

Compass

YOUR GENETIC
COMPASS

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Your Genetic Compass[®]

HOW GENOMIC SCIENCES HAVE USHERED IN THE NEW ERA OF PERSONALIZED NUTRITION & SKIN CARE

Millions of Americans are taking food supplements and applying skin care products in a never ending battle to stay & look younger, feel better, and age gracefully. They often choose products based on what they read, see and hear. Only a small percentage actually receive advice from their health care practitioner. For most, this guessing game leaves people uncertain, confused and often ingesting supplements and applying topical creams that are not specific to their individual needs.

With over half of the population of the United States taking nutritional supplements and using topical skin care products, the vast majority are uncertain as to what they're using and why. Many times this shot-gun approach leads to the over (or under) consumption of vitamins and minerals and active ingredients. For the most part, the very nutrients the body and skin needs never make it into the shopping cart.

HOW IS ONE TO CHOOSE FROM THE HUNDREDS OF NUTRITIONAL SUPPLEMENTS AND SKIN CARE PRODUCTS?

In the last sixty years, nutritional and dermatological sciences have pushed forward and made tremendous breakthroughs. The era of 'one size fits all' is coming to an end.

In a book published in the 1950's entitled Biochemical Individuality, University of Texas

biochemist, Roger Williams argued:

"Each of us has a unique chemical makeup that induces various responses to foods, drugs and the environment. The reason we are unique is that our genes are different."

New discoveries about our unique chemical makeup has helped breathe life in to the fields of Pharmacogenetics, Nutrigenetics and Dermagenetics. Pharmacogenetics is the science of combining pharmacology and genomic capabilities.

More than 100,000 people die each year as a result of adverse responses to medications. Annually 2.2 million people experience serious reactions while others don't respond at all. Nutrigenetics and Dermagenetics also examines the individual's unique genetic make-up to determine which vitamins, minerals, nutrients and active ingredients are necessary to support optimal health.

We have mapped our genetic structure and we are unraveling the working of human biology. This has enormous implications including a new understanding of what specific nutrients best serve our unique genetic, physical and bio-chemical makeup. Nutrients along with certain lifestyle modifications, can help support our strengths and balance our weaknesses.

Our genes may hold the answer to determining our well being.

Genomics

GENOMICS AS A TOOL FOR WELLNESS

Genomics, as a segment of the healthcare industry, can potentially illuminate the path to better health. With rising health care costs and the cost of pharmaceutical medications soaring, more people are taking their personal wellness into their own hands. Not only are they seeking alternative therapies for their ailments, but they are also thinking more about prevention. However, the myriad messages about how to stay and feel healthy can be overwhelming. Often, there is no clear-cut answer as to how to stay and feel healthy.

We now have the opportunity to catch a glimpse of our potential health futures by utilizing DNA testing.

Not only will we be able to determine which areas of our own health we should focus on, but also gain some direction as to which nutritional and skin care products will best serve our individual needs and best support healthy aging.

“By examining a person’s DNA, which can be taken from the mouth with just a small swab or scraping device. It is already possible to predict the probability that a person will develop certain diseases. And soon, based on the recently completed mapping of the human genome, it should be possible to predict every forthcoming disease or condition not caused by external (i.e. diet and exercise) factors.”

Best-selling author, economist and futurist Paul Zane Pilzer, in his book *The Next Trillion*

“Inadequate intake or subtle deficiencies in several vitamins are risk factors for chronic diseases such as cardiovascular disease, cancer and osteoporosis”

Kathleen M. Fairfield, MD, Dr.PH & Robert Fletcher MD MS (Published in the Journal of American Medical Association, June 19, 2002)

Genomics

GENOMICS THE HUMAN BOOK OF LIFE

Genome science began formally in 1990 with the establishment of the Human Genome Project. This enormous undertaking is the combined effort between the United States Department of Energy and the National Institutes of Health. The project was based on the mission of pursuing a greater understanding of individual health risks. The Human Genome Project goals were to generate a high-quality reference sequence and identify all human genes, as well as enhance computational resources to support future research and commercial applications.

There are approximately 35,000 genes in the Human Genome, however, functions for more than half of discovered genes are unknown. Genes are made up of DNA base pairs arranged in a double-helix formation. Our individual uniqueness lies in the small differences of bases that can exist where single base DNA differences (SNPs) occur in humans. The SNP information promises to revolutionize the process of finding gene locations for disease-associated sequences. Finding the DNA sequences underlying such common diseases as cardiovascular disease, diabetes, arthritis and cancer is being aided by the human SNP maps. These genes and SNPs provide focused targets for the development of effective new therapies.

