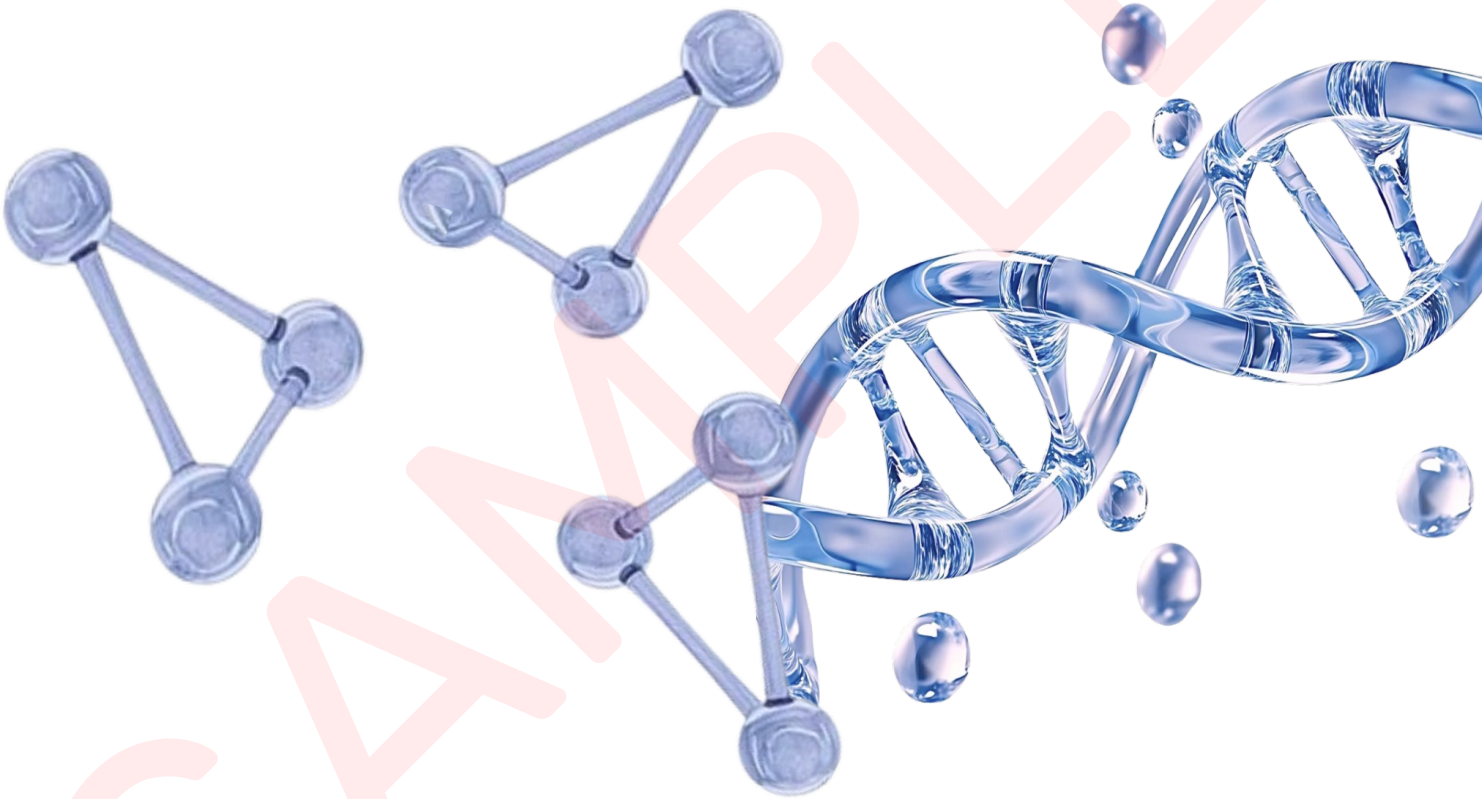
Your *Personalized* Functional

GENETIC INSIGHTS



Disclaimer: This report is for educational purposes only and is not intended to aid the subject directly in the diagnosis, treatment, and/or curing of any condition. When reviewing this report, it is important to understand that not all genetic variants result in symptoms or medical conditions, as outcomes depend on a combination of genetic, lifestyle, and environmental factors. If you have health concerns, please promptly seek guidance from a qualified healthcare provider. Misuse of this report is characterized by any reliance on its contents to diagnose, treat, and/or cure of any symptom or health condition. DNA Regimen and its affiliates are not and may not be held liable for any damages or issues arising from misuse of this report.

Client Profile

Name:	John Doe
Birth Year:	1980
Test Date:	2024-08-02
Provider Name:	Test Provider
Clinic Name:	Example Clinic
Test ID #:	WSTP2407

Table Of Contents

Definitions

Autophagy
The body's recycling system, breaking down and reusing damaged or old cell components to maintain healthy cellular function

Detoxification
The body's process of degrading, neutralizing, and eliminating harmful substances and byproducts from the body

Enzyme
A special type of protein that speeds up chemical reactions

Epigenetics
Changes in gene expression that do not alter the DNA sequence, but functions like on-off switches in response to lifestyle and environmental factors

Gene Expression
The process by which a gene's DNA instructions are read and converted into functional proteins, enzymes, or other molecules needed for biological processes

Genetic Variant
A common DNA difference that may influence health, traits, or disease risk

Genotype
The specific genetic makeup defined by the sequence of nucleotide bases (Guanine [G], Cytosine [C], Adenine [A], Thymine [T]) in the DNA, determining the alleles an individual carries

Inflammation
The body's response to injuries, infections, or harmful substances; acute inflammation is normal but chronic inflammation may be harmful

Methylation
A chemical process that fine-tunes how genes function by adding or removing methyl groups to DNA, acting like on-off switches

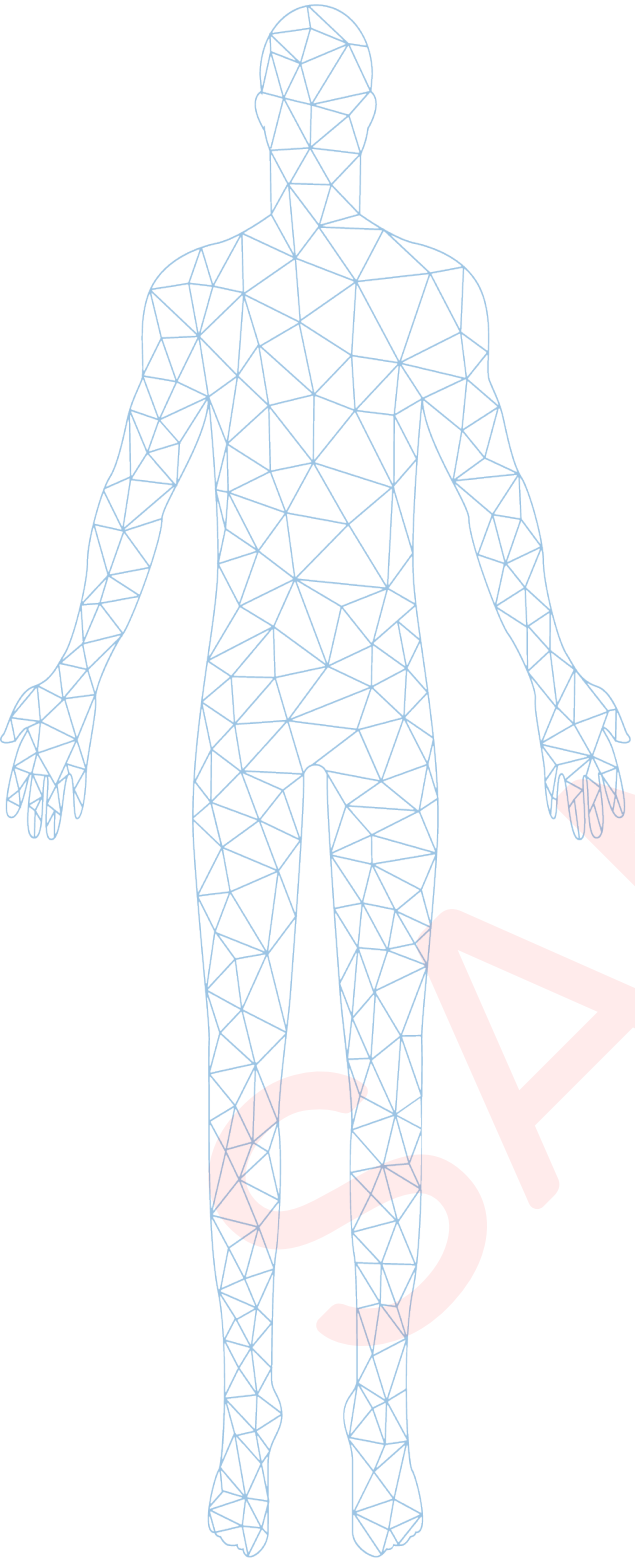
Neurotransmitters
Chemical messengers that send signals between nerve cells in the brain and body

Oxidative Stress
An imbalance between the production of reactive oxygen species (ROS) and the body's ability to counteract their harmful effects with antioxidants, resulting in damaged cells and various health issues

Protein
A chain of amino acids folded into its functional shape, built from a gene's DNA blueprint, and is responsible for carrying a vast majority of cellular functions

Single Nucleotide Polymorphism (SNP)
A specific type of genetic variant that involved a change in a single nucleotide at a specific position in the DNA sequence; SNPs are the most common form of genetic variation among individuals

Report Overview



Your genes are your body's unique DNA blueprint, like an instruction manual, shaping your physical traits, biological functions, and health predispositions

Genetic data provides valuable and actionable health insights. Genes play a key role in shaping the body's responses to lifestyle and environmental factors.

Your DNA blueprint comes to life through gene expression, a process that determines when and how your body uses the manual's instructions. Environmental factors, lifestyle choices, nutrition, hydration, exercise, sleep, and stress influence gene expression.

Changes in gene expression do not alter your DNA sequence but may affect gene function through epigenetic markers that act as switches to turn genes on or off. For instance, regular exercise and stress management may activate genes that reduce inflammation. Conversely, poor nutrition and environmental toxins may negatively alter gene expression, increasing inflammation and disease susceptibility.

Genetic variants, including single nucleotide polymorphisms (SNPs), may impact the efficiency of gene expression and interact with epigenetic mechanisms. SNPs may alter the coding sequence of a gene, potentially changing the protein and enzyme activity and affecting their function. Genetic variants may impact your body's response to environmental factors and lifestyle choices.

This genetic report covers 123 clinically relevant SNPs across nine categories of health: Neurotransmitters, Inflammation, Autophagy, Detoxification, Hormones, Gut, Nutrients, Methylation, and Mitochondria. Examining your unique genetic makeup offers insights that may lead to advancements in personalized medicine and positively impact your health and wellness.

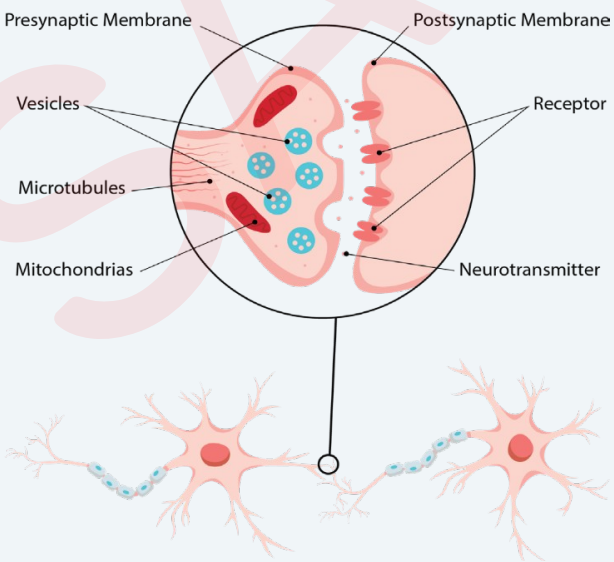
Neurotransmitters

Brain Health and Mood

Neurotransmitters are chemical messengers that transmit signals between nerve cells throughout the brain and body, influencing mood, movement, sleep, and stress response. Neurotransmitters rely on clear communication between the brain and body to function effectively. Factors such as environment, lifestyle, nutrition, gut health, and hormone levels may impair neurotransmitter pathways. Genetic variants influence how efficiently these pathways function.

Neurotransmitter pathways may influence:

- → Mood and cognitive function
- → Motivation and reward regulation
- → Brain-body communication
- → Gut-brain axis
- → Pain tolerance
- → Stress response and resilience
- → Sleep and circadian rhythm
- → Hormone balance



Genetic variants may disrupt neurotransmitter pathways by altering the production, transport, or metabolism of key neurotransmitters, such as serotonin (mood regulation), dopamine (motivation), GABA (calming effects), or norepinephrine (alertness), affecting communication between the brain and body.

Inflammation

The Body's Defense System

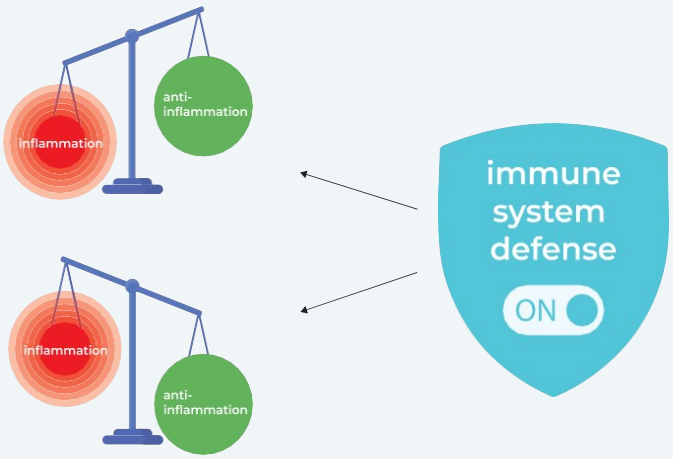
Inflammation is the immune system's response to various threats (e.g., injuries, infections, or harmful substances), to protect the body, repair tissues, and eliminate pathogens. The intensity and duration of inflammation are influenced by genetics, lifestyle choices, environmental factors, and nutrition. Acute inflammation is a short-term immune response that resolves once the threat is eliminated. Chronic inflammation is a prolonged and dysregulated immune response, often lasting for months or years, resulting in tissue damage and an increased risk of disease. Genetic variants influence the efficiency of inflammatory responses and the rate of recovery.

Inflammatory pathways may influence:

- → Brain health and mood
- → Cardiovascular function
- → Joint and muscle health
- → Immune balance
- → Autoimmune activity
- → Infection recurrence
- → Viral load and latency
- → Oxidative stress load

Inflammation acts as the body's alarm system, activating to protect and heal, then deactivating when the threat is neutralized.

Genetic variants may cause lingering inflammation by altering cytokine signals that control its strength and duration. For example, some variants increase cytokines, intensifying inflammation, while others delay recovery, resulting in fatigue, joint pain, or frequent infections.



Autophagy

Cellular Recycling

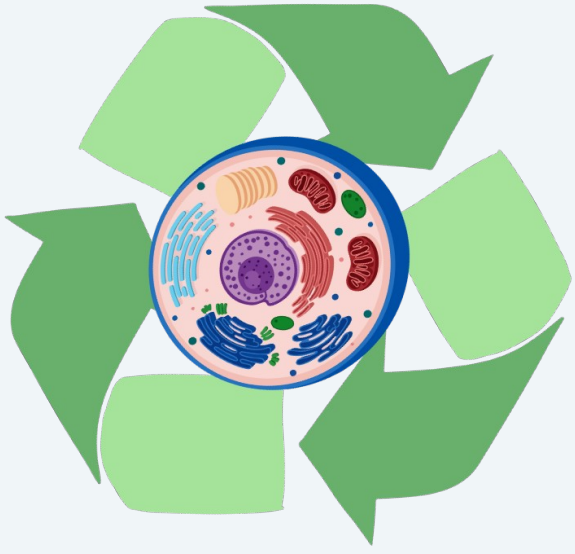
Autophagy is the body's cellular recycling system that breaks down and reuses damaged or old cell parts to maintain cellular health. Factors such as genetic variants, environment, lifestyle, nutrition, physical activity, and sleep may influence how well this system functions, impacting stress resilience, immune regulation, and healthy aging.

Autophagy pathways may influence:

- → Metabolic health and energy regulation
- → Cellular repair and healthy aging
- → Brain and vision function
- → Cardiovascular efficiency
- → Gut barrier integrity and microbiome balance
- → Stress response and resilience
- → Immune regulation
- → Inflammation

Autophagy acts as the cell's recycling system, removing and reusing damaged and old cell components to maintain cellular balance. When this process slows down, it may impair metabolism, cardiovascular and brain function, and overall vitality.

Genetic variants may modulate the efficiency of autophagy, shaping the body's response to aging, stress, and inflammation.



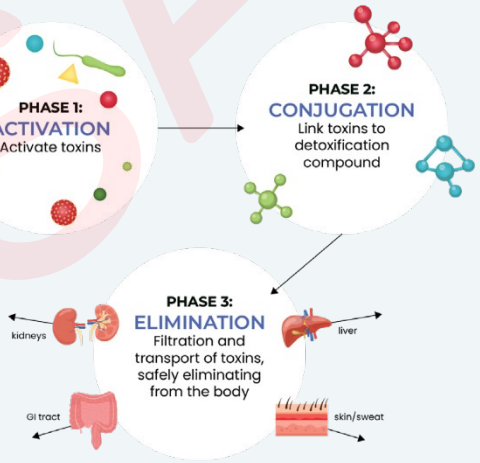
Detoxification

Activation, Neutralization, and Elimination

Detoxification is the body's natural process of degrading, neutralizing, and eliminating harmful substances and byproducts. It involves the liver, lungs, kidneys, digestive tract, and skin. Detoxification occurs in three phases: activation, neutralization, and elimination. Genetic variants influence the efficiency of detoxification enzymes (toxin transformers) and transport systems (toxin removers), impacting how effectively the body clears harmful substances and byproducts through the three phases of detoxification.

Detoxification pathways may influence:

- → Processing, degradation, and elimination of medications, chemicals, and harmful substances
- → Neutralizing free radicals and recycling antioxidants
- → Liver enzyme function
- → Gut barrier protection
- → Skin and respiratory resilience
- → Hormone balance and clearance
- → Inflammation



Detoxification is the body's process for removing harmful chemicals, hormones, and toxins through three phases: activation, conjugation, and elimination.

Genetic variants may influence phase II detox, where enzymes attach substances to molecules like glutathione (the master antioxidant) for safer clearance via the liver, kidneys, and gut.

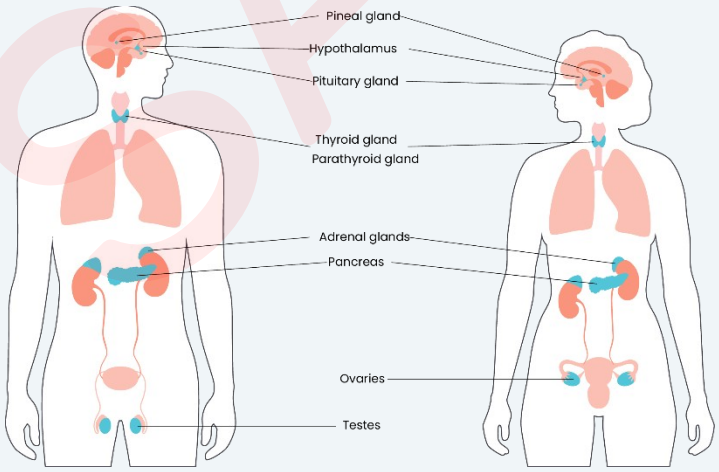
Hormones

Mood, Metabolism, and Reproduction

Hormones are chemical messengers that circulate in the bloodstream to regulate mood, metabolism, and reproduction. Environmental factors, stress, sleep, nutrition, and metabolic health may influence hormone activity. Balanced hormone levels depend on how well hormones are produced, how effectively cells respond to them, and how quickly they are removed from the bloodstream. Genetic variants influence how the body produces, utilizes, and clears hormones.

Hormone pathways may influence:

- → Hormone balance
- → Energy levels and mood
- → Stress response and resilience
- → Thermal regulation and body weight
- → Appetite and metabolism
- → Reproductive health
- → Detoxification and clearance of sex hormones (testosterone, estrogen, progesterone, DHEA)



Hormones shape overall health, keeping the body balanced when signals align.

Disrupted hormone signaling may cause changes in energy, mood, metabolism, body temperature, fertility, libido, thyroid function, menstrual cycles, and cognitive functioning.

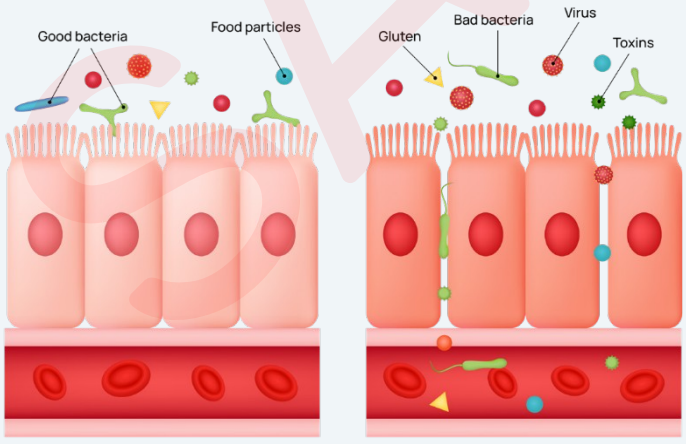
Gastrointestinal

Gut Health

The gastrointestinal system digests food, absorbs nutrients, and supports gut and immune health. The gut lining serves as a selective barrier, allowing nutrient absorption and blocking harmful substances. Environmental factors, nutrition, hydration, gut flora, and stress may shape gut health. Genetic variants influence the gut lining's strength, immune response, and digestion efficiency.

