

Epigenetics: Your DNA Is NOT Your Destiny!*

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Epigenetics: study of biological mechanisms that turn genes on and off and hence, affect gene EXPRESSION

- Genotype describes the inherited genes. Phenotype describes gene expression.

Resources: Genetics Home Reference: <http://ghr.nlm.nih.gov/gene/>

National Center for Biotechnology Information: <http://www.ncbi.nlm.nih.gov/gene/>

Epigenetics: the power to affect expression of our genes through our choices!

- Food intake, Environmental exposures (where you live, where you work, toxins, drug use, medications), Lifestyle (exercise, stress), Sleep, Social/Spiritual, Age

Genetic variations are called **SNPs** (Single Nucleotide Polymorphisms)

- Normal alleles from both parents = Wild-type genotype (Normal function/expression)
- A variation (SNP) in one allele = Heterozygous genotype
- A variation (SNP) in both alleles = Homozygous genotype (More severe variation)

Methylation Genes

- **MTHFR** (A1298C, C677T): activates folate to 5-MTHF

Functions of Methylation

<ul style="list-style-type: none">• Controls genetic expression• Conversion of food to energy• Cellular protection• Brain and muscle health• Production and balance of neurotransmitters	<ul style="list-style-type: none">• Stress and relaxation response• Detoxification• Immune response• Inflammation & gut integrity• DNA repair and reduction of errors
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Health Risks with Methylation SNPs

<ul style="list-style-type: none">• Abnormal blood clotting• Heart Disease• Stroke• High blood pressure (HTN, preeclampsia)• Eye problems, including glaucoma	<ul style="list-style-type: none">• Behavioral health problems• Cognitive problems• Miscarriages• Cleft lip and palate• Spina bifida
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Supporting Poor Methylators

<ul style="list-style-type: none">• Higher intake of folate sources, such as leafy greens• Higher intake of B12 sources (i.e. eggs)• Supplements: B6, B12 and/or Folate	<ul style="list-style-type: none">• Avoidance of food additives, preservatives and pesticides• Avoidance of high-intensity exercise• Adequate sleep• Beneficial gut bacteria
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Vitamin & Mineral Genes

- **BCO1 (aka BCMO1)**: converts dietary beta-carotene to active vitamin A
- **GC**: binding protein that transports Vitamin D to target tissues
- **SLC23A1**: encodes protein that transports vitamin C to organs

- **SLC30AB**: encodes protein that transports zinc intracellularly

Supporting Vitamin/Mineral SNPs with specific vitamin/mineral that is affected (i.e. Vit D, Vit C, zinc)

Detoxification Genes

- Start w/ **CYP**: involved in the formation (synthesis) and breakdown (metabolism) of various molecules/chemicals
- Start w/ **GPX**: reduce hydrogen peroxide and hydroperoxides to protect cells against oxidative damage
- Start w/ **GST**: conjugate certain toxins with glutathione
- **COMT**: produces enzymes that breaks down brain neurotransmitters (dopamine, epinephrine, norepinephrine) and estrogen
 - SNPs assoc. with alcohol use disorder, fibromyalgia, opioid addiction, schizophrenia
- **SOD**: makes superoxide dismutase to break down toxic superoxide radicals
 - SOD1 SNP assoc. with amyotrophic lateral sclerosis (ALS)
 - SOD2 SNP assoc. with premature aging, motor neuron disease, cancer

Supporting Detoxification SNPs

<ul style="list-style-type: none"> • Organic, whole foods that are less processed • Foods rich in antioxidants • Supplementation of vitamin C, NAC, glutathione, SAME • Supplements/herbs that support detox process (i.e. taurine, milk thistle, chlorella) 	<ul style="list-style-type: none"> • Supplement cofactors for the enzymes affected • Limit exposure to pesticides, food additives, household chemicals, VOCs • Sleep! • Stress management
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Weight Management Genes

- **ADIPOQ**: SNP associated with poor glucose and lipid metabolism
- **FTO**: SNP associated with increased appetite and decreased satiety
- **MC4R**: SNP assoc. with increased appetite
- **PPARG**: SNP assoc. with poor lipid management

Supporting Weight Management SNPs

- Best supported through diet high in unprocessed, whole plant foods, and high-quality protein and fats; Probiotics, fermented foods; Regular exercise/activity

Cardiovascular Health Genes

- **APOA2**: SNP may result in hypercholesterolemia
- **Factor II & Factor V**: rare SNP's increasing risk for bleeding
- **Factor V Leiden (R506Q)**: SNP increased risk for venous thrombosis, hence blood clotting
- **NOS3**: nitric oxide gene involved in vascular smooth muscle relaxation
 - SNP assoc. with coronary spasm, hypertension, stroke, Alzheimer's disease
- **AGT**: angiotensinogen gene regulates blood pressure and balance of fluids and salt in the body
 - heterozygous SNP increases risk for hypertension
 - homozygous SNP causes abnormal kidney development at birth & hypotension

