HEALTH PRACTITIONER GUIDE

For Licensed HealthCare Professionals

Gene SNP
DNA Screening Analysis

nutraMetrix®
ADVANCED NUTRACEUTICALS
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>PAGE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION .................................................</td>
</tr>
<tr>
<td>GENE BASICS ..................................................</td>
</tr>
<tr>
<td>POLYMORPHISMS (BY GENE CATEGORY)</td>
</tr>
<tr>
<td>HEART HEALTH PANEL ........................................</td>
</tr>
<tr>
<td>ANTIOXIDATION/DETOXIFICATION PANEL ..................</td>
</tr>
<tr>
<td>BONE HEALTH PANEL .........................................</td>
</tr>
<tr>
<td>INFLAMMATION PANEL ........................................</td>
</tr>
<tr>
<td>INSULIN SENSITIVITY PANEL ...............................</td>
</tr>
<tr>
<td>NUTRITION AND SUPPLEMENTATION ........................</td>
</tr>
<tr>
<td>CONTACT INFORMATION ......................................</td>
</tr>
</tbody>
</table>

## INDIVIDUAL PANEL LOCATOR

<table>
<thead>
<tr>
<th>GENE NAME</th>
<th>PAGE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>APOC3</td>
<td>5</td>
</tr>
<tr>
<td>CETP</td>
<td>6</td>
</tr>
<tr>
<td>LPL</td>
<td>7</td>
</tr>
<tr>
<td>eNOS</td>
<td>8</td>
</tr>
<tr>
<td>MTHFR</td>
<td>11</td>
</tr>
<tr>
<td>MTR</td>
<td>12</td>
</tr>
<tr>
<td>MS_MTRR</td>
<td>13</td>
</tr>
<tr>
<td>CBS</td>
<td>14</td>
</tr>
<tr>
<td>GSTM1</td>
<td>21</td>
</tr>
<tr>
<td>GSTT1</td>
<td>22</td>
</tr>
<tr>
<td>GSTP1</td>
<td>23</td>
</tr>
<tr>
<td>MnSOD</td>
<td>25</td>
</tr>
<tr>
<td>SOD3</td>
<td>26</td>
</tr>
<tr>
<td>VDR</td>
<td>29</td>
</tr>
<tr>
<td>COL1A1</td>
<td>30</td>
</tr>
<tr>
<td>IL-6</td>
<td>34</td>
</tr>
<tr>
<td>TNFα</td>
<td>35</td>
</tr>
<tr>
<td>ACE</td>
<td>38</td>
</tr>
<tr>
<td>PPARγ2</td>
<td>39</td>
</tr>
</tbody>
</table>
INTRODUCTION

Great advances recently made in human genetics allow for the customization of preventive healthcare advice to suit the genetic profile of an individual. NutraMetrix, in partnership with Sciona, created the Gene SNP DNA screening analysis, a powerful tool that can help your patients make the dietary and lifestyle changes best suited for their particular needs.

This health practitioner guide contains reference material for these personalized recommendations. For each gene screened in the test, the guide describes the relationships between gene variations (polymorphisms) and altered metabolic processes that may affect long-term health outcomes. We also outline nutritional and lifestyle advice based on gene variations. (The Health Practitioner Program is not available in Canada.)

On page 3 of the guide, you will find essential information explaining the important link between genes and enzyme-driven metabolic processes.

HOW THE TEST WORKS

Each person completes a Lifestyle Questionnaire and submits a DNA sample painlessly taken by sterile buccal (cheek) swabs. The sample must be taken at least one hour after eating or drinking, and the swab must be firmly rubbed for about one minute. This ensures an adequate collection of epithelial cells for genetic analysis. Three weeks after receiving the questionnaire and the DNA sample, Sciona provides the results of the test in the form of a personalized report, with recommendations for customized Gene SNP nutritional supplements. The report tells your patient if he/she has a gene variation that requires the patient to make specific nutrition and lifestyle changes to achieve optimal health. The information gained from the report may lead your patient to make the right lifestyle changes and supplementation choices.

HEART HEALTH & B VITAMIN USE

Heart health depends on a balance of environmental, dietary and genetic factors. The Gene SNP analysis screens for genes that affect a variety of factors linked with heart health, including the metabolism of cholesterol, antioxidant activity and the levels of homocysteine in blood. In addition, some people have genetic variations that have an impact on the way their bodies use B vitamins. This is important in heart health because niacin has been found to be effective in patients with hypercholesterolemia, inappropriately small LDL particles and atherosclerosis. Niacin plays a role in the prevention of a second heart attack. Similarly, folate, vitamin B6 and vitamin B12 have important roles in the conversion of homocysteine (an amino acid that is toxic to the endothelial cells) back to methionine.

DETOXIFICATION AND ANTIOXIDANTS

A toxin is a substance that causes tissue irritation or produces a wide range of harmful effects. Many environmental physicians believe that daily exposure to pesticides, industrial chemicals, food additives and especially second-hand smoke is deleterious to our health. Some toxins can accumulate in the body faster than they can be eliminated or neutralized. This toxic accumulation alters the body’s metabolism and may cause enzyme dysfunction, nutritional deficiencies, hormonal imbalances and impaired immune responses. All of these effects may contribute to physiological decline.

Genes code for enzymes that enable us to deactivate and remove harmful toxins. If appropriate, specific foods and supplements are recommended in Sciona’s report that assist in eliminating toxins. In addition, our bodies
produce their own antioxidants, which are encoded by our genes. These antioxidants affect how well our bodies neutralize free radicals that result in reduced oxidative stress (a destructive condition associated with aging and many chronic diseases). Supplemental antioxidant intake, based upon the results of the Gene SNP analysis, can increase the antioxidant capacity of the body. (Supplements are not available in Canada.)

**BONE HEALTH**

Osteoporosis and low bone mass affect an estimated 23.4 million Americans, the majority of whom are women. As a result, this population is at an increased risk for fractures, particularly of the hip and the spine.

Vitamin D3 is needed for the body to absorb calcium and phosphate. Without adequate vitamin D3, we can't form enough calcitriol (1,25-dihydroxycholecalciferol) and calcium-binding proteins, causing insufficient calcium absorption from food. In this situation, the body must take its calcium from its stores in the skeleton, which weakens existing bone and prevents the formation of strong, new bone.

Calcium is also needed for our heart, muscles and nerves to function properly and for blood to clot. Inadequate calcium intake and absorption significantly contribute to the development of osteoporosis. Many published studies show that low calcium intake throughout life is associated with low bone mass and high fracture rates. National nutrition surveys have shown that many women and young girls consume less than half the amount of calcium recommended to grow and maintain healthy bones.

Variations in “bone health” genes may lead to the formation of altered proteins that can have an adverse effect on bone structure, leading to bone loss. Gene SNP supplements provide customized formulations to maintain bone health.

**INFLAMMATION**

Inflammation is the body’s response to injury, infection or foreign proteins. Inflammation is characterized by pain, redness, heat, swelling and altered function of affected tissue. Although the ability to mount an inflammatory response is essential for survival, the ability to control inflammation is also necessary for health.

Some gene variations produce altered proteins that may hinder inflammatory processes from shutting down when needed. Excess and chronic inflammation are associated with many diseases today. The Gene SNP analysis provides insights into a person's inflammatory control mechanisms.

Recommended nutrients (such as omega-3 fatty acids), based upon the Gene SNP results, can have a beneficial effect on maintaining a healthy anti-inflammation response by altering inflammatory mediator production. (Supplements are not available in Canada.)

**INSULIN SENSITIVITY**

Diabetes is an alarming health problem in the United States and has risen about six-fold since 1950, now affecting about 16 million Americans. About one-third of those 16 million have never been formally diagnosed and do not know that they have the disease. There are two major types of diabetes. Type I or “juvenile diabetes” results when insulin is no longer produced adequately by the pancreas. Type II or “adult onset” diabetes results when the sensitivity to insulin is impaired. Therefore, the body retains high levels of circulating blood glucose that can impair the structure and function of important proteins in the form of glycosylated end products (especially within blood vessels). Eventually these abnormal proteins produce the hallmark manifestations of diabetic complications.
THE LINK BETWEEN GENES AND DISEASE

Many diseases have their roots in our genes. Genes — through the proteins they encode — determine how efficiently we process foods, how effectively we detoxify poisons and how vigorously we respond to infections. More than 4,000 diseases are thought to stem from mutated genes inherited from one’s mother and/or father. When a gene contains a mutation, the protein encoded by that gene will be abnormal. Some protein changes are insignificant, while others are disabling. Common disorders such as heart disease, cancer and asthma arise from a complex interplay among multiple genes and exposure to factors in the environment.

