mcg zeaxanthin), and orange peppers (208mcg lutein and 1665mcg zeaxanthin)

Phytonutrient Requirements

Polyphenols

Research strongly suggests that long term consumption of diets rich in plant polyphenols offer protection against development of cancers, cardiovascular diseases, diabetes, osteoporosis and neurodegenerative diseases.

- Your genotype is associated with a slower metabolism of certain polyphenols, which means you have a higher benefit with a lower intake of green tea, coffee, berries, and chocolate

Phytonutrient Requirements

Cinnamon

Cinnamon lowers blood glucose usually without causing hypoglycemia and increases satiety.

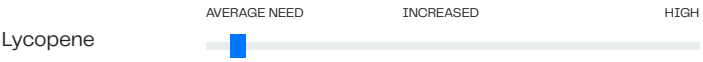
- Your genotype is associated with a higher need for cinnamon to control blood sugar and satiety

Phytonutrient Requirements

Isothiocyanates from cruciferous vegetables are known for their anti-cancer activity. Certain genotypes require higher levels of this anti-cancer activity.

- Your genotype combinations are associated with a higher requirement of cruciferous vegetables
- Cruciferous vegetables include broccoli, Brussels sprouts, cabbage, cauliflower, radishes, turnips, Bok choy, and watercress
- Aim for 1–2 cups of cruciferous vegetables per day

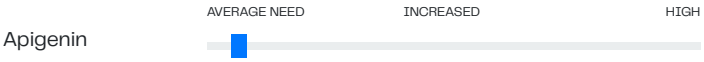
Phytonutrient Requirements



Lycopene is found in tomatoes, watermelon, guava and pink grapefruit, and has unique benefits for the heart, breast, prostate and skin.

- Your genotype combinations are associated with a lower to average requirement for lycopene

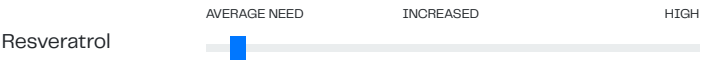
Phytonutrient Requirements



Apigenin is a flavonoid that possess anti-inflammatory, antioxidant and anti-cancer properties. Certain genotypes require higher levels for breast health.

- Your genotype is associated with an average need for apigenin for breast health

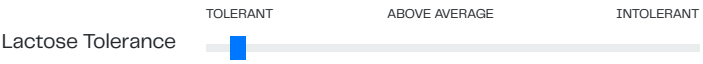
Phytonutrient Requirements



Resveratrol is a plant chemical produced in response to stress from the elements, and has been found to protect against heart disease and potentially extend life.

- Your genotype combinations are associated with an average requirement for resveratrol and heart health

Lactose Tolerance



Lactose is the major carbohydrate in milk. The arrival of farming in Europe around 8,500 years ago necessitated adaptation to new environments, pathogens, diets, and social organizations. One of the best examples of genetic dietary changes to this is the lactase enzyme in northern Europeans that only dates to the last 4,000 years.

- Your LCT genotype is associated with lactose tolerance
- The ability to digest lactose is much more common in people of European ancestry
- Approximately 32 percent of the world's population is lactose tolerant
- Since this gene only looks at lactose, sensitivities to dairy can still exist

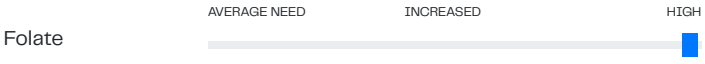
Caffeine Metabolism

Variants in the CYP1A2 gene determine the rate at which you metabolize caffeine.

- You are a slow metabolizer of caffeine
- Slow metabolizers have a slower metabolism of caffeine, meaning it takes longer to break down caffeine and can be more harmful for cardiovascular health in higher doses
- Slow metabolizers have also been found to have elevated fasting blood sugar from caffeine consumption
- Females who are slow metabolizers that take oral contraceptives are especially sensitive to the negative effects of caffeine
- Exercise and cruciferous vegetable consumption helps increase caffeine metabolism

METHYLATION

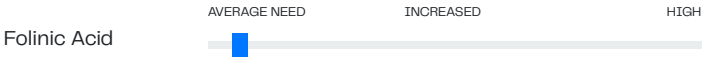
Methylation



MTHFR 677 and MTHFR 1298 genotypes determine your folate requirements to assist normal homocysteine levels.

- Your genotype combination is associated with a higher than average requirement for folate to maintain healthy homocysteine levels
- If your homocysteine is elevated, check that you are getting enough folate
- High homocysteine has been implicated in amyloid buildup, DNA damage and cancer, mitochondrial dysfunction, cardiovascular disease, age-related macular degeneration, apoptosis of neurons and depression

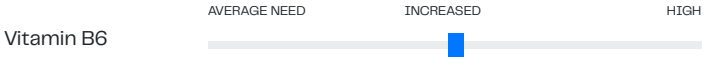
Methylation



Folinic acid is a second type of folate found in folate-rich food.

- You have an average requirement for folinic acid to maintain healthy methylation and homocysteine levels

Methylation



Vitamin B6 plays an important role in homocysteine metabolism and CBS gene function.

- A combination of your genotypes related to vitamin B6 serum levels and methylation requirements are associated with a higher than average requirement for B6 to maintain healthy methylation and homocysteine levels
- B6 is highest in wild salmon, wild cod, pistachios, avocados, Yukon gold or red potatoes, taro root, sweet potatoes, spinach, cauliflower and unfiltered fermented drinks
- Many medications deplete B6 including antibiotics, oral contraceptives, ACE inhibitors, antacids, and proton pump inhibitors

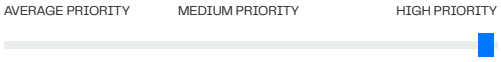
Methylation

Vitamin B12 plays an important role in homocysteine metabolism.

- You have an average requirement for B12 to maintain healthy methylation and homocysteine levels

Methylation

Riboflavin (B2)



Vitamin B2 plays a special role in stabilizing the MTHFR gene for homocysteine metabolism.

- Your genotype is associated with a higher than average requirement for riboflavin to maintain healthy methylation and homocysteine levels
- B2 is highest in liver, lamb, fish, yogurt and mushrooms

Methylation

Choline and Betaine

Choline and betaine play a crucial role in homocysteine metabolism, especially for those with variants in MTHFR.

- Your genotype is associated with a higher than average requirement for choline and betaine to maintain healthy methylation and homocysteine levels
- Low choline intake can manifest as memory issues, NAFLD, anxiety, neurological disorders, breast cancer, histamine issues, gallbladder issues, and SIBO
- Choline may be depleted by nighttime pain relievers, antihistamines, sleep aids, antidepressants, incontinence drugs and narcotic pain relievers
- Intense endurance exercise depletes choline levels, and increasing phosphatidylcholine has been found to improve exercise capacity during high-intensity cycling and running, as well as reduce muscle soreness

Methylation

Synthetic Folic Acid

Certain genotypes in the folate metabolism pathway can affect the metabolism of synthetic folic acid, leading to high circulating levels.

- Your genotype combinations may decrease the metabolism of synthetic folic acid, which can increase circulating levels and affect overall folate metabolism
- When possible, avoid foods and drinks fortified with folic acid, and supplements that use folic acid
- Supplements that use methylfolate or folinic acid are better options

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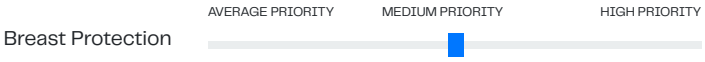
HORMONE SUPPORT

Hormone Support

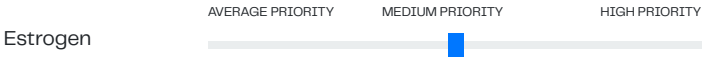


Breast Protection

Certain glutathione SNPs are associated with breast protection.

- Your genotypes for multiple genes are associated with slightly lower glutathione protection for breast health
- Boosting glutathione can be accomplished with selenium, glycine, cysteine, vitamin C, and cruciferous vegetables

Hormone Support

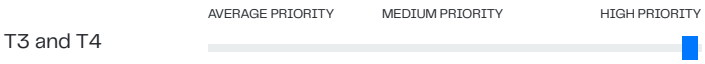


Estrogen Detoxification

There are multiple genes in the estrogen detoxification pathway that have a cumulative value on the ability to properly detoxify estrogen.

- Your combination of numerous genotypes in the estrogen pathway are associated with reduced estrogen detoxification
- To reduce the risk of harmful estrogen metabolites, you should avoid xenoestrogens, manage stress levels, and focus on gut health
- Increasing prebiotic fiber, polyphenols, magnesium and bifidobacteria may improve breast health by reducing the amount and activity of harmful estrogen metabolites

Hormone Support

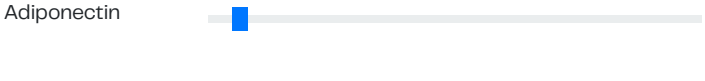


T3 and T4

T3 and T4 level variations have been associated with variants in the DIO1 gene.

- Your genotype is associated with low T3 and high T4 levels due to being more susceptible to chlorine-based chemicals blocking the DIO1 enzyme from converting T4 to T3
- T3 and T4 levels can still be in range based on other epigenetic factors
- Avoid organochlorines from non-organic meat, dairy, fruits and vegetables, and PCBs from seafood in polluted areas

Hormone Support



Adiponectin

ADIPOQ encodes for adiponectin, a protein secreted by fat cells that affect insulin and glucose metabolism. Low levels of adiponectin play a role in obesity, insulin resistance and Type 2 diabetes.

- Your genotype is associated with normal adiponectin levels, which can increase the effect of insulin, improve glucose metabolism and assist a healthy body weight

Hormone Support

Ghrelin

Variants in genes related to ghrelin levels and dopamine receptor density have been shown to create a larger appetite and the potential for overeating in multiple populations.

- Your genotypes are associated with borderline higher ghrelin levels that could lead to overeating and abdominal weight gain
- A focus should be on a protein and fiber-rich breakfast, monounsaturated and polyunsaturated fats, 7-8 hours of sleep per night, healthy vitamin D levels and aerobic exercise over 1 hour or high intensity exercise to stabilize ghrelin levels

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MENTAL HEALTH & COGNITIVE PERFORMANCE

Mental Health and Cognitive Performance

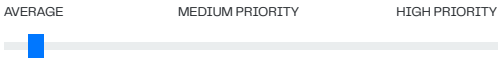
Brain Repair and Maintenance

Multiple genes are responsible for daily neural repair and maintenance, and a combination of genotypes are associated with decreased neural repair.

- Your genotype combination is associated with average to improved neural repair
- You can be proactive for neural repair with eight hours of sleep per night, DHA, B-vitamins, Lion's Mane mushrooms, zinc, vitamin C, and vitamin E

Mental Health and Cognitive Performance

Concussion Recovery

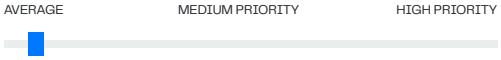


A combination of genotypes in the pathways responsible for glutamate transport and modulation, BDNF levels, neural repair, and inflammation during a concussion are associated with delayed or improved recovery.

- Your genotype combination is associated with improved recovery from concussions

Mental Health and Cognitive Performance

Episodic Memory

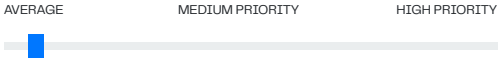


The 5-HT2A gene is associated with episodic memory, which is the ability to recall details of an event.

- Your 5-HT2A genotype is associated with an improved episodic memory

Mental Health and Cognitive Performance

Cardio, Mood and Cognitive Fitness



Cardiovascular exercise has a tremendous influence on neurotransmitter balance, memory and cognitive fitness.

- You have an average requirement for cardiovascular exercise to improve mood and cognitive fitness

Mental Health and Cognitive Performance

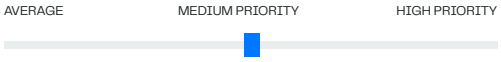
Mood (Folate)

MTHFR genotypes determine folate requirements for healthy BH4 levels responsible for neurotransmitter balance. The current daily value for folate is 400mcg DFE.

- Your genotype may require 400-600mcg (or more) for healthy BH4 levels responsible for neurotransmitter balance
- Foods high in folate include:
- Liver (215mcg) 3 oz.
- Spinach (131mcg) 1/2 cup cooked
- Asparagus (89mcg) 4 spears
- Brussels sprouts (78mcg) 1/2 cup
- Broccoli (52mcg) 1/2 cup

Mental Health and Cognitive Performance

Anxiety (Choline)

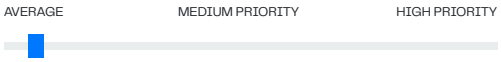


The PEMT gene is associated with your required choline intake to support memory, anxiety and REM sleep.

- Your PEMT genotype is associated with a higher need for choline (550mg or more) to support memory, anxiety and REM sleep
- Research has shown that uridine, DHA, and choline combined increases levels of phosphatidylcholine in the brain more than each on their own
- Foods high in choline include:
- Liver (356mg) for 3 oz.
- Egg (294mg) for 2 eggs
- Beef top round (234mg) for 6 oz.
- Chicken breast (144mg) for 6 oz.
- Chicken thigh (120mg) for 6 oz.
- Edamame (107mg) for 1/2 cup

Mental Health and Cognitive Performance

Anxiety (Glutamate and GABA)

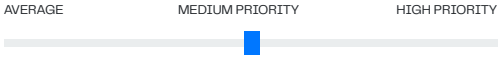


Anxiety is linked to altered levels of one or multiple neurotransmitters. Understanding the genetic link to specific levels of neurotransmitters can help you be precise in your approach to reduce anxiety.

- Your genotype combination is associated with an improved modulation of glutamate levels that could help prevent glutamate-related anxiety

Mental Health and Cognitive Performance

Fear Response

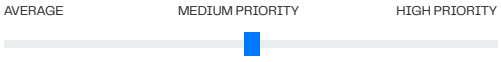


The FAAH gene is associated with anandamide levels, correlated with a heightened fear response to potential threats, while BDNF variants affect the ability to extinguish the fear response.

- Your genotype combination is associated with a heightened fear response that may affect your ability to extinguish fear memories
- Getting 30 minutes or more of aerobic exercise per day (especially in altitude), CBD, and hops help increase anandamide – known as the "bliss molecule" – to reduce the fear response

Mental Health and Cognitive Performance

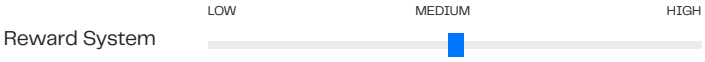
Addiction



ANKK1 modulates the density of dopamine receptors in the brain and is the most-studied genetic variant related to addictions. Variants have been associated with alcoholism, opioid addiction, sugar addictions, compulsive eating, obesity and Internet addiction.

- Your genotype is associated with a lower density of dopamine receptors for the ANKK1 gene, reducing dopamine targets within the striatum of the brain
- Lower dopamine targets could lead to a higher likelihood of addictive behaviors
- Getting 8 hours of sleep per night, keeping your blood sugar balanced with adequate protein and fiber, high-intensity exercise, lower media exposure, vitamin D, healthy iron levels, omega-3's, and meditation all increase dopamine receptor density

Mental Health and Cognitive Performance



COMT rs4680 has been linked in a meta-analysis to variations in the reward response based on genotypes associated with low and high dopamine levels.

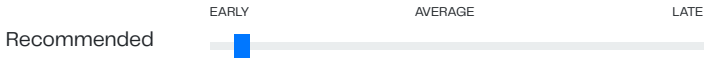
- Your genotype is associated with a slightly higher dopamine response to reward processing that could improve motivation as well as decision making

Warrior or Strategist

Your COMT genotype is associated with the "Hybrid" that has intermediate to high levels of dopamine and may be able to express the Warrior or Strategist traits depending on life experience. Higher dopamine is useful in complex environments that require maximal performance in terms of memory and attention for survival.

- If your levels of dopamine get too high and you find yourself irritable, impulsive, and stressed, add strength training 3-5 times a week and increase your magnesium and vitamin C intake for balance.
- Average to low catecholamine intake recommended (coffee, green tea, berries, chocolate)
- For men and premenopausal women, avoid IPA beers due to a higher estrogenic effect that can slow COMT down further

Sleep Support

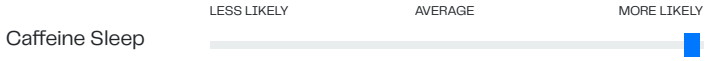


Recommended Wake Time

Research has found that MTNR1B G allele carriers had a significant association with delayed melatonin release in the evenings and a substantially longer duration of elevated melatonin levels in the morning.

- Due to melatonin release ending earlier in the morning for your genotype, an earlier wake time (earlier than 6:30am) may be easier without light exposure
- Melatonin supplementation was not found to cause impaired glucose intolerance for your CC genotype

Sleep Support

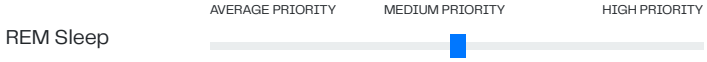


Caffeine Sleep Disturbance

The rate at which caffeine is metabolized genetically is associated with variations of sleep disturbance.

- You are a slow metabolizer of caffeine, which could affect sleep if caffeine is consumed in the afternoon or evening
- To accelerate the metabolism of caffeine, schedule cardio exercise after consumption and increase cruciferous vegetable intake

Sleep Support



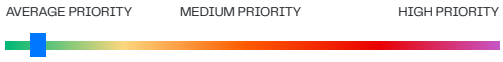
REM Sleep

Acetylcholine plays a role in promoting REM sleep, the phase that occurs while we dream and where memory consolidation occurs.

- Your genotype is associated with increased sensitivity to not meeting your daily choline requirements for acetylcholine production and REM sleep
- You may be more sensitive to anticholinergic drugs, which block acetylcholine and have been found in research to cause cognitive decline
- Make sure you are getting at least 550mg of choline per day, walking 45 minutes or more per day, and if consuming alcohol, you will sleep better if you consume it before 6:00pm and limit the quantity

Stress Management

Stress Perception

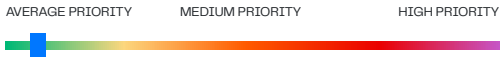


Your perception of stress is unique to your genotypes and life experience. Variants in 5-HT2A are associated with perceived stress, low vagal tone, anxiety, depression, OCD, and IBS, especially in females.

- Your genotypes are associated with a lower perception of stress.

Stress Management

Stress and Digestion

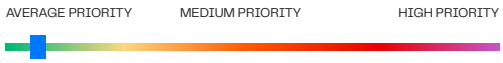


The G allele carriers of ADRB2 were associated with a higher percentage of IBS cases, twice the rates of anxiety, and functional chest pain diagnoses.

- Your genotype is associated with a reduced percentage of digestive disorders, IBS, and anxiety related to adrenaline levels

Stress Management

Cardio and Stress Relief



The 5-HT2A gene for the serotonin has a role in BDNF regulation – which helps regulate the excitatory neurotransmitter glutamate and calming neurotransmitter GABA. The A allele for 5-HT2A rs6314 was found to cause a lower expression of BDNF, and can compound the effect for those with variants in BDNF for mood and behavior in response to stress.

- Your genotype combination is associated with reduced susceptibility to low BDNF levels in response to stress, helping balance glutamate and GABA

Stress Management

Weight Training and Stress Relief

Weight lifting has a higher impact on hormonal pathways that may provide higher levels of stress relief based on the speed of these pathways.

- Your genotype is associated with slightly higher dopamine levels and a reduced clearance of adrenaline
- Weight lifting helps speed up the pathway responsible for clearing excess dopamine and adrenaline, and therefore is a useful tool for you to use for chronic stress

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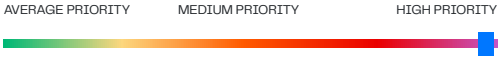
DETOXIFICATION

Toxin Sensitivity

Mycotoxins



Mycotoxins are toxic compounds that are naturally produced by certain types of fungi. Research suggests that mycotoxins can decrease the formation of glutathione due to decreased gene expression of the enzymes needed to form glutathione.

- Your genotype is associated with lower glutathione levels which may cause glutathione depletion to occur at a faster rate and decrease mycotoxin detoxification
- The highest exposure to mycotoxins can be in foods grown or stored in damp conditions
- This may include grains, nuts, corn, coffee, wine, beer, grape juice, sorghum, rice, dried beans, apples, pulses, cacao products, and spices
- Boosting glutathione can be accomplished with selenium, glycine, cysteine, alpha lipoic acid, vitamin C, and cruciferous vegetables

Toxin Sensitivity

Xenoestrogens

Xenoestrogens are synthetic hormone disruptors found in plastics and pesticides.

- Your genotype is associated with a slower metabolism of xenoestrogens, and therefore the damage may be greater from xenoestrogen exposure
- Increasing magnesium targets the enzyme responsible for assisting xenoestrogen detoxification

Toxin Sensitivity

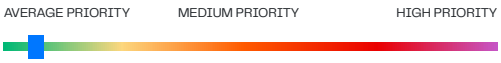
Occupational Toxins

Workers exposed to certain chemicals over a long period in the metalworking, petroleum, agricultural industries and in glass factories are at increased risk for occupational skin cancers.

- Your genotypes are associated with an increased sensitivity to these toxins
- Focus on zinc, selenium, niacin, and vitamin C to improve DNA protection for skin health
- Ellagic acid, lutein, zeaxanthin, cocoa polyphenols, chaga tea, green tea and citrus have all been found to help protect against skin damage and cancerous growth

Toxin Sensitivity

Ethanol

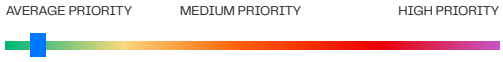


ALDH2 encodes for aldehyde dehydrogenase, and variants can affect the levels of acetaldehyde and therefore the carcinogenic effect of alcohol.

- Your genotype is not associated with a higher risk of alcohol-related adverse reactions including flushing, palpitation, nausea, headache, drowsiness, breathlessness, and general discomfort

Toxin Sensitivity

Formaldehyde

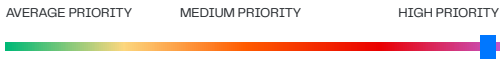


The International Agency for Research on Cancer has classified formaldehyde as carcinogenic to humans. Sources of formaldehyde in the home include building materials, smoking, household products, gas stoves, kerosene space heaters, as a food preservative, permanent-press clothes, and draperies, as a component of glues and adhesives, and as a preservative in some paints and coating products. Variants in the XRCC3 DNA repair gene have been associated with higher DNA damage from formaldehyde.

- Your genotype is not associated with an increased sensitivity to formaldehyde

Toxin Sensitivity

Benzo(a)pyrene

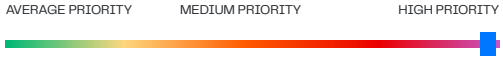


Benzo(a)pyrene is a carcinogenic compound produced from the burning of wood or trash, tobacco smoke, asphalt, coal, diesel exhaust, charred meat, and gas cooking.

- Your genotype combinations are associated with decreased detoxification of benzo(a)pyrene
- It is recommended to increase your intake of cruciferous vegetables, vitamin C, vitamin E, vitamin A, resveratrol, curcumin, green tea, and white tea to protect and detoxify benzo(a)pyrene

Toxin Sensitivity

Aromatic Amines

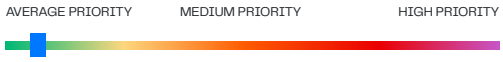


Aromatic amines are found in cigarettes, rubber factories, hair dyes that contain 4-aminobiphenyl, and meat cooked at high temperatures.

- Your genotype combinations are associated with a poor detoxification ability of aromatic amines
- If your exposure is higher to aromatic amines, increase cruciferous vegetable intake, carotenoids, vitamin C, and use marinades for meat when barbecuing

Toxin Sensitivity

Benzene



Sources of benzene include cigarette smoke, gasoline, exhaust, fires, industrial emissions, paint, detergent, glue, furniture wax, building materials, paint, petrochemical manufacturing, oil storage tanks, urban-industrial areas, service stations, certain foods, certain creams, groundwater contamination, and underground gasoline leaks.