OUR PHYSICAL UNIQUENESS IS LARGELY DUE TO SNPS

The DNA between any two humans is about 99.1% identical. Except for identical twins, variations in just a small fraction of our DNA account for the major ways in which one human is different from another. These small variations in DNA are called SNPs, which stands for 'single nucleotide polymorphisms' or (SNPs, pronounced 'snips'). Scientists have identified about 1.4 million locations where single-base DNA differences occur in humans. This information is helping revolutionize the process of finding chromosomal locations for disease-associated sequences.



HOW THE KNOWLEDGE OF SNPs CAN BE USED TO IMPROVE OUR LIVES

The awesome feat of compiling the Book of Life was accomplished by technologies that spelled out the entire human DNA genome (made up of the chemical base pairs symbolized by the letters A,G,C and T).

We can think of DNA as a string of 3 billion of these letters, in which the sequence of letters follows a precise order. If we compare the DNA sequence of any two people, we sometimes see variation in a letter. This letter variation is a SNP. For example, at a specific position along the string of DNA, one person may have the letter “A “ whereas another person may have the letter “T”. These variations (SNPs) occur, on average, once in every 2,000 letters of the DNA.

Researcher Bruce Ames Ph.D., from the Department of Cell and Molecular Biology at University of California, Berkeley wrote in his review article in the Proceedings of the National Academy of the Sciences: *Cancer Prevention and Diet: Help from Single Nucleotide Polymorphism:*

“...Understanding causality is the prerequisite for effective action. Causality can be established by combining epidemiology, a key tool for identifying major risk factors, with research on mechanism. It is becoming apparent that a better understanding of nutrition and nutrition-genetic interaction will be one important consequence of the genomic revolution.”

► **Pharmacogenetics:** SNPs may explain why people react differently to different types or amounts of medicines. For example, patients can react differently to the same heart medication, such as a “beta-blocker.” Since SNPs can affect the structure and function of proteins and enzymes, they can influence how efficiently a medicine is absorbed and metabolized. A major goal of the pharmacogenetics industry is to use the science of SNPs to help determine which drugs are most suitable for any given patient.

New Science

THE NEW SCIENCE OF NUTRAGENETICS AND DERMAGENETICS

Nutrigenetics and Dermagenetics are a combination of the sciences of genetics, nutrition and skin care that reveal personalized information regarding an individual's status and provides the basis for selecting a dietary, nutritional and skin care program best suited to achieving the healthiest and longest life possible.

- ▶ Nutrigenetics and Dermagenetics use SNP testing to identify areas of an individual's genetic make-up that may be functioning less than optimally.
- ▶ Nutrigenetics and Dermagenetics can help guide individuals in choosing the optimal combination of nutrients and vitamins and topical active ingredients matched to their unique genetic make-up.

For the first time, this revolutionary SNP science is making it possible to personalize and tailor health and skin care products. How is this done?

GENETICALLY GUIDED PERSONALIZATION OF NUTRIENT AND SKIN CARE FORMULATIONS.

The Nutrigenetic and Dermagenetic SNP assessments examine a variety of genes which are responsible for making proteins that play a very important role in our overall health. These include oxidative stress, heart

and circulatory health, immune health, bone health, pulmonary health, eye/vision health, defense against environmental pollutants, collagen breakdown, photoaging, skin slacking & wrinkling and mild irritation.

KEY POINT *If the Nutrigenetic and Dermagenetic SNP test predicts that you might not be as efficient as possible in any given health area, you may be able to do something about it. For every SNP tested, there are potentially compensating and enhancing nutrients that can put you on a better path toward optimal health.*

KEY POINT *Due to our busy lifestyles and environmental exposure, most people don't have enough time in everyday life for 5-6 servings of fruits and vegetables as well as a total skin care regime. It is logical then that most everyone should use a basic multivitamin and mineral formulation as well as base topical skin care formulation to cover the major areas of general nutrition and skin fitness, and add additional ingredients based upon your personal genetic SNP test results.*



This means that now you can use a more scientific approach to being proactive and doing your best to prevent health challenges that might otherwise occur later in life. We all know that good nutrition can be important in helping prevent cancer, heart disease in defending against other diseases.

Again, Researcher Bruce Ames Ph.D., in *Cancer Prevention and Diet: [Help from Single Nucleotide Polymorphisms](#)*, wrote:

“Optimizing micronutrient intake (through better diets, fortification of foods, or multivitamin-mineral pills) can have a major impact on public health at low cost. Other micronutrients are likely to be added to the list of those whose deficiency causes DNA damage in the coming years. Tuning-up human metabolism, which varies with genetic constitution and changes with age, is likely to be a major way to minimize DNA damage, improve health, and prolong healthy lifespan, and a drop of blood [a cheek swab] or a gene chip could be part of the way to accomplish this.”