Gene mutations can be either inherited from a parent or acquired. A hereditary mutation is an error that is present in the DNA of virtually all body cells. Acquired mutations are changes in DNA that develop throughout a person’s life. In contrast to hereditary mutations, acquired mutations arise in the DNA of individual cells; the genetic errors are passed only to direct descendents of those cells. Acquired mutations can also be induced by environmental stresses such as ionizing radiation and chemical toxins.

Altered genes are now known to play a part in cancer, heart disease, diabetes and many other common diseases. Genetic flaws increase a person’s risk of developing these common and complex disorders. The diseases themselves stem from interactions of genetic predispositions and environmental factors, including diet and lifestyle.

Gene SNP DNA Screening Analysis examines a person’s DNA — taken from cells in the mouth — for specific single nucleotide polymorphisms that signal the potential for long-term health consequences. NutraMetrix, in partnership with Sciona, created the Gene SNP DNA Screening Analysis to help your patients make the dietary and lifestyle changes best suited for their particular needs based upon individualized gene screening.
Heart health depends on a complex balance of environmental, dietary and genetic factors. Scionia screens DNA for several categories of genes that may play an important role in heart health, according to the latest research:

- Lipid and cholesterol metabolism: genes in this category influence the way that dietary fats and cholesterol are metabolized. Alterations in the efficiency of these genes can lead to higher levels of LDL, or “bad” cholesterol, which is a risk factor for heart disease.
  
  APOC3 (page 5)  
  CETP (page 6)  
  LPL (page 7)  
  eNOS (page 8)

- B vitamin use (page 9): genes in this category influence the levels of homocysteine in the blood. Raised homocysteine may be a risk factor for heart disease.
  
  MTHFR (page 11)  
  MTR (page 12)  
  MS_MTRR (page 13)  
  CBS (page 14)
GENE SUMMARY

Gene name: Apolipoprotein C-III (APOC3)

Function: APOC3 protein is found in HDL, LDL and VLDL cholesterol particles; it is expressed in the liver and intestine; APOC3 inhibits the activity of lipoprotein lipase and delays clearance of triglyceride-rich lipoproteins in the liver

Apolipoprotein location: 50% contained in LDL particles and 2% in HDL particles

Variation:

• C3175G: Guanine (G) in place of cytosine (C) at position 3175 of the gene
  Not known at present whether the variation affects RNA processing or whether it is a marker for an uncharacterized variation
  Associated with higher plasma levels of APOC3
  Associated with higher levels of cholesterol, plasma triglycerides and VLDL-triglycerides

RESULTS INTERPRETATION

No variation: The APOC3 gene has no variations and the protein it produces should be present at normal levels.

Variation: The APOC3 gene has a variation that increases the levels of APOC3 activity in plasma, possibly leading to increased levels of plasma triglycerides. Studies have shown that individuals with this variation respond well to a diet rich in mono-unsaturated fats and low in saturated fats, demonstrated by significant lowering of LDL cholesterol levels.
**HEART HEALTH**

**CETP**

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**AREA OF ACTIVITY**

Heart Health

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**GENE SUMMARY**

- **Gene name**: Cholesterol Ester Transfer Protein (CETP)
- **Function**: CETP activity results in the net transfer of cholesterol ester from HDL to other lipoproteins, and in the subsequent uptake of cholesterol by hepatocytes (liver cells)
- **Protein location**: Plasma; synthesized in the liver
- **Variation**:
  - **G279A**: Adenine (A) in place of guanine (G) at position 279 of the gene
    - The variation has not been functionally characterized
    - The A allele has been associated with reduced plasma CETP levels, increased HDL levels and reduced risk of cardiovascular disease.

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**RESULTS INTERPRETATION**

- **No variation**: The CETP gene has no variations; this version of the gene has been associated with lower HDL levels, but individuals with this form of CETP have a stronger response to dietary changes: they show an increase in HDL and greater lowering of LDL and VLDL levels when placed on a diet rich in linoleic acid and low in cholesterol.

- **Variation**: The CETP gene has a variation that has been associated with lower LDL and VLDL levels. The variation has a protective effect, which is most marked in individuals consuming moderate amounts of alcohol. In a 1995 study, individuals with this variation showed a reduced risk of cardiovascular disease with consumption of more than 25g/day of alcohol.
GENE SUMMARY

**Gene name:** Lipoprotein Lipase (LPL)

**Function:** Key enzyme in the metabolism of triglyceride-rich lipoproteins; hydrolyzes triglycerides in large triglyceride-rich lipoprotein particles, including VLDL and chylomicrons; enhances receptor-mediated uptake of lipoproteins by the liver and artery wall

**Enzyme location:** Most tissues of the body, including adipose tissue

**Variation:**

- **C1595G:** Guanine (G) in place of cytosine (C) at position 1595 of the gene
  - G generates premature stop codon which shortens the protein by two amino acids; the functional effect of this change has not yet been characterized
  - Associated with higher HDL, lower VLDL and lower triglycerides
  - Associated with greater reduction of cholesterol levels while on a diet rich in unsaturated fats

RESULTS INTERPRETATION

**No variation:** The LPL gene has no variations, which means that the full-length enzyme is produced. However, this form of the gene has been associated with higher levels of VLDL and triglycerides and lower levels of HDL.

**Variation:** The LPL gene has a variation that shortens the length of the protein by two amino acids. This variation has been associated with lower triglyceride and VLDL levels, and higher HDL levels. Individuals with this variation have demonstrated greater reduction of cholesterol levels when unsaturated fats replace saturated fats in the diet.
**Area of Activity**
Heart Health

**Gene Summary**

**Gene name:** Endothelial Nitric Oxide Synthase (eNOS, also abbreviated as NOS3)

**Function:** Produces nitric oxide from arginine, which is involved in smooth muscle relaxation; promotes blood clotting through activation of platelets

**Enzyme location:** Platelets

**Variation:**
- **G894T:** Thymine (T) in place of guanine (G) at position 894 of the gene
  - Reduced production of nitric oxide, possibly due to polymorphism affecting cleavage of the protein
  - Associated with increased formation of atherosclerotic plaques
  - Smokers with the G allele (no variation) show reduction of vascular function
  - The G allele (no variation) has been associated with improved vascular function when the diet is rich in omega-3 fatty acids

**Results Interpretation**

**No variation:** The eNOS gene has no variation, which means that the eNOS enzyme should be producing nitric oxide efficiently.

**Variation:** The eNOS gene has a variation that has been associated with decreased production of nitric oxide, an important factor in vascular function. Individuals with this variation are strongly advised not to smoke, and it is suggested that they consume omega-3 fatty acids in order to help support vascular function.
Certain variations alter the function of genes responsible for B vitamin metabolism. Changes in the metabolism of B vitamins may lead to increased homocysteine levels, which have been linked to heart disease and venous thrombosis. There may also be alterations in the building and repair of DNA, which can influence the normal growth and functioning of our bodies.

B vitamin metabolism genes included in the Sciona screen:

- MTHFR (page 11)
- MTR (page 12)
- MS_MTRR (page 13)
- CBS (page 14)

The water-soluble B vitamin folate, known as folic acid in its synthetic form, plays a crucial role in two sets of major cellular processes: synthesis of new DNA, and DNA repair and expression (the “turning on” of genes). A key role in regulating these two branches of folate metabolism is played by the enzyme MTHFR, which is part of a complex pathway that also requires vitamins B12 and B6 and involves many other genes, including MTR, MS_MTRR and CBS, which are included in the current DNA screen. The enzymes produced by the B vitamin genes work together to use folate from the diet to generate small molecular “tags” called methyl groups that are responsible for DNA methylation, an important control mechanism.

When folate levels are too low or one of the enzymes in the pathway works less efficiently than optimal, both branches of folate metabolism can be disrupted. In the DNA synthesis pathway, the wrong components may be incorporated into the growing DNA molecule, making it unstable. In the second metabolic pathway, methyl groups remain “stuck” on an intermediary metabolic product called homocysteine and DNA methylation fails to take place. The result is a buildup of homocysteine levels in the blood, which has been linked to cardiovascular disease, venous thrombosis and neural tube defects in fetuses. Moreover, without proper methylation, genes become activated at wrong times and DNA repair is faulty. Polymorphisms in the B vitamin gene group have been linked to increased homocysteine levels and to a variety of diseases, especially when dietary folate levels are low.
Diagram 1
Biochemical pathway showing chemical intermediates of folic acid metabolism and enzymes that carry out the reactions.