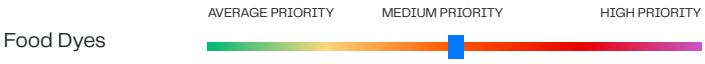
- Your genotype is associated with an average sensitivity to benzene

Toxin Sensitivity

Aspartame is an artificial sweetener that has been linked to behavioral, neurological and cognitive problems, increased blood sugar, thyroid issues, and certain types of cancer.

- Your genotype combinations may lower the sensitivity to aspartame
- Possible neurophysiological symptoms include learning problems, headache, seizure, migraines, irritable moods, anxiety, depression, and insomnia
- Artificial sweeteners in general increased waist circumference 500 percent while aspartame increased blood sugar in diabetes-prone mice
- Aspartame has been found to contribute to the formation of tumors in the CNS such as gliomas, medulloblastomas, and meningiomas, increased lymphoma and leukemia and, is an excitotoxin to brain neurons
- Aspartame in the body further metabolizes to formaldehyde, and rat studies found that formaldehyde (as a metabolite of aspartame) caused increased TSH levels and worsens the capacity of the gland leading to thyroid failure

Toxin Sensitivity



Food dyes have been found to inhibit mitochondrial respiration: the ability of the powerhouse of your cells to convert nutrients to energy. They have also been found to especially affect those with ADHD.

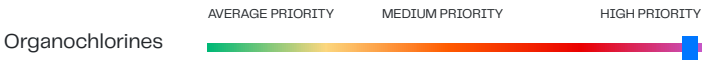
- Your genotype combination is associated with a higher sensitivity to food dyes
- Avoid foods and drinks that use food dyes when possible

Pesticides, Herbicides and Heavy Metal Sensitivity

Glyphosate is an herbicide that has been found to be highly toxic.

- Your genotype is associated with average cellular protection against the herbicide glyphosate
- The highest glyphosate levels have been found in non-organic wheat and non-organic pulses like beans, lentils, and peas
- A meta-analysis of human epidemiological studies suggests a link between exposures to glyphosate and an increased risk for non-Hodgkin's lymphoma
- An association between glyphosate and thyroid disease comes from plots over time of the usage of glyphosate in the U.S. on corn and soy time-aligned with plots of the incidence rate of thyroid cancer in the U.S.
- Manganese deficiency and toxicity can occur simultaneously from glyphosate exposure due to a disruption in liver enzymes, causing transportation of manganese through the vagus nerve to the brainstem where excess manganese can lead to Parkinson's disease
- The gut bacterium Lactobacillus is negatively impacted by glyphosate and the depletion in associated with celiac disease
- Humic acid from Shilajit has been shown in vivo to reduce glyphosate concentration, inhibit the destructive effect of glyphosate on beneficial bacteria, and protect and repair against tight junction injury of the digestive system

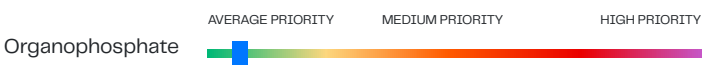
Pesticides, Herbicides and Heavy Metal Sensitivity



Organochlorines are found in certain pesticides, PCBs and sucralose.

- Your genotype is associated with decreased protection against organochlorines
- Organochlorine pesticides and PCBs are found in fatty animal foods and contaminated seafood
- Sucralose – also known as Splenda – is an organochlorine that destroys gut flora like lactobacillus, which disturbs selenocysteine levels present in the catalytic center of enzymes that protect the thyroid from free radical damage
- Selenium and zinc have been found to be the most effective for positive DIO1 gene expression

Pesticides, Herbicides and Heavy Metal Sensitivity



PON1 plays a large role in removing pesticides and is also involved with supporting HDL function and LDL oxidation. Organophosphates are a class of insecticides, including parathion and chlorpyrifos, that were among the most widely used insecticides available until the 21st century.

- Your PON1 genotype is associated with improved PON1 levels and detoxification of organophosphate insecticides

Pesticides, Herbicides and Heavy Metal Sensitivity

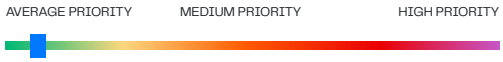
Arsenic

Arsenic is a heavy metal that is damaging at high levels. The highest dietary sources of inorganic arsenic include contaminated groundwater and rice. A consistent and growing body of evidence has shown that people who metabolize arsenic poorly may be at two to four times the risk of developing certain cancers and other arsenic-related diseases than people who are better metabolizers.

- Your genotype combination is associated with a reduced detoxification of arsenic
- The highest dietary sources of inorganic arsenic include contaminated groundwater and rice.
- Optimal selenium and folate intake have been found to improve arsenic detoxification and mitigate toxicity
- Chlorogenic acid – a polyphenol highest in light roast coffee – has been found to inhibit arsenic-induced neurotoxicity in mice
- Chlorogenic acid is also found in moringa tea, strawberries, cherries, bilberries, and wild blueberries

Pesticides, Herbicides and Heavy Metal Sensitivity

Cadmium



Chemical agriculture uses high amounts of synthetic organophosphates, creating a very high phosphorus content. Synthetic phosphorus concentrates the amounts of heavy metals, like cadmium in non-organic soils and food. Choosing organic produce is one of the best ways to avoid excess cadmium.

- Your genotype is associated with average detoxification of the heavy metal cadmium

Pesticides, Herbicides and Heavy Metal Sensitivity

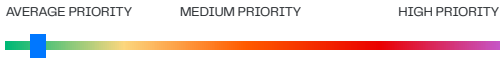
Mercury

Mercury is a neurotoxin linked to neurological and behavioral disorders including tremors, insomnia, memory loss, neuromuscular effects, headaches, and cognitive and motor dysfunction. Burning coal for power and heat is a major source of mercury exposure. Glutathione is responsible for protecting against and detoxifying heavy metals like mercury.

- Your glutathione genotypes are associated with reduced protection against mercury toxicity
- Mercury is found in many pharmaceutical drugs, dental amalgams, and large fish including swordfish, ahi tuna, and halibut
- Selenium blocks mercury uptake, folate decreases mercury levels, and magnesium and holy basil protect against mercury toxicity

Pesticides, Herbicides and Heavy Metal Sensitivity

Lead



Lead-based paint, lead-based dust in older buildings, contaminated water, and air pollution are the major sources of lead. Exposure to lead over time may cause abdominal pain, constipation, depression, distraction, forgetfulness, irritability, and nausea.

- Your genotype is associated with improved detoxification of lead

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IMMUNE SUPPORT, ANTIOXIDANTS AND INFLAMMATION

Bacteria, Yeast, Parasites and Viruses

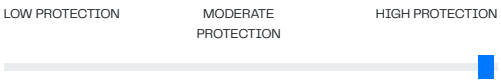
H. Pylori

The inactive “non-secretor” genotype for FUT2 confers resistance to H. Pylori. H. Pylori is present in approximately 50% of the population in developed countries.

- You do not have the non-secretor genotype for FUT2, associated with an average susceptibility to H. Pylori
- H. Pylori inhibition has been demonstrated with alcohol extracts of the mushroom Lion's Mane

Bacteria, Yeast, Parasites and Viruses

Malaria



Research has shown that MTHFR genotypes influence T-lymphocytes, natural killer cells, and protection against malaria.

- Your genotype is associated with boosted levels of thymidine, which may increase lymphocyte replication and immune function in response to malaria
- The malaria parasite needs higher amounts of folate to survive and replicate
- For malaria-endemic regions, a homozygous MTHFR 677 genotype is superior due to lower folate levels

Bacteria, Yeast, Parasites and Viruses

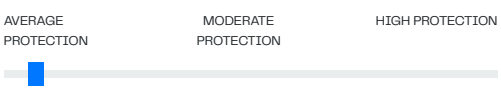
Norovirus

The inactive “non-secretor” genotype for FUT2 confers resistance to the Norovirus.

- You do not have the non-secretor genotype for FUT2, associated with an average susceptibility to the Norovirus

Bacteria, Yeast, Parasites and Viruses

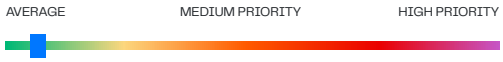
DNA Viruses



DNA viruses include HPV, Epstein Barre, herpes, and smallpox. Folate is a precursor to BH4 to produce nitric oxide. Nitric oxide acts as an antiviral that is more potent against DNA viruses.

- Your genotype combination is associated with lower BH4 levels with insufficent folate, lowering protection against DNA viruses
- Low BH4 affects the aggressiveness of DNA viruses
- To increase BH4, include foods high in folate, vitamin C, L-arginine, B6, magnesium, and selenium for healthy nitric oxide levels and DNA virus support
- BH4 is depleted by high blood sugar, high omega-6 intake, chronic stress, high levels of mercury, arsenic, lead and aluminum, aspartame, and oxidative stress

COVID-19

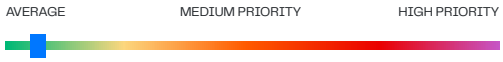


SARS-CoV-2 Susceptibility

Genome-wide association studies have identified a region of chromosome 3p21.31 as the for conferring susceptibility to infection with LZTFL1 as the candidate gene. ApoE-e4, ACE2 and TMPRSS2 polymorphisms have been shown to be strongly associated with the susceptibility, severity, and clinical outcomes of COVID-19.

- Your genotype combination is associated with a reduced probability to SARS-CoV-2 infection
- Advanced age, obesity, and being male are considered the top risk factors for SARS-CoV-2 susceptibility, especially when combined with Type 2 diabetes, high blood pressure, and cardiovascular disease
- Research has shown that CBD, Chaga mushroom, birch bark and olive oil may stop SARS CoV-2 entry by helping block the "lock" for viral entry
- The flavonols kaempferol, quercetin, myricetin, fisetin and their derivatives were the most documented molecules with antiviral activities against SARS-CoV-2
- Propolis has antiviral activity and inhibitory effects on ACE2, TMPRSS2 and PAK1 signaling pathways used by SARS-CoV-2, while promoting immunoregulation of pro-inflammatory cytokines, and reducing the risk of cytokine storm syndrome

COVID-19

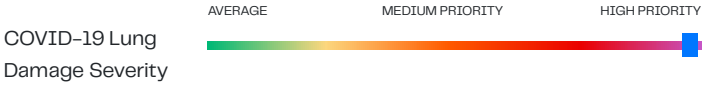


COVID-19 Viral Severity

ACE2 (the receptor for SARS-CoV-2) is reduced in individuals that are carriers of ApoE4. Once the virus fuses with the cellular membranes, it takes control, shuts down more ACE2 receptors, closing the door behind it. Fewer ACE2 receptors lead to elevated angiotensin II levels, which increases the viral load. This leads to a more severe infection, NF-kb activation, lung damage, and viral replication.

- An analysis of your ApoE genotype and numerous genes involved in the viral inflammatory pathways show an association with a reduced risk of viral severity
- The risk of viral severity can still be increased by existing health issues including Type 2 diabetes, obesity, high blood pressure, and cardiovascular disease
- In September 2020, Boston University found that SARS-CoV-2 is highjacking the NF-kB pathway and should be a target for suppressing viral aggressiveness
- In addition to vaccination, NF-Kb inhibitors can be both preventative for inflammation and successful with slowing viral aggressiveness
- These include vitamin C, vitamin D, zinc, selenium, magnesium, cordyceps mushrooms, resveratrol, triterpenoids (Chaga, reishi, olive oil, holy basil), caffeic acid (coffee, Chaga, elderberry), and anthocyanins (elderberry, goji berries, cacao)
- The dietary flavonols kaempferol, quercetin, myricetin, fisetin were the most documented molecules with antiviral activities against SARS-CoV-2, and had a broad spectrum of biological activities that could reduce the severity of infection symptoms and enhance the immune response
- The strong association between air pollution exposure and COVID-19 mortality suggests that inhaled noxious particles influence COVID-19 outcomes

COVID-19



COVID-19 Lung Damage Severity

Scientists at the University of Oxford published results in November 2021 that variants in the LZTFL1 gene doubles the risk of lung failure and death from COVID-19. Approximately 60% of people with South Asian ancestry, 15% of people with European ancestry, 2% of people with African-Caribbean ancestry and 1.8% of people with East Asian ancestry carry the high-risk variant. Scientists found that the LZTFL1 gene high-risk variant affects the lungs, but does not have an impact on the immune system.

- Your genotype is associated with an increased risk COVID-19 related lung damage severity
- In addition to vaccination, NF-Kb inhibitors can be both preventative for inflammation and successful with slowing viral aggressiveness
- These include vitamin C, vitamin D, zinc, selenium, magnesium, cordyceps mushrooms, resveratrol, triterpenoids (Chaga, reishi, olive oil, holy basil), caffeic acid (coffee, Chaga, elderberry), and anthocyanins (elderberry, goji berries, cacao)
- The strong association between air pollution exposure and COVID-19 mortality suggests that inhaled noxious particles influence COVID-19 outcomes, especially for those more prone to lung inflammation
- Diet-induced dyslipidemia (abnormal levels of triglycerides, LDL, and low HDL) alters the trafficking of immune cells to the lung and increases the risk of respiratory tract infections

COVID-19

Glutathione

Glutathione is the master antioxidant system involved in oxidative stress, detoxification, and immunity. The functional capacity of immune cells and the ability to cope with oxidative stress has been proposed as one of the significant markers of health and longevity. In both animals and humans, those who reach exceptionally old age have immune markers the same as young adults.

- Your genotype combination is associated with decreased baseline glutathione levels
- Glutathione decreases with age, and low levels of glutathione are associated with chronic exposure to chemical toxins, heavy metals and excess alcohol, immunocompromised conditions, and neurodegenerative disorders
- Glutathione has been found to increase by 20% with deep breathing practices like Tai Chi or yoga
- For exercise, a combination of aerobic exercise and circuit weight training produced the highest glutathione effect
- Selenium, glycine, cysteine, vitamin C, and cruciferous vegetables all improve glutathione levels
- Chicken or bone broth, herbs, and spices are some of the best dietary ways to maintain higher levels of glutathione
- Some of the all-stars include cinnamon, anise, sage, and thyme due to also containing the antiviral compound caffeic acid

COVID-19

Vitamin A

Vitamin A and some other retinoids show important immunomodulatory properties, including the ability to increase the efficiency of actions of type 1 interferons, an important antiviral cytokine released by the innate immune system against viral infections. Coronaviruses similar to SARS-CoV-2 can suppress the host IFN-I-based antiviral response as part of their infection mechanism.

- Your genotype is associated with a 69% lower conversion rate of beta-carotene to vitamin A, making it important to include more animal-based vitamin A to hit your daily target
- Vitamin A intake by country shows that Spain is the country with the lowest population meeting nutritional requirements for vitamin A, followed by Belgium and Finland
- Germany and Portugal show the best, and with the exception of Finland, countries with suboptimal Vitamin A status are correlated (although not significantly) with their COVID-19 incidence and mortality

COVID-19

Vitamin C

Optimal status of vitamin C plays an important role in the proper working of the immune system.

- Your genotype is associated with average serum vitamin C levels
- Countries such as the UK, France, Netherlands, and Belgium do not reach optimal dietary intake of vitamin C
- Germany stands out for its level of vitamin C intake in comparison with other countries
- Despite suboptimal vitamin C intake correlating weakly with COVID-19 incidence, it correlates strongly with deaths percentage, which could suggest a positive effect to fight infection once the individual has already been infected with SARS-CoV-2

COVID-19

Vitamin D

Vitamin D plays a key role in modulating the immune system, and suboptimal or deficient consumption of vitamin D is associated with various conditions related to a malfunction of the immune system and dysregulations in inflammatory status.

- Your genotype is associated with below average circulating levels of vitamin D
- A 2021 study found that those with the GG genotype for CYP2R1 were associated with 5.9 higher odds of experiencing severe COVID-19
- Vitamin D intake is deficient in all countries studied with COVID severity, with Spain, France, and Italy as the countries with the lowest intake
- A meta-analysis of the studies appears to show that vitamin D is only useful for those who are clinically low (below 20 ng/ml), with moderate doses daily or weekly to raise levels being more effective than periodic large doses

COVID-19

Selenium

Suboptimal or deficient levels of selenium are associated with decreased cytotoxicity of NK cells, decreased antibody titers, and impaired cellular immunity. Supplementation is commonly related to improvements in cellular immunity and an improved optimal immune response against viruses, including an inhibitory effect on the development of the poliovirus and influenza.

- Your genotype is associated with an average need for selenium
- Glutathione peroxidase 1 (GPX1) is a selenoenzyme with described antioxidant and antiviral properties that depends on nutritional selenium status
- Spain is at the top for meeting selenium requirements while Denmark is at the bottom
- The only two populations above the median of the countries analyzed included Finland and France, while the rest of the countries are below the general median

COVID-19

Zinc

Optimal status of zinc is essential for the proper operation of the immune system and regulates NF-kb, where zinc deficiency in the setting of severe infection provokes a systemic increase in NF-kB activation. In vitro approaches have shown that zinc can inhibit SARS-CoV-1 replication.

- Your genotype is associated with lower serum zinc
- Scientific evidence supports that optimal zinc intake or supplementation should be considered part of the strategy to reduce COVID-19 effects, with early reports finding that 15-23mg a day show significant improvement in symptoms

COVID-19

Copper

Copper plays a key role in optimal performance of relevant components of the immune system, such as NK cells, macrophages, neutrophils, and monocytes. A deficiency has been related to less effective immune responses against infections, vulnerability for the heart and blood vessels to damage, and increased virulence. Excessive intake is also associated with negative immune function.

- Your genotype is associated with lower serum copper

COVID-19

Iron

Suboptimal levels of iron are associated with decreased killer efficiency of NK cells and lymphocytes as well as with compromised cytokine production. Both iron uptake disturbances and metabolism are implicated in virulence of airway hospital-acquired infection and chronic respiratory infections. In contrast, excessive iron levels can generate harmful cellular toxicity, so their serum levels must be well regulated.

- Your genotype combination is associated with average serum iron levels
- A retrospective study based on 50 hospitalized Chinese subjects with confirmed COVID-19 demonstrated that 90% of these subjects had abnormally low serum iron concentrations
- Populations with lower iron status could be more prone to suffer a mild to severe (or critical) symptomatology of COVID-19 and the fact of monitoring patient iron levels has been proposed as a potential early marker to predict COVID-19 severity and mortality
- Iron levels should always be monitored by your practitioner

COVID-19

B12

Sufficient vitamin B12 intake is essential for antibody production and a deficiency is related to a lower concentration of circulating lymphocytes and altered antibody-based responses. SARS CoV-2 infection is related to an aggravation of the cellular metabolism and the homocysteine pathway causing severe complications from COVID-19, and the correct supply of vitamin B12, folate and B6 may be crucial for COVID-19 patients.

- Your genotype is associated with intermediate B12 levels
- Some of the countries least affected by SARS-CoV-2 show the highest levels of vitamin B12 intake (Portugal and Finland)
- Some of the countries most affected by SARS-CoV-2 (Belgium and Spain) have intakes below the median

COVID-19

Folate

Folate is crucial for optimal Th-1 mediated immune response and proper antibody production. Suboptimal levels of folate may trigger imbalances in T and NK cell mediated immune responses and decrease the amount of antibody production.

- Your genotype combination is associated with a higher than average need for folate
- The correct intake of vitamin B6, folate and B12 in patients affected by COVID-19 has been proposed as part of the disease treatment, even by supplementation formulas, in an attempt to regulate the disruption of cellular metabolism of the homocysteine pathway caused by the SARS-CoV-2 infection

COVID-19

B6 (Pyridoxine)

Vitamin B6 is essential for maintaining cytotoxic activity of NK cells, lymphocyte development, and B-cell antibody production. Suboptimal intake is associated with lower concentrations of circulating lymphocytes, impaired lymphocyte maturation, and decreased antibody-based responses.

- Your genotype is associated with low serum B6 levels, requiring a higher than average intake of B6
- The correct intake of vitamin B6, folate and B12 in patients affected by COVID-19 has been proposed as part of the disease treatment, even by supplementation formulas, in an attempt to regulate the disruption of cellular metabolism of the homocysteine pathway caused by the SARS-CoV-2 infection

COVID-19

Bifidobacteria

Approximately 80% of your immune system is in your gut. The good bacteria bifidobacterium is highest in breast-fed infants and has been found to be lower in the higher-risk demographics for COVID-19 including those with diabetes, obesity, asthma and the elderly. Bifidobacteria populations have been found to vary based on the FUT2 genotype.

- Your genotype is associated with improved bifidobacteria levels in the gut, helping to protect against lower and upper respiratory infections
- Prebiotics – found in foods like bananas, garlic, leeks, barley, asparagus, pistachios, onions, and polyphenol-rich foods – have been found in human trials to increase bifidobacteria levels

COVID-19

Glycine

Glycine is one of the three major amino acids for glutathione production, protecting the body from oxidative damage during the immune response, and supporting T-cell proliferation.

- Your genotype is associated with low type 1 collagen production, increasing your glycine requirement
- Type I collage is a major structural protein in the lung and is stimulated during certain inflammatory reactions in the lung
- Collagen protein, bone, or chicken broth that gelatinizes, gelatin, meat with the skin, ribs, shanks, and drumsticks are all ways to increase dietary glycine
- Baobab is considered an exceptionally good source of plant-based glycine found in the hunter-gatherer Hazda diet

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DNA PROTECTION & REPAIR

DNA Protection & Repair

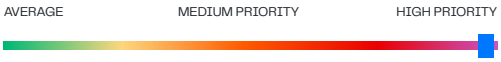
Glutathione Protection

Glutathione is the master antioxidant system involved in oxidative stress, detoxification, and immunity. Glutathione status parallels telomerase activity, an important indicator of lifespan.

- Your genotype combinations are associated with slightly decreased baseline glutathione levels
- Glutathione decreases with age, and low levels of glutathione are associated with chronic exposure to chemical toxins, heavy metals and excess alcohol, immunocompromised conditions, and neurodegenerative disorders
- Glutathione has been found to increase by 20% with deep breathing practices like Tai Chi or yoga
- For exercise, a combination of aerobic exercise and circuit weight training produced the highest glutathione effect
- Selenium, glycine, cysteine, vitamin C, and cruciferous vegetables all improve glutathione levels
- Chicken or bone broth, herbs, and spices are some of the best dietary ways to maintain higher levels of glutathione
- Some of the all-stars include cinnamon, anise, sage, and thyme due to also containing the antiviral compound caffeic acid

DNA Protection & Repair

Catalase Protection

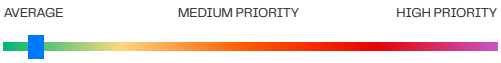


CAT makes an enzyme called catalase, which helps reduce oxidative stress. CAT is present in all aerobic cells while research has found the highest correlation to prostate, breast, liver, and blood health.

- Your genotype is associated with reduced catalase levels
- Low catalase increases the sensitivity to DNA damage from BPA plastic
- Foods high in flavonoids, the mushroom Lion's Mane, holy basil, cumin, anise, fennel, caraway, cardamom, and deep breathing practices all improve catalase levels

DNA Protection & Repair

Mitochondrial Protection

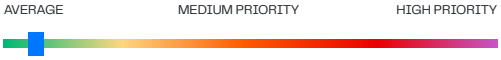


The SOD2 gene is responsible for superoxide dismutase levels, an important protector of the mitochondria, the powerhouse of the cell.

- Your genotype is associated with increased mitochondrial protection

DNA Protection & Repair

UV Protection

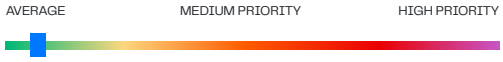


One hypothesis for variants in MTHFR 677 is that they were selected based on higher folate intake and UV exposure, both common in Mediterranean climates. What happens in the body when MTHFR enzymatic function is reduced is that thymidine production increases. Thymidine enhances the repair of UV-induced DNA damage to help quickly repair sun damage.