Further:

“It is already apparent that there are many polymorphisms that influence risk in heart disease. Single nucleotide polymorphisms provide a powerful molecular tool for investigating the role of nutrition in human health and disease, and their integration into clinical, metabolic, and epidemiologic studies can contribute enormously to the definition of optimal diets.”

THE IMPACT OF GENETIC SCIENCE REACHES INTO DISEASE PREVENTION.

The information in the Book of Life is revolutionizing clinical medicine as well as preventive health and skin care programs including Nutrigenetics and Dermagenetics. SNPs not only account for many of our physical differences, but they also account for our biochemical differences. Being ‘more or less’ efficient in one biochemical pathway, may have long term consequences related to how well we can fight disease, or even how rapidly we age. Through Nutrigenetics and Dermagenetics, people are able to better influence their own health outcomes.

Oxidation

APPLICATIONS OF SNP TESTING: OXIDATION — THE PARADOX OF LIFE

We are exposed every moment of our lives to highly reactive and toxic molecules, called reactive oxygen species (ROS) that damage our bodies. From the moment we are conceived to the day we die, oxidation of critical proteins, lipids, nucleic acids and sugars occurs in every cell in our bodies. One strongly supported theory of aging (and of many age-related diseases) is that uncorrected oxidative events result in the deterioration of cellular function.

KEY POINT *Over time the accumulation of oxidative events harms cell machinery and DNA as well as damaging critical proteins and lipids. This creates sub-optimal function of organs, which leads to aging in general as well as to specific vulnerability to age-related diseases.*

There are several sources of ROS. One such source of ROS occurs while burning sugar to generate energy. Indeed, it is estimated that 3 to 5% of all sugar that we consume is converted to ROS in our bodies. In other words, to live – we must burn – and this burning of sugar causes damage. Our immune system produces many ROS in the process of fighting and destroying pathogens. Free radicals are a normal part of our inner environment.

Lifestyle also affects our exposure to environmental agents that cause production of ROS. For example, cigarette smoke contains

many substances that dramatically increase ROS and exposure to sunlight increases oxidation of the skin. On a daily basis we are inadvertently exposed to many environmental substances which increase oxidation in the body.

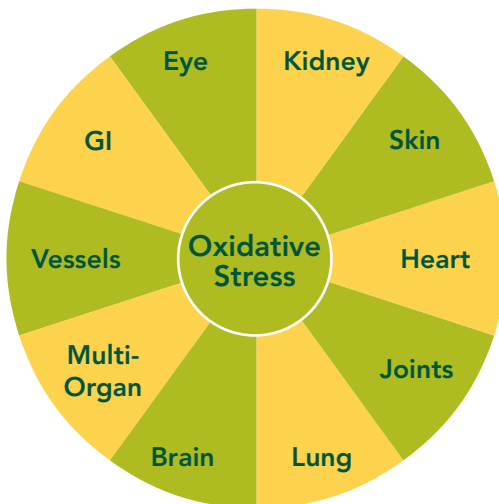
The body's defenses against oxidation and ROS include several important enzymes and proteins that increase the rate of beneficial chemical reactions. The major function of these antioxidant enzymes is to convert ROS to non-toxic substances. One such enzyme, superoxide dismutase (SOD), when made in a less than optimal form has been linked to increased risk for macular degeneration, a condition in which the eye breaks down. In this case, the inability of 'less than optimal SOD' to completely neutralize ROS in the eye may expose our eyes, over time to, greater damage. Other antioxidant enzymes as well as antioxidant vitamins and minerals are also associated with effective removal of ROS. Therefore, with a 'less than optimal SOD', it is possible to compensate with other antioxidants supplied through the diet. The effective functioning of an antioxidant defense system is critical to countering the aging process and for the prevention of related degenerative conditions. Indeed, in animal models, enhanced activity of many of these antioxidant enzymes is associated with increased life span.



The only source of other important anti-oxidant compounds is from our diet or from supplementation or applications of topical skin care products. Many of these vitamins and active ingredients are antioxidants that play a critical role in the protection of the body from ROS. As essential vitamins and active ingredients, there is a need for a daily ingestion and topical application of these antioxidants to help maintain life and to protect the body from the effects of ROS. Therefore a minimal daily antioxidant intake is important to help counter the never-ending production of ROS.