- **Apo E**
 - Apo E3/3: normal genotype in >50% of population
 - Apo E2/2: rare SNP assoc. with type III hyperlipidemia and 2-3 fold increased risk for CVD
 - Apo E4: most common SNP associated with increased risk for Alzheimer's disease and dementia, and hyperlipidemia with 1.5-fold increase for CVD
 - Heterozygous (E4/3) – increased risk for late-onset Alzheimer's disease
 - Homozygous (E4/4) – increased risk for earlier-onset Alzheimer's disease

Supporting Cardiovascular SNPs

<ul style="list-style-type: none"> • Whole plant foods, that are less processed & low sugar • High-quality protein that is low in saturated fats • Emphasis of omega-3 fats, unsaturated fats • Probiotics, fermented foods 	<ul style="list-style-type: none"> • Regular exercise • Stress Management • Supplementation: B-vitamins, Vit. C, Vit. D, Vit. K, Omega-3, Resveratrol... • Herbs: Ashwagandha, Rhodiola...
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Glucose Homeostasis Genes

- **SLC30A8**: SNP reduces zinc transport to increase risk for type 2 diabetes
- **TCF7L2**: SNP implicated in blood glucose homeostasis to increase risk for type 2 diabetes

Support Glucose SNPs through diet high in unprocessed, whole plant foods, and high-quality protein and fats; also regular exercise; supp. zinc if applicable

Cognition & Neurological Genes

- Includes **Apo E**, **COMT**, **MTHFR** (discussed)
- **MAOA**: involved in breakdown of serotonin, epinephrine, norepinephrine, dopamine and tyramine
 - SNP causing low MAOA activity primarily in males, causing mild intellectual disability and behavioral problems, including aggressive and violent outburst → helps to reduce high tyramine foods
 - SNP causing high MAOA activity in females, causing panic disorders, severe anxiety and overwhelming fear
- **DRD2**: encodes subtype of dopamine receptor
 - SNPs associated with schizophrenia, opioid addiction and alcohol use disorder, due to dysregulation of dopamine
- **TPH2**: encodes enzyme in first step of serotonin production
 - SNPs assoc. with attention deficit-hyperactivity disorder (ADHD) and major depressive disorder

Supporting Cognition & Neurological SNPs (CAUTION: supplementation depends on individual needs!)

- Support methylation and detoxification SNPs
- Add neurotransmitter pre-cursors/amino acids: 5-HTP, L-Tyrosine, Taurine, L-theanine
- Add co-enzymes in neurotransmitter production: B6, Folate, Mg, Zinc, etc.
- Add herbs and food extracts
 - Bacopa, Vinpocetine, Ginkgo biloba, Rhodiola, etc.
 - Blueberry/Grape polyphenols, Curcumin, Green tea catechins, Quercetin flavonoid, etc.
- Add neurotransmitters: such as GABA

Immunity Genes

- **IL Genes:** SNPs affect various functions in inflammation to increase risks for the following
 - **IL-1B:** alopecia areata (AA) and gastric cancer
 - **IL-4:** AA and ischemic stroke
 - **IL-6:** arthritis, type 1 diabetes, IBS
 - **IL-10:** shingles, Crohn disease, rheumatoid arthritis
 - **IL-13:** psoriatic arthritis, asthma, allergic rhinitis
- **TNF:** tumor necrosis factor superfamily involved in cell proliferation, differentiation, apoptosis (cell death), lipid metabolism, coagulation
 - SNPs implicated in autoimmune diseases (arthritis), insulin resistance, cancer

Supporting Immunity SNPs

<ul style="list-style-type: none">• Gut support: over 70% of immune support!• Vitamins: Vit C, Vit D,• Minerals: Zinc	<ul style="list-style-type: none">• Herbs/Extracts: Aloe vera, mushrooms, quercetin, citrus bioflavonoids, elderberry, lemon balm, hesperidin• Support immune function with healthy diet, sleep and stress management
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Genes Specific to Medication Tolerance

- **SLCO1B1:** involved in removal of drug compounds such as statins
- **NAT2:** involved in activation and deactivation of arylamine and hydrazine drugs and carcinogens

Testing Options

- Genetic testing can get very expensive! Ranging \$60-\$700+
- Specific profiles: cardiovascular, detoxification, estrogen, immunity, neurological, pharmacogenic...
- A la carte options: MTHFR, EpoE, COMT, SOD2, IL, etc.
- Other: interpret raw data from 23andME, Ancestry.com (least expensive and gives variety of SNPs)

Can assist gene function no matter what!*

<ul style="list-style-type: none">• Organic, whole foods that are less processed• Foods rich in antioxidants• Support a healthy microbiome• Supplementation based on symptoms, blood tests or other evaluations	<ul style="list-style-type: none">• Limit exposure to pesticides, food additives, household chemicals, VOCs• Sleep!• Stress management• Choose exercise that invigorates vs. depletes/drains
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*Gene testing will guide more specific support. Supplementation depends on individual needs/tolerance; caution with over-supplementation.