- Your MTHFR genotype is associated with increased UV protection from the sun

DNA Protection & Repair

Skin Protection

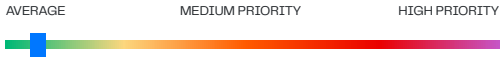


GPX1 activity is considered to be the most important antioxidant enzyme defense mechanism in the skin.

- Your genotype is associated with improved antioxidant protection for the skin

DNA Protection & Repair

Lung Protection



Variants in the GSTP1 gene have been associated with lower antioxidant support in the lungs when exposed to environmental pollution.

- Your genotype is associated with increased lung protection against environmental pollutants

DNA Protection & Repair

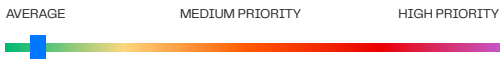
Lung Protection (Asian Ancestry)

Glutathione levels and pro-inflammatory cytokines, such as TNF-a, are found in airways and environmental pollutants are known to induce inflammatory responses.

- Your genotype combination is associated with reduced lung protection against environmental pollutants
- It is recommended to increase your intake of cruciferous vegetables, vitamin C, vitamin E, vitamin A, milk thistle, resveratrol, curcumin, green tea, and white tea to target the GSTM1 gene
- Additional support includes cold water immersion, breathing exercises, cordyceps, and ginger to target the TNFA gene

DNA Protection & Repair

Colon Protection



The MLH1 gene codes for a DNA repair enzyme linked to colon health.

- Your genotype is associated with improved DNA protection for colon health

DNA Protection & Repair

Cured Meat and Colon Health

A large-scale genome-wide analysis of over 18,000 people from the U.S., Canada, Australia and Europe found that variants in GATA3 were associated with an increased risk of colon cancer for those eating processed meat compared to those with the normal genotype.

- Your genotype is associated with an increased risk of colon cancer from cured meat consumption
- Keeping a vitamin D level of 34 ng/ml or higher has been found to cut colon cancer risk in half
- A high intake of fruits, vegetables, herbs and spices have also been found to dramatically reduce the risk of colon cancer

DNA Protection & Repair

Eye Protection

Blue light is a high-energy or short-wavelength visible light from your phone and computer that induces inflammation and retinal diseases such as age-related macular degeneration and retinitis pigmentosa.

- Your genotype is associated with higher requirements for foods high in lutein, zeaxanthin, and anthocyanins for eye health
- A meta-analysis found that the rates of myopia (nearsightedness) will increase 140% by 2050 due to our increased time in front of a screen
- Research has found that bilberry and lingonberry exert protective effects against blue LED light-induced retinal photoreceptor cell damage due to their polyphenol content
- Increase your dietary intake of dark purple berries, dark leafy greens, summer squash, green peas, broccoli and Brussels sprouts

DNA Protection & Repair

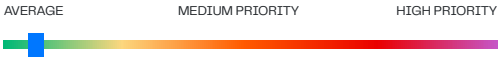
Thyroid Protection

Up to 60 percent of those with a thyroid disorder are unaware of their condition. The cause is considered largely unknown and occurs 10 times more in women than in men. Hashimoto's disease runs in the family and 70%–80% of susceptibility to autoimmune thyroid disease is based on genetics.

- Your genotype combination is associated with reduced thyroid protection and a slightly increased risk of Hashimoto's disease
- Autoimmune thyroid disease is associated with celiac disease
- A deficiency in selenium is associated with celiac disease and thyroid disease, and plays a significant role in thyroid hormone synthesis, secretion and metabolism
- Sucralose and glyphosate destroy gut flora like lactobacillus, which disturbs selenocysteine levels present in the catalytic center of enzymes that protect the thyroid from free radical damage
- The artificial sweetener aspartame in the body further metabolizes to formaldehyde, and rat studies found that formaldehyde (as a metabolite of aspartame) caused increased TSH levels and worsens the capacity of the gland leading to thyroid failure

DNA Protection & Repair

Pancreas Protection

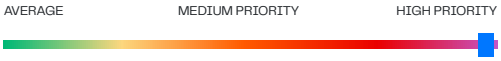


Multiple genes are linked to DNA protection for pancreatic health.

- Your genotype combination is associated with increased DNA protection for pancreatic health

DNA Protection & Repair

Bladder Protection



Certain gene combinations have been found to decrease the detoxification ability of certain toxins found to be carcinogenic for the bladder.

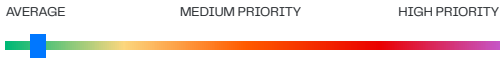
- Your genotype is associated with decreased DNA protection for bladder health
- Avoid tobacco smoke, commercial hair dyes, working in industrial and manufacturing plants, charred meat, and diesel exhaust
- Increase your cruciferous vegetables, carotenoid, and vitamin C intake

myDNA™ | NutriPATH

CARDIOVASCULAR HEALTH & EXERCISE

Cardiovascular Health

HDL and LDL

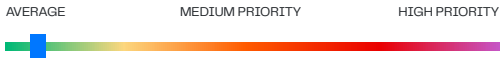


ApoE is connected to HDL and LDL levels, while PON1 is involved with supporting HDL function and LDL oxidation, an important mechanism in atherosclerosis and heart disease.

- Your genotype combination is associated with a higher likelihood of good HDL levels and a lower likelihood of higher levels of LDL, oxidized LDL, and total cholesterol

Cardiovascular Health

VLDL

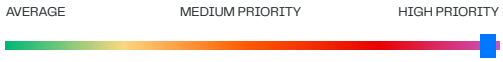


Subjects with variants in PPAR-alpha have been found to have a larger waist circumference and a higher proportion of small, dense LDL particle size.

- Your genotype is not associated with a higher proportion of small, dense LDL particle size

Cardiovascular Health

Triglycerides

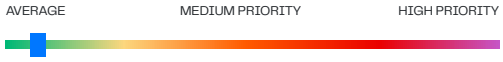


Variants in the FADS1 SNP (rs174546) are associated with elevated triglyceride levels.

- Your genotype is associated with elevated triglycerides
- Numerous studies have found that omega-3 fatty acids administered as fish oil supplements lowers plasma triglyceride levels by 25% to 34%

Cardiovascular Health

ApoB



ApoB is a protein that is involved in the metabolism of lipids and is the main protein constituent of lipoproteins. High levels of ApoB, especially with the higher LDL particle concentrations, are the primary driver of arterial plaque. The PPAR-alpha polymorphism has been associated with ApoB in many populations such as Caucasians, Indians, and African-Americans.

- Your genotype is not associated with elevated ApoB levels

Cardiovascular Health

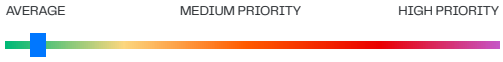
Lp(a)

Lp(a)is a sticky form of LDL that appears to affect plaque growth, LDL particle size and increase the risk of plaque rupture and blood clotting.

- Your genotype is not associated with elevated Lp(a) levels

Cardiovascular Health

Raw Plant Intake

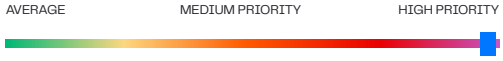


The risk of heart attacks and cardiovascular disease conferred by the 9p21 gene appears to be modified by a prudent diet high in raw vegetables and fruits for South Asian, Latin American, Arab, Chinese and European populations for variants in rs4977574.

- You have an average requirement for raw fruits and vegetables to maintain a healthy heart

Cardiovascular Health

Nitric Oxide

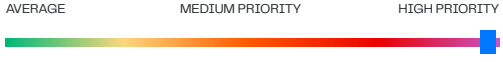


The uncoupling of nitric oxide has been linked to play an essential role in cardiovascular pathologies including dilated cardiomyopathy, ischemia–reperfusion injury, endothelial dysfunction, atherosclerosis, and hypertension.

- Your genotype combinations are associated with a higher than average need for folate to produce adequate BH4, the precursor to nitric oxide
- BH4 is depleted by high blood sugar, high omega-6 intake, chronic stress, high levels of mercury, arsenic, lead and aluminum, aspartame, and oxidative stress
- Other strategies to increase BH4 include vitamin C, L-arginine, B6, magnesium, and selenium

Cardiovascular Health

Homocysteine

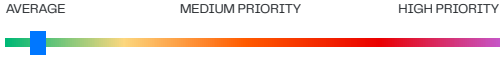


Homocysteine is a non-protein amino acid that is produced from methionine, can be recycled back into methionine and converted into cysteine in the methylation cycle. High homocysteine levels have been connected to depression, blood clots, inflammation, macular degeneration, dementia, and cancer.

- You have a higher than average need for folate to maintain healthy homocysteine levels

Cardiovascular Health

High Blood Pressure

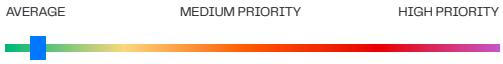


Age-related increases in blood pressure have been observed in almost every population, except among hunter-gatherers and farmers. High physical activity, low-stress levels, and potentially protective diets high in fruits, vegetables, potassium, lower in calories, salt, and alcohol are the major contributing factors to the stark differences.

- Your genotype combination is associated with normal blood pressure levels

Cardiovascular Health

Blood Clots

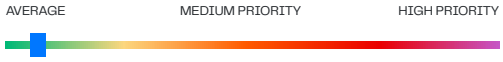


Deep vein thrombosis is a condition that occurs when a blood clot forms in a vein deep inside a part of the body and is most common for those over 60. Variants in F5 increase the risk of deep vein thrombosis.

- Your genotype is not associated with deep vein thrombosis

Cardiovascular Health

Uric Acid

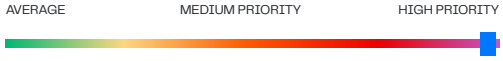


Variants in the ABCG2 gene have been associated with elevated uric acid levels and an increased risk of gout in Asians, Europeans, African Americans, Mexican Americans, and American Indians. Epidemiological studies have shown that uric levels are positively correlated with gout, hypertension, atherosclerosis, atrial fibrillation, and heart failure.

- Your genotype is associated with average uric acid levels

Cardiovascular Health

Fibrinogen



Fibrinogen is a soluble protein in the plasma that is broken down to fibrin by the enzyme thrombin to form clots. Fibrinogen serves to stop excessive bleeding, but in high amounts can cause blot clots.

- Your genotype is associated with elevated fibrinogen levels
- Avoid BPA plastic, unfiltered tap water, and phthalates (chemical personal care products)
- Increase the probiotic lactobacillus planatarum and discuss the use of nattokinase with your health practitioner if fibrinogen levels are elevated

Cardiovascular Health

Hemochromatosis

A homozygous HFE C282Y may lead to an iron overload due to increased iron absorption and disrupted metabolism. People who are homozygous for the HFE C282Y gene mutation comprise 85 to 90 percent of those with hemochromatosis in whites of western European descent.

- Your wild-type HFE genotype is associated with a reduced likelihood of genetically linked hemochromatosis

Exercise

Power Athlete Potential

ACTN3 is currently the most promising gene for predicting the likelihood of becoming an Olympic level sprint and power athlete in males and females. The RR (CC) genotype expresses the ACTN3 protein found in Type II muscle fibers, which produces explosive and powerful contractions.

- You have the RX genotype for the ACTN3 gene associated with enhanced improvements in strength, power and muscle hypertrophy
- More powerful muscle contractions
- Higher muscle hypertrophy response
- Faster recovery

Exercise

Weight Lifting Inflammation

Weight lifting leads to a variation in muscle inflammatory markers based on genetics and intensity.

- Your gene combination is associated with lower levels of muscle inflammation (creatine kinase) for weight lifting that improves recovery time

Exercise

Endurance Exercise Inflammation

Endurance training leads to a variation in creatine kinase levels based on genetics.

- Your gene combination is associated with lower levels of muscle inflammation (creatine kinase) for endurance exercise that improve recovery time

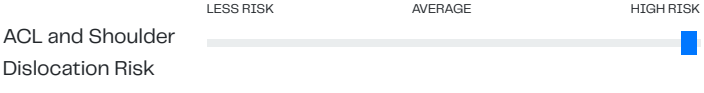
Exercise

High-Intensity Exercise Inflammation

High-intensity exercise is defined as 70% to 85% of your maximum heart rate, and inflammation variation has been associated with the SOD2 gene.

- Your SOD2 genotype is associated with less muscle inflammation in response to high-intensity exercise

Exercise



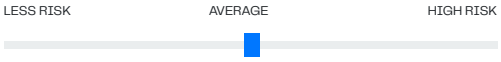
ACL and Shoulder Dislocation Risk

The COL1A1 gene is associated with ACL and shoulder injury risk.

- Your COL1A1 genotype is associated with an increased need for dietary collagen to prevent ACL and shoulder injuries
- Vitamin C, zinc, copper, glycine, proline, lysine, and B6 are all precursors to collagen production

Exercise

Ankle and Hamstring Injury Risk

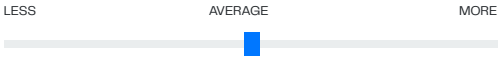


The ACTN3 gene is linked to increased or decreased risk of ankle and hamstring injuries.

- Your ACTN3 genotype is associated with an average risk of ankle and hamstring injuries

Exercise

Cold Endurance

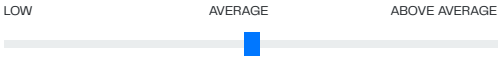


The ACTN3 gene is associated with a lower or higher adaptation rate to cold endurance.

- You have the ACTN3 RX genotype, associated with an average adaptation rate to cold endurance

Exercise

VO2 Max Trainability



VO2 max is measurement for oxygen capacity and endurance training. The most recent research has shown that 97 genes predicted VO2 max trainability. The phenotype is dependent on several of these variants combined together, which may contribute to approximately 50% of an individual's VO2 max trainability.

- Research has shown that your genotypes may be associated with an average VO2 max training response
- Training in the cold, ashwagandha and eluethero root have been found to help increase VO2 max

Exercise

Caffeine Response for Exercise Under 1 Hour

The CYP1A2 gene is associated with caffeine response for improving or decreasing exercise performance.

- Your CYP1A2 genotype is associated with poor exercise performance with activities under 1 hour from caffeine due to being a slow metabolizer

Exercise

Caffeine Response for Exercise Over 1 Hour

The CYP1A2 gene is associated with caffeine response for improving or decreasing exercise performance.

- Your CYP1A2 genotype is associated with increased exercise performance from caffeine when competing in a longer duration event (greater than 1 hour)
- Slow metabolism may be beneficial for endurance competitions by maintaining biologically active levels of caffeine in the body

MY HEALTH REPORT: STRENGTHS

This section is a thorough overview of your individual gene function across the entire analysis in just a few pages. If you are looking for a brief summary of the most important parts of your report without doing a deep dive into the genotype tables and clinical research sections, this is the place to start. Be proud of your inherent genetic strengths!

NUTRIENT METABOLISM & DIGESTION

- **Prebiotics, Probiotics and B12-FUT2** - The rs601338 FUT2 AG genotype in European, African, and Indian populations is associated with intermediate B12 levels and improved bifidobacteria populations in the gut compared to the AA genotype, increasing immune function against respiratory infections.
- **Vitamin C-SLC23A1** - Your genotype is associated with improved whole-body vitamin C homeostasis through dietary absorption and renal reabsorption.
- **Adiponectin-ADIPOQ** - Your genotype is associated with a higher probability of normal adiponectin levels, linked to improved bodyweight, insulin, and glucose levels.
- **Iron** - Your genotype is associated with a lower risk of iron overload for the HFE C282Y gene.
- **Saturated Fat-PPAR-alpha** - You have the wild-type genotype that is associated with improved saturated fat metabolism and ketone body production during fasting. Assess your other fat metabolism genes for a more complete assessment.
- **Fat Metabolism-ACSL1** - Your genotype is associated with improved glucose metabolism from saturated fat intake.
- **Ghrelin and Appetite-FTO** - Your genotype is associated with normal ghrelin levels (hunger hormone), decreasing the risk for overeating and abdominal weight gain.
- **Lactose** - You have the heterozygous AG genotype that is associated with a lower probability of lactose intolerance.
- **Uric Acid-ABCG2** - Your genotype is associated with a lower probability of chronically elevated uric acid levels.
- **Ethanol Metabolism-ALDH2** - Your genotype is less likely to experience facial flushing from alcohol due to improved acetaldehyde metabolism.
- **Stress and IBS-ADRB2** - You have the ADRB2 CC wild-type genotype that is associated with a reduced percentage of digestive disorders, IBS, and anxiety related to adrenaline levels.

METHYLATION

- **Folate-MTHFR 677** - You have the homozygous genotype that is associated with improved protection against UV-induced DNA damage from the sun and a reduced risk of malaria.
- **Folate-MTHFR 1298** - Your genotype is associated with improved BH4 levels and neurotransmitter function. Healthy BH4 levels assist in the management of cardiovascular health, mental health, and digestive health.
- **Folate-MTHFD1 G1958A** - Your genotype is associated with improved metabolism for folinic acid, the second most common type of folate after methylfolate.
- **Folate-DHFR** - Your genotype is associated with an improved breakdown of synthetic folic acid at the beginning of the folate cycle. However, variants in MTHFR 677 can also affect folic acid metabolism.
- **B12, B2 and Zinc-MTR** - You may have improved MTR function, assisting homocysteine metabolism.
- **B12-MTRR** - Your genotype is associated with improved gene function, assisting B12 and homocysteine metabolism.
- **Arsenic-CBS** - Your genotypes are associated with improved arsenic metabolism and detoxification for the CBS genes.

HORMONE SUPPORT

- **Thyroid-DI02** - Your genotype is associated with average T3 and T4 thyroid function in the brain for the DI02 gene. However, other factors can affect T3 and T4 levels including thyroid surgeries.
- **Estrogen Metabolism-CYP1A1** - Your CYP1A1 wild-type genotype is improved for the beginning phase of estrogen metabolism. Please review all genes involved in estrogen metabolism for a complete picture of the process.
- **Estrobolome-FUT2** - Your heterozygous genotype is associated with improved bifidobacteria gut bacteria, assisting the gut phase of estrogen detoxification.
- **MTNR1B-Melatonin** - You have the CC MTNR1B genotype, which is associated with a normal circadian rhythm of melatonin production at night and in the morning. This gives you a wider time range for breakfast and dinner for glycemic control.

MENTAL HEALTH, NEUROTRANSMITTERS & COGNITIVE PERFORMANCE

- **Serotonin Receptor-Memory** - You have the wild-type genotype that is associated with an improved episodic memory, which is the ability to recall details regarding personal experiences, names of people, specific events, and what exactly occurred.
- **Serotonin Receptor-Stress** - You may have improved function for the serotonin receptor gene connected to perceived stress and the ability to regulate chronic stress. This may reduce the probability of low vagal tone, anxiety, depression, and obsessive and compulsive thoughts related to dysregulated serotonin levels.
- **Dopamine, Adrenaline and Estrogen-COMT** - The heterozygous genotype for COMT V158M and H62H scored significantly higher on insight problem-solving tasks and had a greater ability for social facilitation and cooperativeness.
- **Histamines and Migraines-DAO** - The wild-type CC genotype for DAO rs1049793 is associated with a reduced risk of histamine-induced migraine headaches.
- **Glutamate-BDNF** - Your genotype is associated with improved glutamate modulation, brain repair, spatial learning, memory, and adaptability.
- **Glutamate Transport-SLC17A7** - Your genotype is associated with improved recovery from head injuries. However, your APOE and BDNF genotype should also be assessed because these all have a cumulative impact.
- **Cholesterol-APOE** - You have the ApoE e3/e3 genotype, improving cholesterol transport and the maintenance of brain neurons. The ApoE e3 allele improves cognitive fitness, HDL and LDL profiles, viral protection, and the response to plant bioactive compounds.

IMMUNE SUPPORT, ANTIOXIDANTS AND INFLAMMATION

- **Cell Protection-SOD2** - You may have improved SOD2 function to protect to the mitochondria (powerhouse of the cell).
- **Glutathione-GSTM1** - While the GSTM1 null genotype has been associated with a greater sensitivity to benzo(a)pyrene, there is also a benefit to this genotype. The benefit is that the null genotype may retain a higher level of isothiocyanates, the anti-cancer compounds found in cruciferous vegetables that may also be required in higher amounts for this genotype.
- **Glutathione-GSTP1** - You have the wild-type AA genotype for GSTP1 rs1695 that is associated with improved glutathione antioxidant protection for breast, lung, or prostate health; however, supplemental vitamin E as alpha-tocopherol may be inflammatory. Your GSTP1 rs1138272 genotype may increase or decrease this effect.
- **Heavy Metals-GSTP1** - You have the wild-type CC genotype for GSTP1 rs1138272 that is associated with improved glutathione antioxidant protection against heavy metals, pesticides, and air pollution for colon, prostate, lung, throat, and fertility health. Your GSTP1 rs1695 genotype may increase or decrease this effect.
- **Glutathione-GPX1** - Your genotype is associated with improved selenium status and glutathione peroxidase to boost DNA protection, heat stress tolerance, skin protection and longevity.
- **Glutathione-CTH** - Your genotype is associated with improved gene function, leading to adequate cysteine for glutathione production.
- **Nitric Oxide-NOS1** - Your genotype is associated with an average required intake of red, yellow, and orange vegetables to modulate the inflammatory process for NOS1.
- **Nitric Oxide-NOS2** - Your NOS2A gene is functioning optimally for reducing the probability of age-related macular degeneration from cigarette smoke.
- **Eye Health-ARMS2** - Your genotype is associated with a lower sensitivity to the negative effects of smoking on eye health.

DETOXIFICATION

- **Liver Enzyme-CYP1A1** - Your genotype is associated with improved detoxification of benzopyrene from cigarette smoke and will assist the function of your GSTM1 gene.
- **Liver Enzyme-CYP1A2** - You have the CC genotype for CYP1A2 that is associated with a reduced sensitivity to heterocyclic amines (fried meat). CYP1A2 should be reviewed in combination with the GSTM1 and NAT2 genotypes for a cumulative value.
- **Liver Enzyme-THC and CYP2C9** - You have the wild-type genotype that is associated with improved metabolism of THC, the active psychoactive compound in cannabis.
- **Liver Enzyme-CYP2D6** - Your genotype is associated with improved metabolism of certain drugs associated with CYP2D6 rs1065852. However, more CYP2D6 SNPs are needed for a complete panel. Please talk to your doctor about further testing for CYP2D6 and drug metabolism.
- **Liver Enzyme-CYP2E1** - Your genotype is associated with improved metabolism of benzene and acrylamide for colon health.
- **Liver Enzyme-CYP3A4** - Your genotype is associated with normal metabolism of certain drugs that use this enzyme. We recommend further pharmacogenomic testing with your doctor for more information regarding CYP3A4.

DNA DAMAGE, PROTECTION AND REPAIR

- **DNA Repair-ATM** - Your genotype is associated with improved DNA repair function for pancreatic health.
- **Breast-ESR2** - For women with the AG ESR2 rs2987983 genotype, your genotype is associated with improved tumor suppression function for breast health. All genes related to breast health should be analyzed to better determine the cumulative value for breast protection.
- **DNA Repair-MDM2** - Your MDM2 genotype is associated with improved DNA repair for sun damage if you are female.
- **DNA Repair-MLH1** - Your genotype is associated with improved DNA repair for colon, endometrium, lung, and brain protection.
- **Longevity-SIRT1** - Your SIRT1 genotype is associated with normal SIRT1 activity for longevity. While not a weakness, you may want to increase SIRT1 activity epigenetically to increase the probability of longevity, especially if you have the APOE-e4 allele. A sedentary lifestyle, aging, poor diet, and obesity lowers SIRT1 activity. Exercise, fasting, 7-8 hours of sleep per night, saunas, polyphenols, vitamin D, omega-3 fatty acids, resveratrol, magnesium, and melatonin have all been found to increase SIRT1 activity.