KEY POINT *We may be able to help slow the aging process by increasing the intake and topical application of antioxidant vitamins and active ingredients? There are now numerous published reports showing that in animal models, supplementation of the diet and topical application of antioxidants, at levels higher (and usually many fold higher) than the recommended minimum daily intake and topical application of antioxidants, can slow aging of memory, skin aging and motor function and increase the life span.*

OXIDATIVE STRESS AFFECTED PHYSIOLOGIC SYSTEMS



Resistance

PROBABILITY OF RESISTANCE TO OXIDATIVE STRESS

There appears to be a small subset of the human population who handle the ravages of oxidative stress better than most of us. For these fortunate individuals, both parents provided them with a battery of optimal genetic response pathways to deal with oxidative stress. These individuals would best be defined, perhaps, as the upper 5% of a probability bell curve of the entire population's measured ability to handle oxidative stress.

Likewise, there is another 5% at the lower end of the curve who, for reasons of the genetic lottery, received little protective abilities from either parent. These individuals handle oxidative stress minimally.

Then there are the rest of us - everyone else who fits somewhere inside the 90% portion of the bell curve in our abilities to handle oxidative stress. Some of us are higher on the curve, some lower, but regardless of where we fall on the curve, we all require some additional help.

RESISTANCE TO OXIDATIVE STRESS



Figure 1. The probability bell curve of humankind's ability to handle oxidative stress.

Customizing

CUSTOMIZING PERSONAL CARE FORMULATIONS BASED ON NEEDS

BUILDING BETTER NUTRITIONAL SUPPLEMENT AND SKIN CARE PROGRAMS BASED ON BIOCHEMICAL INDIVIDUALITY

Genetic profiling from a simple cheek swab can be a very useful tool. In combination with a patient's lifestyle and metabolic factors, genetic tests give physicians more insight into treating their patients as individuals. A person's genetic profile is part of what makes us unique and can produce different nutritional and skin care needs based upon Biochemical Individuality. From the results of genetic evaluation and SNP analysis

combined with an understanding of metabolic pathways and biochemistry, it is possible to make recommendations for specific nutritional and skin care products for individuals. As one puts together information gained from metabolic, genetic and lifestyle evaluation, even better customized nutritional and skin care formulations can be designed to fit individual needs.

INFORMATION ON PATIENT RESULTS

As the preceding sections have described, the science of applied genetics is developing rapidly and has now progressed into realms that are practical for long-term health maintenance considerations. Accordingly, the GeneLink Scientific and Medical advisory board has selected a group of genes that are important to oxidative stress. While not absolutely linked to the onset of specific degenerative diseases, these genes are directly linked to important metabolic pathways that potentially affect an individual's overall health.

KEY POINT *The specific SNPs chosen are related to the relative biochemical activities (efficiency) of the genes and their product proteins that occur at relatively high frequencies in the population. All of these genes are well characterized in the scientific literature. Furthermore, they are linked to metabolic pathways where specific compensatory supplementation can be defined.*

Thus, the GeneLink SNP profiles in Nutragenetics AND Dermagenetics provide a personalized approach to nutritional supplement selection and topical skin care that targets individual requirements.

