ImmunoGenomic Profile

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Genova Diagnostics® Europe
Innovative Testing for Optimal Health

Patient: **SAMPLE PATIENT**
Age: 49
Sex: F
MRN:

Order Number:
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Immuno Genomic Profile Results

This profile identifies genetic single nucleotide polymorphisms associated with increased risk of developing defects in immune competence and surveillance. Immune system polymorphisms have been associated with increased risk of asthma, atopy, osteopenia, arthritis, heart disease, auto-immunity and infectious diseases.

Chronic Inflammation

IL-1?: Interleukin 1-beta, produced mainly by blood monocytes, mediates the panoply of host inflammatory reactions collectively known as acute phase response. Polymorphisms in IL-1? may predispose individuals to chronic inflammatory conditions by upregulating COX2 activity and prostaglandin production. Other effects include hypochlorhydria, predisposition to H. pylori infection and gastric cancer.

TH-1 Cytokine (Viral Infection & Cancer)

TNF-?: Tumor necrosis factor-alpha is a pro-inflammatory cytokine that can contribute to arthritis, asthma and osteoporosis. Polymorphisms of TNF-? inappropriately activate inflammatory response and increase TNF-? production.

TH-2 Cytokines (Allergy, Asthma & Atopy)

IL-4: Polymorphisms in Interleukin-4 lead to increased IL-4 production and to decreased barrier function in lung epithelial cells causing a hyper-responsiveness to antigen stimulus, leading to increased risk and severity of bronchial asthma.
IL-6: Interleukin-6 contributes to inflammatory response and also affects adipose tissue metabolism, lipoprotein lipase activity, and hepatic triglyceride secretion. This particular SNP has been associated with elevations in serum triglycerides in response to carbohydrate intake and decreased levels of HDL cholesterol.
IL-10: Interleukin-10 has an inhibitory effect on TH-1 cytokine production. Polymorphisms in IL-10 may affect the risk of frequent viral infections, cancer and auto-immune diseases such as rheumatoid arthritis or lupus (SLE).
IL-13: Interleukin-13 acts to promote IgE synthesis and IgE-based mucosal inflammation typical of atopy and bronchial asthma. These SNPs are associated with increased IL-13 production and activity.

Immune Markers

Chronic Inflammation

IL-1β 

TH-1 Cytokine

TNF-α 

TH-2 Cytokines

IL-4 

IL-6 

IL-10 

IL-13 

The Third Wave™ Invader DNA assay is used to detect polymorphisms in the patient's DNA sample. In this assay, a solution hybridization method is used in which two oligonucleotides hybridize in tandem with the specific DNA sequences. Subsequent Cleavase® and hybridization reactions result in generation of fluorescent signal. The biplex format of the assay enables simultaneous detection of all variants in a single reaction tube. The sensitivity and specificity of this assay is 99.7%.

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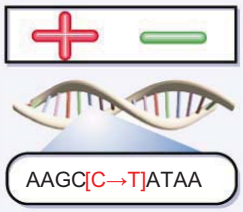
Chronic Inflammation

IL-1β

Chromosome 2

-31C-T



www.genovations.com/giil1b

HEALTH IMPLICATIONS: Interleukin-1β, produced mainly by blood monocytes, is an inflammatory cytokine that can inhibit acid secretion in the stomach and stimulate bone resorption. This polymorphism slightly increases IL-1β production, leading to increased inflammation. Increased IL-1β has also been shown to suppress hydrochloric acid secretion in the stomach, as well as increase susceptibility to Helicobacter pylori infection and gastritis and gastric cancer in H. pylori-infected individuals. This genotype may provide slight protection against breast and lung cancer.

MINIMIZING RISKS: If H. pylori infection is present, eradication and mucosal repair are essential. Once repaired, regular betaine hydrochloride with meals may be warranted to prevent re-infection. Slight risk of atrophic gastritis and infection may be diminished by reduced alcohol consumption, avoiding smoking, and regularly ingesting fruit. Be careful with all NSAIDs, which reduce gastric blood flow and increase IL-1β. Production of IL-1β is suppressed by agents such as fish oils, L-glutamine, milk thistle (silymarin), curcumin, boswellia, ginkgo biloba, and resveratrol.