CARDIOVASCULAR HEALTH & EXERCISE

- **Power and Recovery-ACTN3** - You have the RX genotype associated with enhanced improvements in strength, muscle hypertrophy, sprint times, protection from eccentric training-induced muscle damage, and a reduced risk of sports injury. The RX genotype may represent the best of both ACTN3 genotypes for strength training, maintaining lean muscle mass later in life, and longevity.
- **Lung Cytokines-TNFA** - If you have Asian ancestry, your genotype is associated with improved TNF-a gene function for lower inflammation in the lungs.
- **Muscle Recovery-IL6** - You have the GG genotype that is associated with lower levels of muscle inflammation post-exercise and improved recovery, faster sprint times, and is more common in sprint and power athletes compared to endurance athletes.
- **Muscle Inflammation-SOD2** - You have the wild-type genotype that is associated with improved SOD2 function in response to high-intensity exercise, reducing the inflammatory response in muscle tissue compared to the homozygous carriers.
- **Pesticides, HDL and LDL-PON1** - You have the wild-type genotype associated with improved PON1 activity for pesticide detoxification and protection against LDL oxidation.
- **LDL-LPA** - Your genotype is associated with healthy Lp(a) levels, a sticky form of LDL that affects plaque levels.
- **Raw Fruit and Vegetable Intake-9p21** - You have the wild-type genotype that is associated with an average requirement for raw fruit and vegetable intake for cardiovascular health and may improve your cardiovascular profile.
- **Blood Clots-F5** - Your genotype is associated with improved gene function for a lower probability of deep vein thrombosis.
- **Blood Pressure-ACE1** - Your genotype is associated with lower baseline ACE levels, improving blood pressure. Depending on ACE2 levels and dietary habits, you may have a more balanced renin-angiotensin system for blood pressure.
- **Potassium and Magnesium-ADD1** - If you have Asian ancestry, your wild-type genotype is associated with a reduced risk of a higher sodium intake causing elevated blood pressure.
- **Blood Pressure-AGTR1** - You have the wild-type genotype, associated with a lower probability for high blood pressure, elevated triglycerides, elevated ApoB, and NAFLD from excess dietary fat and carbohydrate intake.
- **Blood Pressure-ACE2** - Your genotype is associated with higher baseline ACE2, improving the balance between ACE1 and ACE2 for blood pressure, and potentially lowering the risk of COVID-19 severity. Other dietary habits and health issues could affect this result.
- **Phytoestrogens-TMPRSS2** - You have the AA genotype that is associated with a lower expression of TMPRSS2 and may decrease the susceptibility to viral infections and prostate cancer (men).

MY HEALTH REPORT: WEAKNESSES

Genes are not your destiny - they are your blueprint. Please understand that these weaknesses can be turned into strengths based on the personalized recommendations given below. Making strategic changes to diet, environment, stressors, and even relationships can have a profound effect on optimizing gene function. Aim to turn every weakness into a strength by giving attention to the proactive, customized dietary and lifestyle modification recommendations in this section!

NUTRIENT METABOLISM & DIGESTION

- **Beta Carotene to Vitamin A Conversion Rate-BCMO1** - Your BCMO1 genotype combination is associated with a reduced conversion rate of plant-based beta carotene (squash, sweet potatoes, carrots) to vitamin A. This increases your need for foods higher in vitamin A like eggs, cod liver oil, wild salmon oil and organ meats for skin, digestion, healthy eyes, lungs, and immunity.
- **ALA to EPA and DHA Conversion-FADS2** - Your genotype is associated with a reduced conversion of plant-based omega-3 ALA (walnuts, flax seeds, and pumpkin seeds) to EPA and DHA. Increased EPA and DHA intake may be needed.
- **B6-NBPF3** - You are more likely to have low B6 levels due to variants in the NBPF3 gene, increasing the sensitivity to medications that deplete B6 (oral contraceptives, antibiotics, ACE inhibitors, antacids, proton pump inhibitors and more). You need to focus on increasing foods high in B6 like wild salmon, pistachios, avocados and potatoes.
- **Saturated Fat-APOA2** - You have the homozygous genotype that is associated with a higher probability of weight gain from over 22 grams of saturated fats daily (mainly cheese, cream, and ice cream). Focus on avocados, olive oil, nuts, seeds, fish, and coconut oil as your main sources of fat. Increase fiber intake while eliminating cheese, ice cream, and minimizing dairy in general.
- **Carbohydrates-TCF7L2** - Your genotype is associated with an increased probability of elevated blood sugar from refined sugar and grains. A diet low in refined sugar and flour, higher in protein and omega-3 fatty acids, glycine, diversified prebiotic foods, olive oil, cinnamon, turmeric, dark roast coffee and cordyceps mushrooms may be more beneficial.
- **Histamines-APB1** - You have the heterozygous CT genotype that is associated with intermediate histamine breakdown in the digestive tract. While not as impactful as the homozygous genotype, histamine sensitivity could still occur.

METHYLATION

- **Folate-MTHFR 677** - You have the homozygous genotype that is associated with a reduced function of approximately 50-70%. This increases the need for riboflavin and methylfolate for normal homocysteine levels.
- **B12-TCN2** - Your B12 transportation may be affected if lithium levels are low due to your genotype in the TCN2 gene.
- **Choline-PEMT** - Your genotype is associated with an increased need for dietary choline for liver health, normal homocysteine levels, breast health for women, and a healthy pregnancy for women.
- **B6-CBS** - Your genotype is associated with reduced CBS gene function for homocysteine levels, gut repair, and brain health, increasing your need for B6.

HORMONE SUPPORT

- **Sex Hormone Binding Globulin** - If you are female, your genotype is associated with a sensitivity to oral contraceptives and hormone replacement therapy in relation to sex hormone binding globulin (SHBG) levels for healthy hormone levels. If you are male, higher SHBG levels could affect bone mineral density and SHBG may need to be tested. However, variants may also positively lead to higher testosterone levels.

- **Thyroid-DI01** - The homozygous AA genotype for the DI01 gene is associated with higher T4 levels and a sensitivity to organochlorine pesticides and PCBs. You may have a higher need for selenium and zinc if you have elevated T4 and low T3 levels.

- **Vitamin D-CYP2R1** - Your genotype is associated with low circulating vitamin D levels that can affect immunity, breast health in women, and testosterone levels in men. Check your vitamin D levels and make sure you are in range.

- **Estrogen Metabolism-CYP2C19** - Individuals with the CC genotype for CYP2C19*17 are considered the normal metabolizer phenotype, which may lack the estrogen metabolism benefits of the ultra-rapid metabolizer phenotype. Please review all genes involved in estrogen metabolism for a complete picture of the process.

- **Estrogen Metabolism-CYP1A2** - For men and women with the CYP1A2 CC slow caffeine metabolism genotype, coffee intake was found to be less protective for breast and prostate health compared to the AA fast metabolizer.

- **Estrogen Metabolism-COMT** - For estrogen metabolism and detoxification, those with the intermediate AG COMT V158M genotype may have an increase in harmful estrogen metabolites that can cause DNA damage. To reduce the risk of these metabolites, you should avoid xenoestrogens, manage stress levels, maintain gut health, increase magnesium intake, and consume green tea polyphenols.

MENTAL HEALTH, NEUROTRANSMITTERS & COGNITIVE PERFORMANCE

- **Dopamine, Adrenaline and Estrogen-COMT** - The heterozygous AG COMT V158M genotype is associated with a slower breakdown of dopamine, adrenaline, and estrogen, creating higher circulating levels in response to stress due to variants in the COMT genes. This may increase your need for magnesium, vitamin C, strength training, and sprints to reduce stress levels.

- **Dopamine Receptors-ANKK1** - Your genotype is associated with a lower density of dopamine receptors, reducing dopamine targets within the striatum of the brain known for rewarding feedback. Lower dopamine targets could lead to a higher likelihood of addictive behaviors, compulsive eating, and ADHD. Getting 8 hours of sleep per night, keeping your blood sugar balanced with adequate protein and fiber, high-intensity exercise, lower media exposure, vitamin D, omega-3's, and meditation all increase dopamine receptor density.

- **Histamines and Hyperactivity-HNMT** - You have the AA genotype that is associated with increased hyperactivity in response to food dyes and sodium benzoate. Excess histamine is lowered by vitamin C, choline, folate, magnesium, chamomile, basil, stinging nettle, echinacea, fennel, ginger and wild oregano.

- **Anandamide-FAAH** - You have the common CC genotype that encodes for the fast activity of FAAH. This is associated with naturally lower anandamide levels that could increase anxiety, pain, pesticide sensitivity and a heightened stress response to threatening situations. You may benefit from aerobic exercise over 30 minutes (especially in altitude), CBD oil, red clover tea (women), kaempferol (raspberries, capers, cumin, cloves, almonds, cherry tomatoes, red wine), cacao, echinacea, rosemary, and hops to increase anandamide levels.

- **Brain Health-PEMT** - Your genotype is associated with an increased need for dietary choline and daily walks for memory, anxiety, and REM sleep.

IMMUNE SUPPORT, ANTIOXIDANTS AND INFLAMMATION

- **Cell Protection-CAT** - Your genotype is associated with lower catalase levels and a sensitivity to BPA plastic and cell damage. This increases the need for foods high in flavonoids, the mushroom Lion's Mane, holy basil, cumin, anise, fennel, caraway, cardamom, and deep breathing practices to improve catalase levels.
- **Glutathione-GSTM1** - You have the null genotype that is associated with a higher sensitivity to benzo(a)pyrene from the burning of wood or trash, tobacco smoke, asphalt, coal, diesel exhaust, charred meat, and gas cooking. If you have the GSTM1 null and NAT2 slow acetylator combination, that may affect lung, breast, bladder, skin, colon, and kidney health. It is recommended to increase your intake of cruciferous vegetables, vitamin C, vitamin E, vitamin A, milk thistle, resveratrol, curcumin, green tea, and white tea.
- **Eye Health-CFH** - Your genotype is associated with an increased need for lutein, zeaxanthin, bilberry, lingonberry, vitamin C, and vitamin E for healthy eyes.

DETOXIFICATION

- **Liver Enzyme-CYP1B1** - You have the GG genotype that is associated with reduced detoxification of polycyclic aromatic hydrocarbons (highest in vegetable oils), oral contraceptives, cigarette smoke, an increased sensitivity to excessive sun exposure, and high-dose biotin supplementation. You can assist CYP1B1 with seaweed, celery, berries, rooibos tea, red wine, and dark roast coffee.
- **Vitamin K2-VOKRC1*2** - Your genotype is associated with a higher sensitivity to vitamin K2 induced deficiency from antibiotics and the blood thinner Warfarin.
- **Aromatic Amines-NAT2** - You have the slow acetylator genotype for the NAT2 gene. This is associated with reduced detoxification of aromatic amines found in tobacco smoke, commercial hair dyes, industrial and manufacturing plants, charred meat, and diesel exhaust for bladder, prostate and breast health. Cruciferous vegetables, carotenoids, and vitamin C all assist NAT2 detoxification.
- **Statins-COQ2** - Your genotype is associated with a higher likelihood of statin drug-induced muscle pain.

DNA DAMAGE, PROTECTION AND REPAIR

- **DNA Repair-TP53** - You have the homozygous CC genotype that may be advantageous for fertility in cold climates, but also increases the need for selenium, zinc, vitamin C, reishi, and niacin for DNA repair against chemical toxicity to the thyroid gland and skin.
- **Processed Meat and Colon Cancer-GATA3** - Your genotype is associated with a sensitivity to processed meats (hot dogs, salami, pepperoni) and colon cancer risk due to variants in GATA3. Reduce processed meat intake, optimize vitamin D levels and increase berries, apples, sauerkraut, broccoli, tomatoes, basil, rosemary, garlic, onions and leeks.

CARDIOVASCULAR HEALTH & EXERCISE

- **VO2 Max-PPARGC1A** - Your genotype is associated with a higher need for more strategies to increase oxygen capacity for aerobic exercise, including a structured endurance program, cold exposure, and adaptogens. Your genotype in the GSTP1 rs1695 gene can also influence this result.

- **Muscle Injury-COL1A1** - You have the wild-type CC genotype that is associated with an increased need for dietary collagen for healthy skin, tendons, corneas, lungs, and bones. Vitamin C, zinc, copper, glycine, proline, lysine, and B6 are all precursors to collagen production.

- **Caffeine-CYP1A2** - You have the "slow metabolizer" genotype for caffeine metabolism, increasing the sensitivity to caffeine intake. If you are female and taking oral contraceptives, and you have genetic variants in COMT, this can increase the sensitivity to caffeine even higher. Exercise and cruciferous vegetables may assist caffeine metabolism.

- **Triglycerides-FADS1** - Your genotype is associated with a higher need for EPA and DHA omega-3 fatty acids to maintain healthy triglyceride levels.

- **Fibrinogen-ESR2** - Your genotype is associated with potentially elevated fibrinogen (increased risk of blood clots) levels in postmenopausal women. This increases the need to avoid BPA plastic, unfiltered tap water, and phthalates (chemical personal care products). Increase the probiotic lactobacillus planatarum and discuss the use of nattokinase with your health practitioner if fibrinogen levels are elevated.

- **Stress-ADRB2** - You have the heterozygous AG genotype for ADRB2 rs104271 that is associated with a higher sensitivity to chronic stress on your heart, especially with variants in COMT. Optimize COMT function and ADRB2 with foods that contain magnesium and vitamin C, deep breathing, and consider adaptogens to lower the stress response.

YOUR PERSONALIZED DNA-BASED GROCERY LIST

This section of the report represents the most expansive, actionable summary of what you can do, right now, to dramatically up-regulate gene function, building a happier, healthier you! No technical expertise is required - just make these recommendations non-negotiable when you visit the grocery store.

Your grocery list is generated based on a combination of unique gene variants that require an increased intake of the following vitamins, minerals, phytonutrients, amino acids, fiber and more. This list generates the foods and drinks based on the highest levels for each section and does not take into account any food allergies or sensitivities.

 **B12**	Seafood, meat, dairy (if consuming dairy) and unfiltered fermented drinks
 **B2**	Lamb, salmon, yogurt, liver and oyster mushrooms
 **B6**	Wild salmon, yellowfin tuna, liver, chicken breast, unfiltered fermented drinks, pistachios, avocado, sweet potatoes, and spinach
 **Beta-Carotene**	Sweet potatoes, carrots, spinach, squash, cantaloupe, and broccoli
 **Betaine**	Spinach, shrimp, beets, and whole grain sourdough bread
 **Boron**	Prunes, avocados, raisins, peaches, apples, pears, and peanut butter
 **Copper**	Potatoes, shiitake mushrooms, cashews, sunflower seeds, dark chocolate, and shellfish

	**Folate**	Collard greens, beets, black-eyed peas, raw spinach, asparagus, hummus, broccoli, romaine lettuce, parsley, liver, strawberries, oranges, and sprouted lentils
	**Glucosinolates**	Brussels sprouts, mustard greens, turnips, savoy cabbage, kale, watercress, red cabbage, broccoli cauliflower, and Bok Choy
	**Glycine**	Broth, collagen powder, meat with the skin, ribs, shanks, drumsticks, and baobob
	**Lithium**	Mineral water, shellfish, tomatoes, spinach, unpeeled potatoes, eggplant, cabbage, rooibos tea, rosehips, pastured eggs and Saccharomyces cerevisiae (yeast)
	**Lutein and Zeaxanthin**	Cooked spinach, cooked kale, raw spinach, raw parsley, goji berries, asparagus, and eggs
	**Magnesium**	Sprouted pumpkin seeds, hemp seeds, chia seeds, Gerolsteiner mineral water, spinach, wild salmon, and peanut butter
	**Niacin**	Yellowfin tuna, canned tuna, wild salmon, ground turkey, chicken breast, liver, skirt steak, white button mushrooms, and brown rice
	**Omega-3's**	Seafood and pastured eggs
	**Phytoestrogens**	Dark berries, beans, sourdough bread, hummus, peanuts, miso soup, flax seeds (women), tahini sauce, and cruciferous vegetables (broccoli, cabbage, kale, Brussels sprouts)

Potassium

Wild salmon, avocados, potatoes, acorn squash, coconut water, sweet potato, spinach, tomato sauce, and bananas

Prebiotics

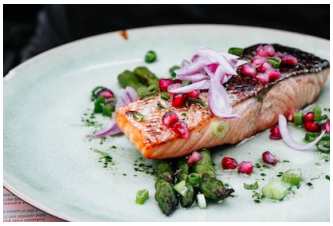
Pistachios, leeks, asparagus, radicchio, bananas, garlic, kiwi, onions, artichokes, Tiger nuts, chicory root, yacon syrup and foods high in polyphenols

Vitamin A

Liver, pastured eggs, cod liver oil, wild salmon oil, eel, and sockeye salmon

Vitamin C

Bell peppers, guava, black currants, strawberries, oranges, and broccoli



Vitamin D

Sockeye salmon, cod liver oil, canned tuna, wild herring, and sardines

Zinc

Oysters, crab, lobster, beef, lamb, pork loin, liver, and sprouted pumpkin seeds

PERSONALIZED BLOOD WORK

These results are generated based on a combination of gene variants unique to you. These biomarkers may not be out of range based on your diet and lifestyle habits, but they may be the ones for you to monitor to ensure you are making the right choices based on your genetic results (your predispositions).

For example, if vitamin D comes up in this section, it does not mean that your current levels of vitamin D are actually low. What we are saying is that based on a variety of genetic factors, your variants could make it more difficult to obtain recommended levels of circulating vitamin D, so it might be prudent to further monitor to ensure that you are taking the necessary steps to turn genetic weaknesses into strengths and maintain correct levels.

B12

If poor B12 status is suspected, methylmalonic acid (MMA) levels may be needed to accurately assess B12 status, absorption, and requirements

Homocysteine

Homocysteine should be between 7-9

Iodine

A urinary iodine test can assess iodine levels

LDL

Test LDL-P, LDL-C, and small dense LDL

Thyroid Panel

The genes for the thyroid gland look at T3 and T4 function, but not TSH

Triglycerides

Triglycerides should be <150

Vitamin D

Vitamin D should be between 35-50 ng/ml. Check both 25 and 1,25-dihydroxyvitamin D.

MY CLINICAL RESEARCH SUMMARY: NUTRIENT METABOLISM & DIGESTION

Beta Carotene to Vitamin A Conversion Rate-BCMO1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
BCMO1 A379V rs7501331	Heterozygous CT
BCMO1 R267S rs12934922	Heterozygous AT

Recap

Improves BCMO1 Gene Function: Vitamin A in the form of retinol and zinc.

Decreases BCMO1 Gene Function: Relying on beta-carotene for vitamin A requirements.

BETA CAROTENE TO VITAMIN A CONVERSION RATE-BCMO1

Research: If you are heterozygous or homozygous for BCMO1 A379V or BCMO1 RS267S, you have a reduced conversion of beta-carotene to vitamin A. If you have a heterozygous or homozygous BCMO1 RS267S and BCMO1 RS267S, the reduction is even more dramatic. Many nutrition labels will have beta-carotene listed as vitamin A, however this is not true vitamin A.

The normal conversion for beta-carotene (carrots, sweet potatoes) to retinol is 1:6 and 1:12 for other carotenoids. Female volunteers carrying the T variant of rs7501331 (379V) had a 32% lower ability to convert beta-carotene, and those carrying at least one T in both SNPs (379V and R267S) show a 69% lower ability to convert beta-carotene into retinol.

In a cohort study of 48,400 US men and 75,170 US women, during a follow-up period of more than 26 years, a higher total vitamin A intake was associated with a reduction in cutaneous squamous cell carcinoma risk.

You want to make sure you consume animal based vitamin A (pastured egg yolks, wild salmon oil, cod liver oil, butter) along with zinc for digestive lining repair, oral health, eye health, iron mobilization, mitochondria health, skin health (sunburns deplete vitamin A in the skin, and acne responds to vitamin A), healthy lung function, and increased immunity.

ALA to EPA and DHA Conversion-FADS2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
FADS2 rs1535	Homozygous GG
FADS2 rs174575	Homozygous GG

Recap

Improves FADS2 Gene Function: EPA and DHA omega-3 fatty acids.

Decreases FADS2 Gene Function: Relying on plant-based omega-3 fatty acid ALA for those with the heterozygous or homozygous variant.

ALA TO EPA AND DHA CONVERSION-FADS2

Research: You may have a decreased conversion rate of the plant based omega-3 fatty acid ALA to DHA and should choose DHA sources for sufficient omega-3's.

FADS1 and FADS2 are enzymes that are involved in converting omega-3 and omega-6 fatty acids for brain development and inflammation control. Like the lactase gene, FADS1 is likely to be a critical gene of adaptation. In this case, it was in response to a plant-based diet versus a meat and fish based diet depending on migration routes and food availability.

It has been hypothesized that populations that began to rely more on plant-based diets adapted with the selected allele in FADS2 to synthesize more EPA and DHA from plants. The Inuit populations of Greenland, for example, who rely heavily on seafood with very little plant intake, have a deleted allele showing an opposite adaptation to a diet without plants.

A meta-analysis has found an association between variants in FADS2 in European heritage and a low conversion rate of ALA (plant-based omega-3) to DHA. There is also evidence for gene variants in those with African, Chinese, and Hispanic ancestry having a reduced conversion rate.

Children who had a higher dietary ratio of omega-6 to omega-3 were vulnerable for developing colitis if they also presented specific variants in FADS2.

A higher need of animal-based EPA and DHA may be needed for those with variants in FADS2.

B6-NBPF3

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
NBPF3 rs4654748	Heterozygous CT

Recap

Improves NBPF3 Gene Function: B6

Decreases NBPF3 Gene Function: Sugar, stress, high intake of alcohol and refined flour based carbohydrates, antibiotics, oral contraceptives, ACE inhibitors, antacids, proton pump inhibitors, Phenytoin, bronchodilators, Digoxin, diuretics, hormone replacement therapy, Estradiol, MAO inhibitors, St. John's Wort and Parnate.

B6-NBPF3

Research: You may require a higher intake of B6. Heterozygotes have a 1.45 ng/mL lower Vitamin B6 blood concentration than the wild-type genotype.

Vitamin B6 plays a major role in neurotransmitter health. B6 deficiency can manifest as anorexia, irritability, anxiety, depression, muscle pain, bad PMS/low progesterone, nausea, seizures, migraines, dermatitis, age related macular degeneration (with low folate and B12) and lethargy.

Researchers have found an inverse association between ovarian cancer risk and vitamin B6 intake. Subjects with the highest vitamin B6 intake showed a 24 percent decrease in the likelihood of developing ovarian cancer compared to the individuals with the lowest intake.

Women of reproductive age, especially current and former users of oral contraceptives, teenagers, male smokers, non-Hispanic African-American men, and men and women over age 65 are most at risk of B6 deficiency. Data suggests that oral contraceptive users have extremely low plasma PLP levels. Three quarters of the women who reported using oral

contraceptives, but not vitamin B6 supplements, were vitamin B6 deficient.

Saturated Fat-APOA2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
APOA2 rs5082	Homozygous GG

Recap

Improves APOA2 Gene Function: Keeping saturated fat intake below 22 grams.

Decreases APOA2 Gene Function: High saturated fat intake, especially from dairy.

SATURATED FAT-APOA2

Research: Research has shown that those with the GG genotype for APOA2 had a BMI that was 6.8% higher than the normal and heterozygous genotype when consuming over 22 grams of saturated fat. The main sources surpassing the 22 gram mark were likely coming from cheese and all the different types of cream.