Gut pathways may influence:

- → Mood and emotional wellness
- → Neurotransmitter production and availability
- → Gut-brain axis
- → Digestion and nutrient absorption
- → Microbiome balance
- → Bowel regularity
- → Food sensitivities and allergies
- → Immune defenses and inflammation
- → Hormone regulation



Gut health connects to energy, mood, and immunity, which may support multiple body systems.

When gut function is disrupted, it may lead to bloating, fatigue, bowel irregularity, food sensitivities, nutrient deficiencies, or reduced immune resilience. Genetic variants may reveal inefficiencies in gut barrier strength, digestion, and immunity.

Vitamins & Minerals

Micronutrients

Vitamins and minerals are essential micronutrients that facilitate thousands of chemical reactions and support optimal cellular function. Vitamins and minerals influence mood, immunity, musculoskeletal health, and tissue repair. Nutrient levels depend on environmental factors, lifestyle choices, stress, and nutrition. Genetic variants affect how efficiently the body absorbs, transports, or utilizes vitamins and minerals.

Vitamin and mineral pathways may influence:

- → Mood, cognitive function, energy levels
- → Neurotransmitter function
- → Immune health and antioxidant protection
- → Bone, joint, muscle, skin, hair, and nail health
- → Hormone regulation

Vitamins and minerals act like spark plugs by fueling the body's optimal functioning. Inefficient pathways may lead to fatigue, brittle nails or hair, or a weakened immune system.

Genetic variants may alter nutrient pathways by affecting absorption, transportation, or activation.

Methylation

A Core Cellular Function

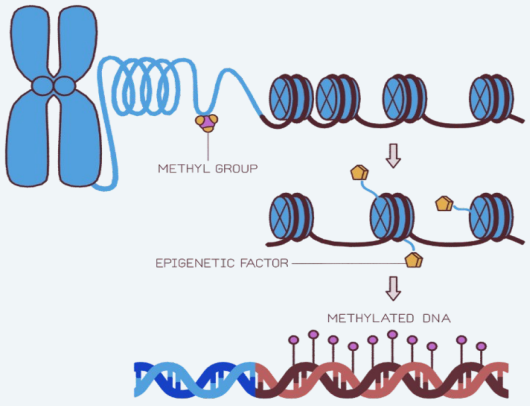
Methylation is a chemical process that fine-tunes how genes function by adding or removing methyl groups to DNA, acting like on-off switches. Methylation is shaped by environmental factors, lifestyle choices, nutrition, exercise, stress, sleep, and hormone balance. Genetic variants may directly or indirectly influence DNA methylation patterns, potentially impacting gene expression and homocysteine levels.

Methylation pathways may influence:

- → DNA repair, cellular health, and metabolic health
- → Mood and cognitive function
- → Neurotransmitter metabolism
- → Detoxification
- → Immune regulation and resilience
- → Cardiovascular health
- → Hormone balance and clearance

Methylation supports essential body systems, such as hormone regulation, detoxification, and metabolism. When methylation pathways are impaired, it may lead to fatigue, mood changes, hormone imbalances, or a heightened sensitivity to toxins and pollutants.

Genetic variants may influence how effectively folate and vitamin B12 are converted from synthetic forms (folic acid) into active forms (methylfolate and methylcobalamin) the body can use.



Mitochondria

The Cells' Powerhouses

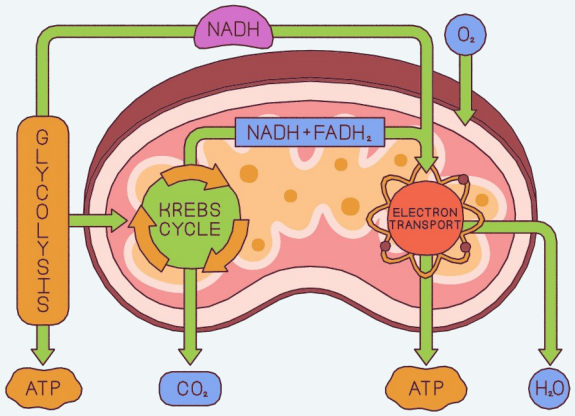
Mitochondria, often called the cell's powerhouses, generate most of the body's energy. These tiny organelles within cells convert nutrients and oxygen into ATP, the cell's main energy source. Mitochondrial performance, shaped by environmental factors and lifestyle choices, is sensitive to oxidative stress and nutrient depletion. Genetic variants influence how mitochondria produce energy and utilize nutrients.

Mitochondrial pathways may influence:

- → Cellular health and longevity
- → Energy production and stamina
- → Muscle strength and endurance
- → Recovery from stress and exercise
- → Brain function
- → Sensitivity to oxidative stress
- → Sensitivity to nutrient depletion

Mitochondria act like the power plants of the cells. Small changes in their performance may impact the entire body. When mitochondrial function is impaired, it may lead to fatigue, premature signs of aging, muscle weakness, or oxidative stress.

Genetic variants may influence how mitochondrial pathways use nutrients like CoQ10 and NAD, impacting cellular health and vitality.

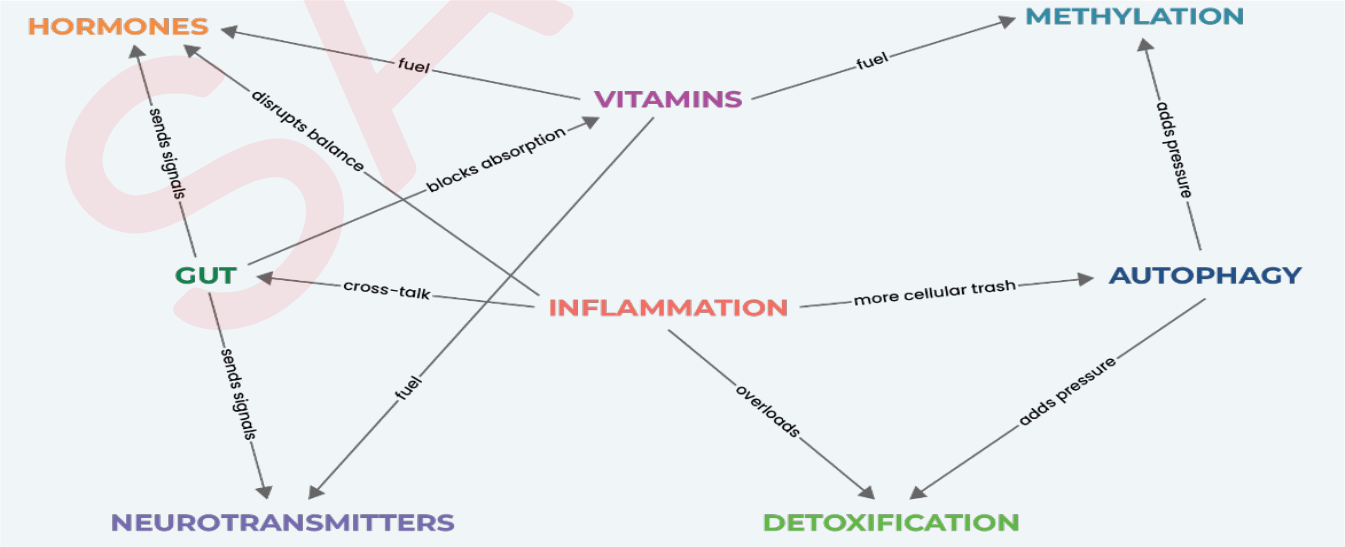


Summary

While each category of health has unique needs, lifestyle and environmental factors may support overall health and promote optimal functioning across body systems.

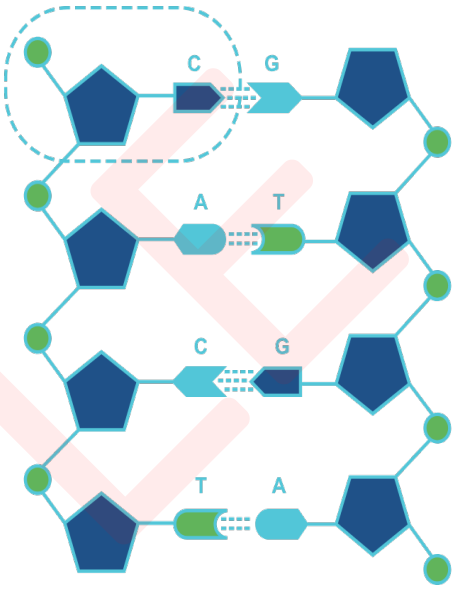
Foundational Ways to Support Your Genes

- A variety of whole foods, including colorful vegetables, fruits, quality proteins, and healthy fats
- Proper hydration throughout the day
- A fitness routine tailored to individual needs and limitations
- Adequate sleep through a consistent sleep-wake schedule
- Stress management strategies such as deep breathing, mindfulness, or relaxing hobbies
- Limiting unnecessary exposure to environmental toxins, pollutants, and chemicals when possible
- Incorporating rest and recovery periods between instances of physical, mental, and emotional strain
- Digestive support through balanced meals, mindful eating, and adequate fiber intake



Your Genetic Guide

Everyone has genetic variants, making each person's DNA unique.



A genetic variant is either heterozygous or homozygous, representing an alteration in the DNA sequence that differs from the most common version of a gene, known as a wild type.

Genetic variants do not function in isolation, they are influenced by interactions with other genes, biological processes, body systems, and external conditions.

Having a genetic variant does not inherently indicate a problem. Many variants remain neutral unless influenced by specific lifestyle or environmental factors, and some may offer protective health benefits.

Genetic variants influence optimal choices in food, supplementation, exercise, sleep, stress management, and how efficiently the body utilizes nutrients and removes toxins.

Color-Coded Key

Results will be presented as Wild Type (-/-), Heterozygous (+/-), or Homozygous (+/+)

ICONS	RESULT TYPE	MEANING	SUGGESTED ACTION
Wild Type (–/–)	Both copies are typical	Functions normally	No support needed
Heterozygous (-/+)	One typical copy, one altered copy	May have reduced function	Support may be beneficial
Homozygous (+/+)	Two altered copies	Likely reduced function	Support is likely beneficial

Your Genetic Test Results

Your genetic test results reveal potential health connections to symptoms and associated health conditions linked to specific genetic variants. However, not all genetic variants lead to symptoms or health conditions, as outcomes depend on a combination of genetic, lifestyle, and environmental factors. Always seek guidance from a qualified healthcare provider when making health, lifestyle, or environmental choices.

NEUROTRANSMITTERS				Chemical messengers in the brain and body that send signals between nerve cells to regulate mood, cognition, movement, and autonomic functions		
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
BDNF	rs6265	-/-	Promotes brain cell growth and survival, influencing learning, memory, and brain health	Anxiousness, low mood, impaired short-term memory, cognitive difficulties (e.g., learning, focusing, memory), mood swings, heightened stress response	Increased risk of anxiety depression, bipolar disorder, Alzheimer's disease, Parkinson's disease	Anti-inflammatory foods (e.g., berries, seeds, dark leafy greens)
COMT	rs4680	-/-	Breaks down dopamine and other neurotransmitters, influencing mood, stress response, and cognitive function	Brain fog, anxiousness, low mood, mood swings, sensory overload, headaches, Increased pain sensitivity, muscle pain, addictive tendencies, compulsive thinking, heightened stress response	Increased risk of anxiety, depression, stress-related disorders, bipolar disorder, substance use disorder, chronic pain	Polyphenol-rich foods (e.g., colorful fruits and vegetables, almonds, dark chocolate)
COMT H62H	rs4633	-/-				
DBH	rs1108580	+/+	Converts dopamine into norepinephrine, influencing mood, cardiovascular health, stress response, and energy regulation	Fatigue, low mood, difficulty concentrating, dizziness upon standing, heightened stress response	Increased risk of depression, bipolar disorder, cardiovascular issues, hypertension, orthostatic hypotension, substance use disorder	Antioxidant-rich foods (e.g., berries, nuts, dark leafy greens) Tyrosine-rich foods (e.g., chicken, fish, and eggs)
GAD1	rs3828275	-/+	Converts glutamate into GABA, a neurotransmitter that calms brain activity and regulates mood and sleep	Fatigue, anxiousness, low mood, mood swings, insomnia, difficulty staying asleep, impaired short-term memory, muscle pain, cognitive difficulties (e.g., learning, memory), complusive thinking, racing thoughts, wired but tired, heightened stress response	Increased risk of anxiety, depression, epilepsy, bipolar disorder, autism spectrum disorder (ASD), stress-related disorders	Anti-inflammatory foods (e.g., berries, salmon, tumeric)
	rs769407	-/-				
HTR2	rs6313	-/+	Directs the production of a serotonin receptor that regulates mood, sleep, and emotional balance by binding serotonin in the brain	Anxiousness, mood swings, difficulty concentrating, irritability, impulsivity	Increased risk of depression, anxiety, bipolar disorder	Omega-3-rich foods (e.g., salmon, flaxseed, chia seeds)
MAOA	rs6323	+/+	Breaks down serotonin, dopamine, and norepinephrine, regulating mood, focus, and stress response	Anxiousness, low mood, irritability, mood swings, brain fog, difficulty concentrating, sensory overload, heightened stress response	Increased risk of depression, anxiety, bipolar disorder, cognitive decline, increased aggression in men and heightened anxiety in women; risk increases when paired with childhood trauma	Polyphenol-rich foods (e.g., colorful fruits and vegetables, almonds, dark chocolate)

NEUROTRANSMITTERS						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
MAOB	rs1799836	-/-	Breaks down dopamine and other neurotransmitters, influencing mood, motivation, and cognitive function	Anxiousness, low mood, irritability, mood swings, sensory overload, difficulty concentrating	Increased risk of depression, anxiety, Parkinson's disease, substance use disorder	Polyphenol-rich foods (e.g., colorful fruits and vegetables, almonds, dark chocolate)
SLC6A4	rs1042173	-/+	Regulates serotonin levels in the brain, influencing mood, and emotional wellbeing	Anxiousness, low mood, impulsivity, difficulty concentrating	Increased risk of depression and anxiety, autism spectrum disorder (ASD), stress-related disorders	Omega-3-rich foods (e.g., salmon, flaxseed, chia seeds)
SYN1	rs1142636	-/-	Regulates neurotransmitter release at synapses, supporting brain communication, learning, and memory	Anxiousness, mood swings, impulsivity, irritability, cognitive difficulties (e.g., learning, focusing, memory)	Increased risk of depression, anxiety, autism spectrum disorder (ASD), epilepsy, bipolar disorder, neurodegenerative diseases	Anti-inflammatory foods (e.g., nuts, berries, cherries)
TPH2	rs4570625	-/-	Converts tryptophan into serotonin in the brain, influencing mood, sleep, appetite, and emotional wellbeing	Anxiousness, low mood, irritability, impulsivity, mood swings, difficulty concentrating, heightened stress response	Increased risk of depression, anxiety, autism spectrum disorder (ASD), neurodevelopmental disorders, stress-related disorders	Tryptophan-rich foods (e.g., turkey, eggs, pumpkin seeds)

INFLAMMATION			The immune system's response to various threats (e.g., injuries, infections, harmful substances), involving biological processes that promote inflammation to protect the body, repair tissues, and eliminate pathogens			
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
C3	rs10402876	-/+	Fights infections (e.g., bacteria and viruses) and regulates inflammation	Joint pain, muscle pain, vision issues, skin issues	Increased risk of infections, age-related macular degeneration, systemic lupus erythematosus, rheumatoid arthritis, kidney diseases	Antioxidant-rich foods (e.g., berries, nuts, dark leafy greens)
CD14	rs2569191	-/-	Helps immune cells detect and respond to bacterial infections, playing a key role in inflammation and immune defense	Joint pain, muscle pain, nasal congestion, sneezing, coughing, wheezing, itchy eyes, runny nose, skin issues, allergy-like symptoms	Increased risk of allergies, asthma, cardiovascular diseases, autoimmune disorders, inflammatory conditions	Omega-3-rich foods (e.g., mackerel, flaxseed, walnuts)
IL5	rs2069812	+/+	Boosts immune responses, particularly by activating eosinophils (white blood cells) to fight parasites and allergens	Wheezing, coughing, nasal congestion, skin rashes, ear pain or pressure, ringing in the ears, dizziness, vertigo	Increased risk of allergies, asthma, allergic rhinitis, atopic dermatitis, eosinophil-related disorders, autoimmune disorders, Epstein-Barr virus (EBV)	Quercetin-rich foods (e.g., onions, apples, kale)
IL6	rs1800795	-/+	Regulates immune responses and inflammation, influencing the body's reaction to infections, stress, and chronic diseases	Joint pain, muscle pain, fatigue	Increased risk of rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, type 2 diabetes, metabolic syndrome, cardiovascular diseases	Vitamin C-rich foods (e.g., broccoli, bell peppers, oranges)

INFLAMMATION						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
IL1B	rs1143634	-/+	Triggers inflammation to fight infections and repair tissues	Joint pain, muscle pain, upper respiratory issues	Increased risk of rheumatoid arthritis, inflammatory bowel disease (IBD), asthma, cardiovascular diseases, cancer susceptibility, Alzheimer's disease, Parkinson's disease, obesity, type 2 diabetes	Omega-3-rich foods (salmon, flaxseed, chia seeds)
IL23R	rs11209026	-/+	Regulates inflammation and immune responses to target pathogens (e.g., fungi and bacteria)	Joint pain, muscle pain, gastrointestinal issues, skin rashes	Increased risk of Crohn's disease, ulcerative colitis, psoriasis, rheumatoid arthritis, and multiple sclerosis with the A allele; Reduced risk of inflammatory bowel disease, psoriasis, ankylosing and spondylitis with the G allele	Polyphenol-rich foods (e.g., colorful fruits and vegetables, almonds, dark chocolate)
IL2RA	rs12722489	-/-	Regulates immune cell activity	Joint pain, muscle pain, nerve pain	Increased risk of type 1 diabetes, multiple sclerosis, rheumatoid arthritis	Vitamin D-rich foods (e.g., salmon, egg yokes, fortified plant-based milks)
TNF	rs1800629	-/-	Triggers inflammation to fight infections	Joint pain, muscle pain, fatigue, gastrointestinal issues, headaches, migraines, edema	Increased risk of migraines, cardiovascular diseases, asthma, chronic obstructive pulmonary disease (COPD), Crohn's disease, systemic lupus erythematosus	Anti-inflammatory foods (e.g., grapes, tumeric, salmon)
	rs361525	-/-				
STAT4	rs10181656	-/-	Regulates immune responses by activating immune cells to fight infections	Joint pain, muscle pain, fatigue	Increased risk of systemic lupus erythematosus, rheumatoid arthritis	Vitamin D-rich foods (e.g., salmon, egg yokes, fortified plant-based milks)
TRAF1	rs3761847	-/+	Regulates immune and inflammatory responses	Joint pain, muscle pain, gastrointestinal issues	Increased risk of rheumatoid arthritis, Crohn's disease, ulcerative colitis, systemic lupus erythematosus, cardiovascular diseases	Omega-3-rich foods (e.g., salmon, flaxseed, walnuts)
SOCS1	rs243324	+/+	Regulates immune responses by inhibiting excessive inflammation and cytokine signaling, maintaining immune balance	Joint pain, muscle pain, nerve pain	Increased risk of type 1 diabetes, type 2 diabetes, multiple sclerosis, rheumatoid arthritis, cancer susceptibility, inflammatory bowel disease (IBD), psoriasis	Anti-inflammatory foods (e.g., berries, tumeric, salmon)
CTLA4	rs231775	-/-	Regulates immune responses by acting as a checkpoint to control immune cell activity, helping to prevent autoimmunity	Joint pain, fatigue, skin rashes	Increased risk of type 1 diabetes, rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, Graves' disease, atopic dermatitis, asthma	Vitamin D-rich foods (e.g., salmon, egg yokes, fortified plant-based milks)
AOC1	rs10156191	-/-	Breaks down histamine mainly outside of cells (e.g., gut and tissues), which may play a role in food-related and systemic histamine balance	Brain fog, skin rashes, hives, itchy skin, headaches, gastrointestinal issues, joint pain, muscle pain, nasal congestion, edema, upper respiratory issues	Increased risk of Crohn's disease, ulcerative colitis, pregnancy-related complications	Low-histamine foods (e.g., fresh chicken, white fish, quinoa, oats, berries, broccoli, apples, pears)