Diagram 2
Folate (or Folic Acid) Metabolism
GENE SUMMARY

Gene name: Methylene tetrahydrofolate reductase (MTHFR)

Function: Metabolism of folate/folic acid from the diet; catalyzes the conversion of 5,10-methylenetetrahydrofolate to 5-methyltetrahydrofolate, which is required for homocysteine remethylation (i.e. the addition of a methyl group to homocysteine) to methionine and so keeps homocysteine levels low

Enzyme location: Cytoplasm; found in all tissues

Variations:
- **C677T**: Thymine (T) in place of cytosine (C) at position 677 of the gene
  - Lowers activity of the enzyme approximately 35%
  - Linked to increased homocysteine levels
  - Alters ability of coenzyme (FAD) to bind to active enzyme
- **A1298C**: Cytosine (C) in place of adenine (A) at position 1298 of the gene
  - Lowers the activity of the enzyme
  - Alters transcriptional levels of the enzyme approximately 35%

RESULTS INTERPRETATION

No variation: The MTHFR gene has neither of the variations listed above, which means the activity of the enzyme should be normal.

Variation(s): The MTHFR gene has variations that decrease the activity of the enzyme.
**GENE SUMMARY**

**Gene name:** Methionine synthase (abbreviated as MTR)

**Function:** Catalyzes the remethylation of homocysteine to methionine using a methyl group donated by 5-methyltetrahydrofolate, which is the major circulating form of folate in the body.

**Enzyme location:** Cytoplasm; found in all tissues; highest levels of expression in pancreas, heart, brain, skeletal muscle.

**Variation:**

- **A2576G:** Guanine (G) in place of adenine (A) at position 2576 of the gene
  - May increase activity of the enzyme, enhancing conversion of homocysteine to methionine, and may lead to lower homocysteine levels.

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**RESULTS INTERPRETATION**

**No variation:** The MTR gene does not have the variation listed above, which means that the activity of the enzyme should be within normal range.

**Variation:** The MTR gene has a variation that may increase the effectiveness of the enzyme and help to lower plasma homocysteine levels.
**GENE SUMMARY**

**Gene name:** Methionine synthase reductase (abbreviated as MS_MTRR)

**Function:** Catalyzes the regeneration of methylcobalamin (a derivative of vitamin B12), an essential cofactor of the enzyme methionine synthase, which maintains intracellular pools of methionine and tetrahydrofolate keeping homocysteine at non-toxic levels

**Enzyme location:** Cytoplasm; found in all tissues

**Variation:**

- **A66G:** Guanine (G) in place of adenine (A) at position 66 of the gene
  - The A allele has been associated with higher homocysteine levels, although this effect is very moderate
  - The G allele is associated with increased cardiovascular risk, which is independent of homocysteine

**RESULTS INTERPRETATION**

**No variation:** The MS_MTRR gene does not have the variation listed above, which means the effectiveness of the enzyme should be normal.

**Variation:** The MS_MTRR gene has a variation that decreases the effectiveness of the enzyme.
GENE SUMMARY

**Gene name:** Cystathionine Beta Synthase (CBS)

**Function:** Catalyzes the trans-sulfuration of homocysteine to create cystathione, which is then converted to the amino acid cysteine; the process results in the direct removal of homocysteine from the methionine cycle and therefore a reduction in homocysteine levels.

**Enzyme location:** Cytoplasm; found in all tissues; highest levels of expression in liver and pancreas.

**Variation:**
- **C699T:** Thymine (T) in place of cytosine (C) at position 699 of the gene
  - May increase activity of the enzyme, enhancing conversion of homocysteine to methionine, and may lead to lower homocysteine levels.

RESULTS INTERPRETATION

**No variation:** The CBS gene does not have the variation listed above, which means the activity of the enzyme should be within normal range.

**Variation:** The CBS gene has a variation that may increase the effectiveness of the enzyme activity and help to lower plasma homocysteine levels.
HEART HEALTH

NUTRITIONAL AND LIFESTYLE ADVICE

<table>
<thead>
<tr>
<th>DIETARY AND LIFESTYLE FACTORS RELEVANT TO HEART HEALTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Folate</td>
</tr>
<tr>
<td>• Vitamin B6</td>
</tr>
<tr>
<td>• Vitamin B12</td>
</tr>
<tr>
<td>• Fruits and vegetables</td>
</tr>
<tr>
<td>• Antioxidants</td>
</tr>
<tr>
<td>• Refined carbohydrates</td>
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<tr>
<td>• Saturated fat</td>
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<td>• Cholesterol</td>
</tr>
<tr>
<td>• Omega-3 fatty acids</td>
</tr>
<tr>
<td>• Tobacco</td>
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<tr>
<td>• Body weight</td>
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<tr>
<td>• Physical activity</td>
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</tbody>
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**Lipid and cholesterol metabolism:** When forms of the genes associated with higher VLDL, LDL and triglyceride levels are identified, the individuals are advised to reduce consumption of saturated fats and cholesterol, replacing them with unsaturated fats in their diet.

**B vitamin use genes:** If the enzymes in the B vitamin pathway are present in the form that reduces their efficiency, we recommend increasing consumption of folate, vitamin B6 and vitamin B12 and taking the recommended supplement.

**Antioxidant genes:** After screening the MnSOD and SOD3 genes, we determine whether the form of either gene indicates a reduction in overall antioxidant activity; if so, we recommend increased consumption of antioxidants through food and supplementation. We also recommend avoidance of active and passive smoke.

**Inflammation:** For individuals with variations in the IL-6 gene, we recommend increased consumption of antioxidants and fish oils.

**Insulin sensitivity:** Individuals with a deletion in the ACE gene are advised to reduce their intake of refined carbohydrates and simple sugars, and to focus on increasing unrefined complex carbohydrates in their diet. They are also advised to maintain a healthy weight and to engage in regular physical activity.
NUTRITIONAL FOCUS

SATURATED FATS
While some fat in the diet is essential, take into account the impact of different fats on cholesterol metabolism. Saturated fats can raise LDL, or “bad” cholesterol levels; high LDL cholesterol has been linked to cardiovascular disease. Other fats to be avoided are trans fatty acids; they can also increase the “bad” LDL cholesterol and lower the “good” HDL cholesterol. In contrast, unsaturated fats do not increase blood cholesterol and may in fact decrease it. Health authorities in the United States recommend that people get less than 30 percent of their total calories from fat and less than 10 percent of their total calories from saturated fats.

Food sources
Saturated fats: mainly animal foods, high-fat dairy products (such as cheese, whole milk, cream, butter and regular ice cream), fatty, fresh and processed meats, the skin and fat of poultry, lard, palm oil and coconut oil.
Trans fatty acids: block margarines, shortenings, cookies and other baked goods.
Unsaturated fats: vegetable oils, olives, avocados and fatty fish.

CHOLESTEROL
Physicians distinguish between two forms of cholesterol. The so-called “bad” (LDL) cholesterol is the one that increases the risk of disease. However, our blood also contains another form, referred to as “good” (HDL) cholesterol, which is protective against arterial disease. Thus, it’s important to have not only normal blood cholesterol levels but also a healthy ratio between “bad” and “good” cholesterol.

The foods that have the strongest impact on cholesterol levels are saturated fats. Foods rich in cholesterol and trans fatty acids can also increase blood cholesterol, although to a lesser extent.

Fiber has been shown to decrease total cholesterol and increase “good” cholesterol. In particular, soluble fiber foods, such as oat bran and oats, are among the finest foods for combating high cholesterol.

The American Heart Association recommends that a healthy diet should contain on average no more than 300 milligrams of cholesterol daily.

Food sources
Dietary cholesterol is found only in animal foods such as egg yolks, dairy fats (for example, butter), organ meats, beef, chicken and shellfish. Vegetable oils are cholesterol-free.
LIFESTYLE FOCUS

TOBACCO
The findings on the negative effects of smoking can be best summed up by quoting former Surgeon General C. Everett Koop in his address to the Senate in 1998:

"Abundant evidence has established the causal relationship between the use of tobacco and cancer, cardiovascular disease, chronic obstructive lung disease, peripheral vascular disease, stroke and a variety of serious pediatric maladies in children exposed to environmental tobacco smoke. These illnesses are so severe that nearly one of every five deaths in the U.S. is attributed to tobacco."

BODY WEIGHT
The body mass index, or BMI, evaluates your weight in relation to your height. A healthy BMI ranges from 18.5 to 25; people with a BMI of 25 to 30 are classified as overweight; people with a BMI of 30 or higher are considered significantly overweight.

The BMI, however, is not an absolute measure. Some adults in the healthy BMI range may have lots of fat and little muscle, which is not a healthy situation. On the other hand, people who have lots of muscle and little fat may not be overweight even if they have a high BMI.