INFORMATION ON RESULTS

Sample Nutrigenetics Profile Panel for General Nutritional Assessment

Gene Analyzed	General Description	Recommended Support Level
SNP 7: MTRR (Methionine Synthase Reductase)	Homocysteine is a metabolite of the amino acid methionine. Research has shown it is important to control homocysteine levels in order to preserve cardiovascular health. One of the body's methods for keeping homocysteine levels in check is the MTRR enzyme, which transforms homocysteine back to either methionine or cysteine. ²² When an individual has a SNP in the MTRR gene, their ability to clear homocysteine from the blood may be hindered. However, only certain population groups appear to be negatively affected by this SNP. ^{23,200,202}	ADDED SUPPORT + -
SNP 8: MTHFR (Methylene Tetrahydrofolate Reductase)	Like the MTRR enzyme, the MTHFR enzyme is responsible for reducing blood levels of homocysteine. People with a SNP in the MTHFR gene manufacture defective enzymes that can't clear homocysteine from the blood efficiently. Research has shown there is a direct association between a SNP in the MTHFR gene and elevated levels of homocysteine, ²⁰³ particularly in those with low levels of folate. ²⁰⁴	MAXIMUM SUPPORT + +
SNP 9: TNF-α (Tumor Necrosis Factor - α)	Inflammation is a response of the immune system to a perceived attack. While it is a helpful response in the short-term, if inflammation continues on-going, it can negatively affect the cells, tissues, and ultimately, the organs. TNF-α is a cytokine (a chemical messenger of the immune system) that plays a role in inflammatory processes. Individuals with a SNP on the TNF-α gene may have an over-reactive inflammation mechanism, which can negatively affect the joints, ²⁰⁵ brain, ²⁰⁶ lungs, ²⁰⁷ and heart. ²⁰⁸	Optimum Genetic Function - -
SNP 10: PON-1 (Paraoxonase 1)	While it used to be thought that high cholesterol posed a health issue in and of itself, it is now believed that cholesterol only becomes a problem once a healthy carrier, low-density lipoprotein (LDL), becomes oxidized (attacked by free radicals). The PON1 enzyme attaches itself to high-density lipoprotein (HDL), which protects both HDL and LDL from oxidation. ²⁰⁹ Due to common SNPs in the PON1 gene, blood levels of PON1 can vary by a factor of 10 to 40-fold among different individuals. ^{200,209,210} Those with low levels of PON1 have higher levels of oxidized LDL, which can lead to diminished cardiovascular health. ^{210,209,211}	MAXIMUM SUPPORT + +
SNP 11: CYP11B2 (Aldosterone Synthase)	Maintaining blood pressure within the normal range is essential to a healthy heart. The CYP11B2 gene encodes an enzyme called aldosterone synthase, which plays a role in regulating blood pressure. A SNP on the CYP11B2 gene can decrease the ability of blood vessels to relax and constrict in response to changing demands for blood flow. ²¹² (For example, extra blood flow is needed during exercise.) That inability of the vessels to respond properly can set the stage for cardiovascular issues down the road. ^{213,214}	Optimum Genetic Function - -
SNP 12: ApoB (Apolipoprotein B)	Cholesterol is carried through the bloodstream on various lipoproteins: low-density lipoprotein (LDL), high-density lipoprotein (HDL), and very low-density lipoprotein (VLDL). Apolipoproteins make up the protein part of lipoproteins. One of the more researched apolipoproteins is apolipoprotein B (ApoB); it constitutes the protein component of LDL, the "bad" kind of cholesterol carrier. In fact, without ApoB, LDL cannot form. Because people with SNPs on the ApoB gene have higher ApoB levels, they experience moderate increases in total cholesterol, LDL cholesterol, and triglycerides, ^{215,216,217} as well as impaired glucose tolerance ²¹⁸ and increased blood lipid response after meals. ²¹⁹	ADDED SUPPORT + -
Interpreting your Nutrigenetic DNA Test results support level.		
<p>No disadvantage gene SNPs in this nutritional health area</p> <p>A GREEN test result (Homozygous Negative) predicts that you do not have the variant SNP and that the gene is functioning optimally to produce its specific enzyme, hormone, cytokine or structural protein. A comprehensive BASIC nutritional support for this area is added to keep the body functioning optimally.</p>		
<p>One (dis)advantaged gene SNP from one of your parents in this nutritional health area</p> <p>An YELLOW test result (Heterozygous Positive) indicates that you have one variant SNP and that the protein molecule expressing a specific enzyme, hormone, cytokine or structural protein is functioning less than optimal. As a result, it is important to have ADDED nutritional support (SNPNutrients™) for this area to keep body functioning optimally.</p>		
<p>Two (dis)advantaged gene SNPs from both of your parents in this nutritional health area</p> <p>A RED test result (Homozygous Positive) indicates that you have two variant SNPs and that protein molecule expressing a specific enzyme, hormone, cytokine or structural protein is functioning minimally. As a result, it is important to have MAXIMUM nutritional support (SNPNutrients™) for this area to keep the body functioning optimally.</p>		
Optimum Genetic Function - -	Homozygous Negative Neither chromosome carries the SNP	ADDED SUPPORT + -
MAXIMUM SUPPORT + +	Homozygous Positive One chromosome carries the SNP	Homozygous Positive Two chromosomes carry the SNP
<p>www.genelinkbio.com • 800-558-GENE (4363)</p> <p>Profile Assessments are not intended to diagnose, treat, cure, or prevent disease or condition and are designed for educational and information purposes only. These statements have not been evaluated by the Food and Drug Administration. Profiling technologies by GeneLink BioSciences, Inc. U.S. Patent No. 8,291,171. Additional patents pending worldwide.</p>		

As described in the preceding sections, the testing is done by noninvasive cheek swab collection of a sample which is then sent via a confidentially coded process to our laboratory

with the patented GeneLink kit. The example report shows how the SNP testing results are represented.

Future

THE FUTURE

We anticipate rapid advances in knowledge related to SNPs in the genes of many metabolic pathways. Therefore, we have a vigilant process in place to continually identify SNPs that have potential preventative and health maintenance relevance.