INFLAMMATION						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
HNMT	rs11558538	-/-	Breaks down histamine inside of cells (e.g., brain and airways), and influences neurological health, immune activity, and inflammation regulation	Brain fog, skin rashes, hives, itchy skin, gastrointestinal issues, acid reflux, nasal congestion, joint pain, muscle pain, edema, dizziness, anxiousness, nausea, upper respiratory issues	Increased risk of allergic rhinitis, asthma, atopic dermatitis, schizophrenia, peptic ulcers, irritable bowel syndrome (IBS)	Low-histamine foods (e.g., fresh chicken, white fish, quinoa, oats, berries, broccoli, apples, pears)
HNMT	rs12995000	-/-				
HLA-DQA1	rs2187668	-/-	Helps the immune system recognize foreign substances	Joint pain, muscle pain, skin rashes, hives, itchy skin, gastrointestinal issues, nasal congestion, edema, nasal congestion, upper respiratory issues, sneezing, allergic reactions	Increased risk of celiac disease, type 1 diabetes, rheumatoid arthritis, multiple sclerosis, systemic lupus erythematosus, allergies, hypersensitivity to allergens	Gluten-free foods (e.g., quinoa, legumes, rice)
HLA-DQA2	rs2858331	-/-				
HLA-DRB1	rs660895	-/+	Helps the immune system recognize foreign substances	Joint pain, muscle pain, fatigue, skin rashes, hives, itchy skin, gastrointestinal issues, nasal congestion, edema, upper respiratory issues, sneezing, allergic reactions	Increased risk of rheumatoid arthritis, multiple sclerosis, type 1 diabetes, allergies, hypersensitivity to fungi/mold/yeast	Anti-inflammatory foods (e.g., berries, garlic, ginger)
HLA-DRB2	rs9275224	-/+				
ACE	rs4343	-/-	Regulates blood pressure and fluid balance by turning signals on or off that affect how blood vessels tighten or relax	Headaches, dizziness, physical performance and endurance issues	Increased risk of cardiovascular diseases, hypertension, diabetic nephropathy, chronic kidney disease	Potassium-rich foods (e.g. bananas, avocados, sweet potatoes)
	rs526934	+/+				
AGT	rs699	-/+	Regulates blood pressure, electrolyte balance, and fluid balance, impacting cardiovascular health and stress responses	Headaches, dizziness, edema	Increased risk of cardiovascular diseases, hypertension, diabetic nephropathy, chronic kidney disease	Potassium-rich foods (e.g. bananas, avocados, sweet potatoes)
F5	rs6025	-/-	Helps form and stabilize blood clots	Lower extremity edema	Increased risk of thrombophilia, thromboembolism, deep vein thrombosis, pulmonary embolism, pregnancy-related complications surgery-related complications	Vitamin E-rich foods (e.g., seeds, avocados, dark leafy greens)
F10	rs3211719	-/+	Helps form and stabilize blood clots	Prolonged/excessive bleeding from minor cuts, easy bruising, frequent nosebleeds	Increased risk of hemorrhagic diathesis, heavy menstrual bleeding in women, cardiovascular diseases, deep vein thrombosis, pulmonary embolism, myocardial infarction	Omega-3-rich foods (e.g., salmon, flaxseed, walnuts)

INFLAMMATION						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
FTO	rs9939609	-/+	Influences fat metabolism and energy balance, playing a role in body weight regulation	Increased appetite, decreased satiety, greater cravings for high-calorie foods, weight gain	Increased risk of obesity, type 2 diabetes, hypertension, coronary artery disease	Protein-rich foods (e.g., lean meats, lentils, beans)
ADRB2	rs1042714	-/+	Regulates cardiovascular function, respiratory function, metabolic function, immune functions, and responses to stress, exercise, or physical activity	Shortness of breath, restlessness, rapid heart rate and rapid respiration during periods of stress, exercise or physical activity	Increased risk of cardiovascular diseases, obesity, type 2 diabetes, metabolic syndrome	Omega-3-rich foods (e.g., mackerel, flaxseed, chia seeds)
DRD2	rs1076560	-/+	Regulates dopamine, influencing immune regulation, motivation, mood, movement, and neurological health	Anxiousness, low mood, mood swings, headaches, brain fog, decreased motivation, reward-seeking behavior	Increased risk of cognitive decline, Parkinson's disease, substance use disorder, schizophrenia	Iron-rich foods (e.g., read meat, lentils, pumpkin seeds) paired with vitamin C-rich foods (e.g., kiwi, bell peppers, spinach)
IL13	rs1800925	+/+	Regulates immune responses in allergic inflammation and asthma by promoting immune cell activity and mucus production	Wheezing, coughing, nasal congestion, runny nose, itchy eyes, skin issues, scratchy throat, sore throat	Increased risk of asthma, allergic rhinitis, atopic dermatitis, eosinophilic esophagitis, parasitic infections	Vitamin C-rich foods (e.g., kiwi, bell peppers, oranges)
NOS2	rs2248814	-/-	Produces nitric oxide, a molecule that regulates inflammation, immune responses, and blood vessel function	Gastrointestinal issues, joint pain, muscle pain, fatigue, memory problems, sleep disturbances, headaches, migraines, dizziness upon standing	Increased risk of rheumatoid arthritis, inflammatory bowel disease (IBD), multiple sclerosis, cardiovascular diseases, hypertension, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), Alzheimer's disease, Parkinson's disease	Tumeric with black pepper
NOS3	rs1799983	+/+	Produces nitric oxide, a molecule that regulates blood vessel dilation, blood pressure, and cardiovascular health	Fatigue, headaches, migraines, edema	Increased risk of cardiovascular diseases, coronary artery disease, myocardial infarction, endothelial dysfunction, ischemic stroke, pregnancy-related complications, diabetic complications	Dark leafy greens (e.g., spinach, kale, collard greens)
	rs2070744	-/+				
VDR	rs731236	-/-	Helps the body use vitamin D to support calcium absorption, strong bones, immune balance, and healthy cell function	Joint pain, bone pain, muscle weakness, fatigue, mood swings, hair loss, frequent infections	Increased risk of osteoporosis, multiple sclerosis, rheumatoid arthritis, type 1 diabetes, type 2 diabetes, obesity, cancer (e.g., colorectal, breast, prostate), impaired immune function	Vitamin D-rich foods (e.g., cod liver oil, salmon, fortified plant-based milks)

AUTOPHAGY				A process where the body breaks down and recycles old or damaged cell parts to maintain cellular balance and promote longevity		
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
APOA2	rs5082	-/-	Regulates lipid metabolism, influencing cholesterol levels and cardiovascular health	Fatigue, brain fog, weight gain	Increased risk of obesity, cardiovascular diseases, metabolic syndrome, heart disease, stroke, type 2 diabetes	Fiber-rich foods (e.g., whole grains, legumes, vegetables),
APOA5	rs662799	+/+	Regulates triglyceride metabolism, influencing blood lipid levels and cardiovascular health	Fatigue, brain fog, weight gain	Increased risk of hypertriglyceridemia, cardiovascular diseases, metabolic syndrome, heart disease, stroke, type 2 diabetes	Omega-3-rich foods (e.g., salmon, flaxseed, chia seeds)
APOB	rs558660	+/+	Transports cholesterol and fats in the blood, influencing lipid metabolism and cardiovascular health	Fatigue, brain fog, weight gain	Increased risk of hypercholesterolemia. cardiovascular diseases, atherosclerosis, coronary artery disease, myocardial infarction, metabolic syndrome, heart disease, stroke, type 2 diabetes	Low-fat foods (e.g., whole grains, legumes, vegetables)
APOE	rs429358	-/-	Transports cholesterol and fats in the blood and brain, influencing cardiovascular and brain health	Memory problems, mood swings, headaches, migraines, fatigue	Increased risk of Alzheimer's disease, cognitive decline, cardiovascular diseases, progression of traumatic brain injury and multiple sclerosis	Whole grains (e.g., oats, quinoa, brown rice)
	rs7412	-/-				
ATG12	rs26538	-/-	Encodes a protein for autophagosome formation, enabling cells to tag and remove damaged components during cellular recycling	Memory problems, joint pain, muscle pain, weight gain	Increased risk of obesity, type 2 diabetes, cancer, Alzheimer's disease, Parkinson's disease, Huntington's disease, rheumatoid arthritis, systemic lupus erythematosus, and inflammatory bowel disease (IBD), atherosclerosis, heart disease	Antioxidant-rich foods (e.g., berries, dark leafy greens, nuts)
ATG16L1	rs10210302	-/+	Encodes a protein complex that directs the elongation and maturation of autophagosomes (degrades cells and recycles the components), regulating immune responses in the gut	Memory problems, gastrointestinal issues	Increased risk of Crohn's disease, susceptibility to infections, Alzheimer's disease, Parkinson's disease	Omega-3-rich foods (e.g., mackerel, flaxseed, chia seeds)
	rs2241880	-/+				
ATG5	rs510432	+/+	Encodes a protein required for the initiation of autophagy to break down old cell parts, keep cells steady, and handle oxidative stres	Memory loss, joint pain, weight gain	Increased risk of cancer (e.g., breast, colorectal, gastric), Parkinson's disease, systemic lupus erythematosus, inflammatory bowel disease (IBD), susceptibility to infections	Antioxidant-rich foods (e.g., berries, dark leafy greens, nuts)

AUTOPHAGY						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
FABP2	rs1799883	-/+	Facilitates the absorption and transport of dietary fats in the intestines, influencing lipid metabolism and metabolic health	Weight gain	Increased risk of type 2 diabetes, obesity, metabolic syndrome, cardiovascular diseases	Fiber-rich foods (e.g., whole grains, legumes, vegetables)
FOXO3	rs2802292	+/+	Regulates cellular balance, stress resilience, metabolism, and longevity by activating genes involved in cell death, autophagy, oxidative stress defense, and stem cell maintenance	Fatigue, joint pain, dry skin, premature signs of aging	Increased risk of age-related diseases, cardiovascular diseases, neurodegenerative diseases, type 2 diabetes; the G allele may increase lifespan by enhancing stress resistance and cellular maintenance through better gene regulation, leading to longer, healthier lives in carriers	Spermidine-rich foods (e.g., sauerkraut, kimchi, natto)
GHRL	rs696217	-/-	Helps regulate appetite, metabolism, and energy balance by influencing the body's production of the hormones ghrelin and obestatin, which may affect weight and metabolic health	Increased appetite, weight gain, fatigue, gastrointestinal issues	Increased risk obesity, eating disorders, metabolic syndrome, type 2 diabetes, cardiovascular diseases	Fiber-rich foods (e.g., whole grains, legumes, vegetables)
INSR	rs1799817	-/+	Binds insulin to regulate blood sugar, metabolism, and cell growth, impacting diabetes risk and overall metabolic health	Increased thirst, increased appetite, fatigue, frequent urination, weight gain around the midsection	Increased risk of insulin resistance, type 2 diabetes, cardiovascular diseases, metabolic syndrome, hyperglycemia, dyslipidemia, hypertension, polycystic ovary syndrome (PCOS)	Low glycemic index foods (e.g., non-starchy vegetables, whole grains, seeds)
	rs2059806	-/-				
PARK1	rs104893875	-/-	Regulates dopamine release in the brain, supporting healthy movement, mood, and neurological function	Tremors, mood swings, stiff muscles, sleep disturbances	Increased risk of Parkinson's disease, Lewy body dementia, multiple system atrophy	Antioxidant-rich foods (e.g., berries, dark leafy greens, nuts)
PARK2	rs3798963	-/-	Protects neurons in the brain by removing damaged proteins and mitochondria, influencing neurological function	Tremors, mood swings, stiff muscles, sleep disturbances	Increased risk of early-onset Parkinson's disease, cardiovascular diseases, obesity, type 2 diabetes	Polyunsaturated fats (e.g., olive oil, avocado, nuts and seeds)
PPARG	rs1801282	-/-	Regulates fat cell development, glucose metabolism, and inflammation, influencing metabolic health	Fatigue, weight gain, increased thirst, increased appetite, joint pain	Increased risk of type 2 diabetes, obesity, cardiovascular diseases, metabolic syndrome; Reduced risk of cardiovascular diseases, type 2 diabetes, improved insulin sensitivity and glucose tolerance, protective effect from metabolic syndrome with the G allele	Low glycemic index foods (e.g., non-starchy vegetables, whole grains, seeds)
	rs3856806	-/+				

AUTOPHAGY						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
SIRT1	rs12778366	-/-	Regulates cellular processes like metabolism, DNA repair, and stress response, promoting longevity and overall health	Fatigue, weight gain joint pain, muscle pain, memory problems	Increased risk of chronic pain, obesity, type 2 diabetes, metabolic syndrome, age-related diseases, Alzheimer's disease, rheumatoid arthritis, inflammatory bowel disease (IBD)	Polyphenol-rich foods (e.g., grapes, apples, berries)
SMURF1	rs1007008	-/+	Regulates cell signaling pathways involved in bone development, immune responses, and cellular stress by breaking down proteins	Memory problems	Increased risk of osteoporosis, Alzheimer's disease, Parkins on's disease, autoimmune disorders	Antioxidant-rich foods (e.g., berries, dark leafy greens, nuts),

DETOXIFICATION				The body's process of degrading, neutralizing, and eliminating harmful substances and byproducts through detoxification pathways		
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
AHCY	rs819147	+/+	Breaks down a substance into adenosine and homocysteine, supporting methylation processes that regulate protein function, gene expression, and cellular health	Fatigue, brain fog, memory problems, weight gain	Increased risk of osteoporosis, elevated homocysteine levels, cardiovascular diseases, endothelial dysfunction, atherosclerosis, cognitive decline, Alzheimer's disease, insulin resistance, obesity, dyslipidemia, hypertension	Nutrient-dense foods (e.g., whole grains, nuts and seeds, colorful fruits and vegetables)
CAT	rs1001179	-/+	Neutralizes harmful reactive oxygen species (ROS), protecting cells from oxidative stress and supporting cellular health	Fatigue, brain fog, memory problems, mood swings, headaches, vision issues	Increased risk of oxidative stress, atherosclerosis, hypertension, coronary artery disease, metabolic syndrome, Alzheimer's disease, Parkinson's disease	Antioxidant-rich foods (e.g., berries, dark leafy greens, colorful vegetables)
CTH	rs1021737	-/-	Converts cystathionine into cysteine, supporting detoxification, antioxidant production, and cardiovascular health	Fatigue, brain fog, headaches, mood swings	Increased risk of cardiovascular disease, hypertension, atherosclerosis, neurodegenerative diseases, cognitive decline	Sulfur-rich foods (e.g., onions, cruciferous vegetables, garlic)
GPX3	rs8177412	-/+	Helps protect cells by using glutathione to neutralize harmful molecules in the blood and tissues, reducing oxidative stress and supporting neurological health	Fatigue, brain fog, difficulty concentrating, joint pain, muscle pain, allergy-like symptoms	Increased risk of oxidative stress, hypertension, atherosclerosis, metabolic disorders, neurodegenerative diseases, environmental sensitivity to pollutants and toxins	Selenium-rich foods (e.g., Brazil nuts, seafood, brown rice)

DETOXIFICATION						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
GSR	rs1002149	-/-	Regenerates glutathione to protect cells from oxidative stress and support detoxification and cellular health	Fatigue, brain fog, difficulty concentrating, joint pain, muscle pain	Increased risk of oxidative stress, cancer risk, cardiovascular diseases, atherosclerosis, hypertension, coronary artery disease, metabolic syndrome, Alzheimer's disease, Parkinson's disease, age-related diseases	Selenium-rich foods (e.g., Brazil nuts, seafood, brown rice)
GSTM1	rs1056806		Supports detoxification and antioxidant defenses by using glutathione to clear environmental toxins, neutralize reactive oxygen species, and reduce oxidative stress	Fatigue, brain fog, difficulty concentrating, joint pain, muscle pain, allergy-like symptoms	Increased risk of oxidative stress, cancer (e.g., lung, breast, prostate), Alzheimer's disease, Parkinson's disease, asthma, allergies, impaired detoxification of environmental pollutants and allergens, liver diseases	Sulfur-rich foods (e.g., onions, cruciferous vegetables, garlic)
GSTM3	rs7483	-/-	Maintains antioxidant and detox balance by using glutathione to clear environmental toxins, neutralize reactive oxygen species, and reduce oxidative stress	Fatigue, brain fog, difficulty concentrating, joint pain, muscle pain, allergy-like symptoms	Increased risk of oxidative stress, cancer (e.g., lung, breast, prostate), Alzheimer's disease, Parkinson's disease, asthma, allergies, impaired detoxification of environmental pollutants and allergens, liver diseases	Sulfur-rich foods (e.g., onions, cruciferous vegetables, garlic)
GSTP1	rs1138272	-/+	Maintains antioxidant and detoxification balance by using glutathione to clear environmental toxins, neutralize reactive oxygen species, and reduce oxidative stress; it also metabolizes certain drugs, impacting efficacy and toxicity	Fatigue, brain fog, difficulty concentrating, joint pain, muscle pain, allergy-like symptoms	Increased risk of oxidative stress, cancer (e.g., lung, breast, prostate), atherosclerosis, hypertension, Alzheimer's disease, Parkinson's disease, asthma, allergies, impaired detoxification of environmental pollutants and allergens	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
GSTP1 105V	rs1695	-/+	Detoxifies harmful chemicals and neutralizes reactive oxygen species, impacting cellular protection against oxidative stress; it also metabolizes certain drugs, impacting efficacy and toxicity	Joint pain, muscle pain, difficulty concentrating, allergy-like symptoms	Increased risk of oxidative stress, cancer (e.g., lung, breast, prostate), atherosclerosis, hypertension, Alzheimer's disease, Parkinson's disease, asthma, allergies, impaired detoxification of environmental pollutants and allergens	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
NAT2	rs1208	+/+	Metabolizes certain drugs, chemicals, and toxins, eliminating them from the liver and gastrointestinal tract	Rapid drug metabolism (e.g., breakthrough symptoms), slow drug metabolism (e.g., heightened side effects)	Increased risk of cancer (e.g., bladder), systemic lupus erythematosus	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)

DETOXIFICATION						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
SOD1	rs4998557	-/+	Neutralizes harmful free radicals, protecting cells from oxidative stress and supporting neurological and cellular health	Fatigue, brain fog, muscle weakness, skin rashes, upper respiratory issues, gastrointestinal issues	Increased risk of amyotrophic lateral sclerosis (ALS), atherosclerosis, cancer risk, Parkinson's disease, Alzheimer's disease, diabetes, age-related diseases	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
SOD2	rs4880	+/+	Neutralizes harmful free radicals, protecting cells from oxidative stress and supporting mitochondrial and cellular health	Fatigue, brain fog, muscle weakness, skin rashes, upper respiratory issues, gastrointestinal issues	Increased risk of oxidative stress, coronary artery disease, hypertension, cancer (e.g., breast, prostate), Parkinson's disease, Alzheimer's disease, diabetes, metabolic syndrome	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
SOD3	rs2855262	-/+	Neutralizes harmful free radicals, protecting tissues from oxidative stress and supporting cardiovascular and immune health	Fatigue, brain fog, muscle weakness, skin rashes, upper respiratory issues, gastrointestinal issues	Increased risk of oxidative stress, atherosclerosis, coronary artery disease, chronic obstructive pulmonary disease (COPD), asthma, Parkinson's disease, Alzheimer's disease, rheumatoid arthritis, inflammatory bowel disease (IBD), type 2 diabetes	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
SUOX	rs7297662	+/+	Converts toxic sulfites into harmless sulfates, supporting detoxification and protecting cells from oxidative stress and neurological damage	Fatigue, brain fog, skin issues, gastrointestinal issues	Increased risk of neurological disorders, metabolic disorders, impaired detoxification pathways	Molybdenum-rich foods (e.g., legumes, nuts, organ meats)
TSC1	rs118203342	-/-	Regulates cell growth and division to maintain cellular balance and prevent tumor formation	Seizures, skin abnormalities, cognitive impairment	Increased risk of tuberous sclerosis complex (e.g., benign tumors in the brain, kidneys, heart, lings, and skin), brain lesions, autism spectrum disorder (ASD)	Anti-inflammatory foods (e.g., berries, garlic, ginger)
TSC2	rs28934872	-/-	Regulates cell growth and division to maintain cellular balance and prevent tumor formation	Seizures, skin abnormalities, cognitive impairment	Increased risk of tuberous sclerosis complex (e.g., benign tumors in the brain, kidneys, heart, lings, and skin), brain lesions, autism spectrum disorder (ASD), progression of lymphangioleiomyomatosis in women with TSC	Anti-inflammatory foods (e.g., berries, garlic, ginger)

HORMONES				Chemical messengers that circulate the bloodstream to regulate mood, metabolism, reproduction, and energy levels		
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
CYP19A1	rs4646	-/+	Converts androgens into estrogens, playing a critical role in regulating hormone levels and influencing reproductive health and bone density	Fatigue, weight gain, breast tenderness, mood swings, decreased libido, sleep disturbances	Increased risk of gynecomastia, breast cancer, endometriosis, polycystic ovary syndrome (PCOS), osteoporosis, bone-related conditions, impaired fertility, impaired ability to metabolize endocrine disrupters	Flavonoids (e.g., chrysin, apigen, luteolin; found in berries, cruciferous vegetables, and parsley)
CYP1A1	rs1048943	-/-	Metabolizes various substances (e.g., drugs, environmental toxins and pollutants, polycyclic aromatic hydrocarbons (PAHs), hormones, neurotransmitters, and metabolites), influencing detoxification and hormonal balance	Fatigue, mood swings, acne, vision issues, skin, issues, rapid drug metabolism (e.g., breakthrough symptoms), hyperpigmentation	Increased risk of lung cancer, colorectal cancer, prostate cancer, chronic obstructive pulmonary disease (COPD)	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
CYP1B1	rs1800440	-/-	Metabolizes environmental toxins, drugs, and hormones, influencing detoxification and hormonal regulation	Fatigue, mood swings	Increased risk of breast cancer, prostate cancer, lung cancer, endometrial cancer	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, nuts and seeds)
DIO2	rs225014	-/+	Converts inactive thyroid hormone (T4) into its active form (T3), regulating thyroid function, metabolism, and energy balance	Fatigue, weight gain, brain fog, difficulty concentrating, memory problems, low mood, mood swings, sleep disturbances	Increased risk of hypothyroidism, insulin resistance, type 2 diabetes, osteoporosis, impaired cognitive function, depression	Selenium-rich foods (e.g., Brazil nuts, seafood, organ meats)
FOXE1	rs1867277	+/+	Regulates thyroid gland development and function, influencing thyroid hormone production for metabolism and growth	Fatigue, weight gain, low mood, mood swings	Increased risk of thyroid cancer, congenital hypothyroidism, craniofacial malformations (e.g., cleft lip, cleft palate), Hashimoto's thyroiditis, Graves' disease, low T3/T4 levels	Selenium-rich foods (e.g., Brazil nuts, seafood, organ meats)
FSHR	rs6165	-/+	Regulates reproductive processes (e.g., egg development in ovaries and sperm production in testes), influencing fertility and hormonal balance	Fatigue, low mood, mood swings, weight gain, irregular menstrual cycles in women	Increased risk of endometriosis, polycystic ovary syndrome(PCOS), anovulation, reduced response to FSH stimulation in women (potentially impacting fertility treatments), reduced sperm quality in men	Nutrient-rich foods (e.g., pumpkin seeds, fatty fish, dark leafy greens)