There are many BMI calculators on the Internet, including one at the National Heart, Lung and Blood Institute: http://nhlbi.nih.gov/health/dci/DI/BMI/BMICalculator.htm

PHYSICAL ACTIVITY
Physical activity that improves cardio-respiratory fitness — running, walking, aerobics, swimming and cycling — has been shown to reduce the risk of obesity and of numerous disorders, including heart disease, high blood pressure, type 2 diabetes and certain cancers.

Activity need not be strenuous to have a beneficial impact on health. U.S. health authorities recommend that all adults get at least 30 minutes of moderate physical activity a day — preferably every day. People trying to maintain a healthy weight after weight loss are advised to be even more physically active.
**HEART HEALTH**

**NUTRITIONAL AND LIFESTYLE ADVICE**

**DIETARY AND LIFESTYLE FACTORS RELEVANT TO B VITAMIN USE**

- Folate
- Vitamin B6
- Vitamin B12

**Normal or increased enzyme activity:** Recent studies show that most people do not have adequate folate levels in their diet. Even when the genes responsible for B vitamin use work at their best, the customer should consume healthy levels of folate and vitamins B6 and B12. Women need to take folic acid supplementation during pregnancy, but only in consultation with their physician.

**Lower enzyme activity:** If the DNA screen indicates lower effectiveness of the enzymes due to the particular form of the gene, we advise the individual to increase dietary intake of B vitamins and to take vitamin supplements which include folic acid, vitamin B6 and vitamin B12, as recommended.
NUTRITIONAL FOCUS

B VITAMINS

B vitamins are important players in the most fundamental processes that make your body work. These vitamins — including folate (known as “folic acid” in synthetic form) and vitamins B6 and B12 — are used to help make new DNA for cells that are constantly growing and renewing themselves, such as skin and blood cells. In addition, folate contains an important component that can be used to turn genes on and off, as well as to help repair DNA. Although the B vitamins are required by your body in only tiny amounts, these substances are crucial for normal metabolism. Studies show that the average American diet is deficient in many B vitamins.

A shortage of B vitamins can cause a harmful substance called homocysteine to build up in your blood. According to the latest medical research, this buildup has been linked to heart disease and a variety of other illnesses. B vitamin deficiency has also been linked to certain forms of anemia and problems with the nervous system.

• Folate, B6 and B12 are water-soluble vitamins; they can be destroyed by heat and cooking. Keep cooking time to a minimum and prepare foods rich in these vitamins by steaming, microwaving or stir-frying.

• Drinking alcohol reduces the benefits of B vitamins. Keep alcohol consumption within the recommended limits. The U.S. Department of Health defines a moderate alcohol intake as no more than one drink per day for women and no more than two drinks per day for men.

Food sources

• Folate: liver, leafy vegetables, citrus fruit, whole grains, wheat germ, avocados
• Vitamin B6: poultry, pork, eggs, beans, legumes, whole grains, sunflower seeds
• Vitamin B12: liver, kidney, red meat, poultry, fish, eggs, soy powder, yeast extracts
When potentially toxic compounds are ingested or inhaled, they are removed from the body in a series of detoxification reactions generally divided into two stages, Phase I and Phase II.

**Phase I detoxification.** The enzymes involved at this stage are known as activators; they activate the substance that needs to be removed, allowing the next phase to proceed. They work by attaching a single oxygen or nitrogen atom to the toxic compound.

**Phase II detoxification.** The enzymes that take over at this stage are called excretors because they catalyze reactions leading to the excretion of toxins from the body. These enzymes bind the chemical compound glutathione to the toxins activated in Phase I, making these potentially harmful substances water-soluble so that the body can remove them in urine or sweat. The test screens three Phase II genes belonging to the Glutathione S-Transferase gene family:

- GSTM1 (page 21)
- GSTT1 (page 22)
- GSTP1 (page 23)

Decreased activity or complete deletion of these genes can reduce the rate at which toxins are removed from the body, increasing the chances of these toxins causing damage to the DNA, proteins and tissues of the body.

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**Diagram: The two phases of detoxification**

- Ingestion of char-grilled, well-done red meat
  - Formation of toxins, such as PAH, HCA, nitroso compounds
- Oxidative stress leading to free radical formation-sun exposure, smoking, etc.
  - Slow excretor enzymes
- Phase I Detoxification
  - Byproduct-activated toxins
- Phase II Detoxification
  - Excretor enzymes GSTM1, GSTT1, GSTP1
  - Make activated toxins and free radicals water-soluble
- Normal excretor
- Excretion of toxins and free radicals from the body
- Damaged Tissue
GENE SUMMARY

Gene name: Glutathione S-transferase M1 (GSTM1)

Function: Binds glutathione to products of Phase I detoxification and other compounds including products of oxidative reactions for rapid excretion from the body

Enzyme location: Cytoplasm; found primarily in liver

Variation: Complete absence of gene

RESULTS INTERPRETATION

No variation: The GSTM1 gene is present and should be functioning properly.

Variation: There is a complete deletion of the GSTM1 gene, so overall Phase II detoxification activity and antioxidant activity are compromised.
AREAS OF ACTIVITY
Detoxification
Antioxidant Activity

GENE SUMMARY

Gene name: Glutathione S-transferase T1 (GSTT1)
Function: Binds glutathione to products of Phase I detoxification and other compounds including products of oxidative reactions for rapid excretion from the body
Enzyme location: Cytoplasm; found in liver, lungs, red blood cells
Variation: Complete absence of gene

RESULTS INTERPRETATION

No variation: The GSTT1 gene is present and should be functioning properly.
Variation: There is a complete deletion of the GSTT1 gene, so overall Phase II detoxification activity and antioxidant activity are compromised.
**GENE SUMMARY**

**Gene name**: Glutathione S-transferase P1 (GSTP1)

**Function**: Binds glutathione to products of Phase I detoxification and other compounds including products of oxidative reactions for rapid excretion from the body

**Enzyme location**: Cytoplasm; found in all tissues and cells except red blood cells

**Variations**:

- **A313G**: Guanine (G) in place of adenine (A) at position 313 of gene
- **C341T**: Thymine (T) in place of cytosine (C) at position 341 of gene

Both variations result in an alteration of the active site of the enzyme so that its three-dimensional structure is changed, leading to a reduction in activity.

**RESULTS INTERPRETATION**

**No variation**: The GSTP1 has neither of the variations listed above, so the activity of the enzyme should be normal.

**Variation(s)**: The GSTP1 gene has variations that decrease the activity of the enzyme.
Oxygen is vital for life as we know it, but it can form highly reactive and potentially dangerous molecules, called free radicals. Free radicals are normal products of energy-producing processes in the body, but excessive amounts of these highly reactive oxygen molecules can damage DNA, proteins and cell membranes. An excess of free radicals leads to oxidative stress, which has been linked to a variety of common disorders, including heart disease, chronic inflammation and cancer, as well as accelerated aging. Our bodies have built-in defenses against free radicals: genes that make antioxidant enzymes, which neutralize these highly reactive molecules.

Dietary sources of antioxidants and antioxidants produced within the body, which include the enzymes manganese superoxide dismutase (MnSOD) copper and zinc superoxide dismutase (SOD3), provide defense against oxidative damage by removing reactive oxygen species. Also contributing to antioxidant activity is the GST family of genes, otherwise known for its detoxification effects. Many people have variations in the genes that produce and regulate antioxidant enzymes. As a result of the variations, these enzymes may have altered activity, which means that free radicals in the body tissues may not be neutralized efficiently.

Antioxidant activity genes:

- MnSOD, also known as SOD2 (page 25)
- SOD3 (page 26)

The following genes produce enzymes that are involved in detoxification and also perform antioxidant activity:

- GSTM1 (page 21)
- GSTT1 (page 22)
- GSTP1 (page 23)
ANTIOXIDATION / DETOXIFICATION

MnSOD

AREAS OF ACTIVITY
Antioxidant Activity
Heart Health

GENE SUMMARY
Gene name: Manganese superoxide dismutase (MnSOD), also known as superoxide dismutase 2 (SOD2)
Function: Free radical scavenger, destroys free radicals
Enzyme location: Mitochondria
Variations:
- **T-28C**: Cytosine (C) in place of thymine (T) at position –28, the signal sequence of the gene, which directs the enzyme into the mitochondria
  - Does not actually affect the function of the enzyme
  - Makes transfer of active enzyme into mitochondria less efficient
  - Research into long-term health outcomes of this variation indicates that this reduced transport may decrease the incidence of some illnesses associated with oxidative stress
- **T175C**: Cytosine (C) in place of thymine (T) at position 175 of the gene
  - Disrupts structure of active enzyme, making it less stable

RESULTS INTERPRETATION
No variation at position -28: The MnSOD active enzyme should be intact; however, the distribution of the enzyme is concentrated in the mitochondria. As a result, the enzyme may not be reaching parts of the cell where it is effective. This means that individuals without this variation should increase antioxidants in their diet.