With over half of all adult Americans using supplements and skin care, the benefits of being able to more precisely target an indi-

vidual's nutritional or skin health needs, seem obvious. Imagine a world in which we know exactly which, or how much of a vitamin, mineral, or nutritional regimen we need for optimal health, energy and well being. For those who believe their health interests are best served by cutting edge science, keeping a sharp eye on new advances in genetic science seems a self-prescription worth observing.



Questions

FREQUENTLY ASKED QUESTIONS

Why should I use a GeneLink Profile Assessment for personalizing my nutritional and skin care programs?

Not everyone is alike – and not everyone responds to nutrients, topical active ingredients or even medicines in the same way.

In the absence of a sophisticated measurement tool such as GeneLink's Nutrigenetics and Dermagenetics Profile Assessment, most people are often *forced to simply guess* which nutritional and skin care products are right for them.

GeneLink's powerful Nutrigenetic and Dermagenetics Profile Assessments™ provide a scientific basis for more accurately predicting your unique needs. This information is used to guide *tailored* nutritional and skin care formulations to help you achieve *optimal health and performance*.

You can expect superior results, improved healthy aging benefits and the peace of mind that comes from knowing you are taking advantage of a scientifically personalized program that is focused on your unique physiologic makeup.

Why don't I just take handfuls of multi-vitamins and apply many topical ingredients to cover everything my body and skin needs?

Although it's possible to 'just take handfuls' of multi-vitamins and apply multiple

topical ingredients, most health professionals would agree it certainly isn't practical; The average person simply can't afford nor would they be able to easily swallow or apply all of the ingredients required to "cover all their bases." Also, there is increasing evidence that taking or applying too much of certain nutrients and active ingredients may even be harmful.

For example, *you can get too much* antioxidant protection. Damping down your metabolic system by excessive, *unbalanced* antioxidant intake can cause as many problems as not getting enough. Different free radicals require specific antioxidants –and there is no single antioxidant that addresses all types of free radicals.

Some manufacturers and distributors would have us believe that a 'cookie cutter' or 'one-size-fits-all' approach is good enough. Don't believe it.

When *your* long-term health and performance is at stake, a personalized *scientific approach* is best.

How do I take the test and when are the results returned?

Everything you need is included in GeneLink's Patented Collection Kit™. The process takes about 5 minutes and is easy as brushing your teeth. You simply swab the inside of your mouth (the inner cheeks) with the cotton swabs which are included.

Send the collected sample to GeneLink's laboratories in the pre-addressed, postage paid envelope. Your confidential results are typically delivered in 4-6 weeks.

What is GeneLink's privacy policy? How does the company plan to ensure my confidential information is kept private?

GeneLink respects the privacy of every individual and has taken numerous precautions to create a process that will allow individuals to maintain the highest level of privacy.

All information provided by the customer is kept on a secure server and all samples are identified by barcode only. Your private information is never shared with a third-party. GeneLink maintains a strict confidentiality policy.

After the evaluation is completed, all DNA sample material is destroyed.

What are the details of the SNP analysis process?

1. After receiving the swabs, GeneLink's lab extracts the DNA. (All samples are bar coded for confidentiality and control).
2. Next, the lab amplifies the region of the DNA containing the SNP (single nucleotide polymorphism) using what is called a PCR (polymerase chain reaction).
3. The SNP is measured by a single nucleotide base extensions method called SNP-IT™ Technology.
4. The results of these SNP measurements are translated by GeneLink's computers and developed in to a confidential report called a Nutrigenetic Profile™.

How accurate is this testing technology?

There are several types of methods to determine DNA polymorphisms (SNPs). GeneLink utilizes the Single Base Chain Extension (SBCE) assay which is the most accurate method available to detect single nucleotide polymorphisms. The SBCE assay identifies the (SNP) directly on the DNA.

The profile accuracy is nearly 100%. The assay is performed robotically, which virtually eliminates human error in sample manipulation. In rare instances, when a particular SNP area of a profile 'does not read,' it is repeated. All repeats thus far have been successful.

What is the science behind the determination of a need for Basic Support, Added support and Maximum support?

There are two copies of every gene, one from each parent. The SNP analysis examines each copy. Moreover, for each gene copy, the SNP will exist as either variant A (e.g., desirable) or variant B (e.g., undesirable).

All individuals will end up with SNP reads of: A/A or A/B or B/B. In this case:

If a person has B/B (Maximum Support is suggested) because that person has two undesirable SNPs.