HORMONES						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
LEPR	rs1137101	-/+	Regulates appetite, energy balance, and metabolism, influencing weight management and metabolic health	Fatigue, weight gain, increased appetite, decreased satiety	Increased risk of obesity, obesity-related cancers, type 2 diabetes, insulin resistance, metabolic syndrome, hypertension, dyslipidemia, atherosclerosis, may impact fertility and menstrual cycles	Protein-rich foods (e.g., lean meats, eggs legumes)
SRD5A1	rs166050	-/+	Converts testosterone into dihydrotestosterone (DHT), a potent androgen that influences hair growth, prostate health, and hormonal balance	Fatigue, mood swings, hair loss, acne, oily scalp, irregular menstrual cycles in women	Increased risk of androgenetic alopecia, androgen-related skin conditions, benign prostatic hyperplasia, prostate cancer, hormone disorders	Healthy fats (e.g., avocados, olive oil, nuts and seeds)

GASTROINTESTINAL				The gastrointestinal tract digests food, absorbs nutrients, and maintains overall gut health		
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
CYP1A2	rs762551	-/+	Metabolizes caffeine, drugs, and environmental toxins and pollutants, influencing gastrointestinal health, detoxification, and drug response	*AA genotype*: Fatigue, brain fog, joint pain, breakthrough symptoms from rapid drug clearance, higher caffeine tolerance, reduced drug efficacy *CC genotype*: Heightened side effects, adverse caffeine effects; anxiousness, jitters, restlessness, insomnia, gastrointestinal issues, tachycardia, heart palpitations	Increased risk of cancers associated with environmental toxins and pollutants, hypertension, impaired fasting glucose, and myocardial infarction with the CC genotype; reduced risk of hypertension and myocardial infarction but an increased risk of oxidative stress with the AA genotype	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, dark leafy greens)
FUT2	rs45478900	-/-	Adds fucosal sugars in the mucus lining of the gastrointestinal tract, to feed beneficial bacteria (e.g., Bifidobacterium), influencing digestion and immune balance	Fatigue, gastrointestinal issues, bloating, diarrhea, constipation, irregular bowel movements	Increased risk of infections (e.g., Helicobacter pylori, norovirus, and influenza in non-secretors), type 1 diabetes, inflammatory bowel disease (IBD), Crohn's disease, altered vitamin B12 absorption and metabolism; reduced risk of norovirus infection in secretors	Prebiotic-rich foods (e.g., apples, onions, garlic)
	rs492602	+/+				
MCM6	rs4988235	-/+	Regulates the activity of the lactase gene (LCT), influencing whether lactose can be digested into adulthood and affecting tolerance to dairy products.	Flatulence, diarrhea, constipation, abdominal pain, abdominal cramping, abdominal bloating, gastrointestinal issues, weight loss	Increased risk of lactose intolerance with the CC genotype; reduced risk of lactose intolerance with the CT and TT genotypes	Dairy-free foods and beverages (e.g., plant-based milks and yogurt)

VITAMINS & MINERALS				Essential micronutrients that fuel energy production and support optimal cellular functioning		
rsID	Gene	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
BCOM1	rs12934922	-/+	Converts beta-carotene into vitamin A (retinol), supporting vision, immune function, and skin/hair health	Fatigue, vision issues, difficulty seeing at night, dry eyes, dry skin, dry hair, slow wound healing, frequent infections	Increased risk of vitamin A deficiency, retinal dysfunction, impaired fertility, impaired immune function	Preformed vitamin A-rich foods (e.g., beef liver, eggs, cod liver oil)
	rs7501331	-/-				
GC	rs2282679	-/-	Transports vitamin D and its metabolites in the blood, supporting immune function, bone health, and vitamin D metabolism	Fatigue, low mood, muscle weakness, bone pain, frequent fractures, slow wound healing, or frequent infections	Increased risk of osteoporosis, impaired bone mineralization, multiple sclerosis, type 1 diabetes, rheumatoid arthritis, cardiovascular diseases, infections	Vitamin D-rich foods (e.g., cod liver oil, salmon, fortified plant-based milks)
SLC23A1	rs33972313	-/-	Facilitates vitamin C uptake into cells, supporting antioxidant defense, immune function, and collagen synthesis	Fatigue, muscle pain, joint pain, nerve pain, bleeding gums, easy bruising, slow wound healing	Increased risk of vitamin C deficiency, scurvy, gum disease, hypertension, atherosclerosis, stroke, impaired immune function, type 2 diabetes, metabolic syndrome, osteoporosis	Vitamin C-rich foods (e.g., kiwi, bell peppers, oranges)
SLC30A8	rs11558471	+/+	Regulates zinc levels in pancreatic cells, influencing insulin storage and secretion, and glucose metabolism	Fatigue, frequent thirst, increased appetite, difficulty concentrating	Increased risk of impaired insulin secretion, impaired glucose tolerance, type 2 diabetes	Zinc-rich foods (e.g., oysters, pumpkin seeds, ground beef)
SLC5A6	rs1395	+/+	Facilitates the uptake of biotin (vitamin B7), pantothenic acid (vitamin B5), and other vitamins into cells, supporting metabolism, energy production, and cellular health	Fatigue, brain fog, numbness, tingling, nerve pain, muscle spasms/twitches, muscle weakness, skin rashes, brittle nails, hair loss, impaired coordination and balance	Increased risk of metabolic disorders, atopic dermatitis, neurological disorders	Biotin-rich foods (e.g., sunflower seeds, chicken liver, egg yokes) Pantothenic acid-rich foods (e.g., lean meats, avocados, whole grains)
TTPA	rs4501570	+/+	Transports vitamin E in the body to protect cells from oxidative stress, supporting neurological function, cardiovascular health, and skin health	Fatigue, brain fog, vision issues, tingling, numbness, muscle weakness, impaired coordination and balance, dry skin, premature skin aging	Increased risk of Alzheimer's disease, Parkinson's disease, cardiovascular diseases, atherosclerosis, infections, inflammatory conditions	Vitamin E-rich foods (e.g., avocados, sunflower seeds, almonds)
	rs4587328	+/+				
	rs4606052	+/+				

METHYLATION				A chemical modification process that fine-tunes gene expression by adding or removing methyl groups (acting as on-off switches), without altering the DNA sequence		
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
FOLR1	rs2071010	-/-	Binds folate (vitamin B9) to facilitate its transport into cells, supporting DNA synthesis, cell growth, and brain function	Irritability, mood swings, sleep disturbances, muscle pain, joint pain, impaired coordination and balance	Increased risk of neurological disorders, cognitive decline, cardiovascular diseases, neural tube defects	Folate-rich foods (e.g., leafy greens, legumes, avocados)
FOLR2	rs651933	-/-				
DHFR	rs1643649	-/+	Converts a form of folate (vitamin B9) needed for DNA synthesis, cell division, and metabolic processes	Fatigue, brain fog, mood swings	Increased risk of neural tube defects, cardiovascular diseases, cancer risk, altered sensitivity to methotrexate, cognitive decline, neurodegenerative diseases	Folate-rich foods (e.g., leafy greens, legumes, avocados)
MTHFS	rs6495446	-/-	Converts a form of folate into a usable form for cellular processes, supporting folate metabolism, DNA synthesis and repair, and cellular health	Fatigue, brain fog, mood swings	Increased risk of neural tube defects, coronary artery disease, stroke, cancer risk, neurodegenerative diseases, homocystinuria	Folate-rich foods (e.g., leafy greens, legumes, avocados)
MTHFD1	rs1076991	-/-	Facilitates folate metabolism, supporting homocysteine regulation, DNA synthesis, methylation, and cellular health	Fatigue, brain fog, mood swings, anxiousness, headaches	Increased risk of neural tube defects, cardiovascular diseases, cancer risk, cognitive decline, neurodegenerative diseases, altered sensitivity to methotrexate	Folate-rich foods (e.g., leafy greens, legumes, avocados)
MTHFR A1298C	rs1801131	+/+	Converts folate into a form used for methylation, supporting DNA synthesis, repair, and overall cellular health	Fatigue, brain fog, mood swings, anxiousness, low mood, irritability, headaches, migraines, muscle pain, joint pain numbness, tingling	Increased risk of neural tube defects, cardiovascular diseases, coronary artery disease, peripheral arterial disease, stroke, pregnancy-related complications (i.e., preeclampsia, recurrent miscarriage, placental abruption), depression, anxiety, schizophrenia, cognitive decline, neurodegenerative diseases, cancer risk	Folate-rich foods (e.g., leafy greens, legumes, avocados) Vitamin B12-rich foods (e.g., beef, chicken, eggs)
MTHFR C677T	rs1801133	-/-				
SLC19A1	rs1051266	-/+	Transports folate into cells, supporting DNA synthesis, methylation, and cellular health.	Fatigue, brain fog, mood swings, low mood, anxiousness	Increased risk of neural tube defects, cardiovascular diseases, coronary artery disease, stroke, cancer risk, cognitive decline, neurodegenerative diseases	Folate-rich foods (e.g., leafy greens, legumes, avocados)

METHYLATION						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
MTR	rs1805087	-/+	Converts homocysteine to methionine using folate and vitamin B12, supporting methylation, DNA synthesis, and cellular health	Fatigue, memory problems, mood swings, numbness, tingling, joint pain, muscle pain, muscle weakness, pale skin	Increased risk of elevated homocysteine, neural tube defects, cardiovascular diseases, coronary artery disease, stroke, peripheral artery disease, vitamin B12 deficiency, neurological disorders, cognitive impairment, dementia, Alzheimer's disease, cancer risk	Vitamin B12-rich foods (e.g., beef, chicken, eggs)
MTRR	rs1801394	+/+	Supports homocysteine conversion to methionine for methylation, DNA synthesis, and cellular health	Fatigue, memory problems, mood swings, numbness, tingling, muscle pain, joint pain, muscle weakness, pale skin	Increased risk of elevated homocysteine, neural tube defects, cardiovascular diseases, cognitive decline, Alzheimer's disease, pregnancy-related complications	Vitamin B12-rich foods (e.g., beef, chicken, eggs)
	rs1802059	-/-				
TCN2	rs1801198	+/+	Transports vitamin B12 (cobalamin) into tissues, supporting DNA synthesis, red blood cell formation, and neurological function	Fatigue, brain fog, weakness, memory problems, mood swings, muscle pain, muscle weakness, joint pain, pale skin	Increased risk of vitamin B12 deficiency, elevated homocysteine, cardiovascular diseases, megaloblastic anemia, neuropathy, cognitive impairment, dementia, pregnancy-related complications	Vitamin B12-rich foods (e.g., beef, chicken, eggs)

MITOCHONDRIA			The cell's powerhouses, generating adenosine triphosphate (ATP) to fuel energy requirements			
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
ATP5C1	rs1244414	-/-	Generates ATP in mitochondria, supporting energy production and cellular function	Fatigue, muscle weakness, reduced stamina, memory problems, exercise intolerance	Increased risk of metabolic disorders, mitochondrial dysfunction, cardiovascular diseases, Parkinson's disease, Alzheimer's disease, reduced exercise performance	Polyphenol-rich foods (e.g., berries, pomegranates, peppermint)
COQ2	rs6535454	+/+	Synthesizes coenzyme Q10 (CoQ10), a molecule critical for mitochondrial energy production and antioxidant defense	Fatigue, muscle weakness, muscle cramps, numbness, tingling, mood swings	Increased risk of CoQ10 deficiency, neurological disorders, mitochondrial dysfunction, encephalopathy, myopathy, kidney dysfunction, kidney disease	Coenzyme Q10-rich foods (e.g., fatty fish, organ meats, pistachios)

MITOCHONDRIA						
Gene	rsID	Result	Gene Function	Symptoms	Associated Health Conditions	Nutritional Support
COX5A	rs8042694	-/+	Facilitates the final step in generating ATP in mitochondria, driving energy production and supporting cellular energy needs	Fatigue, brain fog, vision issues, muscle weakness, exercise intolerance	Increased risk of metabolic disorders, mitochondrial dysfunction, mitochondrial myopathies, Parkinson's disease, Alzheimer's disease, amyotrophic lateral sclerosis, lactic acidosis, cardiovascular diseases, obesity, insulin resistance, type 2 diabetes, reduced exercise performance, age-related diseases, oxidative stress	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, dark leafy greens) Healthy fats (e.g., avocados, olive oil, nuts and seeds)
COX6C	rs4626565	-/-				
NDUFS7	rs809359	+/+	Initiates ATP production in the mitochondria, supporting mitochondrial function	Fatigue, brain fog, vision issues, muscle weakness, exercise intolerance	Increased risk of mitochondrial dysfunction, metabolic diseases, degenerative diseases, Leigh syndrome, Parkinson's disease, Alzheimer's disease, cardiovascular diseases, reduced exercise performance, type 2 diabetes, cancer risk, age-related diseases, oxidative stress	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, dark leafy greens) Healthy fats (e.g., avocados, olive oil, nuts and seeds)
NDUFS8	rs1051806	-/+				
NDUSF3	rs4147730	-/-				
UQCRC2	rs11648723	-/-	Helps generate ATP, supporting cellular energy needs, mitochondrial function, and metabolic function	Fatigue, brain fog, vision issues, muscle weakness, exercise intolerance, seizures	Increased risk of metabolic diseases, degenerative diseases, mitochondrial dysfunction, mitochondrial myopathies, metabolic syndrome, Parkinson's disease, Alzheimer's disease, cardiovascular diseases, reduced exercise performance	Antioxidant-rich foods (e.g., berries, colorful fruits and vegetables, dark leafy greens)
	rs4850	-/-				

References

Abbas, A., Delvin, E. E., & Rozen, R. (2010). A common MTHFR polymorphism (C677T) may impact folate status in women during pregnancy. Mutagenesis, 25(4), 365–369. https://doi.org/10.1093/mutage/geq013

Alghadir, A. H., Gabr, S. A., & Al-Eisa, E. (2015). Assessment of the effects of glutamic acid decarboxylase antibodies and trace elements on cognitive performance in older adults. Clinical Interventions in Aging, 10, 1901–1907. https://doi.org/10.2147/CIA.S95974

Alkhaldi, H. A., & Vik, S. B. (2023). Analysis of compound heterozygous and homozygous mutations found in peripheral subunits of human respiratory Complex I, NDUFS1, NDUFS2, NDUFS8, and NDUFV1, by modeling in the E. coli enzyme. Mitochondrion, 68, 87–104. https://doi.org/10.1016/j.mito.2022.11.007

Alcántara-Ortigoza, B. E., García-de Teresa, M. T., Falfán-Valencia, A., González-Huerta, L. M., Cuevas-Covarrubias, S., Frias, S., & Alcántara-Ortigoza, M. A. (2020). First comprehensive TSC1/TSC2 mutational analysis in Mexican patients with tuberous sclerosis complex reveals numerous novel pathogenic variants. Scientific Reports, 10(1), Article 62759. https://doi.org/10.1038/s41598-020-62759-5

Amir Shaghaghi, M., Bernstein, C. N., Serrano León, A., El-Gabalawy, H., & Eck, P. (2014). Polymorphisms in the sodium-dependent ascorbate transporter gene SLC23A1 are associated with susceptibility to Crohn's disease. The American Journal of Clinical Nutrition, 99(2), 378–383. https://doi.org/10.3945/ajcn.113.068015

Antosz, K., Batko, J., Błażejewska, M., Gawor, A., Sleziak, J., & Gomułka, K. (2024). Insight into IL-5 as a potential target for the treatment of allergic diseases. Biomedicines, 12(7), 1531. https://doi.org/10.3390/biomedicines12071531

Aronica, L., Ordovas, J. M., Volkov, A., Lamb, J. J., Stone, P. M., Minich, D., Leary, M., Class, M., Metti, D., Larson, I. A., Contractor, N., Eck, B., & Bland, J. S. (2022). Genetic biomarkers of metabolic detoxification for personalized lifestyle medicine. Nutrients, 14(4), Article 768. https://doi.org/10.3390/nu14040768

Artigalás, O., Vanni, T., Hutz, M. H., Ashton-Prolla, P., & Schwartz, I. V. (2015). Influence of CYP19A1 polymorphisms on the treatment of breast cancer with aromatase inhibitors: A systematic review and meta-analysis. BMC Medicine, 13, Article 139. https://doi.org/10.1186/s12916-015-0373-9

Aschebrook-Kilfoy, B., Neta, G., Brenner, A. V., Hutchinson, A., Pfeiffer, R. M., Sturgis, E. M., Xu, L., Wheeler, W., Doody, M. M., Chanock, S. J., & Sigurdson, A. J. (2012). Common genetic variants in metabolism and detoxification pathways and the risk of papillary thyroid cancer. Endocrine-Related Cancer, 19(3), 333–344. https://doi.org/10.1530/ERC-11-0372

Badran, M., Golbidi, S., Ayas, N., & Laher, I. (2015). Nitric oxide bioavailability in obstructive sleep apnea: Interplay of asymmetric dimethylarginine and free radicals. Sleep Disorders, 2015, Article 387801. https://doi.org/10.1155/2015/387801

Bahrami, A., Sadeghnia, H. R., Tabatabaeizadeh, S.-A., Bahrami-Taghanaki, H., Pahlevani, N., Meshkat, Z., Ferns, G. A., & Ghayour-Mobarhan, M. (2020). Association of VDR (rs2228570, rs731236, rs7975232, rs1544410) and DBP (rs7041) genes polymorphisms with chronicity of hepatitis B in Iranian patients. Gene Reports, 19, 100615. https://doi.org/10.1016/j.genrep.2020.100615

Banjabi, A. A., Al-Ghafari, A. B., Kumosani, T. A., Kannan, K., & Fallatah, S. M. (2020). Genetic influence of vitamin D receptor gene polymorphisms on osteoporosis risk. International Journal of Health Sciences (Qassim), 14(4), 22–28. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7346971/

Bartolini, D., Giustarini, D., Pietrella, D., Rossi, R., & Galli, F. (2020). Glutathione S-transferase P influences the Nrf2-dependent response of cellular thiols to seleno-compounds. Cell Biology and Toxicology, 36(4), 379–386. https://doi.org/10.1007/s10565-020-09517-5

Berger, S. M., Weber, T., Perreau-Lenz, S., Vogt, M. A., Gartside, S. E., Maser-Gluth, C., Lanfumey, L., Gass, P., Spanagel, R., & Bartsch, D. (2012). A functional Tph2 C1473G polymorphism causes an anxiety phenotype via compensatory changes in the serotonergic system. Neuropsychopharmacology, 37(9), 1986–1998. https://doi.org/10.1038/npp.2012.46

Bermingham, E. N., Hesketh, J. E., Sinclair, B. R., Koolaard, J. P., & Roy, N. C. (2014). Selenium-enriched foods are more effective at increasing glutathione peroxidase (GPx) activity compared with selenomethionine: A meta-analysis. Nutrients, 6(10), 4002-4031. https://doi.org/10.3390/nu6104002

Bianco, B., Loureiro, F. A., Trevisan, C. M., Peluso, C., Christofolini, D. M., Montagna, E., Laganà, A. S., & Barbosa, C. P. (2021). Effects of FSHR and FSHB variants on hormonal profile and reproductive outcomes of infertile women with endometriosis. Frontiers in Endocrinology, 12, 760616.