Variation at position -28: A variation at this position means that the enzyme does not become concentrated in the mitochondria. The enzyme’s distributed activity appears to have advantages; it is associated with a decreased incidence of some illnesses linked to oxidative stress. No genotype-based nutritional advice is required.

No variation at position 175: The MnSOD enzyme should be functioning properly; no genotype-based nutritional advice is required.

Variation at position 175: A variation at this position affects the structure and function of the active enzyme, which can lead to a reduction in its efficiency and to reduced antioxidant activity.
# AREAS OF ACTIVITY

Antioxidant Activity  
Heart Health

## GENE SUMMARY

**Gene name:** Copper, zinc superoxide dismutase (SOD3), also known as Cu,Zn SOD  
**Function:** Free radical scavenger, destroys free radicals  
**Enzyme location:** Extracellular, major SOD enzyme in plasma, lymph and synovial fluid; major antioxidant enzyme activity of the walls of blood vessels  
**Variation:**  
- **C760G:** Guanine (G) in place of cytosine (C) at position 760 of the gene  
  - Results in loss of affinity for heparin and increased release from the vascular wall into the plasma  
  - Associated with loss of expression of gene in tissues

## RESULTS INTERPRETATION

**No variation:** The SOD3 enzyme should maintain its affinity for heparin and expression of this antioxidant activity within tissues and blood vessel walls should be within normal levels.  

**Variation:** The SOD3 has a variation that causes it to lose its affinity for heparin and results in the release of the active enzyme from tissues and blood vessels into extracellular fluids at a more rapid rate. Consequently, antioxidant activity at certain locations may be reduced.
DIETARY AND LIFESTYLE FACTORS RELEVANT TO ANTIOXIDANTS

- Fruits and vegetables
- Antioxidants
- Tobacco

Optimal location/ enzyme activity: If the DNA screen indicates that the enzymes produced by antioxidant genes are expected to be in their ideal location and have normal activity, we recommend a diet with a healthy variety of antioxidant-rich fruits and vegetables for optimum health. The GST family of genes also contribute antioxidant activity and are taken into account in antioxidant nutritional advice; an absence of variations in these genes means that they should be functioning effectively.

Lower activity/sub-optimal location: If the DNA screen indicates that the enzymes produced by the antioxidant genes are either not expected to be in their ideal location or have reduced activity, we recommend increased antioxidant consumption to support antioxidant activity in the body, along with avoidance of tobacco smoke. When considering the GST family of genes, we focus on consumption of cruciferous and allium vegetables.

NUTRITIONAL FOCUS

ANTIOXIDANTS

Fruits and vegetables are regarded as the best source of dietary antioxidants; numerous studies have proven that a high intake of fruits and vegetables may reduce the risk of coronary heart disease and certain cancers. An ideal intake includes a minimum of three to four portions of vegetables and at least three portions of fruit daily, including at least one portion of citrus fruit. Apart from fruits and vegetables, common foods particularly rich in various antioxidants are soy products (tofu, tempeh, soya milk, yogurts and cheese), green and black tea, and garlic, as well as red wine, which has beneficial health effects if consumed in moderation.

Vitamins A, C and E, beta carotene and the trace element selenium are important antioxidants.

Food sources

Below are several examples of foods rich in major antioxidants.
- Vitamin A: eggs, milk, cheese, cream, meat, liver, kidney, cod, halibut, fish oil
- Vitamin C: citrus fruit, kiwi fruit, strawberries, tomatoes, alfalfa sprouts, green peppers
- Vitamin E: wheat germ, corn, nuts, seeds, olives, spinach, green leafy vegetables
Rather surprisingly, our bones are not fixed structures; in fact, bone replacement takes place during our entire life span. Our cells work continuously to dissolve old bone and create new bone tissue. From age 30, both men and women start losing bone mass; the loss is particularly marked in women after menopause. According to the latest research, genetic factors are believed to play an important role in determining a person’s overall bone health.

- Variations in “bone health” genes may lead to the formation of altered proteins that can have an effect on bone structure.
- Some alterations in structure may lead to bone loss, particularly if a person’s diet lacks nutrients that are vital for bone health.
- Certain alterations may offer a protective effect that can reduce the amount of bone lost.

Genes associated with bone health:

- VDR (page 29)
- COL1A1 (page 30)
- IL-6 (page 34)
- TNFα (page 35)

Inheritance studies indicate that 60-70% of the variability in bone mineral mass or bone mineral density (BMD) can be accounted for by genetic variations; diet and other environmental factors contribute 30-40% to total phenotypic variance in bone mineral mass or BMD.
**GENE SUMMARY**

**Gene name:** Vitamin D receptor (VDR)

**Function:** Hormone receptor important in vitamin D response, which controls the expression of hormone sensitive genes

**Receptor location:** Cell nuclei

**Variations:**

- **TaqI**
- **BsmI**
- **FokI**

The above variations refer to restriction enzyme recognition sites within the gene.  
*TaqI, BsmI* variations have no known functions; may be linked to a functional SNP.  
*FokI* variation has been associated with lower transcriptional activity.

Variations are thought to influence calcium absorption, which is mediated by vitamin D and its receptor in the intestines; absorption appears to be reduced with the variations.  
*BsmI* allele is associated with lower insulin sensitivity.  
*FokI* allele is associated with higher insulin levels in plasma.

**RESULTS INTERPRETATION**

**No variations in TaqI or FokI:** The VDR gene has none of the variations listed above. Calcium absorption should be normal and no specific corrective measures are recommended. The advice is to consume DRI levels of vitamin D and calcium, but not to exceed these levels.

**No variation in BsmI:** The absence of this variation in the VDR gene is associated with lower bone density and higher fracture rates when dietary calcium is low; we recommend adequate calcium and vitamin D levels in the diet to help build bone mass.

**Variation(s):** The VDR gene has at least one of the variations listed above; we recommend adequate calcium and vitamin D levels to help build bone mass.
**AREA OF ACTIVITY**

Bone Health

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**GENE SUMMARY**

**Gene name:** Collagen type 1 alpha gene (COL1A1)

**Function:** Type I collagen is a member of group I collagen (fibrillar forming collagen); forms the fibrils of tendons, ligaments and bones; in bones, the fibrils are mineralized with calcium hydroxyapatite

**Collagen location:** Skin and bone

**Variation:**

- **SP1 G>T (Mcs1)**

  The variation leads to increased production of collagen a1(I) relative to collagen a2(I); the increased ratio may result in the production of a1(I) homotrimers, which have been associated with reduced bone strength

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**RESULTS INTERPRETATION**

**No variation:** The COL1A1 gene does not have the variation listed above, so type 1A collagen is synthesized as normal.

**Variation:** The COL1A1 gene has a variation that influences the proportion of type I collagen alpha chains produced by bone cells, leading to abnormal mineralization of bone and reduced bone strength. We recommend adequate calcium and vitamin D levels in the diet to help build bone mass. Excess caffeine consumption can accelerate bone loss in individuals with this variation.
The main determinants of peak bone mass are genetic factors, early-life nutrition, diet and exercise. Of the nutritional factors, calcium and milk are the most important contributors to peak bone mass. Some of these factors may interact; for example, a low dietary calcium in addition to an unfavorable VDR gene variation may result in low peak bone mass.

Individuals with certain forms of “bone health” genes have an increased requirement for calcium and vitamin D, which are needed to maintain bone health, slow down bone loss and prevent osteoporosis. It is vital that these people include plenty of calcium-rich foods in their diet, as well as foods rich in vitamin D. However, the recommended levels for calcium and vitamin D should not be exceeded.

Certain variations in “bone health” genes increase the harmful effect of caffeine on bone. It is important that individuals with these variations keep their caffeine consumption to a minimum, below the recommended 300 milligrams a day.

If the person’s “bone health” genes contain variations that reduce bone mineral density and increase the risk of osteoporosis, being underweight adds additional risk. (Bones are strengthened when they have a load to bear, and people who are small-boned or underweight do not have the ongoing benefit of such strengthening.) Underweight people need to ensure that they consume all the necessary nutrients for good bone health and exercise regularly.

For people who are at an increased risk of osteoporosis because they have variations in their “bone health” genes, it is of great importance to incorporate weight-bearing exercises — such as walking, running and aerobics — into their regular exercise program. If bones are already known to be weakened, all exercise should be done under the supervision of a specially trained health professional.
NUTRITIONAL FOCUS

CALCIUM
U.S. government surveys show that only 12 percent of the population consumes a “good” diet, with insufficient intake of calcium-rich dairy products being one of the major shortfalls.