Here is an example of high saturated fat foods:

Bacon cheeseburger: 13 grams
8 oz. T-Bone Steak: 14 grams
3 slices of cheddar cheese: 18 grams
Ice cream with fudge and whipped cream: 30 grams
Milkshake: 68 grams

If you keep your saturated fat to eggs (1.6 grams per egg), butter (7 grams in 1 tbsp.), ghee (3 grams per tsp.) and red meat (leaner cuts 8 grams for 6 oz.) all in moderation, you most likely will not go over 22 grams of saturated fat each day.

Two studies have been done on APOA2. The first involved a population of European and Hispanic of Caribbean origin. The second study involved a Mediterranean, Chinese and Asian Indian population. In the second study, they found a significant association of the GG males but was not detected in females.

The most interesting finding about the APOA2 gene was the suggestion that APOA2 acts as a satiety signal with saturated fat and negatively affects the function of lipoprotein lipase, the enzyme that breaks down fats. Lipoprotein lipase is only produced when muscles are actively flexed, like when you stand. But when you sit for long periods of time, the enzyme becomes inactive.

Due to having the GG genotype of APOA2, you should keep your total saturated fat intake (eliminate or limit cheese, cream and ice cream) below 22 grams if you struggle with your weight, especially for males. Coconut oil is a saturated fat exception. Avocados, olive oil, nuts, seeds, fish and coconut oil should be your main sources of fat along with fiber, while eliminating cheese, ice cream and minimizing dairy in general. Fiber intake is associated with enhanced satiety and reduced food intake, and people with the GG genotype will benefit from increasing their fiber intake when consuming a meal with saturated fat. Berry polyphenols may decrease the risk of obesity by inhibiting lipase and lowering fat absorption. You should also take many standing and walking breaks throughout the day to activate the lipoprotein lipase enzyme to burn fat.

Carbohydrates-TCF7L2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
TCF7L2 rs7903146	Heterozygous CT

Recap

Improves TCF7L2 Gene Function: A Paleolithic and low-carb Mediterranean diet, glycine, omega-3 fatty acids, olive oil, turmeric, cinnamon, prebiotics, organic dark roast coffee, and cordyceps mushrooms.

Decreases TCF7L2 Gene Function: Refined sugar and grains.

CARBOHYDRATES-TCF7L2

Research: The TCF7L2 gene has become the strongest indicator of Type 2 diabetes and gestational diabetes risk for multiple ethnicities in studies. A meta-analysis also found an association with breast, prostate and colon cancer risk, all of which are connected to blood sugar levels and the risk is reduced by many of the same nutrients that improve this gene's function. Other genes and family history need to be assessed for cancer risk and prevention.

This gene is unique in its relation to Type 2 diabetes because people with variants in TCF7L2 may not exhibit risk signs like obesity. In fact, they may have a low body mass index (BMI) and low triglycerides. The increased risk is hypothesized to be due to the effect of TCF7L2 on the sensitivity of the pancreatic ß-cells to incretins, not overall insulin sensitivity.

Incretins are hormones that are released from the gastrointestinal tract after a meal and regulate the amount of insulin secreted. The two most important incretin hormones are GLP-1 and GIP. Researchers believe that increasing incretin sensitivity may decrease the risk of type 2 diabetes.

One study found that the consumption of meals based on the Paleolithic diet (no grains or dairy) focusing on fish, polyphenol-rich foods, fiber-rich vegetables, and spices high in phytochemicals resulted in significant increases in incretin and increased perceived satiety (feeling full). All three test meals were normalized to contain 50 grams of carbohydrates. Sufficient protein in particular shows promise in the management of Type 2 diabetes by stimulating incretin, insulin secretion, and slowing gastric emptying.

Two clinical studies have demonstrated that plasma GLP-1 levels rise following the ingestion of gelatin, a protein extraordinarily rich in glycine. Another study found that higher levels of indolepropionic acid produced by good bacteria due to a diet higher in prebiotic fiber-rich food decreased the risk of Type 2 diabetes.

Spices also appear very effective. Turmeric significantly increases the secretion of the incretin GLP-1. Cinnamon lowers blood glucose usually within physiological levels without hypoglycemia and increases satiety, showing it may act by potentiating the effects of incretin hormones.

There is a progressive deterioration of beta-cell function in patients with Type 2 diabetes. In vitro studies demonstrated that pancreatic beta-cell viability increased dramatically with cordyceps extract treatment, implying that cordyceps protect beta cells. This is crucial for the TCF7L2 gene due to the communication between pancreatic beta cells and incretins. The researchers concluded that “the potential ability of cordyceps to preserve beta-cell function may afford a promising therapy for diabetes.”

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
HLA-DQ8	HLA-DQ8-rs7454108	TT		
HLA DQ2.5	HLA DQ2.5-rs2187668	CC		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
BCMO1 A379V BCMO1 encodes the conversion rate from beta-carotene to vitamin A.	BCMO1 A379V-rs7501331		CT	
	BCMO1 R267S-rs12934922		AT	
FADS2 The FADS2 gene encodes the conversion of plant based omega-3 fatty acid alpha linolenic acid (ALA) to EPA.	FADS2-rs1535			GG
	FADS2-rs174575			GG
FUT2 The FUT2 gene controls prebiotic production, B12 absorption and how much bifidobacteria you carry in your digestive tract. The rs601338 SNP is found in European, African and Indian populations.	FUT2-rs601338		AG	
NBPF3 NBPF3 has been associated with vitamin B6 levels.	NBPF3-rs4654748		CT	
SLC23A1 Solute carrier family 23 member 1 (SLC23A1) is one of the two transporters which aids in the absorption of vitamin C into the body. Polymorphisms in the gene are associated with reduced plasma vitamin C levels in the body.	SLC23A1-rs33972313	CC		
ACAT1-02 The ACAT gene converts protein and fat to ATP (energy) in the mitochondria, and plays an important role in cellular cholesterol homeostasis.	ACAT1-02-rs3741049	GG		
ADIPOQ ADIPOQ encodes for adiponectin, a protein secreted by fat cells that affect insulin and glucose metabolism. Low levels of adiponectin play a role in obesity, insulin resistance and Type 2 diabetes.	ADIPOQ-rs2241766	TT		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
HFE-C282Y A homozygous HFE C282Y may lead to an iron overload due to increased iron absorption and disrupted metabolism. Compound heterozygotes C282Y/H63D and single C282Y heterozygotes carry a very low risk of hemochromatosis, making the homozygous C282Y the most clinically relevant.	HFE-C282Y-rs1800562	GG		
PPAR-alpha The PPAR-alpha gene plays a vital role in fatty acid metabolism and ketosis, and is considered one of the most critical targets for ameliorating abnormalities with triglycerides, HDL, LDL, VLDL, and ApoB.	PPAR-alpha-rs1800206	CC		
ACSL1 Long-chain acyl CoA synthetase 1 (ACSL1) plays an important role in fatty acid metabolism and triglyceride synthesis. Disturbance of these pathways may result in dyslipidemia and insulin resistance, hallmarks of the metabolic syndrome.	ACSL1-rs9997745		AG	
FTO Polymorphisms in the FTO genes have been shown to cause higher ghrelin levels (hunger hormone) in many populations, which can create a larger appetite and the potential for overeating.	FTO-rs17817449		GT	
	FTO-rs9939609		AT	
APOA2 The APOA2 gene contains instructions for making a protein called apolipoprotein A-II, which is found in HDL cholesterol particles. The homozygous genotype has been linked to saturated fat intake and weight gain.	APOA2-rs5082			GG

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
TCF7L2 TCF7L2 polymorphisms have been associated with low incretin hormones and impaired insulin secretion.	TCF7L2-rs7903146		CT	
LCT LCT is the gene connected with the ability to breakdown lactose in dairy.	LCT-rs4988235		AG	
APB1 APB1 is encodes for the DAO enzyme to breakdown histamines primarily in the digestive tract. The homozygous genotype may increase the risk of migraines from histamines in women or a hypersensitivity to Aspirin in men.	APB1-rs10156191		CT	
ABCG2 (Q141K) The ABCG2 (Q141K) gene is located at the membrane of kidney proximal tubule cells, where it mediates renal urate secretion. Variants in this gene are linked to reduced uric acid excretion.	ABCG2 (Q141K)-rs2231142	GG		
ALDH2 Alcohol metabolism in the liver most commonly involves the enzymes alcohol dehydrogenase and aldehyde dehydrogenase, metabolizing alcohol to acetaldehyde, and then to acetate. ALDH2 encodes for aldehyde dehydrogenase, and variants can affect the levels of acetaldehyde and therefore the carcinogenic effect of alcohol.	ALDH2-rs671	GG		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
ADRB2 The beta-2-adrenergic receptor (ADRB2) is the main target of the catecholamine epinephrine, and a primary mediator of the stress response. ADRB2 is widely expressed both in the gastrointestinal tract and in the CNS.	ADRB2-rs1042714	CC		
PPCDC PPCDC is necessary for the biosynthesis of coenzyme A and variants in this SNP are associated with serum zinc levels.	PPCDC-rs2120019		CT	
SELENBP1 The Protein Selenium Binding 1 gene codes for an integral membrane protein involved in antigen presentation and serum copper levels.	SELENBP1-rs2769264	TT		
TFR2 The TFR2 gene provides instructions for making a protein called transferrin receptor 2 to help iron enter liver cells. The receptor on the surface of liver cells binds to transferrin, which transports iron through the blood to tissues throughout the body. When transferrin binds to transferrin receptor 2, iron is allowed to enter the cell.	TFR2-rs7385804		AC	

MY CLINICAL RESEARCH SUMMARY: METHYLATION CYCLE

Folate-MTHFR 677

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
MTHFR 677 rs1801133	Homozygous AA

Recap

Improves MTHFR 677 Gene Function: Riboflavin and methylfolate.

Decreases MTHFR 677 Gene Function: Proton pump inhibitors, oral contraceptives, NSAIDs, anticonvulsants, antivirals, antibiotics, acid blockers/antacids and hypothyroidism.

FOLATE-MTHFR 677

The highest cluster of the homozygous MTHFR 677 genotype is found in Mexico and Hispanics in the US, Italy, Northern China, Spain, and France. The lowest frequency is found in black people (within and outside Africa), Inuit, Finland, Canada, the Netherlands, Germany, and Russia.

The homozygous MTHFR 677 gene has been found to have a 50-70% reduced enzymatic function. One hypothesis is that the homozygous MTHFR genotype was selected based on higher folate intake and UV exposure, both common in Mediterranean climates. What also happens in the body when MTHFR enzymatic function is reduced is that thymidine production increases. Thymidine enhances the repair of UV-induced DNA damage to help quickly repair sun damage.

The sun also depletes folate due to UV radiation. However, darker skin - common in the Mediterranean - contains higher melanin levels, which helps protect against folate loss. Increased thymidine and darker skin protected against the hot sun of the Mediterranean. At the same time, the environment provided more folate-rich fruits and vegetables to supply more dietary folate for other biochemical functions.

Another hypothesis is that malaria exposure - caused by a parasite through mosquito bites and has been prevalent in the Eastern Mediterranean and Southeast Asia - altered the MTHFR genotype selection. The malaria parasite needs higher amounts of folate to survive and replicate. Reduced MTHFR function lowered folate levels and boosted levels of thymidine, which may increase lymphocyte replication and immune function in response to malaria.

One concern with the homozygous MTHFR 677 genotype is high homocysteine. High homocysteine has been implicated in amyloid buildup, DNA damage and cancer, mitochondrial dysfunction, cardiovascular disease, age-related macular degeneration, apoptosis of neurons and depression. Multiple studies have found that riboflavin is essential for MTHFR 677 and that the homozygous genotype is associated with high homocysteine when riboflavin status is low. Reduced levels of methylfolate can also lead to decreased production of neurotransmitters, reduced conversion of homocysteine to methionine, and reduced s-adenosylmethionine (SAMe) concentrations.

One study in 259 post-menopausal women found that for those with variants in CYP1B1 (rs1056836), KRAS (rs61764370) and MTHFR (rs1801133 and rs1801131), oral contraceptives and hormone replacement therapy was associated with shorter leukocyte telomere length. Shorter leukocyte telomeres are connected to premature aging and may increase the risk of cancer, cardiovascular disease, obesity, diabetes, chronic pain, and sensitivity to perceived psychological stress.

A large meta-analysis showed the lack of statistically significant association between MTHFR mutations and coronary heart disease except in the Middle East and Japan, where it portrayed statistical significance.

It is essential to consider riboflavin intake, PEMT, MTR/MTRR, BHMT and CBS activity to assess overall homocysteine metabolism. Too high or too low levels of B12, B6, folate or their co-factors may cause dysregulation of methyl donor activity.

B12-TCN2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
TCN2 C766G rs1801198	Homozygous GG

Recap

Improves TCN2 Gene Function: Lithium.

Decreases TCN2 Gene Function: Depleted lithium levels.

B12-TCN2

Research: Low vitamin B12 concentrations in the cell can be the result of low vitamin B12 intake, but they can also be attributable to a disturbance in the absorption, transport, or cellular uptake of this vitamin. High B12 levels on blood tests may indicate poor intracellular transport and absorption.

Approximately 20-25% of circulating cobalamin binds to transcobalamin 2 (TCN2), which is referred to as active vitamin B-12. A 2017 meta-analysis found that subjects with the rs1801198 GG genotype had significantly lower concentrations of holotranscobalamin and higher concentrations of homocysteine (European descent only) than subjects with the CC genotype.

In Chinese patients, the CG and GG genotypes were higher in patients with mild, moderate, and severe ulcerative colitis compared with those with remission ulcerative colitis. The average homocysteine level was elevated, whereas the average vitamin B12 and folate levels were reduced.

If you have the GG TCN2 genotype, you may require more dietary lithium to assist B12 transport. Lithium ranges widely based on the water supply. It is highest in certain mineral waters, shellfish, tomatoes, spinach, unpeeled potatoes, eggplant, cabbage, rooibos tea, rosehips, pastured eggs and Saccharomyces cerevisiae (yeast). Countries that consume the most lithium include the inhabitants of China, Mexico, Austria, and Sweden.

Testing lithium levels may be a useful marker for certain disorders like depression and bipolar disorder. One study found that young US children with autism and their mothers had unusually low levels of lithium compared to neurotypical children and their mothers.

Researchers have also explored lithium's role in preventing cancer metastasis when cancer cells are expressing high levels of TGFBIp. Inhibition of TGFBIp expression in cancer cells by lithium decreased tumor metastasis to the lungs, liver, and lymph nodes.

Be aware that high B12 supplementation depletes lithium levels, and dosing lithium supplementation should be done with extreme caution due to its suppressing effect on the thyroid hormones.

Choline-PEMT

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
PEMT rs7946	Heterozygous CT
PEMT rs12325817	Wild Type CC

Recap

Improves PEMT Gene Function: Choline, vitamin C and estrogen.

Decreases PEMT Gene Function: Nighttime pain relievers, antihistamines, anti-seizure medications, sleep aids, antidepressants, incontinence drugs and narcotic pain relievers.

CHOLINE-PEMT

Improves PEMT Gene Function: Choline, vitamin C and estrogen.

Decreases Gene Function: Nighttime pain relievers, antihistamines, anti-seizure medications, sleep aids, antidepressants, incontinence drugs and narcotic pain relievers.

Research: Phosphatidylethanolamine-N methyltransferase (PEMT) catalyzes the synthesis of phosphatidylcholine.

Choline is responsible for shuttling fat out of the liver, aiding the gallbladder, healthy cell membranes to protect against inflammation, lowering anxiety, preventing damage from glutamate spikes, deep sleep, healthy DNA, healthy pregnancy and breast health. Non-Alcoholic Fatty Liver Syndrome occurs mainly from a choline deficiency. Choline deficiency also increases sensitivity to carcinogenic chemicals, mycotoxins and vegetable oils due to poor cell membrane health.

Research shows that the highest dietary intake of choline is found from people in the Northern countries, whereas Mediterranean countries had the lowest intake. Worldwide, total choline intake in adults ranges from 284 mg/day to 468 mg/day for men, from Taiwan and Sweden, respectively; and from 263 mg/day to 374 mg/day for women, from Mexico and Sweden. Major food sources of dietary choline vary by country. For example, eggs, meat, and dairy are the major sources of total dietary choline in New Zealand, while eggs, seafood, meats, and soy products are the predominant sources in Japan and China.

Having one or more T alleles at rs7946 is associated with having lower phosphatidylcholine production in the liver.

More than 40% of women have a genetic polymorphism in PEMT (rs12325817) that makes this gene unresponsive to estrogen, which creates the same high choline requirement as men. These women may be especially sensitive to dietary choline variations during pregnancy. One study found that the highest quintile of choline consumption was associated with a lower risk of breast cancer compared with the lowest quintile.

Eighty percent of the women who were homozygous for the rs12325817 SNP manifested signs of choline depletion (liver or muscle dysfunction), relative to 43% of subjects carrying one copy of the variant allele and 13% of subjects without the SNP. Almost 75% of the North Carolina population in the United States has one variant allele.

B6-CBS

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
CBS A13637G rs2851391	Heterozygous CT

Recap

Improves CBS Gene Function: B6 and SAMe as co-factors, selenium and folate to increase arsenic detoxification.

Decreases Gene Function: Antibiotics, arsenic, birth control, ACE inhibitors, antacids, proton pump inhibitors, Phenytoin, bronchodilators, Digoxin, diuretics, hormone replacement therapy, Estradiol, MAO inhibitors, St. John's Wort, high cysteine and Parnate.

B6-CBS

Research: CBS is an important enzyme in the transsulfuration pathway that catalyzes the conversion of homocysteine (HCY) to cystathionine, a substrate for glutathione synthesis.

The CBS gene requires B6 and healthy SAMe production to regulate function. Deficiencies in CBS activity are the most frequent

cause of familial high homocysteine and the underlying cause of the CBS genetic disorder homocystinuria, which is characterized by severe high homocysteine levels.

Research has hypothesized that rs2851391 variants might reduce the activity of CBS, and thus was positively associated with homocysteine levels and a marginal association with decreased plasma B12 levels.

One study demonstrated a significant association of both elevated homocysteine levels and low vitamin B6 levels with CBS polymorphisms in the presence of nonvalvular atrial fibrillation.

Hydrogen sulfide (H2S) may also need to be the focus with CBS and homocysteine levels. H2S is produced in the brain, pancreas, liver, reproductive tissues. Low levels of HS2 affect repair of the GI tract and disrupted levels of HS2 can lead to cognitive deficits or excitation in the brain.

Reduced CBS activity could cause low H2S concentrations, affecting mitochondrial health and the gut/brain axis. Abnormalities of hydrogen sulfide in the body have been identified in several disorders including ulcerative colitis, Alzheimer's disease, Down's syndrome, and possibly in diabetes.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
MTHFR 677 The MTHFR 677 gene encodes the MTHFR gene to convert folate into the active form, methylfolate. Variants in this gene slow down enzymatic function.	MTHFR 677-rs1801133			AA
MTHFR 1298 MTHFR 1298 is involved in converting 5-methylfolate (5MTHF) to tetrahydrofolate (THF). Unlike MTHFR 677, the 1298 variant does not lead to elevated homocysteine levels unless paired with a heterozygous MTHFR 677.	MTHFR 1298-rs1801131	TT		
MTHFD1 G1958A (Methylenetetrahydrofolate dehydrogenase 1) encodes a protein that possesses three distinct enzymatic activities in the interconversion of 1-carbon derivatives of tetrahydrofolate.	MTHFD1 G1958A-rs2236225	GG		
DHFR A20965G Dihydrofolate reductase (DHFR) catalyzes the reduction of dihydrofolate to tetrahydrofolate (THF) and affect synthetic folic acid metabolism.	DHFR A20965G-rs1643659	TT		
	DHFR C19483A-rs1677693	GG		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
MTR A2756G MTR (methionine synthase) combines folate, methyl B12 and homocysteine into methionine.	MTR A2756G-rs1805087	AA		
MTRR A66G MTRR attaches a methyl group to B12 and variants here will slow the process. When both MTR and MTRR exist, dysfunction can occur.	MTRR A66G-rs1801394		AG	
TCN2 C766G Transcobalamin II (TCN2, or holotranscobalamin when bound) transports B12 to peripheral tissues. Variants in this gene may affect B12 transport.	TCN2 C766G-rs1801198			GG
PEMT Variants in PEMT may increase the need for choline and increase the sensitivity to anticholinergic drugs.	PEMT-rs7946		CT	
	PEMT-rs12325817	CC		
CBS A13637G The Cystathione Beta-Synthase (CBS) enzyme pulls homocysteine to hydrogen sulfide (H2S) and glutathione, requiring B6 and SAMe as a modulator.	CBS A13637G-rs2851391		CT	
CBS The Cystathione Beta-Synthase (CBS) enzyme pulls homocysteine to hydrogen sulfide (H2S) and glutathione, requiring B6 and SAMe as a modulator. CBS rs234709 and rs4920037 assists in arsenic detoxification.	CBS-rs234709	CC		
	CBS 191150T-rs4920037	GG		
BHMT	BHMT-rs3733890	GG		

MY CLINICAL RESEARCH SUMMARY: HORMONE SUPPORT

Sex Hormone Binding Globulin

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
SHBG rs1799941	Heterozygous AG
SHBG rs12150660	Heterozygous GT

Recap

Improves SHBG Gene Function for Women: SHBG levels that are too low will benefit from a high-fiber, low-fat diet, coffee, no sugar, and exercise 3-5 times a week. SHBG levels that are too high may be caused from SHBG variants combined with estrogen therapy (oral contraceptive or hormone replacement therapy). Improves SHBG Gene Function and Testosterone for Men: Magnesium, zinc, vitamin D, fish or fish oil, boron, adequate protein and a higher healthy fat intake (if testosterone is low and other fat genes are working optimally).

Decreases SHBG Gene Function for Men and Women: Anorexia, fatty liver, obesity, Type 2 diabetes, high fructose corn syrup, agave and crystalline fructose.

SEX HORMONE BINDING GLOBULIN

Research Women: Sex Hormone Binding Globulin (SHBG) is synthesized in the liver, and in the blood it transports and regulates the access of sex steroids to their target tissues. Serum levels of SHBG are influenced by hormonal as well as nutritional and metabolic status.

In a study of Italian women free of diabetes, serum SHBG levels showed a U-shaped trajectory with age, declining from age 20 to age 60, and increasing after the age 60 progressively after each decade. These changes mirror the age-related changes in BMI and fasting insulin, suggesting that BMI and insulin negatively influence SHBG concentration.

The SHBG levels in AA homozygotes for rs1799941 were 39% higher than in GG homozygotes in post-menopausal women. Subjects with the A allele (GA+AA) for rs1799941 had a trend for lower free estradiol index compared to the GG genotype. They also had a significantly lower bone mineral density (BMD) at the intertrochanter of the hip and trend for lower BMD at the total hip.

Changes in SHBG concentration will also affect the levels of bioavailable testosterone in women. Elevations in estradiol (as occurs during pregnancy), oral contraceptives, hormone therapy, anorexia and hyperthyroidism cause a marked increase in SHBG levels with a subsequent decrease in serum free testosterone levels. Levels of SHBG that are too high could affect mood, lean muscle mass, bone strength and sex drive.

Hypothyroidism, Type 2 diabetes, fatty liver and obesity are associated with SHBG levels that are too low, and therefore very low SHBG can be a biomarker for these disorders. A low-fat and high-fiber diet alone or combined with exercise reduces insulin, BMI levels and increases SHBG levels.

Research Men: Sex Hormone Binding Globulin (SHBG) is synthesized in the liver, and in the blood it transports and regulates the access of sex steroids to their target tissues. Serum levels of SHBG are influenced by hormonal as well as nutritional and metabolic status. In men, SHBG levels increase with age as testosterone levels decline.

Only a small fraction of the total testosterone - from 1% to 2% - is free in the blood and biologically active. About 40% to 70% of total testosterone travels around with SHBG and may not available to your cells. This means a large part of total testosterone may not be biologically active and available to your cells if SHBG is too high even though your testosterone is in a healthy range.