Biglari, S., Nikuei, P., Mir, A., Vahidnezhad, H., Youssefian, L., Moghaddam, A. S., Tabatabaiefar, M. A., Saeidian, A. H., Khorram, E., Fard, M. A. F., Farbood, Z., Shahrooei, M., Khorram Khorshid, H. R., & Esmaeilzadeh, E. (2025). Ataxia with Vitamin E deficiency: Case series, Vitamin E therapy response, founder effect, and in silico analysis. Clinical Genetics, 107(3), 366–368. https://doi.org/10.1111/cge.14658

Boehm, E., & Relja, B. (2022). Anti-inflammatory effects of the neurotransmitter dopamine. ChemBioEng Reviews, 9(3), 296–317. https://doi.org/10.1002/cben.202100050

Bolton, M. J., Chapman, B. P., & Van Marwijk, H. (2020). Low-dose naltrexone as a treatment for chronic fatigue syndrome. BMJ Case Reports, 13(1), Article e232502. https://doi.org/10.1136/bcr-2019-232502

Booz, G. W. (2011). Cannabidiol as an emergent therapeutic strategy for lessening the impact of inflammation on oxidative stress. Free Radical Biology & Medicine, 51(5), 1054–1061. https://doi.org/10.1016/j.freeradbiomed.2011.01.007

Borel, P., Szabo de Edelenyi, F., Vincent-Baudry, S., Malezet-Desmoulin, C., Margotat, A., Lyan, B., Gorrand, J.-M., Meunier, N., Drouault-Holowacz, S., & Bieuvelet, S. (2011). Genetic variants in BCMO1 and CD36 are associated with plasma lutein concentrations and macular pigment optical density in humans. Annals of Medicine, 43(1), 47–59. https://doi.org/10.3109/07853890.2010.531757

Borensztajn, K., Stiekema, J., Nijmeijer, S., Reitsma, P. H., Peppelenbosch, M. P., & Spek, C. A. (2008). Factor Xa stimulates proinflammatory and profibrotic responses in fibroblasts via protease-activated receptor-2 activation. The American Journal of Pathology, 172(2), 309–320. https://doi.org/10.2353/ajpath.2008.070347

Bortolato, M., Godar, S. C., Alzghoul, L., Zhang, J., Darling, R. D., Simpson, K. L., Bini, V., Chen, K., Wellman, C. L., Lin, R. C., & Shih, J. C. (2013). Monoamine oxidase A and A/B knockout mice display autistic-like features. International Journal of Neuropsychopharmacology, 16(4), 869–888. https://doi.org/10.1017/S1461145712000715

Bourgin, M., Kepp, O., & Kroemer, G. (2022). Immunostimulatory effects of vitamin B_5 improve anticancer immunotherapy. OncoImmunology, 11(1), Article 2031500. https://doi.org/10.1080/2162402X.2022.2031500

References

Bourdetsky, D., Peretz, A., & Tirosh, B. (2020). Transient vitamin B5 starving improves mammalian cell homeostasis and protein production. Metabolic Engineering, 60, 77–86. https://doi.org/10.1016/j.ymben.2020.03.008

Bouayed, J., Rammal, H., & Soulimani, R. (2009). Oxidative stress and anxiety: Relationship and cellular pathways. Oxidative Medicine and Cellular Longevity, 2(2), 63–67. https://doi.org/10.4161/oxim.2.2.7944

Braithwaite, V. S., Jones, K. S., Schoenmakers, I., Silver, M., Prentice, A., & Hennig, B. J. (2015). Vitamin D binding protein genotype is associated with plasma 25OHD concentration in West African children. Bone, 74, 166–170. https://doi.org/10.1016/j.bone.2014.12.068

Bresciani, G., Cruz, I. B. M., de Paz, J. A., Cuevas, M. J., & González-Gallego, J. (2015). Manganese superoxide dismutase and oxidative stress modulation. Advances in Clinical Chemistry, 68, 87–130. https://doi.org/10.1016/bs.acc.2014.11.001

Briguglio, M., Vitale, J. A., Galentino, R., Banfi, G., Zanaboni Dina, C., Bona, A., Panzica, G., Porta, M., Dell'Osso, B., & Glick, I. D. (2020). Healthy eating, physical activity, and sleep hygiene (HEPAS) as the winning triad for sustaining physical and mental health in patients at risk for or with neuropsychiatric disorders: Considerations for clinical practice. Neuropsychiatric Disease and Treatment, 16, 55–70. https://doi.org/10.2147/NDT.S229206

Bukowska, A., Zacharias, I., Weinert, S., Skopp, K., Hartmann, C., Huth, C., & Goette, A. (2013). Coagulation factor Xa induces an inflammatory signalling by activation of protease-activated receptors in human atrial tissue. European Journal of Pharmacology, 718(1–3), 114–123. https://doi.org/10.1016/j.ejphar.2013.09.006

Calabrese, V., Giuffrida Stella, A. M., Calvani, M., & Butterfield, D. A. (2006). Acetylcarnitine and cellular stress response: Roles in nutritional redox homeostasis and regulation of longevity genes. The Journal of Nutritional Biochemistry, 17(2), 73–88. https://doi.org/10.1016/j.jnutbio.2005.03.027

Cant, R., Dalgleish, A. G., & Allen, R. L. (2017). Naltrexone inhibits IL-6 and TNFα production in human immune cell subsets following stimulation with ligands for intracellular Toll-Like receptors. Frontiers in Immunology, 8, Article 809. https://doi.org/10.3389/fimmu.2017.00809

Cao, J., Ma, Q., Ye, K., Zhao, L., Li, J., Wang, S., Li, Y., Sun, Y., Zhang, Y., Wang, Y., Qi, X., Wang, J., & Ma, X. (2022). Therapeutic mechanisms of berberine to improve the intestinal barrier function via modulating gut microbiota, TLR4/NF-κ B/MTORC pathway and autophagy in cats. Frontiers in Microbiology, 13, Article 961885. https://doi.org/10.3389/fmicb.2022.961885

Cao, S. S., & Kaufman, R. J. (2018). Endoplasmic reticulum stress and oxidative stress in cell fate decision and human disease. Journal of Cellular and Molecular Medicine, 22(1), 3–19. https://doi.org/10.1111/jcmm.13459

Carter, C. J. (2011). Schizophrenia: A pathogenetic autoimmune disease caused by viruses and pathogens and dependent on genes. Journal of Pathogens, 2011, Article 128318. https://doi.org/10.4061/2011/128318

Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., McClay, J., Mill, J., Martin, J., Braithwaite, A., & Poulton, R. (2003). Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. Science, 301(5631), 386–389. https://doi.org/10.1126/science.1083968

Castagna, M. G., Pinchera, A., Marsili, A., Giannetti, M., Molinaro, E., Fierabracci, P., … Elisei, R. (2009). Thyroid cancer in thyroid nodules: Diagnostic accuracy of ultrasound and fine-needle aspiration cytology in relation to histotype and genetic pattern. The Journal of Clinical Endocrinology & Metabolism, 94(5), 1623–1629. https://doi.org/10.1210/jc.2008-2156

Chang, J., Zhang, B., Heath, H., Galjart, N., Wang, X., & Thiele, C. J. (2010). Nicotinamide adenine dinucleotide (NAD)-regulated DNA methylation alters CCCTC-binding factor (CTCF)/cohesin binding and transcription at the BDNF locus. Proceedings of the National Academy of Sciences of the United States of America, 107(50), 21836–21841. https://doi.org/10.1073/pnas.1002130107

Chen, Z., Wang, O., Nie, M., Elison, K., Zhou, D., Li, M., … Xing, X. (2015). Aromatase deficiency in a Chinese adult man caused by novel compound heterozygous CYP19A1 mutations: Effects of estrogen replacement therapy on the bone, lipid, liver and glucose metabolism. Molecular and Cellular Endocrinology, 399, 32–42. https://doi.org/10.1016/j.mce.2014.09.016

Cheng, X., Zong, Z., Mei, X., Wang, Z., Song, Y., Wang, H., & Wang, Y. (2025). Exploring the impact of angiotensin-converting enzyme (ACE) gene polymorphism on early diastolic function in hypertension using four-dimensional echocardiography. BMC Cardiovascular Disorders, 25, Article 95. https://doi.org/10.1186/s12872-025-04498-x

Christensen, R. D., Grubb, P. H., & Yaish, H. M. (2019). Hazardous hyperbilirubinemia in a neonate with novel homozygous biallelic GSR (glutathione reductase) mutations. Annals of Pediatrics, 2(1), Article 1014. https://meddocsonline.org/annals-of-pediatrics/hazardous-hyperbilirubinemia-in-a-neonate-with-novel-homozygous-biallelic-GSR-glutathione-reductase-mutations.pdf

Comas-Basté, O., Sánchez-Pérez, S., Veciana-Nogués, M. T., Latorre-Moratalla, M. L., & Vidal-Carou, M. C. (2020). Histamine intolerance: The current state of the art. Biomolecules, 10(8), 1181. https://doi.org/10.3390/biom10081181

Corella, D., & Ordovas, J. M. (2009). Nutrigenomics in cardiovascular medicine. Circulation: Cardiovascular Genetics, 2(6), 637–651. https://doi.org/10.1161/CIRCGENETICS.109.891366

Cunha, A. R., Umbelino, B., Correia, M. L., & Neves, M. F. (2017). Oral magnesium supplementation improves endothelial function and attenuates subclinical atherosclerosis in thiazide-treated hypertensive women. Journal of Hypertension, 35(1), 89–97. https://doi.org/10.1097/HJH.0000000000001129

Czeczuga-Semeniuk, E., Galar, M., Jarząbek, K., Kozłowski, P., Sarosiek, N. A., & Wołczyński, S. (2018). The preliminary association study of ADIPOQ, RBP4, and BCMO1 variants with polycystic ovary syndrome and with biochemical characteristics in a cohort of Polish women. Advances in Medical Sciences, 63(2), 242–248. https://doi.org/10.1016/j.advms.2018.01.002

Da Costa, L. A., García-Bailo, B., Badawi, A., & El-Sohemy, A. (2012). Genetic determinants of dietary antioxidant status. In Encyclopedia of human nutrition (3rd ed.). Elsevier. https://doi.org/10.1016/B978-0-12-398397-8.00008-3

Dai, Q., Zhu, X., Manson, J. E., Song, Y., Li, X., Franke, A. A., Costello, R. B., Rosanoff, A., Nian, H., Fan, L., Murff, H., Ness, R. M., Seidner, D. L., Yu, C., & Shrubsole, M. J. (2018). Magnesium status and supplementation influence vitamin D status and metabolism: Results from a randomized trial. The American Journal of Clinical Nutrition, 108(6), 1249–1258. https://doi.org/10.1093/ajcn/nqy274

Dalbeth, N., Saag, K. G., Palmer, W. E., Choi, H. K., Hunt, B., MacDonald, P. A., Thienel, U., & Gunawardhana, L. (2018). Effects of febuxostat in early gout: A randomized, double-blind, placebo-controlled study. Rheumatology, 57(10), 1769–1777. https://doi.org/10.1093/rheumatology/key164

Dasari, S., & Gonuguntla, S. (2018). Genetic polymorphism of glutathione S-transferases: Relevance to neurological disorders. Pathophysiology, 25(4), 285–292. https://doi.org/10.1016/j.pathophys.2018.06.001

References

David, T., Ling, S. F., & Barton, A. (2018). Genetics of immune-mediated inflammatory diseases. Clinical and Experimental Immunology, 193(1), 3–12. https://doi.org/10.1111/cei.13101

Deng, Y., Han, Y., Gao, Y., Dong, W., & Yu, Y. (2023). The physiological functions and polymorphisms of type II deiodinase. Endocrinology and Metabolism, 38(2), 190–202. https://doi.org/10.3803/EnM.2022.1599

Desbats, M. A., Morbidoni, V., Silic-Benussi, M., Doimo, M., Ciminale, V., Cassina, M., Sacconi, S., Hirano, M., Basso, G., Pierrel, F., Navas, P., Salviati, L., & Trevisson, E. (2016). The COQ2 genotype predicts the severity of coenzyme Q10 deficiency. Human Molecular Genetics, 25(19), 4256–4265. https://doi.org/10.1093/hmg/ddw257

Dhillon, S. S. (2014). Higher activity of the inducible nitric oxide synthase contributes to very early onset inflammatory bowel disease. Journal of Clinical Investigation, 124(5), 1911–1914. https://doi.org/10.1172/JCI74713

Díaz, F. (2010). Cytochrome c oxidase deficiency: Patients and animal models. Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease, 1802(1), 100–110. https://doi.org/10.1016/j.bbadis.2009.07.013

Ding, M., Ellervik, C., Huang, T., Jensen, M. K., Curhan, G. C., Pasquale, L. R., Kang, J. H., Wiggs, J. L., Hunter, D. J., Willett, W. C., Rimm, E. B., Kraft, P., & Chasman, D. I. (2010). Genetic variants of the SRD5A2 and response to finasteride among men with benign prostatic hyperplasia. American Journal of Hypertension, 23(8), 917–923. https://doi.org/10.1038/ajh.2010.90

Dishy, V., Sofowora, G. G., Xie, H. G., Kim, R. B., Byrne, D. W., Stein, C. M., & Wood, A. J. (2001). The effect of common polymorphisms of the beta2-adrenergic receptor on agonist-mediated vascular desensitization. New England Journal of Medicine, 345(12), 1030–1035. https://doi.org/10.1056/NEJM200109203451204

Drake, I., Hindy, G., Ericson, U., & Orho-Melander, M. (2017). A prospective study of dietary and supplemental zinc intake and risk of type 2 diabetes depending on genetic variation in SLC30A8. Genes & Nutrition, 12, Article 30. https://doi.org/10.1186/s12263-017-0586-y

Du, B., Tian, H., Tian, D., Zhang, C., Wang, W., Wang, L., Ge, M., Hou, Q., & Zhang, W. (2018). Genetic polymorphisms of key enzymes in folate metabolism affect the efficacy of folate therapy in patients with hyperhomocysteinaemia. British Journal of Nutrition, 119(8), 887–895. https://doi.org/10.1017/S0007114518000508

Duan, G. (2020). The association between VDR and GC polymorphisms and lung cancer risk: A meta-analysis. Genetic Testing and Molecular Biomarkers, 24(5), 285–292. https://doi.org/10.1089/gtmb.2019.0187

Duell, E. J., Lujan-Barroso, L., Llivina, C., Muñoz, X., Jenab, M., Boutron-Ruault, M.-C., Clavel-Chapelon, F., Racine, A., Boeing, H., Buijsse, B., Canzian, F., Johnson, T., Dalgård, C., Overvad, K., Tjønneland, A., Olsen, A., Sánchez, S. C., Sánchez-Cantalejo, E., Huerta, J.-M., Ardanaz, E., Dorronsoro, M., Khaw, K.-T., Travis, R. C., Trichopoulou, A., Trichopoulos, D., Rafnsson, S., Palli, D., Sacerdote, C., Tumino, R., Panico, S., Grioni, S., Bueno-de-Mesquita, H. B., Ros, M. M., Numans, M. E., Peeters, P. H., Johansen, D., Lindkvist, B., Johansson, M., Johansson, I., Skeie, G., Weiderpass, E., Duarte-Salles, T., Stenling, R., Riboli, E., Sala, N., & González, C. A. (2013). Vitamin C transporter gene (SLC23A1 and SLC23A2) polymorphisms, plasma vitamin C levels, and gastric cancer risk in the EPIC cohort. Genes & Nutrition, 8(6), 549–560. https://doi.org/10.1007/s12263-013-0346-6

Ellis, J. A., Stebbing, M., & Harrap, S. B. (2003). Polymorphism of the androgen receptor gene is associated with male pattern baldness. Journal of Dermatological Science, 31(2), 135–141. https://doi.org/10.1016/S0923-1811(02)00145-7

Erkoc-Kaya, D., Arikoglu, H., Korez, K. M., Ipekci, S. H., & Baldane, S. (2023). Protective effect of the rare variant rs13266634C/T of the SLC30A8 gene in the genetic background of the development of type 2 diabetes in Turkish population. International Journal of Diabetes in Developing Countries, 43(4), 1052–1060. https://doi.org/10.1007/s13410-023-01195-3

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M. I., Corella, D., Arós, F., … Martínez-González, M. A. (2013). Primary prevention of cardiovascular disease with a Mediterranean diet. New England Journal of Medicine, 368(14), 1279–1290. https://doi.org/10.1056/NEJMoa1200303

Ferrucci, L., Perry, J. R. B., Matteini, A., Perola, M., Tanaka, T., Silander, K., Rice, N., Melzer, D., Murray, A., Cluett, C., Fried, L. P., Albanes, D., Corsi, A.-M., Cherubini, A., Guralnik, J., Bandinelli, S., Singleton, A., Virtamo, J., Walston, J., Semba, R. D., & Frayling, T. M. (2009). Common variation in the beta-carotene 15,15'-monooxygenase 1 gene affects circulating levels of carotenoids: A genome-wide association study. American Journal of Human Genetics, 84(2), 123–133. https://doi.org/10.1016/j.ajhg.2008.12.019

Födinger, M., Hörl, W. H., & Sunder-Plassmann, G. (2000). Molecular biology of 5,10-methylenetetrahydrofolate reductase. Journal of Nephrology, 13(1), 20–33.

Forero, D. A., Adan, A., & Lopez-Leon, S. (2020). Association between a functional polymorphism in the monoamine oxidase A (MAOA) gene and both emotional coping style and neuroticism. The Open Neurology Journal, 14(1), 10–20. https://doi.org/10.2174/1874205X02014010010

Galasso, M., Dalla Pozza, E., Chignola, R., Gambino, S., Cavallini, C., Quaglia, F. M., Lovato, O., Dando, I., Malpeli, G., Krampera, M., Donadelli, M., Romanelli, M. G., & Scupoli, M. T. (2022). The rs1001179 SNP and CpG methylation regulate catalase expression in chronic lymphocytic leukemia. Cellular and Molecular Life Sciences, 79(521). https://doi.org/10.1007/s00018-022-04540-7

Gamil, S., Erdmann, J., Abdalrahman, I. B., & Mohamed, A. O. (2017). Association of NOS3 gene polymorphisms with essential hypertension in Sudanese patients: A case control study. BMC Medical Genetics, 18, 128.

Gao, H., Liu, J., Xu, W., Yang, M., Peng, Q., Liu, Y., & Zhang, Y. (2025). Functional characterization of novel variants in the HSD17B3 gene associated with disordered sex development. Human Molecular Genetics. Advance online publication. https://doi.org/10.1093/hmg/ddae199

Gao, X., Yang, J., Wang, B., Wang, Y., Li, Z., Zhang, J., Wang, H., & Zhang, Y. (2021). The genetic architecture of sporadic and familial pituitary tumors. Molecular Genetics & Genomic Medicine, 9(5), Article e1590. https://doi.org/10.1002/mgg3.1590

Gao, X.-R., & Yu, Y.-G. (2018). Meta-analysis of the association between vitamin D receptor polymorphisms and the risk of autoimmune thyroid disease. International Journal of Endocrinology, 2018, Article 2846943. https://doi.org/10.1155/2018/2846943

García-Martín, E., Ayuso, P., Martínez, C., Blanca, M., & Agúndez, J. A. (2009). Histamine pharmacogenomics. Pharmacogenomics, 10(5), 867–883. https://doi.org/10.2217/pgs.09.26

Garutti, M., Lambertini, M., & Puglisi, F. (2021). Checkpoint inhibitors, fertility, pregnancy, and sexual life: A systematic review. ESMO Open, 6(5), Article 100276. https://doi.org/10.1016/j.esmoop.2021.100276

Gawandi, S., J, K., & Kulkarni, S. (2023). Determination of frequency of Type 2 deiodinase Thr92Ala polymorphism (rs225014) in 131I-treated differentiated thyroid cancer patients undertaking L-Thyroxine (L-T4) suppression therapy. Research Square. https://doi.org/10.21203/rs.3.rs-3070668/v1

References

Giovanella, J., Wollinger, L. M., Capra, L., Durigon, F., Grignoli, J. P., & Contini, V. (2021). Diet-gene interaction: effects of polymorphisms in the ACE, AGT and BDKRB2 genes and the consumption of sodium, potassium, calcium, and magnesium on blood pressure of normotensive adult individuals. Molecular and Cellular Biochemistry, 476, 1211–1219. https://doi.org/10.1007/s11010-020-03983-5

Giuffrida, R., Bellone, F., Bosco, L., Bagheri, B., Scuderi, M. R., & Cantarella, G. (2021). IL-5: An inflammatory cytokine with emerging roles in immunity and disease. Frontiers in Immunology, 12, Article 737583. https://doi.org/10.3389/fimmu.2021.737583

González-Castro, T. B., Juárez-Rojop, I., López-Narváez, M. L., & Tovilla-Zárate, C. A. (2013). Association of the 5HTR2A gene with suicidal behavior: CASE-control study and updated meta-analysis. BMC Psychiatry, 13, Article 25. https://doi.org/10.1186/1471-244X-13-25

Goodarzi, M. O., Shah, N. A., Antoine, H. J., Pall, M., Guo, X., & Azziz, R. (2006). Variants in the 5α-reductase type 1 and type 2 genes are associated with polycystic ovary syndrome and the severity of hirsutism in affected women. The Journal of Clinical Endocrinology & Metabolism, 91(10), 4085–4091. https://doi.org/10.1210/jc.2006-1027

Gorzkiewicz, M., Łoś-Rycharska, E., Gawryjołek, J., Gołębiewski, M., Krogulska, A., & Grzybowski, T. (2023). The methylation profile of IL4, IL5, IL10, IFNG and FOXP3 associated with environmental exposures differed between Polish infants with the food allergy and/or atopic dermatitis and without the disease. Frontiers in Immunology, 14, 1209190. https://doi.org/10.3389/fimmu.2023.1209190

Grimble, R. F., Tappia, P. S., & Harris, R. A. (2002). Omega-3 fatty acids and inflammation. The American Journal of Clinical Nutrition, 76(2), 4.