• It is recommended that adult men and women consume 1,300 milligrams of calcium every day.
• One cup of milk contains 300 milligrams of calcium; so do 8 ounces of yogurt.
• One-fourth of a cup of dry milk provides 375 milligrams of calcium.

Food sources
Milk and foods made from milk are the richest dietary sources of calcium. However, calcium is also found in dark green vegetables, nuts, canned salmon and sardines (if you eat the bones) and calcium-fortified foods and beverages.

VITAMIN D
Vitamin D maintains normal blood levels of calcium and phosphorus and aids in the absorption of calcium, helping to form strong bones. This vitamin is found in certain foods, but it can also be created in the skin after exposure to ultraviolet (UV) rays from the sun.

• It is recommended that adult men and women consume 5 micrograms (200 IU) of vitamin D every day.
• The richest source of vitamin D is milk, which in the United States is fortified with 10 micrograms (400 IU) of vitamin D per quart.
• The body manufactures vitamin D when exposed to sunshine; 10 to 15 minutes of sunshine three times a week is adequate to ensure sufficient production of vitamin D.

Food sources
Fortified foods are the major dietary sources of vitamin D. The richest natural source is milk, followed by fish oils and fatty fish.

CAFFEINE
Excessive caffeine can be bad for bone health because it can prevent the absorption of vitamins and minerals, including the ones that build up bone, such as calcium.

• According to the U.S. Department of Agriculture and the National Coffee Association, each cup (6 oz.) of brewed coffee contains 103 mg of caffeine. Current recommendations are not to exceed 300 mg of caffeine a day.
• Caffeine is an ingredient in more than 1,000 over-the-counter and prescription drugs.
• Percolated, drip coffee has the highest concentration of caffeine (115 mg – 135 mg per cup) as the coffee grounds remain in contact with the water for a longer time.
**BIOCHEMICAL FOCUS**

Inflammation is a normal immune response and an essential step in tissue healing. For example, the redness and swelling around an inflamed wound or an infected area are signs that the body's immune system is busy repairing the damage.

The release of cytokines and other inflammatory substances involved in the repair is controlled by genes that regulate inflammation. Normally, when the need for healing disappears, the expression of these genes “shuts down” and inflammation subsides. However, the inflammatory response can get out of hand, triggering reactions that are too strong or inappropriate in their timing.

Recent research has shown that an increasing number of common disorders, such as heart disease, arthritis and inflammatory bowel disease, may be affected by inflammatory processes in the body.

People with certain gene variations produce altered proteins that may hinder inflammatory processes from running smoothly, either by producing increased amounts of inflammatory substances or releasing them when they are not required.

Genes involved in inflammation:

- IL-6 (page 34)
- TNFα (page 35)
AREAS OF ACTIVITY
- Inflammation
- Heart Health
- Bone Health

GENE SUMMARY
- **Gene name:** Interkeukin-6 (IL-6)
- **Function:** Pro-inflammatory cytokine that increases the levels of inflammation
- **Cytokine location:** All tissues

**Variations:**
- **G-634C:** Cytosine (C) in place of guanine (G) at position -634 of the gene
- **G-174C:** Cytosine (C) in place of guanine (G) at position -174 of the gene
  - Variations increase the expression of the IL-6 gene

RESULTS INTERPRETATION
- **No variation:** The IL-6 gene has no variations, so the cytokine it produces should be present at normal levels.

**Variation(s):** The IL-6 gene has variations that increase the activity levels of the cytokine produced by the gene in body tissues; the increase in activity can lead to excess inflammation.
AREAS OF ACTIVITY
- Inflammation
- Heart Health
- Bone Health

GENE SUMMARY
- **Gene name**: Tumor necrosis factor alpha (TNFα)
- **Function**: Pro-inflammatory cytokine that increases the levels of inflammation
- **Cytokine location**: All tissues
- **Variation**: 
  - **G-308A**: Adenine (A) in place of guanine (G) at position -308 of the gene
    - The A allele is associated with increase in activity of the gene

RESULTS INTERPRETATION
- **No variation**: The TNFα gene has no variations, so the cytokine it produces should be present at normal levels.
- **Variation**: The TNFα gene has variations that increase the activity levels of the cytokine produced by the gene in body tissues; this increase in activity can lead to excess inflammation.
DIETARY FACTORS RELEVANT TO INFLAMMATION

- Antioxidants
- Omega-3 fatty acids

**Normal cytokine activity:** We recommend a healthy variety of foods rich in antioxidants and omega-3 fatty acids.

**Increased cytokine activity:** We recommend increased consumption of foods rich in antioxidants and omega-3 fatty acids. Our advice is based on recent medical research showing that certain foods, such as fish oils and foods with high levels of antioxidants, can help avert harmful inflammatory processes.

NUTRITIONAL FOCUS

**OMEGA-3 FATTY ACIDS**

Omega-3 fatty acids are unsaturated fats found in great amounts in fish oil. A diet rich in omega-3 fatty acids may play a role in reducing the risk of coronary heart disease and stroke. Fish oil has also been shown to have an anti-inflammatory effect in many laboratory studies. It appears to reduce the symptoms of inflammation associated with rheumatoid arthritis, Crohn’s disease and psoriasis. Omega-3 fatty acids are also important for the development and proper functioning of the brain and nervous system.

**Food sources**

Oily fish, such as herring, salmon, mackerel, trout, anchovy and sardines, are the richest sources of omega-3 fatty acids. Other fish — cod, plaice, haddock and canned tuna — also contain these fatty acids but in smaller amounts. Additional minor sources of omega-3 fatty acids are flaxseed oil, canola oil, soybean oil and certain nuts.
INSULIN SENSITIVITY

BIOCHEMICAL FOCUS

The insulin resistance syndrome is a term used to describe a combination of medical illnesses that have a common link — abnormalities in how the body uses insulin to metabolize sugars. Normally, food is absorbed into the bloodstream in the form of sugars such as glucose, fats and other basic substances. The increase in glucose in the bloodstream signals the pancreas to release the hormone insulin. This hormone attaches to cells (via the insulin receptor) leading to cellular uptake of glucose (by the liver, skeletal muscle and fat cells) from the bloodstream for storage as glycogen or fat.

In insulin resistance, the body's cells have a diminished ability to respond to the action of the insulin hormone. In other words, there is a loss of insulin sensitivity. To compensate for the loss of sensitivity, the pancreas secretes more insulin. Therefore, people with this syndrome have both reduced sensitivity to insulin and high levels of insulin in the blood.

Physicians suspect that insulin sensitivity may play an important role in some of the most common disorders — including type 2 diabetes, high blood pressure, heart disease and disrupted fat metabolism. Researchers have managed to link insulin sensitivity to at least four different genes that play diverse roles in the body, not necessarily directly related to insulin.

Genes associated with insulin sensitivity:

- ACE (page 38)
- PPARγ2 (page 39)
- VDR (page 29)
- TNFα (page 35)

Variations in genes associated with insulin sensitivity can have a variety of effects on many different processes in the body:

- Some variations may affect the ratio of “bad” (LDL) and “good” (HDL) cholesterol, as well as the levels of triglycerides in the bloodstream
- Some variations may alter fat metabolism
- Certain variations may alter the production of inflammatory substances. People who have variations in this gene category don’t necessarily have insulin resistance. The latest scientific research has shown that sensitivity to insulin can be significantly affected by diet and lifestyle.
AREAS OF ACTIVITY

Insulin Sensitivity
Heart Health

GENE SUMMARY

Gene name: Angiotensin I converting enzyme (ACE)

Function: Converts angiotensin I to angiotensin II, resulting in increased vasoconstrictor activity; also able to inactivate bradykinin, a potent vasodilator; plays an important part in blood pressure regulation and electrolyte balance

Enzyme location: Widely distributed membrane protein

Variation:

- Del (D): Deletion in intron 16

  - The ACE D/D genotype (both alleles have the Del(D) gene variation) has been linked to increased tissue ACE expression at the protein level

RESULTS INTERPRETATION

No variation: The sequence in intron 16 has not been deleted. People with this version of the gene experience enhanced improvement in insulin sensitivity as a result of exercise.