One study showed that serum SHBG concentration is increased in middle-aged men with primary or secondary osteoporosis and is correlated with bone remodeling markers, hip bone mineral density, and vertebral fracture risk. Serum SHBG level was significantly higher (+42.2%), whereas free androgen index was lower (-24.8%) in patients with primary or secondary

osteoporosis. Testosterone and estradiol levels did not correlate with any bone resorption or bone formation markers for men. Another study found that osteoporotic Chinese men had lower free testosterone (FT) and higher levels of SHBG.

You can also go too far in the other direction. A study of men in the U.S indicated that men with lower concentrations of total testosterone and SHBG had a higher likelihood of having metabolic syndrome than those with higher concentrations.

The associations of rs12150660 and rs6258 were confirmed in the three replication cohorts showing that men with the GT and TT genotype for rs12150660 had higher levels of testosterone, free testosterone, and SHBG, while the TC genotype for rs6258 had lower testosterone, calculated free testosterone and SHBG compared to the wild-type CC genotype. Not enough subjects had the homozygous TT genotype to produce data.

The rs6258 SHBG gene was found to substantially affect SHBG binding affinity by lowering free testosterone levels. The lowest testosterone levels were found in those with the GG genotype of rs1210660 and the TC or TT genotype of rs6258. Therefore variants in rs12150660 may benefit free testosterone levels even though SHBG is higher, however this may depends on your rs6258 genotype.

Another study found that individuals with the AA genotype for rs1799941 were associated with decreased sperm motility compared to GG genotypes. Research has found that vitamin C supplementation might improve sperm count, sperm motility, and sperm morphology.

Thyroid-DI01

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
DI01 rs2235544	Homozygous AA

Recap

Improves DI01 Gene Function: Selenium and zinc.

Decreases DI01 Gene Function: Fluoride, fluoroquinolone antibiotics, brominated vegetable oils found in certain soft drinks and sports drinks, certain pesticides, potassium bromate, fire retardants, high mercury or cadmium levels, statin drugs, antacids, proton pump inhibitors, anti-depressants, anti-fungal medications, high lithium supplementation, oral contraceptives, SERMS and corticosteroids.

THYROID-DI01

Research: For the DI01 gene rs2235544, numerous studies have confirmed that the CC genotype has lower T4, and the AA genotype has higher T4 levels. This pattern suggests that the C allele confers improved function of DI01 and would result in increased conversion of free T4 to T3 and reverse T3 to T2. The CC and AC genotype should have normal function while the AA genotype may be more prone to high T4.

In the first birth cohort study looking at DI01 and organochlorines, researchers found that pregnant women with a higher exposure to organochlorine pesticides and PCBs with the AA genotype had a larger decrease in T3 levels. The hypothesis is that the AA genotype is more susceptible to chlorine-based chemicals blocking the DI01 enzyme from converting T4 to T3. High T4 is associated with pregnancy-induced high blood pressure and preeclampsia.

Fatty acid synthase protects cancer cells from apoptosis. The over-expression of fatty acid synthase has been significantly observed in many types of cancer and occurs with high levels of T4. The Rotterdam study included 10,318 patients with baseline measurements for free T4 and TSH, followed for a median of 10.4 years. Higher free T4 (thyroxine) levels were associated with a higher risk for lung and breast cancer, but not prostate or GI cancers. No association was found for TSH levels.

In glioblastoma patients, a 2019 study found that the DI01 rs2235544 CC genotype was associated with a significantly lower risk of death at two years compared to AA and AC genotypes. The C-allele of the DI01 SNP rs2235544 was related to increased circulating free T3/ free T4 ratio in glioma and meningioma patients, indicating a greater T4 to T3 conversion.

Both selenium and zinc target DI01 for the conversion of T4 to T3. If your T4 is high, consider increasing your selenium and zinc

intake.

Vitamin D-CYP2R1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
CYP2R1 rs10741657	Homozygous GG

Recap

Improves CYP2R1 Gene Function: Sun exposure, adequate vitamin D intake and vitamin D co-factors.

Decreases CYP2R1 Gene Function: Lack of sun exposure, high fructose intake and lack of vitamin D co-factors.

VITAMIN D-CYP2R1

Research: Studies confirm that CYP2R1 is the principal 25-hydroxylase in humans and demonstrates that CYP2R1 alleles have dosage-dependent effects on vitamin D homeostasis.

A 2018 meta-analysis of sixteen articles with a total of 52,417 participants was reviewed for rs10741657. The GG genotype was associated with a clear descending trend of 25(OH)D levels when compared with the AA genotype in Caucasian and Asian populations.

Research has shown that oral administration of vitamin D led to negligible increases in serum 25-hydroxy-vitamin D for homozygotes, and significantly lower increases in serum 25-hydroxy-vitamin D in heterozygous subjects than in control subjects. The heterozygous effect may only be relevant in Caucasian populations.

Vitamin D can influence the expression of more than 1,000 genes and vitamin D deficiency has been linked to fatty liver, seizures, infertility, osteoporosis, cancer, autism (mother deficient), depression, heart attacks, Alzheimer's, dementia, high blood pressure, low testosterone in men, autoimmune disorders and more.

The literature is mixed on optimal vitamin D levels, which most likely vary based on your heritage, skin color and current health issues. The most well documented cause of Vitamin D deficiency is inadequate sunlight exposure such as high latitude countries. Paradoxically, despite its high sunlight hours, vitamin D deficiency is well recognized in Middle Eastern women, inner city young adults in America, athletes and dancers in Israel, elite gymnasts in Australia, young Hawaiian surfers, and adolescent girls in England.

For athletes, vitamin D deficiency has long been associated with muscle weakness and suboptimal muscle function. A positive relationship between serum vitamin D level and jump height, jump velocity and power was found in young women.

Clinical vitamin D deficiency is below 20 ng/ml. There is little evidence to prove there is a benefit for levels above 50 ng/ml. The latest cancer research has found that women with 25(OH)D concentrations greater than 40 ng/ml had a 67% lower risk of cancer than women with concentrations less than 20 ng/ml. Pesticides have been linked to suppressing vitamin D levels and creating a vitamin D deficiency. Your PON1 gene function should also be assessed.

Research has found that sunlight is the optimal way to optimize vitamin D levels along with exercise, vitamin D rich foods and vitamin D cofactors, however supplementation may be necessary.

Estrogen Metabolism-COMT

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
COMT rs4680	Heterozygous AG

Recap

Improves COMT Gene Function: Vitamin C, magnesium, and copper (copper should not be too low or too high).

Decreases Gene Function: Chronic stress, sugar, proton pump inhibitors, aspartame, low magnesium levels, low vitamin C levels, low and high copper levels, constipation, xenoestrogens, high homocysteine levels, high SAH levels, estrogen-based medications, and mercury toxicity.

ESTROGEN METABOLISM-COMT

COMT is a phase II enzyme involved in the inactivation of catechol estrogens that can otherwise lead to cancerous growth, while also increasing 2-methoxyestradiol, a metabolite that has been shown to inhibit the growth of breast cancer cells.

Variants in COMT V158M have been shown to decrease enzymatic activity and consequently increases the risk of carcinogenesis due to the accumulation of estrogen metabolites. COMT has been extensively investigated for correlation with different cancer risks including esophageal cancer, colorectal cancer, hepatocellular, carcinoma, lung cancer, breast cancer, ovarian cancer, endometrial cancer, testicular germ cell tumor, and bladder cancer with mixed results.

Due to the COMT V158M heterozygous and homozygous genotypes potentially having reduced estrogen clearance, slowing this pathway down further with chronic stress and a high catecholamine intake combined with poor gut health and low magnesium intake may affect the level of harmful estrogen metabolites.

However, this doesn't mean catecholamines should be avoided. It simply means that the dosage should be altered. For example, green tea has been found to be beneficial for breast cancer prevention in the COMT heterozygous and homozygous genotype because these individuals retained the polyphenols the longest. The wild type may need more to achieve the same benefit. Less is more for COMT variants.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
SHBG Sex Hormone Binding Globulin (SHBG) is synthesized in the liver, and in the blood it transports and regulates the access of sex steroids to their target tissues.	SHBG-rs1799941		AG	
	SHBG-rs12150660		GT	
DI01 DI01 is connected to thyroid health and is responsible for the deiodination of T4 into T3.	DI01-rs2235544			AA
DI02 DI02 is connected to thyroid health and is responsible for the deiodination of T4 into T3. D2 is the only activating deiodinase in the brain.	DI02-rs225014	TT		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
CYP2R1 Vitamin D is technically a hormone, and CYP2R1 is connected to circulating vitamin D levels.	CYP2R1-rs10741657			GG
CYP1A1 CYP1A1 is in the estrogen metabolism pathway along with CYP1B1, CYP1A2, CYP31A, SULT's and COMT.	CYP1A1-rs1048943	TT		
CYP2C19*17 Genetic variability impacts expression and activity of CYP2C19 and therefore can influence drug metabolism and catabolism of estrogens.	CYP2C19*17-rs12248560	CC		
CYP1A2 CYP1A2 is a key enzyme in caffeine metabolism and the 2-hydroxylation of the main estrogens, estrone, and estradiol.	CYP1A2-rs762551	CC		
COMT COMT is involved in catecholamine, dopamine, adrenaline, and estrogen metabolism through the inactivation of the catechol estrogens.	COMT-rs4680		AG	
FUT2 The FUT2 gene controls prebiotic production, B12 absorption, and how much bifidobacteria you carry in your digestive tract.	FUT2-rs601338		AG	
MTNR1B The MTNR1B gene encodes for the melatonin receptor 1B.	MTNR1B-rs10830963	CC		
CYP27B1	CYP27B1-rs4646536			AA
VDR-FOK	VDR-FOK-rs2228570		AG	

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
GC	GC-rs2282679	TT		
DHCR7	DHCR7-rs12785878		GT	

MY CLINICAL RESEARCH SUMMARY: MENTAL HEALTH & COGNITIVE PERFORMANCE

MAO-Serotonin

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
MAO-A rs6323	Wild Type TT

Recap

Improves MAO-A Gene Function: Vitamin B6, folate, B12, B2, magnesium, vitamin C and probiotics.

Decreases Gene Function: Antibiotics, aspartame, oral contraceptives, proton pump inhibitors, high estrogen levels, constipation and deficiencies in the vitamins and minerals above.

MAO-SEROTONIN

Research: MAO-A (Monoamine oxidase A) is a critical enzyme involved in breaking down important neurotransmitters such as serotonin, estrogen, norepinephrine, and dopamine.

You have the TT genotype that encodes for the slow activity of the MAO-A enzyme, which helps preserve serotonin. The TT genotype, constipation, and high estrogen cause a very slow MAO-A enzyme in females, which can increase sensitivity to stress due to high levels of estrogen, serotonin, and poor detoxification. Fiber, B6, B2, and magnesium are crucial for this genotype. The TT genotype may also make you more sensitive to MAO inhibitors, SSRIs, antibiotics and oral contraceptives depending on your estrogen status.

Research has found that the transport of tryptophan (precursor to serotonin) is lower in children with ADHD, and one study found that the rs6323 TT genotype was a protective factor against ADHD in Korean children.

Serotonin levels are more complicated than assessing just MAO-A, including gender, estrogen fluctuations, chronic stress, antibiotic use and general gut health, COMT function, and serotonin transportation and receptor genes. Serotonin is responsible for well-being, happiness, memory, and appetite. When serotonin is too low, it can cause depression, lack of ambition, and a struggle to derive pleasure from life. When it is dysregulated, it can cause IBS, mania, OCD, and drug-induced serotonin syndrome.

To modulate healthy serotonin levels, research has found that aerobic exercise to fatigue, strength training, yoga, and nature walks all are effective. Fermented foods and probiotics (90% of serotonin is made in the gut), getting more sunlight, or taking vitamin D, dark chocolate, fish oil, and a weekly massage are also excellent strategies. However, both extremes of a sedentary lifestyle and excessive exercise negatively affect MAO-A.

Dopamine, Adrenaline and Estrogen-COMT

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
COMT V158M rs4680	Heterozygous AG
COMT rs4633	Heterozygous CT

Recap

Improves COMT Gene Function: Vitamin C, magnesium, and copper (copper should not be too low or too high).

Decreases Gene Function: Chronic stress, sugar, proton pump inhibitors, aspartame, low magnesium levels, low vitamin C levels, low and high copper levels, constipation, xenoestrogens, high homocysteine levels, high SAH levels, estrogen-based medications and mercury toxicity.

DOPAMINE, ADRENALINE AND ESTROGEN-COMT

Research: COMT (catecholamine methyltransferase) shares a pathway with MAO-A and is the gene for dopamine, estrogen, adrenaline and catecholamine metabolism. This pathway requires magnesium, vitamin C and copper as co-factors.

Studies have found that the AG allele in COMT V158M (rs4680) results in an intermediate enzymatic function, while the wild type GG has fast activity, and the AA homozygous genotype has 4-5 times lower COMT activity. This means that dopamine and adrenaline levels should be more level in the AG genotype. However, multiple studies have shown that the AG genotype may fall on the higher end of the dopamine spectrum with cognitive tests.

Research has shown that individuals carrying the A allele of rs4680 or T allele of rs4633 scored significantly higher on insight problem-solving tasks, and for the COMT H62H rs4633 gene, the homozygous TT and heterozygous TC carriers had higher insight problem-solving scores than those with wild-type CC genotype.

A small study found that Caucasian carriers of at least one G allele showed a greater effect for social facilitation and cooperativeness (working together in a group) than the AA homozygous group for COMT V158M.

There are both benefits and detrimental aspects to variants in COMT. The downside of the A allele in COMT V158 is that the body overreacts to stress and pressure that can lead to anxiety, depression, impulsiveness, obsessive behavior, irritability, ADHD and abnormal behavior. It can also create a sensitivity to a higher intake of catecholamines (coffee, black tea, green tea, red wine, chocolate), especially in a stressed state, leading to high dopamine and adrenaline levels making the stress response worse. However, green tea has been found to be beneficial for breast cancer prevention in the AG and AA genotype because these individuals retained the polyphenols the longest. Other genetic variants involved in dopamine transport and receptor function also influence this magnitude.

Having a heterozygous variant in COMT V158M may increase your need for magnesium, vitamin C, and healthy copper levels (not too high or low). Compound weight lifting (squats, bench press, deadlift), sprints, and chopping wood can assist a slow COMT enzyme by increasing testosterone levels, which speed up the pathway and lower the stress response. Supplementation of magnesium and vitamin C may be essential to modulate COMT due to low magnesium levels in the water and soil, or lack of freshly picked fruits and vegetables for vitamin C, and chronic stress levels.

Dopamine Receptors-ANKK1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
ANKK1 rs1800497	Heterozygous AG

Recap

Improves ANKK1 Gene Function: Meditation, 8 hours of sleep per night, balanced blood sugar, vitamin D, omega-3 fatty acids, fiber, high intensity exercise and lower media exposure.

Decreases ANKK1 Gene Function: Low blood sugar, refined sugar, high fructose corn syrup, elevated lead levels, elevated copper levels, iron deficiency, omega-3 deficiency, low vitamin D levels and excessive media exposure.

DOPAMINE RECEPTORS-ANKK1

Research: Dopamine is a neurotransmitter with numerous roles, including reward-motivated behavior and social behavior.

Dopamine is involved in trial-and-error learning. Variants in genes related to dopamine signaling may also affect a person's ability to learn.

The heterozygous AG and homozygous AA genotypes have been correlated with up to a 30% reduction in dopamine receptors in a region of the brain known as the striatum. One small study found that people with the wild-type GG genotype learned from their mistakes easily, while people with the AG or AA genotypes were more likely not to learn from their mistakes and repeat behavior with negative consequences.

Those with sugar addictions, compulsive eating and obesity may have systems that need much more stimulation to feel pleasure caused by fewer D2 dopamine receptors and the need for extra stimulation to make the receptors "turn on." Functional MRI studies of teenagers, both lean and obese, found that the teenagers whose brains didn't light up as much in the dopamine reward centers were more likely to be obese and gain weight later. They also were more likely to have fewer dopamine receptors.

Poor dopamine uptake may contribute to the development of obesity. This relationship was significantly stronger in women with a heterozygous or homozygous A1 variant in rs1800497. The "A" corresponds to the A1 allele and the "G" is called the A2 allele. A1 heterozygous or homozygous women had lower dopamine activation in response to food, and therefore gained more weight potentially due to their diminished pleasure response from dopamine.

Fourteen studies investigated mindfulness meditation as the primary intervention and assessed binge eating, emotional eating, and/or weight change. Results suggest that mindfulness meditation effectively decreases binge eating and emotional eating in populations engaging in this behavior. However, evidence for its effect on weight is mixed.

Researchers found that individuals with Internet addiction showed reduced levels of dopamine D2 receptor availability in subdivisions of the striatum. This helps explain the universal iPhone phenomenon of addictive-reward behavior, with excessive use decreasing dopamine receptors and increasing the craving for more.

The global statistics show that about 10 percent of the world's population has ADHD. When researchers looked specifically at teenagers in the US, they found the diagnoses had risen 52 percent since 2003. ADHD has been associated with decreased dopamine activity. A meta-analysis of 11 studies with 1645 cases and 1641 controls found that variants in rs1800497 may be associated with ADHD.

Studies have also found that children and adults with ADHD are significantly more likely to be overweight, showing the shared connection to decreased dopamine levels. The heavy metal lead disrupts the dopamine pathway, and 16 out of 18 studies found a significant association between blood lead levels and one of the types of ADHD (Combined / Inattentive / Hyperactive-Impulsive). Other research has shown that iron deficiency causes a reduced number of dopamine receptors, and a recent study from the Annals of Medical and Health Sciences Research found that low serum iron, ferritin levels, and vitamin D deficiency may be associated with ADHD.

Vitamin C is proposed as a neuromodulator of glutamate, dopamine, acetylcholine and GABA transmission and related behaviors. One study showed that following a long period of vitamin C deficiency, depressed levels of both dopamine and norepinephrine were reported. Vitamin C also reduces blood lead levels.

Mindfulness training may improve self-regulation of attention. Neuroimaging studies suggest that mindfulness meditation engenders neuroplastic changes in brain areas associated with attentional functioning typically impaired in ADHD. One study found meditation increased endogenous dopamine release of 65% in the ventral striatum during meditation.

Histamines and Hyperactivity-HNMT

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
HNMT rs1050891	Wild Type AA

Recap

Improves HNMT Gene Function: Vitamin C, choline, folate and magnesium, chamomile, basil, stinging nettle, echinacea, fennel, ginger and wild oregano.

Decreases HNMT Gene Function: Food dyes, poor gut flora, gluten sensitivity, too many fermented foods, sodium benzoate, and deficiencies in vitamin C, choline, folate and magnesium.

HISTAMINES AND HYPERACTIVITY-HNMT

Research: HNMT stands for histamine methyltransferase. HNMT is the primary enzyme responsible for histamine metabolism in the brain. Dysfunction of the histaminergic nervous system is associated with various neuropsychiatric disorders including narcolepsy, Alzhemer's disease, Tourette's syndrome, eating disorders, and depression.

This gene requires adequate methyl donors from methionine and choline. If you do not have enough methyl groups available, you may be more prone to high histamine levels. HNMT polymorphisms differ considerably between Chinese and American populations.

In a 2019 mice study, results demonstrated that HNMT played an essential role in regulating brain histamine concentration, controlling aggression and sleep–wake cycles. HNMT disruption did not affect histamine concentration of the skin and stomach.

In children with ADHD, the adverse effect of food dyes and sodium benzoate on ADHD symptoms was determined by histamine degradation in the rs1050891 AA HNMT polymorphism. Histamine is lowered by vitamin C, choline, folate, magnesium, chamomile, basil, stinging nettle, echinacea, fennel, ginger and wild oregano.

Anandamide-FAAH

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
FAAH rs324420	Wild Type CC

Recap

Improves FAAH Gene Function: Exercise over 30 minutes, red clover tea (women), kaempferol, cacao, genistein (fermented soy), Echinacea, 7-hydroxyflavone (parsley, onions, berries, tea, and citrus fruits), β-caryophyllene (cloves, rosemary, hops).

Decreases FAAH Gene Function: Pesticides and phthalates.

ANANDAMIDE-FAAH

Anandamide is a neurotransmitter and endogenous cannabinoid, and is known as the "bliss" molecule that targets the endocannabinoid system.

The endocannabinoid system is involved in many physiological processes including reward, addiction, fertility, pain and energy regulation. This system was named from the cannabis plant, such as marijuana and hemp. THC closely resembles anandamide.

The endocannabinoids play a significant role in pain modulation and inflammation, and have been demonstrated to relieve pain by activating the CB1 and CB2 receptors.

The wild-type genotype (CC) encodes for the fast activity of FAAH, and therefore naturally leads to lower anandamide levels. Those with the homozygous genotype (AA), have the slow-activity of FAAH and naturally higher levels of anandamide. This

means that the CC individuals may have more anxiety and have to work harder to achieve higher levels of happiness, while the AA individuals have less anxiety and naturally higher levels of the "bliss" molecule that stimulate feelings of happiness.

Low levels of anandamide have been linked to slower extinction of fear memories and a heightened stress response to threatening situations than those with higher anandamide levels. Healthy volunteers who carried the rs324420 "A" allele (low FAAH activity, high anandamide levels) had much less amygdala activation when placed in a threatening situation. They also had a weaker correlation between amygdala activation and trait anxiety, which is a general tendency to perceive situations to be threatening and to respond to such situations with subjective feelings of apprehension and tension.

Pesticides such as chlorpyrifos and diazinon alter the endocannabinod system and researchers have hypothesized that eating organic foods lacking pesticide residues may promote endocannabinoid balance. Phthalates are plasticizers added to water bottles, tin cans, food packaging, and even the enteric coating of pharmaceutical pills. Phthalates may act as endocrine disruptors and carcinogens, and have been found to block CB1 receptors, found in the brain.

However, there are also ways for people to lower excessive levels of chronic stress and anxiety by increasing anandamide levels in the body. One of best ways to do this is with exercise. Endorphins (endogenous opioids) enhance the effects of cannabinoids and what has been known as the "runner's high" may in fact be the increase of anandamide. Research found that running and biking over 30 minutes, along with strenuous hiking at high altitude significantly increased anandamide.

Clinical anecdotes suggest that stress-reduction techniques, such as meditation, yoga, and deep breathing exercises impart mild cannabimimetic effects.

Brain Health-PEMT

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
PEMT rs7946	Heterozygous CT
PEMT rs12325817	Wild Type CC

Recap

Improves PEMT Gene Function: Choline, vitamin C, and estrogen.

Decreases Gene Function: Nighttime pain relievers, antihistamines, sleep aids, antidepressants, incontinence drugs and narcotic pain relievers.

BRAIN HEALTH-PEMT

Research: Choline is required for acetylcholine, a neurotransmitter of the vagus nerve that innervates multiple organs including the lungs, heart, liver, stomach, ovaries, and temporal lobe of the brain. A deficiency could affect all of these, especially memory. Acetylcholine also plays a role in promoting REM sleep.

Having one or more T alleles at rs7946 is associated with having lower phosphatidylcholine production in the liver.

Eighty percent of the women who were homozygous for the rs12325817 SNP manifested signs of choline depletion (liver or muscle dysfunction), relative to 43% of subjects carrying one copy of the variant allele and 13% of subjects without the SNP.

Vitamin C has been shown to induce the release of acetylcholine from synaptic vesicles of neurons and increase acetylcholine levels in the brain.

Possible drugs that can cause memory loss include antidepressants, antihistamines, anti-anxiety medications, anti-seizure drugs, muscle relaxants, tranquilizers, sleeping pills, and pain medications given after surgery. Why? The majority of these are in a class called anticholinergic drugs and block acetylcholine.