If a person has A/B (which is less desirable - Added Support is suggested) because that person has only one of the desirable SNPs and an undesirable SNP.

If a person has A/A (Basic Support is recommended) the person receives a basic formulation. (GeneLink agrees with the Journal of American Medicine, The Council for Responsible Nutrition and studies demonstrating that *everyone* benefits from at least a basic nutritional supplementation or skin-care protection)

GeneLink's statistical results demonstrate that *virtually everyone* tested will require Added Support and/or Maximum Support in at least one or two gene SNP areas.

Why are the SNPs used in GeneLink's profiles selected over millions of others?

There are millions of SNPs. However, only certain subsets are associated with increased risk for disease and physiologic health conditions.

GeneLink selects only 'functional SNPs' which indicate poor enzyme function via epidemiological or biochemical studies.

Additionally, GeneLink selects only those SNPs which can be addressed using nutrients or formulations or lifestyle modifications.

These SNPs physically reside in either the coding region (protein portion) of the gene which can alter enzyme function or they reside in the promoter region which affects the level of expression of the gene in question.

What is the clinical research that ties nutritional supplements and topical skin treatments to support SNP predispositions?

All of the enzymes represented in the SNP profile have been well-studied and there is biochemical evidence in almost every instance that correlates why an enzyme affected by the SNP does not function properly. Additionally, there is leading clinical evidence linking SNPs to nutrition.

Thus, for major enzymatic players of oxidative stress, there is a clear fit with the genetics, epidemiology and biochemistry.

For several of the SNPs, there is a direct link between having the SNP and being able to lower oxidative stress or the potential health risks associated with oxidative stress by the

ingestion or application of particular antioxidant nutrients and active ingredients.

For example the SNP for methylenetetrahydrofolate reductase (MTHFR or Heart, Circulatory Health-2), produces an enzyme with decreased affinity (Km) for its direct substrate, 5,10 methylene-THF, which can cause a build up of homocysteine, which is deleterious to heart health. Increasing folic acid (upstream substrate) or the product of the enzyme reaction (5 methyl-THF) can ameliorate the build-up of homocysteine.

For some SNPs there is no definitive clinical evidence available to date that directly links the benefit of a nutrient to the SNP. These studies will come in time. Nevertheless, the fact that the biochemical parameters for all of the SNPs are so well known provides a *rational nutritional approach* to addressing unfavorable physiological conditions, based on scientific knowledge of how the SNP specifically functions.

Who conducted the research and who endorses GeneLink's research?

GeneLink's medical and scientific advisors along with independent academic laboratories and medical centers have conducted nearly 100% of the work. GeneLink's medical and scientific advisors hold positions at major research institutions.

The science and technical information behind GeneLink's technology has been favorably reviewed by the scientific staff department of our various clients and collaborative partners.

Studies have been statistically quantified and involve sophisticated molecular biology, biochemistry and genetic analyses.

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Glossary

GLOSSARY OF TERMS

Amino acids: All proteins are made up of amino acids, of which there are 20. The amino acids of each protein are joined together in a unique order that is determined by the DNA genetic code.

Antioxidant: Any molecule that eliminates the damaging effects of free radicals, including oxygen free radicals, is an antioxidant. Every cell in our body produces natural antioxidant proteins that prevent the build-up of free radicals. In addition, a variety of natural nutrients including certain vitamins can act as antioxidants that help to eliminate free radicals.

Base: Bases (or nucleotides) are the building blocks of DNA. There are four different bases: adenine, thymine, cytosine, and guanine or A, T, C, and G. They are sometimes referred to as genetic letters. The human genome is made up of 3 billion bases that appear to follow a random order (e.g.,.....AGGCTTAT.....etc), but in fact, the order is actually very precise and forms the string of DNA that defines our genes. The bases make up DNA, and DNA makes up genes, and genes make up chromosomes, which altogether forms the human genome.

Biochemical Individuality: Our genetic uniqueness creates demands for specific needs of nutrients beyond the average to facilitate optimal function and prevent premature disease.

Buccal Swab: A special device similar in appearance to a Q-tip. It is used to collect DNA by rubbing the cheeks inside the mouth. It provides a simple, quick and non-invasive way to collect DNA.

Cell: The smallest unit of a living organism. Cells make up our tissues. A cell is enclosed by a membrane and has an inner nucleus that harbors the entire human genome in the form of DNA. Human cells, which number in the trillions, are specialized and make up the various tissues, e.g., nerve cells make up the brain.

Chromosome: The genes are distributed on 46 separate DNA strands called chromosomes. For the relationship between DNA, genes and chromosomes, see Base (above).