Variation: The ACE gene has at least one allele with a deletion in intron 16. The deletion can alter the levels of the enzyme in the plasma, which, in turn, can have many metabolic effects, including a reduction in insulin sensitivity, an increase in blood pressure and alterations in the levels of total cholesterol and plasma triglycerides. Individuals with this gene variation are advised to reduce consumption of refined and simple carbohydrates, to exercise regularly and to aim at maintaining a healthy body mass index, or BMI.
### AREA OF ACTIVITY

Insulin Sensitivity

### GENE SUMMARY

**Gene name:** Peroxisome proliferator-activated receptor gamma (PPARγ2)

**Function:** Transcription factor activated by fatty acids with a major role in glucose and lipid metabolism

**Transcription factor location:** Highest in adipose tissue, also found in skeletal muscle, spleen, heart and liver

**Variation:**

- **Pro12Ala:** Alanine amino acid in place of a proline at position 12 of the protein
  - Reduced promoter activation
  - Associated with lower body mass index, improved insulin sensitivity
  - Associated with higher HDL levels

### RESULTS INTERPRETATION

**No variation:** The PPARγ2 gene has no variation, which means that the transcription factor has no reduction in promoter activity; however, this form of the gene has been associated with increased LDL and reduced insulin sensitivity. Individuals with this form of the gene are advised to reduce consumption of refined and simple carbohydrates, to exercise regularly and to aim at maintaining a healthy body mass index, or BMI.

**Variation:** The PPARγ2 gene has a variation at position 12 of the protein, which means that the transcription factor may have a reduction in promoter activity; but this form of the gene has been associated with a reduced loss of insulin sensitivity and with higher levels of HDL, so there may be some beneficial effects incurred by this form of the gene.
INSULIN SENSITIVITY

NUTRITIONAL AND LIFESTYLE ADVICE

DIETARY AND LIFESTYLE FACTORS RELEVANT TO INSULIN SENSITIVITY

- Refined carbohydrates
- Body weight
- Physical activity

Individuals with forms of the genes associated with loss of insulin sensitivity are advised to reduce consumption of simple sugars as much as possible and to replace refined carbohydrates with unrefined complex carbohydrates in their diet. All individuals with a BMI greater than 25 are advised to reduce their weight to normal levels, due to the increased risk of developing insulin resistance associated with excess body weight. Exercise is also recommended to increase insulin sensitivity. Oligomeric proanthocyanidins (OPCs) have weak angiotension converting enzyme-inhibiting activity and the ingestion of vegetables and fruits high in oligomeric proanthocyanadins, as well as dietary supplements containing OPCs is recommended.

NUTRITIONAL FOCUS

REFINED CARBOHYDRATES

There are two types of carbohydrates: simple carbohydrates, also known as sugars, include table, or cane, sugar and sugars found in fruit and honey; complex carbohydrates, often referred to as starch, are found in such foods as whole grains, potatoes and rice, as well as in bread, pasta and other flour products.

Refined carbohydrates are simple or complex carbohydrates that have been processed to remove a part of the original grain, usually the external husk that contains two thirds of the nutritional content.

A diet high in refined carbohydrates can trigger elevated triglyceride levels, reduce the levels of “good” cholesterol and promote the accumulation of fat.

Recent medical research has also linked diets high in refined carbohydrates to reduced insulin sensitivity and cardiovascular disease.

Food sources

Ideal choices for complex carbohydrates:
- brown rice • oatmeal • whole oats • bulgur (cracked wheat) • popcorn • whole rye
- graham flour • pearl barley • whole wheat • whole grain corn

Sources of sugar and other refined simple carbohydrates:
- cookies • brown and white cane sugar • cakes and pastries • chocolate • ice cream
- soft drinks and cordials • sweets and snack bars • jams and preserves • jellies

Foods that contain refined complex carbohydrates:
- biscuits • cakes and pastries • pizza • sugary processed breakfast cereals • white bread
- white flour • white pasta • white rice
Your *Personal Lifestyle Report* highlights the importance of certain vitamins and minerals for your health. In many cases we advise you to eat foods that contain these nutrients. The table below is a quick reference guide that will help you choose the right foods to achieve this goal. It also lists the nutritional ingredients included in the personal supplement formula.

<table>
<thead>
<tr>
<th>NUTRACEUTICAL</th>
<th>FUNCTION*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-lipoic acid</td>
<td>A potent antioxidant that has been shown to enhance glucose uptake by muscles and promote normal glucose oxidation. Rich sources include yeast and liver.</td>
</tr>
<tr>
<td>Lutein</td>
<td>Lutein is a powerful antioxidant that belongs to the carotenoid family. It has been shown to promote healthy macular density during the aging process. Rich sources include dark green and yellow vegetables.</td>
</tr>
<tr>
<td>Lycopene</td>
<td>Lycopene is another powerful antioxidant of the carotenoid family. It has been shown to help support the function of the prostate gland and the cardiovascular system. Rich sources include tomatoes and watermelon.</td>
</tr>
<tr>
<td>Bilberry fruit extract</td>
<td>Contains powerful antioxidants known as anthocyanidins that have been shown to help support eye health and cardiovascular health.</td>
</tr>
<tr>
<td>Garlic extract</td>
<td>Numerous studies have shown this universally known herb to have beneficial effects on the cardiovascular system.</td>
</tr>
<tr>
<td>Ginkgo biloba leaf extract</td>
<td>A commonly used Chinese herb known for its enhancement of cognitive activity. It contains many polyphenols known as flavonoids and terpenes which are effective free radical neutralizers. Clinical studies have shown that Ginkgo biloba extracts promote improved blood flow in arteries and capillaries, allowing for more efficient uptake of nutrients and oxygen as well as the removal of waste products.</td>
</tr>
<tr>
<td>Green tea leaf extract</td>
<td>One of nature's potent antioxidant protectors. Numerous studies show that green tea and its components, known as polyphenols (including catechin, epicatechin and epigallocatechin gallate), support immune and cardiovascular health, liver function, detoxification and thermogenesis.</td>
</tr>
<tr>
<td>Hawthorne extract</td>
<td>A popular herb in Western Europe, where it is used to support a healthy cardiovascular system. It is also rich in antioxidant flavonoids.</td>
</tr>
<tr>
<td>Silymarin</td>
<td>A powerful herb widely used in Western Europe as a liver tonic, detoxifier and protector. It is a potent free radical scavenger but can also stimulate protein synthesis for the repair and regeneration of liver cells.</td>
</tr>
<tr>
<td>Fish oils</td>
<td>Fish oils have been clinically demonstrated to provide a host of benefits that successfully promote cardiovascular health. Clinical studies show that three grams of EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) daily are required to produce significant benefit.</td>
</tr>
<tr>
<td>Tocotrienol complex</td>
<td>Tocotrienols, members of the vitamin E family, have been shown to stimulate the degradation of HMG-CoA reductase (an enzyme crucial in the production of cholesterol) and assist in limiting cholesterol synthesis. They also reduce oxidative damage to LDL cholesterol and promote healthy blood flow in the arteries.</td>
</tr>
<tr>
<td>Policosanol</td>
<td>Policosanol is isolated from rice bran. Recent evidence suggests that policosanol supports healthy cholesterol levels by affecting the production of HMG-CoA reductase.</td>
</tr>
</tbody>
</table>