A French study looking at 4,128 women and 2,784 men that reported taking anticholinergic drugs showed a greater decline

over four years in verbal fluency scores and in global cognitive functioning than women not using anticholinergic drugs. In men, an association was found with a decline in visual memory and to a lesser extent in executive function. Significant interactions were observed in women between anticholinergic use and age, APOE genotype, or hormone replacement therapy. A significantly 1.4–2 fold higher risk of cognitive decline was observed for continuous anticholinergic users.

These drugs could be especially theoretically problematic for those with poor PEMT function, low estrogen (in women) and a family history of dementia and Alzheimer's disease.

Research shows that only 15% of women get enough choline, and one study found that those with lowest choline have the highest anxiety.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
MAO-A MAO-A (Monoamine oxidase A) is a critical enzyme involved in breaking down important neurotransmitters such as serotonin, estrogen, norepinephrine, and dopamine.	MAO-A-rs6323	TT		
5-HT2A The 5-HT2A gene encodes for serotonin receptors found in the brain and central nervous system and is concentrated in the brain region essential for learning and cognition. Polymorphisms in rs6314 may result in reduced episodic memory in young and middle-aged individuals.	5-HT2A-rs6314	GG		
5-HT2A The 5-HT2A gene encodes for serotonin receptors found in the central nervous system. Polymorphisms in rs6311 and rs6313 may contribute to a reduced capacity to regulate stress, low vagal tone, anxiety, depression, OCD, and IBS, especially in females.	5-HT2A-rs6311	CC		
	5-HT2A-rs6313	GG		
COMT V158M COMT is connected to dopamine, adrenaline, estrogen and catecholamine metabolism.	COMT V158M-rs4680		AG	
	COMT-rs4633		CT	
ANKK1 ANKK1 modulates the density of dopamine receptors in the brain.	ANKK1-rs1800497		AG	

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
DAO C2029G DAO participates in the degradation of extracellular histamine. This gene is connected to migraines.	DAO C2029G-rs1049793	CC		
HNMT C314T Histamine N-methyltransferase (HNMT) is a histamine-metabolising enzyme expressed in the brain. This gene is connected to migraines.	HNMT C314T-rs11558538	CC		
HNMT Histamine N-methyltransferase (HNMT) is a histamine-metabolising enzyme expressed in the brain. This gene is connected to hyperactivity and food dyes.	HNMT-rs1050891	AA		
FAAH FAAH (fatty acid amide hydrolase) is a gene that encodes for anandamide breakdown, a neurotransmitter and endogenous cannabinoid.	FAAH-rs324420	CC		
PEMT Choline is required for acetylcholine, a neurotransmitter of the vagus nerve that enervates numerous organs.	PEMT-rs7946		CT	
	PEMT-rs12325817	CC		
GAD1 GAD1 stands for “Glutamate Decarboxylase 1” and is responsible for the conversion of glutamate to GABA.	GAD1-rs3749034	GG		
BDNF BDNF is a synaptic modulator of glutamate while GABA synapses are also regulated by BDNF.	BDNF-rs6265	CC		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
SLC17A7 SLC17A7 mediates the uptake of glutamate into synaptic vesicles at presynaptic nerve terminals of excitatory neural cells in the brain. Polymorphisms are associated with delayed recovery time from head injuries.	SLC17A7-rs74174284		CG	
APOE Apolipoprotein E (APOE) is a lipid binding protein that transports triglycerides and cholesterol in multiple tissues, including the brain.	APOE-rs429358	TT		
	APOE-rs7412			CC
GAD1 GAD1 stands for “Glutamate Decarboxylase 1” and is responsible for the conversion of glutamate to GABA.	GAD1-rs2241165			TT
	GAD1-rs3791851		CT	
	GAD1-rs3791850	GG		

MY CLINICAL RESEARCH SUMMARY: DETOXIFICATION

Liver Enzyme-CYP1B1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
CYP1B1*6 L432V rs1056836	Wild Type GG

Recap

Improves CYP1B1 Gene Function: Iodine, apigenin, quercetin, myricetin, chrysoeriol (rooibos tea and celery) ghee, vitamin C and resveratrol.

Decreases Gene Function: Heterocyclic amines, xenoestrogens, high biotin supplementation, oral contraceptives, hormone replacement therapy, excessive sun exposure, vegetable oils, grains, fried meat, excess of smoked foods, cigarette smoke exposure and exhaust.

LIVER ENZYME-CYP1B1

Research: Due to the carcinogenic activation of polycyclic aromatic hydrocarbons (cigarette smoke, burning coal, vegetable oils, grains) and estrogens to genotoxic catechol estrogens - both which cause DNA mutations - variants in the CYP1B1 gene are important for breast, ovarian, colon, lung and prostate health. This is especially true for those with variants in GSTM1 and GSTP1. CYP1B1 may also be important for skin health, with excessive sun exposure negatively affecting CYP1B1 expression.

CYP1B1 participates in the first step of estrogen metabolism, the conversion of estrogens to 2- or 4-hydroxyestrogens, and specifically catalyzes the 4-hydroxylation of estrogens. 4-hydroxyestradiol is inactivated by COMT.

According to NCBI, C encodes the Leucine and G the Valine. The CYP1B1 L432V rs1056836 GG (valine) is associated with increased CYP1B1 messenger ribonucleic acid (mRNA) expression with a subsequent elevation in 4-hydroxyestradiol formation resulting in increased estrogen-mediated carcinogenicity. However, this has not been proven in human studies.

Minimizing polycyclic aromatic hydrocarbons, xenoestrogens and high estrogen levels in the body are a priority for CYP1B1. Vegetable oils (soy, corn) have been found to be one of the highest sources of polycyclic aromatic hydrocarbons, while also being a high source of omega-6 fatty acids that can disturb the healthy omega-3 and omega-6 ratio needed to prevent skin cancer growth.

A meta-analysis of 12 studies found that coffee consumption decreased the risk of cutaneous melanoma, while another study found that 2 cups of dark roast coffee per day for one month caused a 23% reduction in DNA damage.

Research has shown that optimal levels of iodine can help modulate the estrogen pathway and help prevent cancerous growth by targeting CYP1A1 and CYP1B1. Iodine deficient breast tissue exhibits early markers of breast cancer, and 30% of iodine stores are in the breast tissue.

One study found that high-dose biotin supplementation (often used in isolation for hair growth) increased CYP1B1 expression and was associated with an increase in the occurrence of single-stranded DNA breaks compared with biotin-deficient cells; while inhibitors of CYP1B1 prevented DNA strand breaks.

Inhibition of CYP1B1 activity was observed for the flavonols quercetin, apigenin and myricetin, while resveratrol has shown to convert to piceatannol through CYP1B!, a tyrosine kinase inhibitor and a compound of known anticancer activity. Chrysoeriol, present in rooibos tea and celery, also acts selectively to inhibit CYP1B1 in vitro and may be especially relevant to patients with CYP1B1 overactivity.

One study in 259 post-menopausal women found that for those with certain genotypes in CYP1B1 (rs1056836), KRAS (rs61764370) and MTHFR (rs1801133 and rs1801131), oral contraceptives and hormone replacement therapy was associated with shorter leukocyte telomere length. Shorter leukocyte telomeres are connected to premature aging, and may increase the

risk of cancer, cardiovascular disease, obesity, diabetes, chronic pain, and sensitivity to perceived psychological stress.

In observational studies, higher levels of exercise are related to longer telomere lengths in various populations, and athletes tend to have longer telomere lengths than non-athletes. This relationship is particularly evident in older individuals and physical activity may confer protection against stress-related telomere length shortening.

Higher coffee consumption has been associated with longer telomeres among female nurses. Be aware that there is a compounding effect with caffeine on the slow metabolizer CYP1A2 CC genotype. Research has shown that oral contraceptives significantly prolong the half-life of caffeine from 6.2 hours to 10.7 hours, and therefore could theoretically cause more cardiovascular issues from caffeine for the CYP1A2 CC genotype.

Vitamin K2-VOKRC1*2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
VKORC1*2 rs9923231	Heterozygous CT

Recap

Improves VOKRC1*2 Gene Function: Vitamin K2, probiotics and prebiotics.

Decreases Gene Function: Warfarin, statin drugs, antibiotics and vitamin K2 deficiency.

VITAMIN K2-VOKRC1*2

Research: Vitamin K2 is produced by intestinal microbiota and is usually enough to cover the daily requirements. It is fat soluble and stored in the liver. If your gut flora is disturbed by FUT2 genes, elevated glutamate, gluten sensitivity, and you have used the drug Warfarin or antibiotics, your K2 requirements may be higher.

Vitamin K2 deficiency is linked to arterial calcification, osteoporosis and poor dental health. This is why long-term use of anticoagulants like Warfarin are linked to accelerated bone loss and bone mass. Recent research has shown that vitamin K2 plays a role in having an inhibitory effect on breast cancer cells.

Polymorphisms in VOKRC1 have been linked to higher rates of arterial calcification and may increase the need for vitamin K2. To paraphrase one study, "A lifelong decreased activity of the VKORC1 enzyme may increase the risk of vascular calcification and could be further worsened by reduced intake of vitamin K2."

Polymorphisms in VOKRC1*2 may increase the sensitivity to Warfarin dosing and vitamin K recycling. VKORC1*2 appears to be the most important in relation to the variability in response to oral anticoagulants and the risk of excessive bleeding. Vitamin K2 has also been found in studies to be inhibited by statin drugs.

Aromatic Amines-NAT2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
NAT2 rs1495741	Homozygous AA

Recap

Improves NAT2 Gene Function: Cruciferous vegetables, unfiltered fermented drinks, meat and fish marinades, blueberries, blackberries, red grapes, kiwi, watermelon, rosemary, parsley, carotenoids, and vitamin C.

Decreases NAT2 Gene Function: Smoking, commercial hair dyes, industrial and manufacturing plants, charred meat, and diesel exhaust.

AROMATIC AMINES-NAT2

Research: N-acetyltransferase 2 (NAT2) could influence the detoxification of numerous drugs, and chemical carcinogens including aromatic amines. Aromatic amines are chemicals found in industrial and manufacturing plants, tobacco smoke, commercial hair dyes, and diesel exhaust.

Generally, the NAT2 phenotype can be classified into slow, intermediate, and rapid acetylator. The AA genotype is the slow acetylator, and numerous studies have associated the NAT2 slow acetylator phenotype with bladder cancer risk in smokers found in America, Europe, and Asia. However, in nonsmokers, rs1495741 AA did not increase susceptibility to bladder cancer when compared to GG and AG genotypes.

Exposure to aromatic amines has been found to increase the risk of breast cancer in those that work in rubber factories, use hair dyes that contain 4-aminobiphenyl (which also affects Tp53), and consistently consumed meat cooked at high temperatures. Research has shown the aromatic amine formed with meat cooked at high temperatures may cause both DNA damage and cause the proliferation of estrogen-sensitive cancer cells.

Heterocyclic aromatic amines, known mutagens formed in cooked meat and fish at high temperatures, are considered the causative agents for the association between meat intake and prostate cancer risk. Researchers found that a high heterocyclic aromatic amine intake was significantly associated with an increased risk of prostate cancer among Japanese men with the NAT2 slow acetylator phenotype, CYP1A1 rs1048943 TC and CC genotype, and CYP1A2 AC and AA genotype.

Marinades, cruciferous vegetables, unfiltered fermented drinks, blueberries, blackberries, red grapes, kiwi, watermelon, rosemary, and parsley all help reduce the carcinogenic risk posed by heterocyclic amines in meat cooked at high temperatures.

Statins-COQ2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
COQ2 rs4693596	Homozygous CC

Recap

Improves COQ2 Gene Function: CoQ10.

Decreases COQ2 Gene Function: Statin drugs.

STATINS-COQ2

Research: Statin drugs deplete CoQ10 and therefore may affect people more with variants in this pathway. One study found that people with the homozygous CC genotype were the most at risk for statin induced myopathy (muscle cramps, stiffness, and spasm). However, a study done in the Czech population in 2017 did not find an association with polymorphisms in COQ2 and low-dose statin drug therapy.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
CYP1A1*2C 4889 CYP1A1 is in the estrogen metabolism pathway along with CYP1B1, CYP1A2, CYP31A, SULT's and COMT. CYP1A1 is involved in the metabolism of benzopyrene.	CYP1A1*2C 4889-rs1048943	TT		
CYP1A2 C164A CYP1A2 metabolizes various environmental procarcinogens, such as heterocyclic amines, nitrosamines, aflatoxin B1 and ochratoxin A.	CYP1A2 C164A-rs762551	CC		
CYP1B1*6 L432V The CYP1B1 gene metabolizes pro-carcinogens such as polycyclic aromatic hydrocarbons and 17 beta-estradiol.	CYP1B1*6 L432V-rs1056836	GG		
CYP2C9*3 A1075C Variants in CYP2C9 rs1057910 may alter the metabolism of THC, the psychoactive compound found in cannabis.	CYP2C9*3 A1075C-rs1057910	AA		
CYP2D6 T100C CYP2D6 metabolizes approximately 50% of drugs in clinical use.	CYP2D6 T100C-rs1065852	GG		
CYP2E1 Research has identified CYP2E1 as the primary P450 isozyme responsible for benzene metabolism at low concentrations, acrylamide to glycidamide, alcohol, Tylenol, and nitrosamines.	CYP2E1-rs2031920	CC		
CYP3A4*1B The CYP3A4 enzyme is involved in the metabolism of approximately 50% of drugs that are used today, cholesterol homeostasis, and the oxidative deactivation of testosterone.	CYP3A4*1B-rs2740574	TT		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
CYP2C19*17 Genetic variability impacts expression and activity of CYP2C19 and therefore can influence drug metabolism and catabolism of estrogens.	CYP2C19*17-rs12248560	CC		
VKORC1*2 Variants in VOKRC1*2 may increase the need for vitamin K2 and a sensitivity to dosing of the drug Warfarin.	VKORC1*2-rs9923231		CT	
NAT2 The NAT2 gene encodes an enzyme that functions to activate and deactivate arylamine, hydrazine drugs, and carcinogens.	NAT2-rs1495741			AA
COQ2 The COQ2 gene encodes an enzyme that functions in the final steps in the biosynthesis of CoQ10 and homozygous variants may increase the risk of statin induced myopathy.	COQ2-rs4693596			CC
CYP17A2	CYP17A2-rs743572	AA		

MY CLINICAL RESEARCH SUMMARY: IMMUNE SUPPORT, ANTIOXIDANTS AND INFLAMMATION

Cell Protection-CAT

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
CAT C-262T rs1001179	Heterozygous CT

Recap

Improves CAT Gene Function: Black cumin seed oil, ginger, Lion's Mane, flavonoids, healthy iron levels, selenium, boron, cumin, anise, fennel, caraway, cardamom, lutein, holy basil and deep breathing relaxation techniques.

Decreases CAT Gene Function: Oxidative stress and BPA plastic.

CELL PROTECTION-CAT

Research: CAT makes an enzyme called catalase, which helps reduce oxidative stress. CAT is present in all aerobic cells while research has found the highest correlation to prostate, breast, liver and blood health.

There are several SNPs identified in the CAT gene, of which the rs1001179 polymorphism (C262T) is the most extensively studied. In comparison with the variant C allele, the variant T allele of the CAT C262T polymorphism has been reported to indicate lower CAT enzymatic activity, higher sensitivity to oxidative stress, and increased DNA damage risk, which can lead to cancer.

If you have variants in CAT C26T, you may have a higher need for flavonoids, selenium, ginger, cumin, anise, fennel, caraway, cardamom, watching iron levels, and deep breathing relaxation techniques (yoga, meditation, prayer) to assist catalase.

Ginger consumption has been reported to decrease lipid peroxidation and normalize the activities of superoxide dismutase and catalase, as well as GSH and glutathione peroxidase, glutathione reductase, and glutathione-S transferase.

Lion’s Mane has been found to promote ulcer protection and significant protection activity against gastric mucosal injury by preventing the depletion of antioxidant enzymes. Treatment with a hot water extract of Lion’s Mane decreased lipid peroxidation and increased superoxide dismutase (SOD) and catalase (CAT) activities, quenching free radicals in the gastric tissue of ethanol-induced rats to exhibit gastroprotective activity.

Glutathione-GSTM1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
GSTM1 rs366631	Wild Type AA

Recap

Improves GSTM1 Gene Function: Cruciferous vegetables, vitamin C, vitamin A, vitamin E, milk thistle, resveratrol, curcumin, green tea and white tea.

Decreases GSTM1 Gene Function: Low intake of vitamin A, C, E and cruciferous vegetables, smoking, burning of wood or trash, asphalt, coal, diesel exhaust, gas cooking, dioxins, and grilled or charred meat.

GLUTATHIONE-GSTM1

Research: GSTM1 rs366631 is a pseudo-SNP that can be used as a GSTM1 deletion marker. The deletion is also known as the null genotype and confers the absence of the GSTM1 protein. The frequency of the null genotype varies from 20% to 80%, depending on the ethnic group studied.

For example, the null genotype is less frequent in western and southern African populations, less frequent in South American populations, intermediate in the Japanese, but is higher in Egyptian, European, American, and Asian populations.

High frequencies of the GSTM1 null genotype have been found in patients with lung cancer (East Asians), breast cancer (over 50 age group and in Asians), bladder cancer (with NAT2 slow acetylator), colorectal cancer, skin cancer, gastric cancer (among Asians with H. Pylori), chronic bronchitis, kidney disease progression, acute myeloid leukemia, acute lymphoblastic leukaemia, head and neck cancer (combined with CYP1A1 variant), endometriosis, type 2 diabetes retinopathy, and recurrent pregnancy loss. All have been regarded as environmentally induced and the risk may change with ethnicity.

Of the major glutathione enzymes, GSTM1 appears to be the most effective at neutralizing cytotoxic and genotoxic reactive compounds. However, the research shows that the null genotype of GSTM1 on its own may not be able to determine carcinogen exposure cancer risk. Instead, a combination of genotypes in the other glutathione and antioxidant genes like GSTP1 and NFE2L2, detoxification genes like CYP1A1 and NAT2, and/or compounding epigenetic habits that appear to modify the effect.

GSTM1 catalyzes the detoxification of alkyl and polycyclic aromatic hydrocarbons, intermediate forms of many carcinogens, specifically metabolically generated epoxide intermediates of benzo(a)pyrene. Benzo(a)pyrene is part of a class of chemicals called polycyclic aromatic hydrocarbons. Sources of benzo(a)pyrene include the burning of wood or trash, tobacco smoke, asphalt, coal, diesel exhaust, and grilled or charred meat. There is evidence that it causes skin, lung, and bladder cancer in humans and in animals. Research has also shown that early markers of cardiovascular disease are associated with occupational exposure to polycyclic aromatic hydrocarbons.

A study also found sensitivity to gas cooking and the GSTM1 null genotype, increasing the sensitivity of the lungs to nitrogen dioxide. Nitrogen dioxide is also found in diesel exhaust. Exposure of human blood plasma to nitrogen dioxide caused rapid losses of ascorbic acid, uric acid, protein thiol groups, lipid peroxidation, and depletions of alpha-tocopherol, bilirubin, and ubiquinol leading to high levels of oxidative stress.

Animal studies and in vitro studies have shown that vitamin C, vitamin E, vitamin A, resveratrol, curcumin, green tea, and white tea can inhibit the carcinogenic effect of benzo(a)pyrene and nitrogen dioxide. In the Norwegian Mother and Child Cohort Study 50,651 women, a higher prenatal exposure to dietary benzo(a)pyrene was found to reduce birth weight. However, increasing dietary vitamin C intake during pregnancy helped reduce any adverse effects of benzo(a)pyrene on birth weight.

Isothiocyanates from cruciferous vegetables are known for their anti-cancer activity. They are stored as glucosinolates in cruciferous vegetables and are hydrolyzed by myrosinase (an enzyme found in plants and intestinal microflora) to form isothiocyanates. Isothiocyanates from cruciferous vegetables are substrates and inducers of GSTM1.

GSTM1 variants may alter isothiocyanates clearance, with the null genotype retaining higher levels of isothiocyanates and therefore the benefits. In numerous studies, the GSTM1 null genotype was the most responsive to cruciferous vegetables for anti-cancer effects against lung cancer, colon cancer, breast cancer, and kidney disease.

The isothiocyanate levels in cruciferous vegetables will range based on growing conditions including sulfur and nitrogen levels, time after harvest and storage (cold transportation and storage of broccoli also cause a loss of glucosinolates up to 70-80%), plant genetics, and cooking preparation. Broccoli sprouts will yield the highest isothiocyanate levels.

Eye Health-CFH

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
CFH rs1061170	Heterozygous CT

Recap

Improves CFH Gene Function: Lutein, zeaxanthin, bilberry, lingonberry, vitamin C, vitamin E, DHA, and zinc.

Decreases CFH Gene Function: Smoking, pesticides, benzene (found in certain laundry detergents, gasoline and paint), aspartame, oxidative stress, elevated TNF-alpha, elevated IL-6, obesity, smoking, diabetes, hypertension, atherosclerosis and low intake of lutein and zeaxanthin.

EYE HEALTH-CFH

Research: Age related macular degeneration (AMD) is the leading cause of blindness in Western societies, but its etiology remains largely unknown.

Variants in CFH confers a 2-fold higher risk of late AMD per copy in individuals of European descent. Research indicates that CFH (rs1061170) polymorphism impacts significantly on retinal function in early AMD patients, and supports the hypothesis that a dysfunctional CFH might result in early retinal function loss due to a reduction in the immune antioxidant defense mechanism. A study from 2005 found that variants in CFH likely explains approximately 43% of AMD in older adults.

Malondialdehyde (MDA) is a common lipid peroxidation product that accumulates in many pathophysiological processes, including AMD. In vivo studies in mice found CFH as a major MDA-binding protein that blocks MDA-modified proteins by macrophages and MDA-induced pro-inflammatory effects. The CFH polymorphism markedly reduces the ability of CFH to bind MDA, indicating a causal link to a cause of age related macular degeneration.

A recent meta-analysis found that the rates of myopia (nearsightedness) will increase 140% by 2050 due to our increased time in front of a screen. Myopia can increase the risk of numerous eye disorders. Blue light is a high-energy or short-wavelength visible light from your phone and computer that induces inflammation and retinal diseases such as age-related macular degeneration and retinitis pigmentosa. Research has found that bilberry and lingonberry exert protective effects against blue LED light-induced retinal photoreceptor cell damage due to their polyphenol content.

Lutein and zeaxanthin can inhibit oxidation of cell membranes and may be protective against UV-induced eye damage. Studies have demonstrated that people in the highest quintile of intake of dietary carotenoids, especially lutein and zeaxanthin concentrations have significantly lower risk of macular degeneration. Blue-eyed adults have far less lutein and zeaxanthin in their retinas.

One study compared diets of 356 patients with macular degeneration with 520 patients with other eye diseases. The data revealed that beta carotene was not especially effective, but that lutein and zeaxanthin were. Another study found that the risk of macular degeneration was reduced 65 percent with high amounts of lutein and zeaxanthin.

Research has found that MDA levels are significantly increased in groups of subjects with deficient levels of vitamin C and vitamin E. Deficiency in these two antioxidants leads to insufficient defense against free radicals and increased MDA levels. Those with polymorphisms in CTH should increase vitamin C and vitamin E intake. In another study, the risk for macular degeneration was found to be 77% lower when vitamin C supplements and a low-glycemic diet was used.

One study followed 3,600 people ages 55-80 years old for six years and found that those that took antioxidants plus zinc were less likely than those who took only antioxidants or only zinc to lose their vision.

Studies show that people who consume more fish, which is rich in DHA-fish fat, are less likely to develop macular degeneration. Eating fish one to three times a week has been associated with a 40 to 75 percent reduction in macular degeneration.

COVID 19 Severity-LZTFL1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
LZTFL1 rs17713054	Heterozygous AG

Recap

Currently unknown.

Currently unknown.