Groneberg, D. A., Kindermann, B., Althammer, M., Klapper, M., Vormann, J., Littarru, G. P., & Döring, F. (2005). Coenzyme Q10 affects expression of genes involved in cell signalling, metabolism and transport in human CaCo-2 cells. International Journal of Biochemistry & Cell Biology, 37(6) .https://doi.org/10.1016/j.biocel.2004.11.017

Gross, T. J., Kremens, K., Powers, L. S., Brink, B., Knutson, T., Domann, F. E., Philibert, R. A., Milhem, M. M., & Monick, M. M. (2014). Epigenetic silencing of the human NOS2 gene: Rethinking the role of nitric oxide in human macrophage inflammatory responses. The Journal of Immunology, 192(5), 2326–2338. https://doi.org/10.4049/jimmunol.1301758

Grosso, G., Laudisio, D., Frias-Toral, E., Barrea, L., Muscogiuri, G., Savastano, S., & Colao, A., on behalf of the Obesity Programs of Nutrition, Education, Research and Assessment (OPERA) Group. (2022). Anti-inflammatory nutrients and obesity-associated metabolic-inflammation: State of the art and future direction. Nutrients, 14(6), Article 1137. https://doi.org/10.3390/nu14061137

Gualtieri, P., Marchetti, M., Frank, G., Smeriglio, A., Trombetta, D., Colica, C., Cianci, R., De Lorenzo, A., & Di Renzo, L. (2023). Antioxidant-enriched diet on oxidative stress and inflammation gene expression: A randomized controlled trial. Genes, 14(1), Article 206. https://doi.org/10.3390/genes14010206

Guest, N. S., & Grant, J. (2025). Human genetics and caffeine: Functional single-nucleotide polymorphism and response to caffeine intake. In Coffee in health and disease prevention (2nd ed., pp. 377–382). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.10707-3

Hagiwara, S., Ishii, I., Sato, H., Hoshino, S., Hagiwara, Y., Kanazawa, K., Kawai, Y., Ishii, T., & Suzuki, S. (2015). Hemizygosity of transsulfuration genes confers increased vulnerability against acetaminophen-induced hepatotoxicity in mice. Toxicology and Applied Pharmacology, 282(2), 195-206. https://doi.org/10.1016/j.taap.2014.11.015

Han, X., Li, B., Ye, X., Mulatibieke, T., Wu, J., Dai, J., Wu, D., Ni, J., Zhang, R., Xue, J., Wan, R., Wang, X., & Hu, G. (2017). Dopamine D2 receptor signalling controls inflammation in acute pancreatitis via a PP2A-dependent Akt/NF-κB signalling pathway. British Journal of Pharmacology, 174(24), 4751–4770. https://doi.org/10.1111/bph.14057

Haskell, C. F., Kennedy, D. O., Milne, A. L., Wesnes, K. A., & Scholey, A. B. (2008). The effects of L-theanine, caffeine and their combination on cognition and mood. Biological Psychology, 77(2), 113–122. https://doi.org/10.1016/j.biopsycho.2007.09.008

Heart Outcomes Prevention Evaluation Study Investigators. (2000). Vitamin E supplementation and cardiovascular events in high-risk patients. New England Journal of Medicine, 342(3), 154-160. https://doi.org/10.1056/NEJM200001203420302

Hernández-Guerrero, C., Parra-Carriedo, A., Ruiz-de-Santiago, D., Galicia-Castillo, O., Buenrostro-Jáuregui, M., & Díaz-Gutiérrez, C. (2018). Genetic polymorphisms of antioxidant enzymes CAT and SOD affect the outcome of clinical, biochemical, and anthropometric variables in people with obesity under a dietary intervention. Genes & Nutrition, 13(1), 1. https://doi.org/10.1186/s12263-017-0590-2

Hettema, J. M., An, S. S., Neale, M. C., Bukszar, J., van den Oord, E. J. C. G., Kendler, K. S., & Chen, X. (2006). Association between glutamic acid decarboxylase genes and anxiety disorders, major depression, and neuroticism. Molecular Psychiatry, 11(8), 752–762. https://doi.org/10.1038/sj.mp.4001845 Note: An erratum was published for this article in Molecular Psychiatry, 11(8), 794.

Heerdt, A. S., Young, C. W., & Borgen, P. I. (1995). Calcium glucarate as a chemopreventive agent in breast cancer. Israel Journal of Medical Sciences, 31(2-3), 101–105.

Huang, Z., Liu, Y., Qi, G., Brand, D., & Zheng, S. G. (2018). Role of vitamin A in the immune system. Journal of Clinical Medicine, 7(9), Article 258. https://doi.org/10.3390/jcm7090258

Hung, J., Yang, T. L., Urrutia, T. F., Li, R., Perry, C. A., Hata, H., Cogger, E. A., Moriarty, D. J., & Caudill, M. A. (2006). Additional food folate derived exclusively from natural sources improves folate status in young women with the MTHFR 677 CC or TT genotype. The Journal of Nutritional Biochemistry, 17(11), 728–734. https://doi.org/10.1016/j.jnutbio.2005.11.009

Imhann, F., Vich Vila, A., Bonder, M. J., Fu, J., Gevers, D., Visschedijk, M. C., Spekhorst, L. M., Alberts, R., Franke, L., van Dullemen, H. M., Ter Steege, R. W. F., Huttenhower, C., Dijkstra, G., Xavier, R. J., Festen, E. A. M., Wijmenga, C., Zhernakova, A., & Weersma, R. K. (2018). Interplay of host genetics and gut microbiota underlying the onset and clinical presentation of inflammatory bowel disease. Gut, 67(1), 108–119. https://doi.org/10.1136/gutjnl-2016-312135

Imre, E., Akçay, S., & Yavuz, D. G. (2025). Aromatase enzyme deficiency in an adult male patient and the effects of estrogen replacement therapy: A rare cause of tall stature. Hormones, 24, 525–532. https://doi.org/10.1007/s42000-025-00640-8

Jang, S., Choi, B., Lim, C., Kim, M., Lee, J.-E., Lee, H., Baek, E., & Cho, K. S. (2024). Neuronal fatty acid-binding protein enhances autophagy and suppresses amyloid-β pathology in a Drosophila model of Alzheimer's disease. PLOS Genetics, 20(11), Article e1011475. https://doi.org/10.1371/journal.pgen.1011475

Ji, J. D., Lee, W. J., Kong, K. A., Woo, J. H., Choi, S. J., Lee, Y. H., & Song, G. G. (2010). Association of STAT4 polymorphism with rheumatoid arthritis and systemic lupus erythematosus: A meta-analysis. Molecular Biology Reports, 37(1), 141–147. https://doi.org/10.1007/s11033-009-9553-z

Jiménez, K. M., Pereira-Morales, A. J., & Forero, D. A. (2019). Morning cortisol levels and cognitive performance in young adults carrying the functional MAOA-uVNTR polymorphism: Evidence for a lower cognitive performance under stress. Brain and Behavior, 9(9), e01376. https://doi.org/10.1002/brb3.1376

References

Jongkees, B. J., Hommel, B., Kühn, S., & Colzato, L. S. (2015). Effect of tyrosine supplementation on clinical and healthy populations under stress or cognitive demands—A review. Journal of Psychiatric Research, 70, 50–57. https://doi.org/10.1016/j.jpsychires.2015.08.014

Kamerbeek, N. M., van Zwieten, R., de Boer, M., Morren, G., Vuil, H., Maitland-van der Zee, A. H., … Roos, D. (2007). Molecular basis of glutathione reductase deficiency in human blood cells. Blood, 109(8), 3560–3566. https://doi.org/10.1182/blood-2006-08-042531

Karasneh, J. A., Darwazeh, A. M. G., Hassan, A. F., & Thornhill, M. (2011). Association between recurrent aphthous stomatitis and inheritance of a single-nucleotide polymorphism of the NOS2 gene encoding inducible nitric oxide synthase. Journal of Oral Pathology & Medicine, 40(9), 715–720.

Kaur, A. (2024). Polymorphisms in FSHR modulating susceptibility to polycystic ovary syndrome: An updated meta-analysis. Journal of Ovarian Research, 17(1), Article 1. https://doi.org/10.1186/S13048-023-01238-7

Khalaf, D., Krüger, M., Wehland, M., Infanger, M., & Grimm, D. (2019). The effects of oral l-arginine and l-citrulline supplementation on blood pressure. Nutrients, 11(7), Article 1679. https://doi.org/10.3390/nu11071679

Kim, J. E., Sheen, Y. Y., & Lee, S. J. (2000). Nitric oxide inhibits dioxin action for the stimulation of Cyp1a1 promoter activity. Biological & Pharmaceutical Bulletin, 23(5), 575–580. https://doi.org/10.1248/bpb.23.575

Kiani, A. K., Donato, K., Dhuli, K., Stuppia, L., Pessina, A., Aleandri, V., Di Baldassarre, A., Medori, M. C., Connelly, S. T., Dundar, M., Dautaj, A., Gatta, V., Bertelli, M., & Beccari, T. (2023). Inositols in polycystic ovary syndrome: A practice-oriented review. European Review for Medical and Pharmacological Sciences, 27(6 Suppl), 38–47. https://doi.org/10.26355/eurrev_202312_34687

Klibaner-Schiff, E., Simonin, E. M., & Nadeau, K. C. (2024). Environmental exposures influence multigenerational epigenetic transmission. Clinical Epigenetics, 16, Article 145. https://doi.org/10.1186/s13148-024-01762-3

Klusek, J., Lewitowicz, P., Oblap, R., Orlewska, E., Witczak, B., Marzec, M. T., Kozłowska-Geller, M., Nawacki, Ł., Wawszczak-Kasza, M., Kocańda, K., Jóźwik, A., & Głuszek, S. (2024). NOS2 polymorphism in aspect of left and right-sided colorectal cancer. Journal of Clinical Medicine, 13(4), 937. https://doi.org/10.3390/jcm13040937

Knutsen, A. P., Vijay, H. M., Kumar, V., Kariuki, B., Santiago, L. A., Graff, R., Wofford, J. D., & Shah, M. R. (2010). Mold-sensitivity in children with moderate-severe asthma is associated with HLA-DR and HLA-DQ. Allergy, 65(11), 1367–1375. https://doi.org/10.1111/j.1398-9995.2010.02382.x

Kobylecki, C. J., Afzal, S., Davey Smith, G., & Nordestgaard, B. G. (2015). Genetically high plasma vitamin C, intake of fruit and vegetables, and risk of ischemic heart disease and all-cause mortality: A Mendelian randomization study. American Journal of Clinical Nutrition, 101(6), 1135–1143. https://doi.org/10.3945/ajcn.114.104497

Koehl, M. (2015). Gene-environment interaction in programming hippocampal plasticity: Focus on adult neurogenesis. Frontiers in Molecular Neuroscience, 8, Article 41. https://doi.org/10.3389/fnmol.2015.00041

Koerber-Rosso, I., Brandt, S., von Schnurbein, J., Fischer-Posovszky, P., Hoegel, J., Rabenstein, H., … (2021). A fresh look to the phenotype in mono-allelic likely pathogenic variants of the leptin and the leptin receptor gene. Molecular and Cellular Pediatrics, 8, 10. https://doi.org/10.1186/s40348-021-00119-7

Kolla, N. J., & Bortolato, M. (2020). The role of monoamine oxidase A in the neurobiology of aggressive, antisocial, and violent behavior: A tale of mice and men. , 194 , Article 101875. https://doi.org/10.1016/j.pneurobio.2020.101875

Koonrungsesomboon, N., Khatsri, R., Wongchompoo, P., & Teekachunhatean, S. (2018). The impact of genetic polymorphisms on CYP1A2 activity in humans: A systematic review and meta-analysis. The Pharmacogenomics Journal, 18(6), 760–768. https://doi.org/10.1038/s41397-017-0011-3

Kotowski, M. J., Ostrowski, P., Sieńko, J., Czerny, B., Tejchman, K., Machaliński, B., Górska, A., Mrozikiewicz, A. E., & Bogacz, A. (2024). The importance of the FUT2 rs602662 polymorphism in the risk of cardiovascular complications in patients after kidney transplantation. International Journal of Molecular Sciences, 25(12), Article 6562. https://doi.org/10.3390/ijms25126562

Krassas, G. E., Poppe, K., & Glinoer, D. (2010). Thyroid function and human reproductive health. Endocrine Reviews, 31(5), 702–755. https://doi.org/10.1210/er.2009-0041

Kraus, J. P., Hašek, J., Kožich, V., Collard, R., Venezia, S., Janošíková, B., Wang, J., Stabler, S. P., Allen, R. H., Jakobs, C., Finn, C. T., Chien, Y.-H., Hwu, W.-L., Hegele, R. A., & Mudd, S. H. (2009). Cystathionine γ-lyase: Clinical, metabolic, genetic, and structural studies. Molecular Genetics and Metabolism, 97(4), 250–259. https://doi.org/10.1016/j.ymgme.2009.04.001

Krushkal, J., Ferrell, R., Mockrin, S. C., Turner, S. T., Sing, C. F., & Boerwinkle, E. (2006). Beta-2 adrenergic receptor polymorphisms and stress responses. Hypertension, 48(1), 99–105. https://doi.org/10.1161/01.HYP.0000225679.15961.5e

Kufareva, I., & Abagyan, R. (2016). Methods of protein structure comparison: Which method for which purpose? Trends in Pharmacological Sciences, 37(11), 905–917. https://doi.org/10.1016/j.tips.2016.08.006

Kumagai, A., Takeda, S., Sohara, E., Uchida, S., Iijima, H., Itakura, A., Koya, D., & Kanasaki, K. (2021). Dietary magnesium insufficiency induces salt-sensitive hypertension in mice associated with reduced kidney catechol-O-methyl transferase activity. Hypertension, 78(1), 138–150. https://doi.org/10.1161/HYPERTENSIONAHA.120.16377

Kurata, K., Hosono, K., Takayama, M., Katsuno, M., Saitsu, H., Ogata, T., & Hotta, Y. (2022). Retinitis pigmentosa with optic neuropathy and COQ2 mutations: A case report. American Journal of Ophthalmology Case Reports, 25, 101298. https://doi.org/10.1016/j.ajoc.2022.101298

Kvetnansky, R., Sabban, E. L., & Palkovits, M. (2009). Catecholaminergic systems in stress: Structural and molecular genetic approaches. Physiological Reviews, 89(2), 535–606. https://doi.org/10.1152/physrev.00042.2006

Franzago, M., Santurbano, D., Vitacolonna, E., & Stuppia, L. (2020). Genes and diet in the prevention of chronic diseases in future generations. International Journal of Molecular Sciences, 21(7), 2633. https://doi.org/10.3390/ijms21072633

Lalani, A. I., Zhu, S., Gokhale, S., Jin, J., & Xie, P. (2017). TRAF molecules in inflammation and inflammatory diseases. Current Pharmacology Reports, 4(1), 64–90. https://doi.org/10.1007/s40495-017-0117-y

Lama, A., Pirozzi, C., Annunziata, C., Morgese, M. G., Murru, E., Comella, F., Banni, S., Trabace, L., & Meli, R. (2022). Palmitoylethanolamide dampens neuroinflammation and anxiety-like behavior in obese mice. Brain, Behavior, and Immunity, 102, 37–50. https://doi.org/10.1016/j.bbi.2022.02.008

References

Leuchter, A. F., Cook, I. A., Hamilton, S. P., Narr, K. L., Toga, A., Hunter, A. M., Faull, K., Whitelegge, J., Andrews, A. M., Loo, J., Way, B., Nelson, S. F., Brooks, J. O., & Baar, W. (2008). Biomarkers to predict antidepressant response: A critical need for personalized medicine. Biological Psychiatry, 63(10), 897–904. https://doi.org/10.1016/j.biopsych.2008.03.014

Leuchter, A. F., McCracken, J. T., Hunter, A. M., Cook, I. A., & Alpert, J. E. (2009). Monoamine oxidase A and catechol-O-methyltransferase functional polymorphisms and the placebo response in major depressive disorder. Journal of Clinical Psychopharmacology, 29(4), 372–377. https://doi.org/10.1097/JCP.0b013e3181ac4aaf

Lewandowski, Ł., Kepinska, M., & Milnerowicz, H. (2020). Alterations in concentration/activity of superoxide dismutases in context of obesity and selected single nucleotide polymorphisms in genes: SOD1, SOD2, SOD3. International Journal of Molecular Sciences, 21(14), Article 5069. https://doi.org/10.3390/ijms21145069

Liao, J. L., Qin, Q., Zhou, Y. S., Ma, R. P., Zhou, H. C., Gu, M. R., Feng, Y. P., Wang, B. Y., & Yang, L. (2020). Vitamin D receptor Bsm I polymorphism and osteoporosis risk in postmenopausal women: A meta-analysis from 42 studies. Genes & Nutrition, 15, Article 20.

Li, J., Humphreys, K., Eriksson, M., Darabi, H., Czene, K., Hall, P., & Liu, J. (2016). Effects of ATM, ATR, CHK1, CHK2 and WEE1 genetic variants on breast cancer risk and clinicopathological presentation in a Swedish population-based study. Breast Cancer Research, 18, Article 114. https://doi.org/10.1186/s13058-016-0771-8

Liebert, A., López, S., Jones, B. L., Montalva, N., Gerbault, P., Lau, W., Thomas, M. G., Bradman, N., Maniatis, N., & Swallow, D. M. (2017). World-wide distributions of lactase persistence alleles and the complex effects of recombination and selection. Human Genetics, 136(11–12), 1445–1453. https://doi.org/10.1007/s00439-017-1847-y

Lietz, G., Oxley, A., Leung, W., & Hesketh, J. (2012). Single nucleotide polymorphisms upstream from the β-carotene 15,15′-monooxygenase gene influence provitamin A conversion efficiency in female volunteers. Journal of Nutrition, 142(1), 161S–165S. https://doi.org/10.3945/jn.111.140756

Lim, Y., Vasu, S., Vyas, A. B., Chamley, L. W., & Barker, G. (2012). Variable expression of human alpha-tocopherol transfer protein (TTPA) in maternal decidua during pregnancy. Placenta, 33(9), 732–734. https://doi.org/10.1080/10717760310001659611

Lipid peroxidation. (n.d.). In Encyclopedia of Toxicology (3rd ed.). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.10707-3

Liskova, A., Koklesova, L., Samec, M., Varghese, E., Büsselberg, D., Kruzliak, P., & Kubatka, P. (2020). Implications of flavonoids as potential modulators of cancer neovascularity. Journal of Cancer Research and Clinical Oncology, 146(12), 3079–3096. https://doi.org/10.1007/s00432-020-03383-8

Liu, H., Huang, Y., Zhao, Y., Kang, G.-J., Feng, F., Wang, X., Liu, M., Shi, G., Revelo, X., Bernlohr, D., & Dudley, S. C., Jr. (2022). Inflammatory macrophage interleukin-1β mediates high- fat diet-induced heart failure with preserved ejection fraction. JACC: Basic to Translational Science, 8(2), 174–185. https://doi.org/10.1016/j.jacbts.2022.08.003

Liu, J., Zhang, H.-X., Chen, M., Wang, Z.-C., Liu, Y.-P., Feng, G.-Y., Shi, Y.-Y., & He, L. (2011). CTLA-4 confers a risk of recurrent schizophrenia, major depressive disorder and bipolar disorder in the Chinese Han population. Brain, Behavior, and Immunity, 25(3), 429–433. https://doi.org/10.1016/j.bbi.2010.10.024

Liu, X., Wei, D., Jiang, J., Tu, R., Liu, X., Luo, Z., Wang, Y., Qiao, D., Shen, F., Li, R., Wang, Y., Jin, Y., Huo, W., Yu, S., Li, L., Wang, L., Mao, Z., & Wang, C. (2020). Associations of SRD5A1 gene variants and testosterone with dysglycemia: Henan Rural Cohort study. Nutrition, Metabolism and Cardiovascular Diseases, 30(4), 616–622. https://doi.org/10.1016/j.numecd.2019.11.011

Livingstone, K. M., Brayner, B., Celis-Morales, C., Moschonis, G., Manios, Y., Traczyk, I., Drevon, C. A., Daniel, H., Saris, W. H. M., Lovegrove, J. A., Gibney, M., Gibney, E. R., Brennan, L., Martinez, J. A., & Mathers, J. C. (2022). Associations between dietary patterns, FTO genotype and obesity in adults from seven European countries. European Journal of Nutrition, 61(6), 2953–2965. https://doi.org/10.1007/s00394-022-02858-3

Lesch, K.-P. (2007). Linking emotion to the social brain: The role of the serotonin transporter in human social behaviour. EMBO Reports, 8(Suppl. 1), S24–S29. https://doi.org/10.1038/sj.embor.7401008

Lewandowski, Ł., Kepinska, M., & Milnerowicz, H. (2020). Alterations in concentration/activity of superoxide dismutases in context of obesity and selected single nucleotide polymorphisms in genes: SOD1, SOD2, SOD3. International Journal of Molecular Sciences, 21(14), Article 5069. https://doi.org/10.3390/ijms21145069

Lopriore, P., Vista, M., Tessa, A., Giuntini, M., Caldarazzo Ienco, E., Mancuso, M., Siciliano, G., Santorelli, F. M., & Orsucci, D. (2024). Primary coenzyme Q10 deficiency-related ataxias. Journal of Clinical Medicine, 13(8), Article 2391. https://doi.org/10.3390/jcm13082391

Losenkov, I. S., Mulder, N. J. V., Levchuk, L. A., Vyalova, N. M., Loonen, A. J. M., Bosker, F. J., Simutkin, G. G., Boiko, A. S., Bokhan, N. A., Wilffert, B., Hak, E., Schmidt, A. F., & Ivanova, S. A. (2020). Association between BDNF gene variant rs6265 and the severity of depression in antidepressant treatment-free depressed patients. Frontiers in Psychiatry, 11, Article 38. https://doi.org/10.3389/fpsyt.2020.00038

Lowe, S. L., Yeo, K. P., Teng, L., Soon, D. K. W., Pan, A., Wise, S. D., & Peck, R. W. (2006). L-5-Hydroxytryptophan augments the neuroendocrine response to a SSRI. Psychoneuroendocrinology, 31(4), 473–484. https://doi.org/10.1016/j.psyneuen.2005.11.005