* These statements have not been evaluated by the Food and Drug Administration. The nutraceuticals products in your personal supplement formula are not intended to diagnose, treat, cure, or prevent any disease.
<table>
<thead>
<tr>
<th>NUTRACEUTICAL</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ginseng, American</td>
<td>An herb shown to help maintain healthy blood glucose levels by decreasing the rate of carbohydrate absorption and improving the rate of insulin secretion.</td>
</tr>
<tr>
<td>Glucomannan</td>
<td>A soluble dietary fiber shown to promote healthy blood sugar levels by delaying stomach emptying and promoting a more gradual absorption of blood sugar from the intestines.</td>
</tr>
<tr>
<td>Gymnema sylvestre</td>
<td>An herb that has been shown to promote insulin secretion, possibly through the regeneration of pancreatic beta-cells, and the reduction of sweets cravings.</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mineral shown to improve insulin production and function.</td>
</tr>
<tr>
<td>Zinc</td>
<td>Mineral shown to improve insulin production and function.</td>
</tr>
<tr>
<td>Chromium</td>
<td>A mineral that works with insulin as the glucose tolerance factor (GTF) in the uptake and metabolism of glucose by the cells, increasing cell sensitivity to insulin and thereby helping maintain healthy blood sugar levels.</td>
</tr>
<tr>
<td>Vanadium</td>
<td>A trace mineral that plays a role in transport of glucose and improves glucose metabolism with regard to glycolysis (production of energy from food) and glycogen synthesis (complex sugar storage).</td>
</tr>
<tr>
<td>Biotin</td>
<td>Biotin has been found to improve overall blood sugar levels and reduce the risk of insulin resistance.</td>
</tr>
<tr>
<td>Glucosamine</td>
<td>An amino sugar naturally produced by the body and a key component of cartilage. Glucosamine helps stimulate healthy joint function and the production of synovial fluid, which lubricates joints and assists in the regeneration of cartilage.</td>
</tr>
<tr>
<td>Vitamin D3</td>
<td>Vitamin D3 promotes proper bone mineralization, as well as normal regulation (or maintenance) of cell growth and immune function. Vitamin D3 aids in the absorption of calcium and phosphate, helping to form and maintain strong bones.</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>A potent antioxidant that is water-soluble and is located mainly in the cytoplasm where it scavenges and neutralizes oxygen radicals and nitrite. It is also an important co-factor for the enzyme that cross-links and strengthens the protein strands forming collagen.</td>
</tr>
<tr>
<td>Manganese</td>
<td>Assists in the manufacture of mucopolysaccharides, one of the main components of connective tissue.</td>
</tr>
<tr>
<td>Boswellia resin</td>
<td>Contains active boswellic acids, which demonstrate anti-inflammatory activity by inhibiting 5-lipoxygenase, a pro-inflammatory enzyme. Boswellic acids are also analgesic because they significantly reduce the total white blood cell count in the joint fluid, lowering the concentrations of inflammatory mediators, and help restore the structural integrity of blood vessels.</td>
</tr>
<tr>
<td>Scutellaria root</td>
<td>Derived from the Scutellaria baicalensis plant. Provides anti-inflammatory activity by inhibiting cyclooxygenase-2. COX-2 is an enzyme that promotes the synthesis and release of inflammatory mediators at sites of inflammation.</td>
</tr>
<tr>
<td>Hops extract</td>
<td>Contains humulone which suppresses COX-2 activity as well as inhibits bone resorption.</td>
</tr>
<tr>
<td>Oleanolic acid</td>
<td>A plant-derived compound that inhibits the activity of the COX-2 enzyme.</td>
</tr>
<tr>
<td>NUTRACEUTICAL</td>
<td>FUNCTION</td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
</tr>
<tr>
<td>Vitamin A (as Beta Carotene)</td>
<td>A potent fat-soluble antioxidant that is found in various cell membranes. When it is metabolized in the liver to vitamin A, it becomes important in the development and maintenance of the skin and immune system. It is also critically important in normal eye function, particularly night vision.</td>
</tr>
<tr>
<td>Vitamin E (d-alpha-tocopheryl succinate)</td>
<td>A fat-soluble antioxidant derived from grains. It is found in cell membranes where it protects against oxygen radicals and lipid peroxides. When vitamin E is dissolved in low-density lipoproteins (LDL), it also protects against the oxidation of cholesterol.</td>
</tr>
<tr>
<td>Selenium</td>
<td>A metal that must be incorporated into glutathione peroxidase before it becomes an antioxidant. Glutathione peroxidase is important in the detoxification of hydroperoxides and helps to restore glutathione as an antioxidant.</td>
</tr>
<tr>
<td>Glutathione</td>
<td>A potent antioxidant tri-peptide that also plays an essential role in protecting the cell from injury by binding to foreign compounds and preventing their reaction with proteins and DNA.</td>
</tr>
<tr>
<td>Grape seed extract</td>
<td>A rich source of oligomeric proanthocyanidins (OPCs). OPCs are bioflavonoids (or complex organic plant compounds) found in fruits, vegetables and certain tree barks. OPCs are powerful antioxidants.</td>
</tr>
<tr>
<td>Red wine extract</td>
<td>Contains flavonoids called leucocyanidins from the skin of red grapes. Leucocyanidins are bioflavonoids with powerful antioxidant properties crucial to their role in supporting the circulatory system.</td>
</tr>
<tr>
<td>Citrus extract bioflavonoids</td>
<td>Resists histamine production and release.</td>
</tr>
<tr>
<td>Copper (from Glucosatrin®)</td>
<td>Copper is an essential trace mineral. It is widely distributed in foods particularly in organ meats, seafood, nuts, seeds, wheat bran cereals, grain products, and cocoa products. Copper is needed for many functions of the body, one of which is synthesis of collagen.</td>
</tr>
<tr>
<td>B Vitamins (from TriActive®)</td>
<td>Studies suggest that folic acid, vitamin B-12 and vitamin B-6 are critical in the normal, healthy conversion of homocysteine into the essential, non-toxic amino acid methionine. One study showed that folic acid, B-12 and B-6 at moderate doses reduced homocysteine levels by 50% over an eight week period. B vitamins have also been shown to aid in red blood cell formation, improved circulation and the maintenance of healthy arteries.</td>
</tr>
<tr>
<td>Folate</td>
<td>Studies suggest that folic acid, vitamin B-12 and vitamin B-6 are critical in the normal, healthy conversion of homocysteine into the essential, non-toxic amino acid methionine. One study showed that folic acid, B-12 and B-6 at moderate doses reduced homocysteine levels by 50% over an eight week period.</td>
</tr>
<tr>
<td>Beta-Sitosterol</td>
<td>A close relative of cholesterol, Beta-Sitosterol competes with cholesterol for absorption in the small intestine, thereby leading to reduced cholesterol absorption.</td>
</tr>
<tr>
<td>Cassia nomame</td>
<td>Supports healthy fat absorption levels by inhibiting intestinal lipases enzymes that degrade fat.</td>
</tr>
<tr>
<td>Guggulsterones</td>
<td>Guggul extract maintains healthy cholesterol levels by acting in the intestine to promote excretion of bile acids from the body. Guggul extract has also been shown to maintain healthy bloodflow.</td>
</tr>
</tbody>
</table>
nutraMetrix™ is a program designed exclusively for health professionals, and specializes in the development and distribution of exceptional quality nutrition and wellness products. nutraMetrix and Sciona, Inc. have teamed up to offer a cutting edge, nutrition-based gene analysis with customized nutritional supplementation and personalized lifestyle advice.*

Sciona, Inc., a private international biotechnology company, is a world leader in the area of nutrigenetics. Sciona develops DNA screens for common gene variants that affect an individual’s metabolism of food, medications and environmental toxins. These genetic screens serve as the basis for providing personalized, science-based health and lifestyle advice to patients.

The Gene SNP DNA Screening Analysis uses Sciona’s Genostic Rules Engine™, a proprietary, patent-pending software program that uses complex mathematical algorithms to produce personalized health recommendations based on an individual’s genetic profile, diet and lifestyle. Sciona currently screens 19 genes for 23 genetic variations associated with nutrition and health.

Sciona’s team of geneticists, biologists, biochemists, and nutritionists include the following key leaders: Dr. Rosalynn Gill-Garrison, Sciona’s Chief Scientific Officer, led the research and development efforts for Sciona from the initial selection of genes through the complete development of the pipeline. After receiving her Ph.D. in biological science at the University of Texas-Austin, she worked at M.D. Anderson Cancer Center on DNA damaging effects of polycyclic aromatic hydrocarbons in animal and bacterial models. As a researcher in the department of oncology, University College London, she investigated DNA damage and the repair of chemotherapeutic agents.

Dr. Keith Grimaldi, Sciona’s Director of Science, Europe, received his Ph.D. from the University of Cambridge. He conducted research in the biochemistry department at the University College London (UCL) on neural and cardiac developmental gene expression. In 1992, he led the group developing novel PCR based methods for detecting DNA damage and repair at the sub-gene and individual nucleotide level.

Sciona received ISO 9001 certification from the international certification body Lloyd’s Register Quality Assurance Ltd (LRQA) in October 2002 for “The development and provision of genotyping services and products based on genetic and lifestyle data.” This certification confirms that Sciona’s quality management system meets the requirements of an international standard. Sciona also upholds rigorous laboratory standards and the company’s laboratory is CLIA (Clinical Laboratory Improvement Amendments) certified. In addition, Sciona has developed the strictest policies and procedures to protect an individual’s privacy.

As a leading biotechnology company specializing in nutrigenetics, Sciona, with nutraMetrix™ are committed to providing your patients with the highest quality genetic testing standards, services and solutions.

* NutraMetrix and customized nutritional supplementation are not available in Canada.
For further information or advice on our service, please contact us at:
1-800-211-1202, extension 2067

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National Dietetic Associations
American Dietetic Association (ADA)
Tel: 1-800-877-1600
www.eatright.org

HEALTH AND RESEARCH ORGANIZATIONS

U.S. NATIONAL INSTITUTES OF HEALTH (NIH)
Tel: 301-496-4000
www.nih.gov

U.S. NATIONAL HUMAN GENOME RESEARCH INSTITUTE
Tel: 301-402-0911
www.nhgri.nih.gov

HEALTHFINDER®
www.healthfinder.gov

INTERNATIONAL FOOD INFORMATION COUNCIL FOUNDATION
http://ific.org/ific/

US DEPARTMENT OF AGRICULTURE FOOD AND NUTRITION INFORMATION CENTER
http://www.nal.usda.gov/fnic/databases.html

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