COVID 19 SEVERITY-LZTFL1

Research: The LZTFL1 gene influences the transition of specialized lung cells to less specialized lung cells during infection and inflammation. Low levels of LZTFL1 promote this transition, while high levels slow the transition. The hypothesis is that less specialized lung cells have fewer ACE2 receptors, and therefore, less chances for viral entry from SARS-CoV-2.

Scientists found that the LZTFL1 gene high-risk variant affects the lungs, but does not have an impact on the immune system. People with the variant genotype have higher levels of LZTFL1, slowing the transition to less specialized cells, leaving more specialized lung cells vulnerable to SARS-CoV-2 viral entry, replication and severity.

Scientists at the University of Oxford published results in November 2021 that variants in the LZTFL1 gene doubled the risk of lung failure and death from COVID-19. Approximately 60% of people with South Asian ancestry, 15% of people with European ancestry, 2% of people with African-Caribbean ancestry and 1.8% of people with East Asian ancestry carry the high-risk variant.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
SOD2 Superoxide dismutase (SOD2) is manganese dependent and protects against superoxide for the mitochondria of the cell. Variants here increase the need for intracellular antioxidant protection.	SOD2-rs4880	AA		
SOD3 Superoxide dismutase (SOD3) is zinc/copper dependent and protects against superoxide for the cell membrane. Variants here increase the need for intracellular and extracellular antioxidant protection.	SOD3-rs1799895	CC		
CAT C-262T CAT makes an enzyme called catalase, which helps reduce oxidative stress.	CAT C-262T-rs1001179		CT	

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
GSTM1 GSTM1 catalyzes the detoxification of alkyl and polycyclic aromatic hydrocarbons (PAHs), intermediate forms of many carcinogens, specifically metabolically generated epoxide intermediates of benzo(a)pyrene.	GSTM1-rs366631	AA		
GSTP1 I105V Glutathione S-Transferase (GSTP1) is linked to the metabolism of mutagens, carcinogens, and other poisonous chemicals. It plays a crucial role in the detoxification process, thereby protecting cells from these compounds. GSTP1 rs1695 is connected to breast, prostate, urinary, esophagus, and skin health.	GSTP1 I105V-rs1695	AA		
GSTP1 C341T Glutathione S-Transferase (GSTP1) is linked to the metabolism of mutagens, carcinogens, and other poisonous chemicals. It plays a crucial role in the detoxification process, thereby protecting cells from these compounds. GSTP1 rs1138272 is connected to the colon, prostate, lung, throat, and fertility.	GSTP1 C341T-rs1138272	CC		
GPX1 The GPX1 (Glutathione peroxidase 1) gene encodes a protein responsible for the modulation and detoxification of hydroperoxides and hydrogen peroxide to protect the mitochondria and cytoplasm of cells against oxidative damage.	GPX1-rs1050450	GG		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
CTH The CTH (Cystathionine Gamma-Lyase) gene encodes an enzyme in the trans-sulfuration pathway that converts cystathionine derived from methionine into cysteine. Glutathione synthesis in the liver is dependent upon the availability of cysteine.	CTH-rs1021737		GT	
NOS1 NOS1 (nNOS) codes for brain neural transmission, memory, learning, psychological stress, the peripheral nervous system and potentially the lymph nodes.	NOS1-rs3782218	CC		
NOS2 NOS2 (iNOS) encodes for wound, tissue damage, infection and hypoxia (low oxygen).	NOS2-rs2248814	GG		
CFH CFH (complement factor H) polymorphism is associated with increased risk of age related macular degeneration.	CFH-rs1061170		CT	
ARMS2 ARMS2 polymorphism is associated with increased risk of age related macular degeneration (AMD).	ARMS2-rs10490924	GG		
LZTFL1 The LZTFL1 gene influences the transition of specialized lung cells to less specialized lung cells during infection and inflammation.	LZTFL1-rs17713054		AG	
IL-10	IL-10-rs1800871	GG		
NQ01	NQ01-rs1800566	GG		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
IL-10	IL-10-rs1800872	GG		
IL-10	IL-10-rs1800896			TT

MY CLINICAL RESEARCH SUMMARY: DNA PROTECTION, DAMAGE & REPAIR

Processed Meat and Colon Cancer-GATA3

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
GATA3 rs4143094	Heterozygous GT

Recap

Improves GATA3 Gene Function: Avoiding processed meats.

Decreases GATA3 Gene Function: Processed meats like hot dogs, cured meats, pepperoni and sausages.

PROCESSED MEAT AND COLON CANCER-GATA3

Research: A large-scale genome-wide analysis of over 18,000 people from the U.S., Canada, Australia and Europe found that variants in GATA3 (rs4143094) was associated with an increased risk of colon cancer for those eating processed meat compared to those with the normal genotype.

A meta-analysis revealed that by raising the serum level of vitamin D to 34 ng/ml, the incidence rates of colorectal cancer could be reduced by half. Researchers projected a two-thirds reduction in incidence with serum levels of 46 ng/ml, which corresponds to a daily intake of 2,000 IU of vitamin D3.

All of the foods below have been found in research studies to reduce the risk of colon cancer: black raspberries, blackberries, raspberries, cranberries, blueberries, apples, oranges, avocado, tomatoes, garlic, onions, shallots, leeks, cabbage, sauerkraut, broccoli, Brussels sprouts, sweet potatoes, beets, spinach, kale, asparagus, cauliflower, turmeric, rosemary, oregano, basil, thyme and parsley. Preventing constipation should be a priority.

Longevity-SIRT1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
SIRT1 rs7895833	Wild Type AA

Recap

Improves SIRT1 Gene Function: Exercise, fasting, 7-8 hours of sleep per night, sauna, polyphenols, vitamin D, omega-3 fatty acids, resveratrol, magnesium, and melatonin.

Decreases SIRT1 Gene Function: The APOE-e4 genotype, high blood sugar, and insulin resistance.

LONGEVITY-SIRT1

Research: SIRT1 regulates numerous genes that accelerate the aging process, modulate DNA repair mechanisms and transcription factors like p53 (tumor suppressor gene), FOXOs (key regulators of lipid metabolism, stress resistance, and

apoptosis) and inhibits NF-kb, a pathway connected to viral inflammation.

SIRT1 activity goes down as we age, and DNA damage accumulates, and its activity is especially harmed by a sedentary lifestyle, poor diet, and obesity. Activation of sirtuins induces the growth of blood vessels, insulin sensitivity and better glucose control, and other health benefits in a wide range of age-related cardiovascular and metabolic disease models. Experimental models have shown that increasing the activity of the sirtuins is associated with the delay of age-related diseases and potentially increasing longevity.

Researchers have observed a significant increase in SIRT1 levels in longevity populations and found a significant positive correlation between SIRT1 levels and age in a Turkish population. The oldest people carrying AG genotypes for rs7895833 had the highest SIRT1 level compared to the AA genotype, suggesting an association between rs7895833 SNP and lifespan longevity.

The average age of older people carrying AG genotype (76.0 ± 1.5 years) was significantly higher than the average age of older people carrying AA genotype (71.3 ± 1.4 years).

Your APOE genotype may also affect SIRT1 activity for longevity. Research from the Buck Institute group found that APOE-e4 reduced expression of SIRT1. The reduced expression of SIRT1 was thought to impair beta-amyloid clearance observed in Alzheimer's. If you have the APOE-e4 allele, the AA SIRT1 genotype may require more SIRT1 activation.

Polyphenols are activators of SIRT1 and contain anti-inflammatory and apoptosis properties. These include piceatannol (a metabolite of resveratrol), olive oil, fisetin (strawberries, apples, grapes), quercetin (wine, peppers, berries, apples) and resveratrol (wine, blackberries, blueberries, pistachios and dark chocolate).

Other activators of SIRT1 that also benefit the APOE-e4 carriers include magnesium, melatonin, vitamin D, and omega-3 fatty acids. One study found that centenarians (those living over 100) have higher total body magnesium and lower calcium levels than most elderly people.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
ATM D1853N ATM coordinates DNA repair by activating enzymes that fix double stranded DNA breaks.	ATM D1853N-rs1801516	GG		
ESR2 ESR2 acts as a tumor suppressor gene that codes for estrogen receptor beta (ER-beta), one of two main types of estrogen receptor activated by estrogen. ESR2 is strongly expressed in the breast.	ESR2-rs2987983		AG	
TP53 TP53 is a tumor suppressor gene responsible for DNA repair.	TP53-rs1042522			CC

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
MDM2 Variants in the MDM2 gene encode a protein that reduces cellular levels of the p53 tumor suppressor protein.	MDM2-rs2279744		GT	
MLH1 MLH1 codes for a DNA repair enzyme linked to colon health.	MLH1-rs1800734		AG	
GATA3 GATA3 factors are involved in cellular maturation with proliferation arrest and cell survival.	GATA3-rs4143094		GT	
SIRT1 SIRT1 senses changes in intracellular NAD+ levels and plays a role in DNA damage and repair.	SIRT1-rs7895833	AA		
XRCC3 XRCC3 participates in DNA double-strand break/recombination repair.	XRCC3-rs861539	GG		

MY CLINICAL RESEARCH SUMMARY: CARDIOVASCULAR HEALTH AND ATHLETIC PERFORMANCE

Power and Recovery-ACTN3

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
ACTN3 rs1815739	Heterozygous CT

Recap

Improves ACTN3 Gene Function: Not applicable for ACTN3.

Decreases ACTN3 Gene Function: Not applicable for ACTN3.

POWER AND RECOVERY-ACTN3

The T (R) allele is associated with enhanced strength and training adaptation, improved protection from eccentric training-induced muscle damage, lower risk of sports injury, and reduced frailty in the elderly. Testosterone levels were also higher in male and female athletes with at least one R allele compared to the XX genotypes. When stratified by race and gender for power athletes in a 2019 meta-analysis, Asian and male athletes benefited the most from the RX (TC) genotype.

The ACTN3 RR and ACTN3 RX groups have not been significantly different, indicating that the presence of one or two R alleles does not have a dose-dependent effect on 200-meter sprint speed in elite athletes. However, there was some evidence for a dose-effect of the ACTN3 R allele and 200-meter sprint speed in elite male African athletes. The ACTN3 RR individuals had (on average) a faster best personal sprint time than ACTN3 RX individuals.

Having the RX genotype may represent the best of both worlds for cold adaptation, longevity, strength training, and exercise recovery.

VO2 Max-PPARGC1A

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
PPARGC1A rs8192678	Homozygous TT

Recap

Improves PPARGC1A Gene Function: Aerobic exercise, cold water exposure, ashwagandha and eleuthero root.

Decreases PPARGC1A Gene Function: Sedentary lifestyle.

VO2 MAX-PPARGC1A

Research: Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PPARGC1A) is a master regulator of mitochondrial biogenesis, mitochondrial respiration, skeletal muscle fiber transformation (from fast to slow twitch), glucose and fatty acid metabolism, and the anti-oxidation machinery. PPARGC1A is expressed in cell types with high oxidative function

(heart, skeletal muscle slow twitch fibers, liver, and pancreas) and in brown adipose tissue.

Several studies have shown that SNPs in PPARGC1A are associated with a significant lower level in aerobic power (i.e., VO2 max) in insulin resistant and untrained individuals as well as in athletes. Healthy untrained adults display a large individual variation in VO2 max that ranges from -20% to more than 50%.

Research indicates that the exercise-induced variation in VO2 max is 47% explained by genetics. If you have heterozygous or homozygous variants in PPARGC1A, you may have a naturally lower VO2 max for aerobic exercise and increased CRP (C-reactive protein) levels.

To increase VO2 max, consider cold exposure. Since mitochondria are what give us the ability to use oxygen in order to produce cellular energy, the more we have the more the aerobic potential.

Cold exposure activates the PPARGC1A gene and PGC1 protein, which makes more mitochondria in the muscle. One study found that 15 minute exposure to cold water (50°F or 10°C) following high intensity running, increases PGC1 in muscle tissue. Another study found that men that were immersed in cold water at 50°F (10°C) for 15 minutes, 3 times a week for four weeks after running were able to increase mitochondrial biogenesis occurring in their muscle tissue.

Adaptogens are another way to increase your VO2 max. One study found that ashwagandha increased velocity, power, VO2 max, lower limb muscular strength and neuromuscular coordination. A second study used elite Indian cyclists for 8 weeks. One group received 500mg of the root extract 2x a day, while the other group received a placebo. There was significant improvement in the experimental group in all parameters, namely, VO2 max and time for exhaustion on treadmill.

A study using eleuthero root found that using 800mg for 8 weeks increased VO2 max of by 12%, endurance time improved 23%, the highest heart rate increased 4%, and metabolism was altered which spared glycogen storage. The study concluded that “this was the first well-conducted study that shows that 8-week ES supplementation enhances endurance capacity, elevates cardiovascular functions and alters the metabolism for sparing glycogen in recreationally trained males.”

Muscle Injury-COL1A1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
COL1A1 rs1800012	Wild Type CC

Recap

Improves COL1A1 Gene Function: Vitamin C, zinc, copper, glycine, proline, lysine and B6 (all precursors to collagen production) and cryotherapy.

Decreases COL1A1 Gene Function: Deficiencies in vitamin C, zinc, copper, glycine, proline, lysine, B6 and excessive NSAID use.

MUSCLE INJURY-COL1A1

Research: According to one study, the gene encoding for the alpha1 chain of type I collagen (COL1A1) has been shown to be associated with cruciate ligament ruptures and shoulder dislocations.

You have the CC genotype for COL1A1, which lowers the production of Type 1 collagen. Approximately 90% of collagen in the body is Type I. Type I collagen is found in the skin, tendons, corneas, lungs and in 95% of bone.

ACL ruptures are considered the most severe injury sustained in sports. The A variant produces more COL1A1. Two AA’s reduced risk of ACL rupture by ten times, while only 5% of the population have two AA’s.

Cryotherapy has been shown to inhibit harmful collagenase (activity on collagen enzyme that breaks down collagen) and also decreased the production of inflammatory E2 series prostaglandins. For athletes, cryotherapy post-training could be a useful tool to help prevent injuries.

Caffeine-CYP1A2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
CYP1A2 C164A rs762551	Wild Type CC

Recap

Increases CYP1A2 Gene Function: A higher cruciferous vegetable intake may help increase caffeine metabolism for those with the CC slow metabolizer genotype, along with exercise.

Decreases CYP1A2 Gene Function: Oral contraceptives.

CAFFEINE-CYP1A2

You have the CC genotype and are a considered a “slow metabolizer” of caffeine. If cardiovascular disease runs in your family, caffeine may be a compounding factor for risk in the CC genotype because caffeine is metabolized at a slower rate.

For athletes, the CC genotype may have a decrease in performance under 1 hour from caffeine, but a greater ergogenic effect from caffeine when competing in a longer duration event (greater than 1 hour) as the slow metabolism may be beneficial in maintaining biologically active levels of caffeine in the body.

If you are female and taking oral contraceptives, there is a compounding effect on the slow metabolizer genotype. Research has shown that oral contraceptives significantly prolong the half-life of caffeine from 6.2 hours to 10.7 hours. People with the CC genotype have also been found to have elevated fasting blood sugar from caffeine consumption.

Over 4 cups of coffee daily may lower bone density in males but not females. Intake of coffee was associated with an increased risk of nonfatal heart attacks only among individuals with slow caffeine metabolism (CC), suggesting that caffeine plays a role in this association. In another prospective study, the risk of heart attacks in heavy coffee drinkers was found to be higher in subjects possessing heterozygous or homozygous COMT genes (lower activity) for those with the slow metabolizing CYP1A2 CC genotype. Therefore if you are a female taking oral contraceptives, have the CC CYP1A2 genotype, and variants in COMT, caffeine could be especially problematic for the heart. Heart disease is the number one cause of death for females in the US.

If you are the CC genotype and you drink coffee, you should consider limiting coffee intake to 1 cup daily. It is also important to review your COMT gene function to better understand a sensitivity to coffee intake.

Triglycerides-FADS1

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
FADS1 rs174546	Homozygous TT

Recap

Improves FADS1 Gene Function: Higher intake of the omega-3 fatty acids EPA and DHA.

Decreases FADS1 Gene Function: Low intake of EPA and DHA.

TRIGLYCERIDES-FADS1

Research: Variants in the FADS1 SNP (rs174546) are associated with elevated triglyceride levels, which appears to be due to a higher need for EPA and DHA from animal foods. Studies have found that plasma triglyceride levels were lower in wild-type CC

genotype when compared to carriers of the minor T allele.

Population average triglyceride levels have increased since 1976 in parallel with the constant growing epidemic of obesity, insulin resistance and Type-2 diabetes. A meta-analysis of 17 population-based prospective trials including 46,413 men and 10,864 women identified plasma triglycerides levels as an independent risk factor for cardiovascular disease.

Triglycerides are essentially fat in the blood that are driven by excess sugar and carbohydrate consumption. They are the driving force behind lipoprotein particles that are potent causes of heart disease, such as small LDL and very low-density lipoprotein (VLDL).

Numerous studies have found that omega-3 fatty acids administered as fish oil supplements lowers plasma triglyceride levels by 25% to 34%. While fish oil is known to lower triglycerides, there doesn't appear to be a difference in the FADS1 genotype response to supplementation.

A meta-analysis of 13 randomized controlled trials found that 500mg of vitamin C resulted in a significant decrease in serum LDL cholesterol and triglyceride concentrations.

Fibrinogen-ESR2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
ESR2 rs4986938	Homozygous TT

Recap

Improves ESR2 Gene Function: Nattokinase and lactobacillus plantarum.

Decrease ESR2 gene function: Obesity, BPA plastic, unfiltered tap water, atrazine (sprayed on golf courses, lawns, non-organic corn and non-organic wheat), dioxins (bleached products, non-organic animal fats) and phthalates (many chemically-based personal care products).

FIBRINOGEN-ESR2

Research: ERS2 (rs4986938) is a gene that has implications for normal, heterozygous and homozygous variants depending on the health issue. In the case of fibrinogen levels and post-menopausal women, it is the homozygous TT genotype that is relevant. Fibrinogen is a soluble protein in the plasma that is broken down to fibrin by the enzyme thrombin to form clots. Fibrinogen serves to stop excessive bleeding, but in high amounts can cause blot clots.

Recent observations indicate the involvement of estrogen receptor beta in the pathogenesis of cardiovascular disease in regards to fibrinogen levels. The relative risk showed a significant elevation of plasma fibrinogen in TT compared with CC and CT genotype.

A human study showed that oral administration of nattokinase decreased plasma levels of fibrinogen, factor VII, and factor VIII. After 2 months of administration, fibrinogen, factor VII, and factor VIII decreased 9%, 14%, and 17%, respectively. Further research has found that the probiotic strain lactobacillus plantarum has been found to significantly lower fibrinogen and LDL. Rat studies have also found that long-term administration of Lactobacillus plantarum is effective against breast cancer.

Stress-ADRB2

Below is a summary of your most significant variant genotypes:

GENE	GENOTYPE
ADRB2 rs1042713	Heterozygous AG

Recap

Improves ADRB2 Gene Function: Deep breathing techniques, magnesium and vitamin C.

Decreases ADRB2 Gene Function: Chronic stress and shallow breathing.

STRESS-ADRB2

Research: ADRB2 activation regulates various biological functions, including heart rate, blood pressure or respiration, and it may modulate the vasodilatation in normal coronary arteries.

In a meta-analysis of seven case-control studies with a total of 6,843 subjects, a higher frequency of polymorphisms in rs1042713 was found with heart attacks or coronary artery disease compared to healthy controls. A similar result was also obtained with polymorphisms in rs1042714. Ethnicity-stratified subgroup analysis suggested that the rs1042714 variants correlated with an increased risk of the two diseases in both Asians and Caucasians, while rs1042713 only contributed to the risk of two diseases in Asians.

If cardiovascular disease runs in your family, you may be more prone to anxiety, high blood pressure and arterial damage from stress. You may also be more sensitive to beta blockers, leading to high triglycerides.

Since ADRB2 is connected to the catecholamine epinephrine, it is also important to look at your COMT gene function. Magnesium, vitamin C and adaptogens should be considered while making lifestyle changes and strategies if chronic stress is present.

Relaxation techniques that involve slow, deep breathing have been found to be an effective therapeutic intervention that counteracts the adverse clinical effects of stress in disorders including hypertension, anxiety, insomnia and aging.

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
ACTN3 ACTN3 encodes for the alpha-actin-3 protein found exclusively within type-II fast-twitch muscle fibers.	ACTN3-rs1815739		CT	
PPARGC1A It has been demonstrated that variants in the PPARGC1A gene affect the exercise-induced change in maximal oxygen uptake (VO2).	PPARGC1A-rs8192678			TT
TNFA Tumor necrosis factor (TNF-a) is a pro-inflammatory cytokine. Variants may increase the risk of asthma in Asian populations.	TNFA-rs1800629	GG		
IL6 IL6 is an interleukin that acts as both a pro-inflammatory cytokine and an anti-inflammatory myokine.	IL6-rs1800795			GG

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
SOD2 Superoxide dismutase (SOD2) is manganese dependent and protects against superoxide for the mitochondria of the cell. The homozygous genotype increases the need for antioxidant support in high-intensity athletes.	SOD2-rs4880	AA		
COL1A1 COL1A1 produces alpha 1 chain of type I collagen, a major protein in tendons and ligaments.	COL1A1-rs1800012	CC		
PON1 PON1 (Paraoxonase) plays a large role in removing pesticides. It is also involved with supporting HDL function and LDL oxidation.	PON1-rs662	TT		
LPA Lp(a)is a sticky form of LDL that appears to affect plaque growth, LDL particle size and increase the risk of plaque rupture and blood clotting.	LPA-rs3798220	TT		
CYP1A2 C164A Variants in CYP1A2 determine caffeine metabolism and effects on bone density and cardiovascular health.	CYP1A2 C164A-rs762551	CC		
9p21 9p21 is considered an important genetic marker for cardiovascular health.	9p21-rs4977574	AA		
FADS1 FADS1 is involved in fatty acid metabolism, and variants in this gene are associated with elevated triglyceride levels.	FADS1-rs174546			TT

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
ESR2 ESR2 codes for estrogen receptor beta (ER-), one of two main types of estrogen receptor activated by estrogen and is linked to fibrinogen levels in post-menopausal women.	ESR2-rs4986938			TT
F5 Variants in F5 increase the risk of deep vein thrombosis, especially if using oral contraceptives.	F5-rs6025	CC		
ADRB2 Beta-2 adrenergic receptor (ADRB2) is abundantly expressed in cardiac cells, and bronchial smooth muscle cells and is connected to stress levels and heart health.	ADRB2-rs1042713		AG	
ACE1 G2350A ACE1 is part of the renin-angiotensin system responsible for the conversion of angiotensin I to angiotensin II, constricting blood vessels and elevating blood pressure.	ACE1 G2350A-rs4343			AA
ADD1 Variants in ADD1 are associated with hypertension in Asians.	ADD1-rs4961	GG		
AGTR1 Angiotensin-II receptor type 1 (AGTR1) is a major component of the renin-angiotensin system for regulating blood pressure and is highly expressed in adipose tissue, liver, leukocytes and the intestine. The homozygous genotype may increase the risk of high blood pressure from excess dietary fat and carbohydrate intake.	AGTR1-rs5186	AA		

Gene & Gene Function	Gene Rsid	Wild Type	Heterozygous	Homozygous
ACE2 A8790G ACE2 is part of the renin-angiotensin system, responsible for degrading angiotensin II and providing balance to ACE1 by dilating blood vessels and lowering blood pressure.	ACE2 A8790G-rs2106809		AG	
TMPRSS2 Transmembrane Serine Protease 2 is highly expressed in the prostate and lungs, and the expression is associated with viral susceptibility and prostate cancer.	TMPRSS2-rs2070788			AA

Sources

Please click the link below if you'd like to browse peer-reviewed studies referenced by this analysis:

https://www.mydna.life/wp-content/uploads/myDNA-Comprehensive-Health-Report-references.pdf