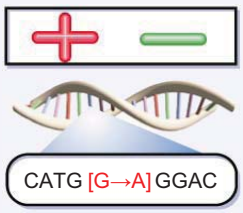
FURTHER EVALUATION: H. pylori stool antigen should be checked to determine if there is an active infection, especially if gastric ulcer symptoms are present. A bone resorption profile is recommended, especially in post-menopausal women.

TH-1 Cytokine
(Viral Infection & Cancer)

TNF-α

Chromosome 6

-308G-A



www.genovations.com/giil1rn

HEALTH IMPLICATIONS: Tumor necrosis factor, alpha (TNF-α) is a pro-inflammatory cytokine secreted from activated macrophages, which plays an important role in host defense against infection. Excessive TNF-α release can result in inflammatory reactions and oxidative stress. This polymorphism is associated with increased production of TNF-α, hence increased inflammatory response. Risk is increased for asthma, allergic dermatitis, insulin resistance (especially in obese individuals), type 2 diabetes (in homozygous-positive individuals), osteoporosis, systemic lupus erythematosus, and stress-induced increases in C-reactive protein.

MINIMIZING RISKS: Risk of insulin resistance can be minimized by abdominal fat loss, avoiding hypoglycemia, and improving insulin sensitivity. Stress management is recommended. TNF-α levels, in general, have been shown to be reduced by agents such as vitamins E and C, N-acetyl cysteine, EPA/DHA (fish oils), curcumin, ginkgo biloba, conjugated linoleic acid, green tea, Siberian ginseng, stinging nettles, lactobacillus (probiotic), estrogen, and DHEA.

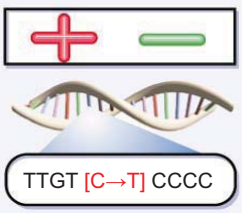
FURTHER EVALUATION: Because individuals with the polymorphism are predisposed to chronic inflammation, C-reactive protein and/or erythrocyte sedimentation rate (ESR) may be warranted as a screen and to monitor therapeutic effectiveness. Because of TNF-α's ability to stimulate bone resorption, regular evaluation of bone resorption markers such as deoxypyridinoline may be indicated.

TH-2 Cytokine
(Allergy, Asthma, & Atophy)

IL-4

Chromosome 2

-590C-T



www.genovations.com/gitnfa

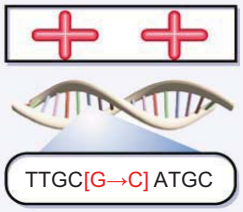
HEALTH IMPLICATIONS: Interleukin-4 is secreted by antigen presenting cells (e.g., macrophages and dendritic cells) and stimulates the differentiation of TH-2 cells and the increased production of IgE. This polymorphism increases the production, release, and inflammatory effects of IL-4 and can lead to increased permeability of the lung and gut epithelia, increasing antigen penetration and humoral immune response to antigen. Individuals with this IL-4 polymorphism have higher circulating levels of IgE. IL-4 and IL-13 signaling appear to be important in the development and severity of eczema, atopy, and asthma.

MINIMIZING RISKS: Elimination of allergens in the environment is indicated, including the use of HEPA filters and dust mite impermeable bedding. Food and inhalant antigens should be identified and eliminated - a rotation diet may prove clinically useful. A combination of cod liver oil, vitamin C and the bioflavanoid quercetin may help stabilize mast cells and reduce their responsiveness to antigen. Beta-sitosterols and their glycosides have been shown to reduce IL-4 secretion while enhancing cell-mediated immunity. Promising new drug therapies include soluble recombinant human IL-4 receptor delivered by nebulizer (Nuvance™; Immunex) that binds and sequesters IL-4, countering its effects. Interferon-gamma therapy suppresses TH-2 immune response and expression of IL-4.

FURTHER EVALUATION: Food and inhalant antibody assessment is warranted. If food antibodies are present, an intestinal permeability assessment may be of clinical value.