Lu, K., Gray, M. A., Oliver, C., Liley, D. T., Harrison, B. J., Bartholomeusz, C. F., Phan, K. L., & Nathan, P. J. (2004). The acute effects of L-theanine in comparison with alprazolam on anticipatory anxiety in humans. Human Psychopharmacology: Clinical and Experimental, 19(7), 457–465. https://doi.org/10.1002/hup.61

Lystad, A. H., Carlsson, S. R., & Simonsen, A. (2019). Toward the function of mammalian ATG12-ATG5-ATG16L1 complex in autophagy and related processes. Autophagy, 15(8), 1485–1486. https://doi.org/10.1080/15548627.2019.1618100

Maffei, L., Murata, Y., Rochira, V., Tubert, G., Aranda, C., Vazquez, M., … Carani, C. (2007). A novel compound heterozygous mutation of the aromatase gene in an adult man: Reinforced evidence on the relationship between congenital oestrogen deficiency, adiposity and the metabolic syndrome. Clinical Endocrinology, 67(2), 218–224. https://doi.org/10.1111/j.1365-2265.2007.02864.x

Maier, L. M., Lowe, C. E., Cooper, J., Downes, K., Anderson, D. E., Severson, C., Clark, P. M., Payne, B., Lowe, J. A., Bruce, I., Jobson, N., Davis, J., Buck, D., McNeill, G., Ollier, W. E. R., Vella, A., Robertson, N. R., Widmer, B., Todd, J. A., … Hafler, D. A. (2008). IL2RA genetic heterogeneity in multiple sclerosis and type 1 diabetes susceptibility and soluble interleukin-2 receptor production. PLoS Genetics, 4(12), Article e1000322. https://doi.org/10.1371/journal.pgen.1000322

Maier, M. L. V., Siddens, L. K., Pennington, J. M., Uesugi, S. L., Tilton, S. C., Vertel, E. A., Anderson, K. A., Tidwell, L. G., Ognibene, T. J., Turteltaub, K. W., Smith, J. N., & Williams, D. E. (2023). Benzo[a]pyrene toxicokinetics in humans following dietary supplementation with 3,3′-diindolylmethane (DIM) or Brussels sprouts. Toxicology and Applied Pharmacology, 460, 116377. https://doi.org/10.1016/j.taap.2023.116377

Majithia, A. R., Tsuda, B., Agostini, M., Gnanapradeepan, K., Robert, R., Rosenzweig, K., Friedline, R. H., Damle, G., Schroeder-Gloeckler, J., Pan, H., Dreyfuss, J. M., Keenan, M., Gray, S., Kratzsch, J., Bornstein, S. R., Böhm, A., Banks, A. S., Savage, D. B., Chatterjee, V. K. K., Schwabe, J. W. R., Rosen, E. D., Czech, M. P., Kahn, B. B., & Lee, S.-J. (2018). A pharmacogenetic approach to the treatment of patients with PPARG mutations. Diabetes, 67(6), 1086–1092. https://doi.org/10.2337/db17-1236

References

Manor, D., & Morley, S. (2007). The alpha-tocopherol transfer protein. Vitamins and Hormones, 76, 45–65. https://doi.org/10.1016/S0083-6729(07)76003-X

Mansoor, M. A., Stea, T. H., Slettan, A., Perera, E., Maddumage, R., Kottahachchi, D., Ali, D. S., Cabo, R., & Blomhoff, R. (2025). Impact of single nucleotide polymorphisms (SNPs) in antioxidant-enzyme genes on the concentrations of folate, homocysteine, and glutathione in plasma from healthy subjects after folic acid supplementation – a randomized controlled crossover trial. Genes & Nutrition, 20(1), Article 1.

Marcadenti, A., & Assis Coelho, R. C. L. (2015). Dietary antioxidant and oxidative stress: Interaction between vitamins and genetics. Journal of Nutritional Health & Food Science, 3(1), 1–7. https://dx.doi.org/10.15226/jnhfs.2015.00138

Marques, M., Laflamme, L., Benassou, I., Cissokho, C., Guillemette, B., & Gaudreau, L. (2014). Low levels of 3,3′-diindolylmethane activate estrogen receptor α and induce proliferation of breast cancer cells in the absence of estradiol. BMC Cancer, 14, 524. https://doi.org/10.1186/1471-2407-14-524

McLean, M. H., & El-Omar, E. M. (2009). Genetic aspects of inflammation. Current Opinion in Pharmacology, 9(4), 370–374. https://doi.org/10.1016/j.coph.2009.06.003

MedlinePlus. (n.d.). Aromatase excess syndrome. In MedlinePlus Genetics. National Library of Medicine. Retrieved September 9, 2025, from https://medlineplus.gov/genetics/condition/aromatase-excess-syndrome/

Megiorni, F., & Pizzuti, A. (2012). HLA-DQA1 and HLA-DQB1 in Celiac disease predisposition: Practical implications of the HLA molecular typing. Journal of Biomedical Science, 19, Article 88. https://doi.org/10.1186/1423-0127-19-88

Meza-Velázquez, R., López-Márquez, F., Espinosa-Padilla, S., Rivera-Guillen, M., Ávila-Hernández, J., & Rosales-González, M. (2017). Association of diamine oxidase and histamine N-methyltransferase polymorphisms with presence of migraine in a group of Mexican mothers of children with allergies. Neurología (English Edition), 32(8), 500–507. https://doi.org/10.1016/j.nrleng.2016.02.01

Mierziak, J., Kostyn, K., Boba, A., Czemplik, M., Kulma, A., & Wojtasik, W. (2021). Influence of the bioactive diet components on the gene expression regulation. Nutrients, 13(11), Article 3673. https://doi.org/10.3390/nu13113673

Mischoulon, D., & Fava, M. (2002). Role of S-adenosyl-L-methionine in the treatment of depression: A review of the evidence. The American Journal of Clinical Nutrition, 76(5), 1158S–1161S. https://doi.org/10.1093/ajcn/76/5.1158S

Mitchell, J. A., Church, T. S., Rankinen, T., Earnest, C. P., Sui, X., & Blair, S. N. (2010). FTO genotype and the weight loss benefits of moderate intensity exercise. Obesity (Silver Spring), 18(3), 641–643. https://doi.org/10.1038/oby.2009.311

Mitchell, R. K. (2016). Molecular genetic regulation of Slc30a8/ZnT8 reveals a role in β-cell glucose sensing and insulin secretion. Molecular Endocrinology, 30(1), 77–88. https://doi.org/10.1210/me.2015-1221

Miyake, N., Yano, S., Sakai, C., Hatakeyama, H., Matsushima, Y., Shiina, M., Watanabe, Y., Bartley, J., Abdenur, J. E., Wang, R. Y., Chang, R., Tsurusaki, Y., Doi, H., Nakashima, M., Saitsu, H., Ogata, K., Goto, Y., & Matsumoto, N. (2013). Mitochondrial complex III deficiency caused by a homozygous UQCRC2 mutation presenting with neonatal-onset recurrent metabolic decompensation. Human Mutation, 34(3), 446–452. https://doi.org/10.1002/humu.22257

Miyamoto-Mikami, E., Tsuji, K., Horii, N., Tabata, I., & Fuku, N. (2018). Gene expression profile of muscle adaptation to high-intensity intermittent exercise training in young men. Scientific Reports, 8(1), Article 16811. https://doi.org/10.1038/s41598-018-35115-x

Mlcek, J., Jurikova, T., Skrovankova, S., & Sochor, J. (2016). Quercetin and its anti-allergic immune response. Molecules, 21(5), Article 623. https://doi.org/10.3390/molecules21050623

Möhler, H. (2012). The GABA system in anxiety and depression and its therapeutic potential. Neuropharmacology, 62(1), 42–53. https://doi.org/10.1016/j.neuropharm.2011.08.040

Montes-de-Oca-García, A., Perez-Bey, A., Velázquez-Díaz, D., Corral-Pérez, J., Opazo-Díaz, E., Rebollo-Ramos, M., Gómez-Gallego, F., Cuenca-García, M., Casals, C., & Ponce- González, J. G. (2021). Influence of ACE gene I/D polymorphism on cardiometabolic risk, maximal fat oxidation, cardiorespiratory fitness, diet and physical activity in young adults. International Journal of Environmental Research and Public Health, 18(7), Article 3443. https://doi.org/10.3390/ijerph18073443

Montomoli, M., Cavalleri, V., D'Onofrio, R., Costa, E., Gagliardi, S., Russo, A., Corti, S., Comi, G. P., & Filippi, M. (2023). A novel SLC5A6 homozygous variant in a family with multivitamin-dependent neurometabolic disorder: Phenotype expansion and long-term follow-up. European Journal of Medical Genetics, 66(8), 104808. https://doi.org/10.1016/j.ejmg.2023.104808

Mota-Pereira, J., Ribeiro, J. C., Fonte, D., Ribeiro, M., Araújo, F., & Carvalho, S. (2023). The impact of BDNF, NTRK2, NGFR, CREB1, GSK3B, AKT, MAPK1, MTOR, PTEN, ARC, and SYN1 genetic polymorphisms in antidepressant treatment response phenotypes. International Journal of Molecular Sciences, 24(7), Article 6758. https://doi.org/10.3390/ijms24076758

Murnane, K. S. (2019). Serotonin 2A receptors are a stress response system: Implications for post-traumatic stress disorder. Behavioural Pharmacology, 30(2 and 3-Spec Issue), 151–162. https://doi.org/10.1097/FBP.0000000000000459

Napoli, N., Gallo, D., & Rizzello, F. (2009). The Val432Leu polymorphism of the CYP1B1 gene is associated with estrogen metabolism in women with endometriosis. Fertility and Sterility, 91(5), 2112–2114. https://doi.org/10.1016/j.fertnstert.2008.04.042

Nathan, P. J., Lu, K., Gray, M., & Oliver, C. (2006). The neuropharmacology of L-theanine (N-ethyl-L-glutamine): A possible neuroprotective and cognitive enhancing agent. Journal of Herbal Pharmacotherapy, 6(2), 21–30.

National Library of Medicine. (n.d.). Lactose intolerance: Your guide to understanding genetic conditions. https://ghr.nlm.nih.gov/condition/lactose-intolerance

Neves, A. R., Garcia, S., Vuong, L. N., Blockeel, C., Spits, C., & Polyzos, N. P. (2024). The additive effect of combinations of FSH receptor gene variants in ovarian response to stimulation. Reproductive Sciences, 31(6), 3560–3568. https://doi.org/10.1007/s43032-024-01700-

Newman, M., & Smeaton, J. (2024). Exploring the impact of 3,3′-diindolylmethane on the urinary estrogen profile of premenopausal women. BMC Complementary Medicine and Therapies, 24, 405. https://doi.org/10.1186/s12906-024-04708-7

Nunziata, A., Funcke, J.-B., Borck, G., von Schnurbein, J., Brandt, S., Lennerz, B., Moepps, B., Gierschik, P., Fischer-Posovszky, P., & Wabitsch, M. (2019). Functional and phenotypic characteristics of human leptin receptor mutations. Journal of the Endocrine Society, 3(1), 27–41. https://doi.org/10.1210/js.2018-00123

References

Oczkowska, A., Kozubski, W., Lianeri, M., & Dorszewska, J. (2013). Mutations in PRKN and SNCA genes important for the progress of Parkinson's disease. Current Genomics, 14(8), 502–517. https://doi.org/10.2174/13892029146661312102058 39

Okasha, H., Song, B., & Song, Z. (2024). Hidden hazards revealed: Mycotoxins and their masked forms in poultry. Toxins, 16(3), Article 137. https://doi.org/10.3390/toxins16030137

Okutan, G., Estévez-López, F., Pires, T., Rona, E., Palla, B., Campello, I., Pérez, B., Latorre, S., Tarriño, L., Santos, I., & Collado, A. (2023). Cumulative effect of AOC1 gene variants on symptoms and pathological conditions in adult women with fibromyalgia: A pilot study. Frontiers in Genetics, 14, Article 1180777. https://doi.org/10.3389/fgene.2023.1180777

Oliveira-Paula, G. H., Costa, L. B., Silva, L. A., & Silva, M. F. (2016). Endothelial nitric oxide synthase tagSNPs influence the antihypertensive response to enalapril. Pharmacogenetics and Genomics, 26(3), 107–114. https://doi.org/10.1097/FPC.0000000000000220

Online Mendelian Inheritance in Man (OMIM). (n.d.). Multiple system atrophy 1, susceptibility to. OMIM Entry 146500. Retrieved September 10, 2025, from https://omim.org/entry/146500

Orlando, A., Chimienti, G., Notarnicola, M., & Russo, F. (2022). The ketogenic diet improves gut–brain axis in a rat model of irritable bowel syndrome: Impact on 5-HT and BDNF systems. International Journal of Molecular Sciences, 23(3), Article 1098. https://doi.org/10.3390/ijms23031098

Ohtsuki, T., Miki, S., Kobayashi, S., Haraguchi, T., & Nakata, E. (2015). The molecular mechanism of photochemical internalization of cell penetrating peptide-cargo-photosensitizer conjugates. Scientific Reports, 5, Article 18577. https://doi.org/10.1038/srep18577

Oliveira-Paula, G. H., Costa, L. B., Silva, L. A., & Silva, M. F. (2016). Endothelial nitric oxide synthase tagSNPs influence the antihypertensive response to enalapril. Pharmacogenetics and Genomics, 26(3), 107–114. https://doi.org/10.1097/FPC.0000000000000220

Oussalah, A., Levy, J., Filhine-Trésarrieu, P., Namour, F., & Guéant, J.-L. (2017). Association of TCN2 rs1801198 c.776G>C polymorphism with markers of one-carbon metabolism and related diseases: A systematic review and meta-analysis of genetic association studies. The American Journal of Clinical Nutrition, 106(4), 1142–1156. https://doi.org/10.3945/ajcn.117.156349

Palinkas, L. A., Reedy, K. R., Smith, M., Anghel, M., Steel, G. D., Reeves, D., Shurtleff, D., Case, H. S., Van Do, N., & Reed, H. L. (2007). Psychoneuroendocrine effects of combined thyroxine and triiodothyronine versus tyrosine during prolonged Antarctic residence. International Journal of Circumpolar Health, 66(5), 401–417. https://pubmed.ncbi.nlm.nih.gov/18274206/

Pan-Montojo, F., & Reichmann, H. (2014). Considerations on the role of environmental toxins in idiopathic Parkinson's disease pathophysiology. Translational Neurodegeneration, 3, 10. https://doi.org/10.1186/2047-9158-3-10

Paulsen, C. E., & Carroll, K. S. (2009). Chemical dissection of an essential redox switch in yeast. Chemistry & Biology, 16(2), 217–225. https://doi.org/10.1016/j.chembiol.2009.01.003

Pawlik, A., Błaszczyk, H., Rać, M., Maciejewska-Skrendo, A., Safranow, K., & Dziedziejko, V. (2020). NOS3 gene rs1799983 and rs2070744 polymorphisms in patients with unstable angina. Journal of Vascular Research, 57(3), 136–142. https://doi.org/10.1159/000506160

Pei, J., Pan, X., Wei, G., & Hua, Y. (2023). Research progress of glutathione peroxidase family (GPX) in redoxidation. Frontiers in Pharmacology, 14, Article 1147414. https://doi.org/10.3389/fphar.2023.1147414

Petrone, I., Bernardo, P. S., Dos Santos, E. C., & Abdelhay, E. (2021). MTHFR C677T and A1298C polymorphisms in breast cancer, gliomas and gastric cancer: A review. Genes, 12(4), 587. https://doi.org/10.3390/genes12040587

Plevin, D., & Galletly, C. (2020). The neuropsychiatric effects of vitamin C deficiency: A systematic review. BMC Psychiatry, 20(1), Article 315. https://doi.org/10.1186/s12888-020-02730-w

Polyzos, N. P. (2021). Effect of polymorphisms in FSHR and FSHB genes on ovarian response and clinical outcomes in assisted reproduction: A systematic review and meta-analysis. Human Reproduction, 36(6), 1711–1721. https://doi.org/10.1093/humrep/deab068

Poorolajal, J., Zeraati, F., Soltanian, A. R., Sheikh, V., Hooshmand, E., & Maleki, A. (2017). Oral potassium supplementation for management of essential hypertension: A meta-analysis of randomized controlled trials. PLOS ONE, 12(4), Article e0174967. https://doi.org/10.1371/journal.pone.0174967

Qin, X.-S., Liu, J.-H., Lyu, G.-T., Peng, M.-L., Yang, F.-N., Qin, D.-C., Li, Y.-Z., & Liu, Y. (2017). Variants in the promoter region of HLA-DQA1 were associated with idiopathic membranous nephropathy in a Chinese Han population. Chinese Medical Journal, 130(14), 1677–1682. https://doi.org/10.4103/0366-6999.209884

Rajoria, S., Suriano, R., Parmar, P. S., Wilson, Y. L., Megwalu, U., Moscatello, A., Bradlow, H. L., Sepkovic, D. W., Geliebter, J., Schantz, S. P., & Tiwari, R. K. (2011). 3,3′-Diindolylmethane modulates estrogen metabolism in patients with thyroid proliferative disease: A pilot study. Thyroid, 21(3), 299–304. https://doi.org/10.1089/thy.2010.0245

Ramos, P. S., Oates, J. C., Kamen, D. L., Williams, A. H., Gaffney, P. M., Kelly, J. A., Kaufman, K. M., Kimberly, R. P., Niewold, T. B., Jacob, C. O., Tsao, B. P., Alarcón, G. S., Brown, E. E., Edberg, J. C., Petri, M. A., Ramsey-Goldman, R., Reveille, J. D., Vilá, L. M., James, J. A., … Gilkeson, G. S. (2013). Variable association of reactive intermediate genes with systemic lupus erythematosus in populations with different African ancestry. The Journal of Rheumatology, 40(6), 842–849. https://doi.org/10.3899/jrheum.120989

Rasoul, M. A., Haider, M. Z., Al-Mahdi, M., Al-Kandari, H., & Dhaunsi, G. S. (2019). Relationship of four vitamin D receptor gene polymorphisms with type 1 diabetes mellitus susceptibility in Kuwaiti children. BMC Pediatrics, 19, Article 71. https://doi.org/10.1186/s12887-019-1448-0

Reisberg, B., Doody, R., Stöffler, A., Schmitt, F., Ferris, S., & Möbius, H. J. (2003). Memantine in moderate-to-severe Alzheimer's disease. New England Journal of Medicine, 348(14), 1333–1341. https://doi.org/10.1056/NEJMoa013128

Renna, M., Bento, C. F., Fleming, A., Menzies, F. M., Siddiqi, F. H., Ravikumar, B., Puri, C., Garcia-Arencibia, M., Sadiq, O., Corrochano, S., Carter, S., Brown, S. D. M., Acevedo-Arozena, A., & Rubinsztein, D. C. (2013). IGF-1 receptor antagonism inhibits autophagy. Human Molecular Genetics, 22(22), 4528–4544. https://doi.org/10.1093/hmg/ddt300

Romieu, I., Sienra-Monge, J. J., Ramírez-Aguilar, M., Moreno-Macías, H., Reyes-Ruiz, N. I., del Río-Navarro, B. E., Hernández-Avila, M., & London, S. J. (2004). Genetic polymorphism of GSTM1 and antioxidant supplementation influence lung function in relation to ozone exposure in asthmatic children in Mexico City. Thorax, 59(1), 8–10. https://doi.org/10.1136/thx.2003.008474

References

Ruksiriwanich, W., Khantham, C., Linsaenkart, P., Chaitep, T., Jantrawut, P., Chittasupho, C., Rachtanapun, P., Jantanasakulwong, K., Phimolsiripol, Y., Sommano, S. R., Arjin, C., Berrada, H., Barba, F. J., & Sringarm, K. (2022). In vitro and in vivo regulation of SRD5A mRNA expression of supercritical carbon dioxide extract from Asparagus racemosus Willd. root as anti-sebum and pore-minimizing active ingredients. Molecules, 27(5), Article 1535. https://doi.org/10.3390/molecules27051535

Rył, A., Rotter, I., Grzywacz, A., Małecka, I., Skonieczna-Żydecka, K., Grzesiak, K., Słojewski, M., Szylińska, A., Sipak-Szmigiel, O., Piasecka, M., Walczakiewicz, K., & Laszczyńska, M. (2017). Molecular analysis of the SRD5A1 and SRD5A2 genes in patients with benign prostatic hyperplasia with regard to metabolic parameters and selected hormone levels. International Journal of Environmental Research and Public Health, 14(11), 1318. https://doi.org/10.3390/ijerph14111318

Saadat, M. (2019). Association between C-262T genetic polymorphism at the NOS3 gene and inflammatory bowel disease. Journal of Clinical and Translational Research, 4(1), 42–46. https://doi.org/10.18053/jctres.04.201901.007

Sá, M. C. I. d., & Castor, M. G. M. (2023). Therapeutic use of palmitoylethanolamide as an anti-inflammatory and immunomodulator. Future Pharmacology, 3(4), 951–977. https://doi.org/10.3390/futurepharmacol3040058

Saadat, M. (2019). Association between C-262T genetic polymorphism at the NOS3 gene and inflammatory bowel disease. Journal of Clinical and Translational Research, 4(1), 42–46. https://doi.org/10.18053/jctres.04.201901.007

Sacchi, S., Marinaro, F., Tondelli, D., Lui, J., Xella, S., Marsella, T., Tagliasacchi, D., Argento, C., Tirelli, A., Giulini, S., & La Marca, A. (2010). Modulation of gonadotrophin induced steroidogenic enzymes in granulosa cells by d-chiroinositol. Reproductive Biology and Endocrinology, 14, Article 52. https://doi.org/10.1186/s12958-016-0187-2

Saceda-Corralo, D., García-Díez, A., & Sánchez-Pérez, J. (2023). Genotyping of the rs1800440 polymorphism in the CYP1B1 gene in patients with frontal fibrosing alopecia. Journal of the American Academy of Dermatology, 89(4), 1102–1104.