Detoxification: The process by which the body manages to destroy and clear itself of accumulating harmful substances, such as environmental toxins. This is accomplished by a variety of detoxifying enzymes.

DNA: The genetic material of all living organisms is made up of the huge molecule called DNA. DNA itself is made up of the four chemical units called A, G, C and T. Three billion A, G, C, and T units follow one another in a unique order to create the specific DNA chain that forms a human being. Sometimes, even if one base is not in the correct order, disease or the risk of disease occurs.

Enzymes: Proteins that carry out all of life's functions, such as metabolizing food, producing energy and controlling movement.

Free radicals: Molecules that have an extra electron that enables them to react rapidly with and damage important proteins, DNA and lipids. If not neutralized, an excess of free radicals can destroy cell structures and generate DNA mutations. A ROS (reactive oxygen species) is a specific type of free radical (see below).

Functional Health Area: Major organ systems of the body, including heart and circulatory system, nervous system, bone etc.

Homocysteine: An amino acid which is normally found in the blood. Increased levels of homocysteine are associated with an increased risk of cardiovascular disease.

Gene: A fundamental unit of heredity. The gene contains instructions for making a new protein. Humans may have as many as 100,000 genes. See Base (above) for relationship between DNA, gene, chromosome and genome.

Gene variation: A naturally occurring variation in the DNA sequence that is an alteration in one or more letters of the genetic alphabet (A, T, C, G) that is present in at least 1% of the population. Scientists call such variations polymorphisms. Most polymorphisms are harmless and are part of normal human genetic diversity. However, others may increase the risk for disease and contribute to aging.

Genetic code: The four bases of DNA combine in a specific manner to spelling

out a 'three-letter code'. This genetic code is carried by individual genes to instruct the specific proteins that are made by the cell. For example, the hemoglobin gene contains its specific genetic code which instructs the cell to produce the hemoglobin protein.

Genome: The complete physical and informational content of our DNA is referred to as the human genome. See Base (above) for the relationship between DNA, gene, chromosome and human genome.

Genomics: The branch of science that studies the structure, informational content and variation in the human genome is referred to as genomics.

Lipoproteins: When proteins combine with lipids, they are referred to as lipoproteins. Lipoproteins, which include HDLs and LDLs, are the principal means by which lipids are transported in the blood.

Macrophage/Foam cell: Macrophages are scavenger cells. A lipid-laden macrophage is called a foam cell/

Metabolism: Natural processes by which food is transformed into energy and its cellular waste products are eliminated.

Mitochondria: Organelles within cells that produce chemical energy (in the form of ATP) from the nutrients we consume.

Nucleotide: See Base above.

Nucleus: The central compartment with the cell that holds the human genome in the form of chromosomes.

Nutragenetics™: The new field of applying SNP testing to help guide personalized formulations for the optimal combination of nutrients and vitamins, matched to an individual's unique genetic make-up is called Nutragenetics.

Oxidative Stress: The chemical state in which the environment within cells becomes highly 'oxidized' and contains an excess of free radicals (see Free Radical above). Free radical can attach themselves to proteins and DNA inside the cell and cause damage. Oxidative stress is linked to many diseases and aging.

Pharmacogenetics: The new field of SNP testing aimed at providing individualized medicine is called Pharmacogenetics.

Physiologic Health: The body's ability to control oxidative stress and eliminate toxins and cholesterol etc.

Polymorphism: See Gene Variation above.

Proteins: Specific combinations of the 20 amino acids (see Amino Acids above) form tens of thousands of proteins that give the human body its form and function. Some proteins serve solely as the enzymes that are responsible for metabolism and DNA replication.

ROS (Reactive Oxygen Species): Free radicals are often referred to as reactive oxygen species (ROS), when molecular oxygen carries an extra electron. See Free Radicals.

SNP: "Single Nucleotide Polymorphism" and is pronounced 'snip'. These are natural genetic variations in our DNA that are largely responsible for why humans differ from one another. There are 3 million SNPs in our DNA.

SNP Frequencies: The degree to which a SNP occurs in a human population. The frequency of all SNPs is greater than 1%.

Toxins: Harmful substances that can be produced by the body, or pathogens or introduced from the environment. Environmental toxins can be introduced by ingestion, breathing or through the skin. Health is dependent upon cellular enzymatic detoxification systems to clear these harmful chemicals from our bodies. Inefficient clearance of toxins can lead to a variety of illnesses and diseases.

Vitamins: Organic nutrients that are essential for normal metabolism, growth and general health. They are required to activate specific enzymes. In addition, some enzymes can defend against oxidative stress by eliminating free radicals.

Contributors

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