TH-2 Cytokine
(Allergy, Asthma & Atopy)

IL-6
Chromosome 7
-174G-C



www.genovations.com/giil4

HEALTH IMPLICATIONS: Excess interleukin-6 inhibits lipoprotein lipase and stimulates hepatic triglyceride secretion. This polymorphism of IL-6 is associated with elevated plasma triglycerides, decreased HDL cholesterol, and increased fasting serum glucose. Thus the risk of developing heart disease and adult-onset diabetes is increased substantially with this polymorphism.

MINIMIZING RISKS: Since carbohydrates are the primary macronutrient stimulus for triglyceride synthesis, a lower carbohydrate diet with the elimination of simple carbohydrates is indicated. However, since excess IL-6 also impairs lipoprotein lipase activity, a low-fat diet is also indicated. Optimally a low-calorie, higher protein, lower carbohydrate, low-fat diet may be optimal. Fish oil supplementation has also been shown to decrease triglyceride levels.

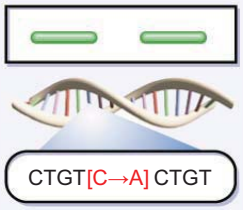
Chronic stress increases concentrations of IL-6 in all individuals, thus, stress reduction and regulation may prove beneficial. Adequate sleep and regular aerobic exercise reduce stress response. Supplements that improve adrenal function and balance include vitamins C and B5, glycyrrhiza (licorice), and adaptogens like the various ginsengs, cordyceps, bacopa and ashwaganda (withania).

Both melatonin and beta-sitosterols from pine trees have been shown to decrease IL-6 production dramatically, reducing inflammatory tendency and improving cell mediated immunity.

FURTHER EVALUATION: A comprehensive cardiovascular assessment is indicated to estimate functional risk and to monitor therapeutic effectiveness. A metabolic dysglycemia assessment, including fasting glucose and insulin, can evaluate the risk of developing adult-onset diabetes. Individuals with a family history of heart disease should consider a Cardio Genomic profile for thorough assessment of predictive genomic risk.

TH-2 Cytokine
(Allergy, Asthma & Atopy)

IL-10
Chromosome 1
-627C-A



www.genovations.com/giil6

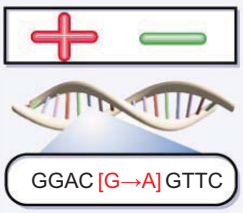
HEALTH IMPLICATIONS: Interleukin-10 is a predominately anti-inflammatory cytokine. IL-10 inhibits the synthesis of other, pro-inflammatory interleukins and acts synergistically with glucocorticoids to reduce inflammation. The homozygous negative polymorphism of IL-10 is associated with normal secretion of IL-10 and therefore with no increased tendency toward chronic inflammation.

MINIMIZING RISKS: None indicated for this polymorphism.

FURTHER EVALUATION: None indicated for this polymorphism.

TH-2 Cytokine
(Allergy, Asthma & Atopy)

IL-13
Chromosome 5
R130Q



www.genovations.com/giil10

HEALTH IMPLICATIONS: Interleukin-13 stimulates inflammation in the airways and is required for the progression of hyper-responsiveness of airways to antigens leading to symptomatic asthma. Either polymorphism (+- or ++) leads to increases in serum IL-13 concentrations and to increased risk for developing atopy and asthma. These effects are likely exacerbated if there is also a polymorphism in IL-4. IL-13 is also known to increase both IgE and IgG antibody production.

MINIMIZING RISKS: Elimination of allergens in the environment is indicated, including the use of HEPA filters and dust mite impermeable bedding. Food and inhalant antigens should be identified and eliminated - a rotation diet may prove clinically useful, especially in cases where IgG antibody production is high. Since IL-13 SNPs are associated with higher levels of IgE production, a combination of cod liver oil, vitamin C and the bioflavanoid quercetin may help stabilize mast cells and reduce their responsiveness to antigens.

Specific anti-inflammatories like boswellia, curcumin, hesperedin, ginger, etc. may reduce inflammation, especially during acute inflammatory reactions.

FURTHER EVALUATION: Food and inhalant antibody assessment is warranted. If food antibodies are present, an intestinal permeability assessment may be of clinical value.

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This test has been developed and its performance characteristics determined by Genova Diagnostics, Inc. It has not been cleared or approved by the U.S. Food and Drug Administration.