Sánchez-Moreno, C., Ordovás, J. M., Smith, C. E., Baraza, J. C., Lee, Y.-C., & Garaulet, M. (2011). APOA5 gene variation interacts with dietary fat intake to modulate obesity and circulating triglycerides in a Mediterranean population. Journal of Nutrition, 141(3), 380–385. https://doi.org/10.3945/jn.110.130344

Sarchielli, P., Alberti, A., Vaianella, L., Pierfelice, F., Baldi, A., Floridi, A., & Gallai, V. (2006). Proinflammatory cytokines, adhesion molecules, and lymphocyte integrin expression in the internal jugular blood of migraine patients without aura assessed ictally. Headache: The Journal of Head and Face Pain, 46(2), 200–207. https://doi.org/10.1111/j.1526-4610.2006.00337.x

Sawaengsri, H., Bergethon, P. R., Qiu, W. Q., Scott, T. M., Jacques, P. F., Selhub, J., & Paul, L. (2016). Transcobalamin 776C→G polymorphism is associated with peripheral neuropathy in elderly individuals with high folate intake. The American Journal of Clinical Nutrition, 104(6), 1665–1670. https://doi.org/10.3945/ajcn.116.139030

Savikina, K. G. (2021). Association of CAT C262T (rs1001179) polymorphism with pathospermia. Journal of Genetic Engineering and Biotechnology, 19(1), 1–7. https://doi.org/10.1186/s43141-021-00043-2

Shan, Z., Bao, W., Zhang, Y., Rong, Y., Wang, X., Jin, Y., Song, Y., Yao, P., & Liu, L. (2014). Interactions between zinc transporter-8 gene (SLC30A8) and plasma zinc concentrations for impaired glucose regulation and type 2 diabetes. Diabetes, 63(5), 1796–1803. https://doi.org/10.2337/db13-0606.

Sharygin, D., Koniaris, L. G., Wells, C., Zimmers, T. A., & Hamidi, T. (2023). Role of CD14 in human disease. Immunology, 169(3), 260–270. https://doi.org/10.1111/imm.13634

Shih, J. C., Chen, K., & Ridd, M. J. (1999). Monoamine oxidase: From genes to behavior. Annual Review of Neuroscience, 22, 197–217. https://doi.org/10.1146/annurev.neuro.22.1.197

Shnayder, N. A., Bochanov, M. M., Dmitrenko, D. A., Trefilova, V. V., Gazizov, A. R., & Nasyrova, R. F. (2021). The role of single-nucleotide variants of NOS1, NOS2, and NOS3 genes in the comorbidity of arterial hypertension and tension-type headache. Molecules, 26(6), Article 1556. https://doi.org/10.3390/molecules26061556

Sies, H., Stahl, W., & Sevanian, A. (2005). Antioxidants and oxidative stress. The American Journal of Clinical Nutrition, 81(1), 261S–266S. https://doi.org/10.1093/ajcn/81.1.261S

Slater, N. A., Rager, M. L., Havrda, D. E., & et al. (2017). Genetic variation in CYP2R1 and GC genes associated with vitamin D deficiency status. Journal of Pharmacy Practice, 30(1), 31–36. https://doi.org/10.1177/0897190015585876

Sleiman, S. F., Henry, J., Al-Haddad, R., El Hayek, L., Abou Haidar, E., Stringer, T., Ulja, D., Karuppagounder, S. S., Holson, E. B., Ratan, R. R., Ninan, I., & Chao, M. V. (2016). Exercise promotes the expression of brain derived neurotrophic factor (BDNF) through the action of the ketone body β-hydroxybutyrate. eLife, 5, e15092. https://doi.org/10.7554/eLife.15092

SNPedia. (2019, December 7). rs6495446. https://www.snpedia.com/index.php/Rs6495446

SNPedia. (2020, November 29). rs1805087. https://snpedia.com/index.php/Rs1805087

SNPedia. (2021, February 28). rs1801133. https://www.snpedia.com/index.php/Rs1801133

SNPedia. (2021, May 23). rs70991108. https://www.snpedia.com/index.php/Rs70991108

Sowaengsri, H., Bergethon, P. R., Qiu, W. Q., Scott, T. M., Jacques, P. F., Selhub, J., & Paul, L. (2016). Transcobalamin 776C→G polymorphism is associated with peripheral neuropathy in elderly individuals with high folate intake. The American Journal of Clinical Nutrition, 104(6), 1665–1670. https://doi.org/10.3945/ajcn.116.139030

Sombié, H. K., Tchelougou, D., Ouattara, A. K., Sorgho, A. P., Yonli, A. T., Djigma, F. W., Yaméogo, S., Somda, D., Kiendrébéogo, I. T., Zoure, A. W., Yelemkoure, E. T., Hien, D. A., Kologo, J. K., Zabsonré, P., & Simpore, J. (2021). Glutathione S-transferase M1 and T1 genes deletion polymorphisms and blood pressure control among treated essential hypertensive patients in Burkina Faso. BMC Research Notes, 14, Article 244. https://doi.org/10.1186/s13104-021-05658-wSpeeckaert, M., Huang, G., Delanghe, J. R., & Taes, Y. E. (2006). Biological and clinical aspects of the vitamin D binding protein (Gc-globulin) and its polymorphism. Clinica Chimica Acta, 372(1-2), 33–42. https://doi.org/10.1016/j.cca.2006.03.011

Stanislawska-Sachadyn, A., Mitchell, L. E., Woodside, J. V., Buckley, P. T., McKinley, M. C., McNulty, H., & McPartlin, J. (2009). The reduced folate carrier (SLC19A1) c.80G>A polymorphism is associated with red cell folate concentrations among women. Annals of Human Genetics, 73(5), 484–491. https://doi.org/10.1111/j.1469-1809.2009.00529.x

Steck, S. E., Gammon, M. D., Hebert, J. R., Wall, D. E., & Zeisel, S. H. (2007). GSTM1, GSTT1, GSTP1, and GSTA1 polymorphisms and urinary isothiocyanate metabolites following broccoli consumption in humans. Journal of Nutrition, 137(4), 904–909. https://doi.org/10.1093/jn/137.4.904

Stein, M. B., Schork, N. J., & Gelernter, J. (2004). A polymorphism of the β1-adrenergic receptor is associated with low extraversion. Neuropsychopharmacology, 29(9), 1729–1734. https://doi.org/10.1038/sj.npp.1300787

References

Stroia, C. M., Ghitea, T. C., Vrânceanu, M., Mureșan, M., Bimbo-Szuhai, E., Pallag, C. R., & Pallag, A. (2024). Relationship between vitamin D_3 deficiency, metabolic syndrome, and VDR, GC, and CYP2R1 gene polymorphisms. Nutrients, 16(9), Article 1272. https://doi.org/10.3390/nu16091272

Subramanian, V. S., Constantinescu, A. R., Benke, P. J., & Said, H. M. (2017). Mutations in SLC5A6 associated with brain, immune, bone, and intestinal dysfunction in a young child. Human Genetics, 136(3), 253–261. https://doi.org/10.1007/s00439-016-1751-x

Taheri, N., Pirboveiri, R., Sayyah, M., & Ghandil, P. (2023). Association of DRD2, DRD4 and COMT genes variants and their gene-gene interactions with antipsychotic treatment response in patients with schizophrenia. BMC Psychiatry, 23, Article 781. https://doi.org/10.1186/s12888-023-05292-9

Taheriniya, S., Arab, A., Hadi, A., Fadel, A., & Askari, G. (2021). Vitamin D and thyroid disorders: A systematic review and meta-analysis of observational studies. BMC Endocrine Disorders, 21(1), Article 171. https://doi.org/10.1186/s12902-021-00831-5

Tamaki, M., Fujitani, Y., Hara, A., Uchida, T., Tamura, Y., Takeno, K., Kawaguchi, M., Watanabe, T., Ogihara, T., Fukunaka, A., Shimizu, T., Mita, T., Kanazawa, A., Imaizumi, M. O., Abe, T., Kiyonari, H., Hojyo, S., Fukada, T., Kawauchi, T., Nagamatsu, S., Hirano, T., Kawamori, R., & Watada, H. (2013). The diabetes-susceptible gene SLC30A8/ZnT8 regulates hepatic insulin clearance. Journal of Clinical Investigation, 123(10), 4513–4524. https://doi.org/10.1172/JCI68807

Tanwar, V. S., Chand, M. P., Kumar, J., Garg, G., Seth, S., Karthikeyan, G., & Sengupta, S. (2013). Common variant in FUT2 gene is associated with levels of vitamin B12 in Indian population. Gene, 515(1), 224–228. https://doi.org/10.1016/j.gene.2012.11.021

Tao, H., Chen, X., Zhou, H., Fu, J., Yu, Q., & Liu, Y. (2020). Changes of serum melatonin, interleukin-6, homocysteine, and complement C3 and C4 levels in patients with depression. Frontiers in Psychology, 11, Article 1271. https://doi.org/10.3389/fpsyg.2020.01271

Tavasolian, F., Desforges, M., Vinh, D. C., Pique-Regi, R., Shamas, A., & Romero, R. (2021). HLA, immune response, and susceptibility to COVID-19. Frontiers in Immunology, 11, Article 601886. https://doi.org/10.3389/fimmu.2020.601886

Tenório, M. C. d. S., Graciliano, N. G., Moura, F. A., Oliveira, A. C. M. d., & Goulart, M. O. F. (2021). N-acetylcysteine (NAC): Impacts on human health. Antioxidants, 10(6), Article 967. https://doi.org/10.3390/antiox10060967

Thakkinstian, A., McEvoy, M., Minelli, C., Gibson, P., Hancox, B., Duffy, D., … Attia, J. (2005). Association of beta2-adrenoceptor polymorphisms with asthma severity: A meta-analysis. Journal of Allergy and Clinical Immunology, 116(3), 582–587. https://doi.org/10.1016/j.jaci.2005.05.042

Tian, B.-X., Sun, W., Wang, S.-H., Liu, P.-J., & Wang, Y.-C. (2021). Differential expression and clinical significance of COX6C in human diseases. American Journal of Translational Research, 13(1), 1–10. https://e-century.us/files/ajtr/13/1/ajtr0115623.pdf

Timpson, N. J., Forouhi, N. G., Brion, M. J., Harbord, R. M., Cookson, W. O., Langenberg, C., Wareham, N. J., & Loos, R. J. (2010). Genetic variation at the SLC23A1 locus is associated with circulating concentrations of L-ascorbic acid (vitamin C): Evidence from 5 independent studies with >15,000 participants. American Journal of Clinical Nutrition, 92(2), 375–382. https://doi.org/10.3945/ajcn.2010.29438

Türkanoğlu, A., Can Demirdöğen, B., Demirkaya, Ş., Bektaş, Ö., & Admiş, Ö. (2010). Association analysis of GSTT1, GSTM1 genotype polymorphisms and serum total GST activity with ischemic stroke risk. Neurological Sciences, 31, 727–734. https://doi.org/10.1007/s10072-010-0330-5

Ülger, Y., & Delik, A. (2025). Gene expression profile in ulcerative colitis patients: FOXO4, ALDOB, SLC26A3, SOD2 genes as potential biomarkers. Genes & Genomics, 47(7), 833–842. https://doi.org/10.1007/s13258-025-01625-y

Unschuld, P. G., Ising, M., Erhardt, A., Lucae, S., Kohli, M., Kloiber, S., Salyakina, D., Thoeringer, C. K., Kern, N., Lieb, R., Uhr, M., Binder, E. B., Müller-Myhsok, B., Holsboer, F., & Keck, M. E. (2007). Polymorphisms in the serotonin receptor gene HTR2A are associated with quantitative traits in panic disorder. American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 144B(4), 424–429. https://doi.org/10.1002/ajmg.b.30412

Veronese, N., Stubbs, B., Solmi, M., Ajnakina, O., Carvalho, A. F., & Maggi, S. (2018). Acetyl-L-carnitine supplementation and the treatment of depressive symptoms: A systematic review and meta-analysis. Psychosomatic Medicine, 80(2), 154–159. https://doi.org/10.1097/PSY.0000000000000537

Vesnina, A., Prosekov, A., Kozlova, O., & Atuchin, V. (2020). Genes and eating preferences, their roles in personalized nutrition. Genes, 11(4), 357. https://doi.org/10.3390/genes11040357

Vijayan, A., Chithra, V., & Sandhya, C. (2024). Modifiable risk factors, oxidative stress markers, and SOD2 rs4880 SNP in coronary artery disease: An association study. Molecular Biology Reports, 51, Article 805. https://doi.org/10.1007/s11033-024-09727-8

Vogelzangs, N., Beekman, A. T. F., van Reedt Dortland, A. K. B., Schoevers, R. A., Giltay, E. J., de Jonge, P., & Penninx, B. W. J. H. (2016). Cytokine production capacity in depression and anxiety. Translational Psychiatry, 6(5), Article e825. https://doi.org/10.1038/tp.2016.92

Walker, L. S. K., & Sansom, D. M. (2015). Confusing signals: Recent progress in CTLA-4 biology. Trends in Immunology, 36(2), 63–70. https://doi.org/10.1016/j.it.2014.12.001

Walsh, E. I., Smith, L., Northey, J., Rattray, B., & Cherbuin, N. (2020). Towards an understanding of the physical activity-BDNF-cognition triumvirate: A review of associations and dosage. Ageing Research Reviews, 60, Article 101044. https://doi.org/10.1016/j.arr.2020.101044

Wang, J., Guan, C., Hou, H., Peng, X., Liu, Y., & Zhang, Y. (2021). A case-control study of relevance between NOS2 rs2297518 polymorphism with preeclampsia risk in the Chinese Han women. Research Square.

Wang, P., Li, S., Wang, M., He, J., & Xi, S. (2017). Association of MTRR A66G polymorphism with cancer susceptibility: Evidence from 85 studies. Journal of Cancer, 8(2), 266–277. https://doi.org/10.7150/jca.17379

Wang, S. (2022). Emerging roles of NDUFS8 located in mitochondrial complex I in different diseases. Molecules, 27(24), Article 8754. https://doi.org/10.3390/molecules27248754

Wang, X. (2019). Association of CYP1A1 rs1048943 variant with aggressive periodontitis: A meta-analysis. Journal of Clinical Periodontology, 46(11), 1061–1069. https://doi.org/10.1111/jcpe.13191

Wang, Y., Choo, J. M., Richard, A. C., Papanicolas, L. E., Wesselingh, S. L., Taylor, S. L., & Rogers, G. B. (2024). Intestinal persistence of Bifidobacterium infantis is determined by interaction of host genetics and antibiotic exposure. The ISME Journal, 18(1), Article wrae107. https://doi.org/10.1093/ismejo/wrae107

References

Wang, Y., Li, O., Li, N., Sha, Z., Zhao, Z., & Xu, J. (2023). Association between the BDNF Val66Met polymorphism and major depressive disorder: A systematic review and meta-analysis. Frontiers in Psychiatry, 14, Article 1143833. https://doi.org/10.3389/fpsyt.2023.1143833

Weder, N., Yang, B. Z., Douglas-Palumberi, H., Massey, J., Krystal, J. H., Gelernter, J., & Kaufman, J. (2008). MAOA genotype, maltreatment, and aggressive behavior: The changing impact of genotype at varying levels of trauma. Biological Psychiatry, 65(5), 417–424. https://doi.org/10.1016/j.biopsych.2008.09.013

Wenzlau, J. M., Juhl, K., Yu, L., Moua, O., Sarkar, S. A., & Rewers, M. J. (2008). A common nonsynonymous single nucleotide polymorphism in the SLC30A8 gene determines ZnT8 autoantibody specificity in type 1 diabetes. Diabetes, 57(10), 2693–2698. https://doi.org/10.2337/db08-0403

Wigner, P., Greb, E., Jasek, K., Leszek, J., Saluk, J., & Bijak, M. (2022). Variation of genes encoding nitric oxide synthases and antioxidant enzymes as potential risks of multiple sclerosis development: A preliminary study. Scientific Reports, 12(1), 10603. https://doi.org/10.1038/s41598-022-14795-6

Witte, A. V., Kerti, L., Hermannstädter, H. M., Fiebach, J. B., Schreiber, S. J., Schuchardt, J. P., Hahn, A., & Flöel, A. (2014). Long-chain omega-3 fatty acids improve brain function and structure in older adults: A randomized controlled trial. Cerebral Cortex, 24(11), 3059–3068. https://doi.org/10.1093/cercor/bht163

Won, E., & Kim, Y.-K. (2020). Neuroinflammation-associated alterations of the brain as potential neural biomarkers in anxiety disorders. International Journal of Molecular Sciences, 21(18), Article 6546. https://doi.org/10.3390/ijms21186546

Wu, N. N., Tian, H., Chen, P., Wang, D., Ren, J., & Zhang, Y. (2019). Physical exercise and selective autophagy: Benefit and risk on cardiovascular health. Cells, 8(11), 1436. https:// doi.org/10.3390/cells8111436

Wu, T., Cai, W., & Chen, X. (2023). Epigenetic regulation of neurotransmitter signaling in neurological disorders. Neurobiology of Disease, 184, Article 106232. https://doi.org/10.1016/j.nbd.2023.106232

Wysocki, T., Olesińska, M., & Paradowska-Gorycka, A. (2020). Current understanding of an emerging role of HLA-DRB1 gene in rheumatoid arthritis–From research to clinical practice. Cells, 9(5), Article 1127. https://doi.org/10.3390/cells9051127

Xiang, L., Wu, H., Pan, A., Patel, B., Xiang, G., Qi, L., Kaplan, R. C., Hu, F., Wylie-Rosett, J., & Qi, Q. (2016). FTO genotype and weight loss in diet and lifestyle interventions: A systematic review and meta-analysis. The American Journal of Clinical Nutrition, 103(4), 1162–1170. https://doi.org/10.3945/ajcn.115.123448

Yang, C., Mai, H., Peng, J., Zhou, B., Hou, J., & Jiang, D. (2020). STAT4: An immunoregulator contributing to diverse human diseases. International Journal of Biological Sciences, 16(9), 1575–1585. https://doi.org/10.7150/ijbs.41852

Ye, Y., Cheng, X., Luo, H. B., Zhang, L., & Hou, Y. P. (2008). CYP1A1 and CYP1B1 genetic polymorphisms and uterine leiomyoma risk in Chinese women. Journal of Assisted Reproduction and Genetics, 25(8), 389–394. https://doi.org/10.1007/s10815-008-9246-x

Zambrano, A. K., Cadena-Ullauri, S., Guevara-Ramírez, P., Ruiz-Pozo, V. A., Tamayo-Trujillo, R., Paz-Cruz, E., Ibarra-Rodríguez, A. A., & Doménech, N. (2023). Genetic diet interactions of ACE: The increased hypertension predisposition in the Latin American population. Frontiers in Nutrition, 10, Article 1241017. https://doi.org/10.3389/fnut.2023.1241017

Zaki, M. S., Selim, L., El-Bassyouni, H. T., Issa, M. Y., Mahmoud, I., Ismail, S., Girgis, M., Sadek, A. A., Gleeson, J. G., & Abdel Hamid, M. S. (2016). Molybdenum cofactor and isolated sulphite oxidase deficiencies: Clinical and molecular spectrum among Egyptian patients. European Journal of Paediatric Neurology, 20(5), 714–722. https://doi.org/10.1016/j.ejpn.2016.05.011

Zang, Y., Doll, M. A., Zhao, S., States, J. C., & Hein, D. W. (2007). Functional characterization of single-nucleotide polymorphisms and haplotypes of human N-acetyltransferase 2. Carcinogenesis, 28(8), 1665–1671. https://doi.org/10.1093/carcin/bgm085

Zhao, N., Liu, C.-C., Van Ingelgom, A. J., Martens, Y. A., Linares, C., Knight, J. A., Painter, M. M., Sullivan, P. M., & Bu, G. (2017). Apolipoprotein E4 impairs neuronal insulin signaling by trapping insulin receptor in the endosomes. Neuron, 96(1), 115-129.e5. https://doi.org/10.1016/j.neuron.2017.09.003

Zhu, K., Xu, A., Xia, W., Li, P., Zhang, B., Jiang, H., Zhou, S., & Wang, R. (2021). Association between NAT2 polymorphism and lung cancer risk: A systematic review and meta-analysis. Frontiers in Oncology, 11, Article 567762. https://doi.org/10.3389/fonc.2021.567762

Zimmermann, E., Skogstrand, K., Hougaard, D. M., Astrup, A., Hansen, T., Pedersen, O., Sørensen, T. I. A., & Jess, T. (2011). Influences of the common FTO rs9939609 variant on inflammatory markers throughout a broad range of body mass index. PLOS ONE, 6(1), Article e15958. https://doi.org/10.1371/journal.pone.0015958

Zuo, P., Zuo, Z., Wang, X., Chen, L., Zheng, Y., Ma, G., & Zhou, Q. (2015). Factor Xa induces pro-inflammatory cytokine expression in RAW 264.7 macrophages via protease-activated receptor-2 activation. American Journal of Translational Research, 7(11), 2326–2334. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4697712/

Zhu, W. (2019). Associations of CYP1 polymorphisms with risk of prostate cancer: An updated meta-analysis. Bioscience Reports, 39(3), BSR20181876.