Commentary is provided to the practicioner for educational purposes, and should not be interpreted as diagnostic or treatment recommendations. Diagnosis and treatment decisions are the responsibility of the practicioner.

The accuracy of genetic testing is not 100%. Results of genetic tests should be taken in the context of clinical representation and familial risk. The prevalence and significance of some allelic variations may be population specific.

Any positive findings in the patient's test indicate genetic predisposition that could affect physiologic function and risk of disease. We do not measure every possible genetic variation. The patient may have additional risk that is not measured by this test. Negative findings do not imply that the patient is risk-free.

Dr. Amy Peace-Brewer
Laboratory Director

Dr. Patrick Hanaway
Chief Medical Officer

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What is Inflammation?

Inflammation is the primary means by which the body repairs cells and tissues that have been damaged. Inflammation also is the primary defense mechanism of our immune system fighting against a hostile environment that includes allergens, viruses, bacteria, yeast, etc. Cytokines are a class of polypeptide chemical compounds within the body that regulate both types of inflammation response. Interleukins are a specific subset of cytokines produced by white blood cells. Specific cytokines and interleukins can be either pro-inflammatory or anti-inflammatory. While a certain level of cytokines is always present in the blood, increased cytokine production can result from external stimulus (e.g., pollen or physical injury) but cytokine levels may also vary based on genetic polymorphisms. Increased production of a pro-inflammatory cytokine or decreased production of an anti-inflammatory cytokine can both result in chronic inflammatory conditions.

Your Body's Immune System

The body's immune system may be broadly divided into two major functional categories: cell-mediated immunity (a.k.a. TH-1 immunity) that protects against viral infections and cancer; and humoral immunity (a.k.a. TH-2 immunity) that controls allergic response and antibody formation. These two branches of the immune system are mildly antagonistic: if one is up-regulated, the other is often down-regulated and vice-versa.

Immune-related Illnesses

Imbalanced cell-mediated immunity can lead to frequent infections and to increased risk of developing certain cancers. Imbalanced humoral immunity can contribute to the development of allergy, asthma, atopy, eczema, inflammatory bowel disease, autoimmune disease, osteoporosis, and even atherosclerosis and heart disease. It is important for our long-term health to maintain balance in our immune response. We need adequate inflammation to ensure environmental defense and tissue repair, but without excess inflammation that can cause substantial cellular damage and numerous disease states.

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Personalized Recommendations for Minimizing Risk

Diet

This section offers **dietary supplementation** considerations based on your unique genetic makeup. These are provided for educational purposes only and are not intended to diagnose or to treat any specific condition. Please consult with your healthcare practitioner for specific interpretation and therapeutic options.

- Eat a diet rich in colorful fruits and vegetables as these are not only high in mineral content but also the primary source of dietary anti-oxidants, essential for minimizing inflammation.
- Increased consumption of cold water fish and/or the consumption of fish oils should be considered in reducing the overall tendency toward inflammation.
- Numerous foods that act as platelet activating factor inhibitors have been shown to reduce tumor necrosis factor production. These include onions and other allium species - garlic, shallots, etc.

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Lifestyle / Environment

This section offers **lifestyle/environment** considerations based on your unique genetic makeup. These are provided for educational purposes only and are not intended to diagnose or to treat any specific condition. Please consult with your healthcare practitioner for specific interpretation and therapeutic options.

- Steps should be taken to reduce the level of ambient allergens in the environment, including the use of HEPA filters, dust mite impermeable bedding, etc.
- Stress reduction through regular aerobic exercise, meditation, adequate sleep, etc. should be undertaken. High stress levels are likely to exacerbate your tendency toward increased inflammation.
- While moderate exercise is helpful, you should avoid excessive exercise as this may promote increased inflammation and bone resorption.

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Nutritional Supplementation

This section offers **nutritional supplementation** considerations based on your unique genetic makeup. These are provided for educational purposes only and are not intended to diagnose or to treat any specific condition. Please consult with your healthcare practitioner for specific interpretation and therapeutic options.

- Betaine hydrochloride and deglycyrrhizinated licorice (DGL) should be considered to improve stomach HCl and mucous production. HCl should only be administered after gastric ulcers are ruled out. Long-term therapy may be needed.
- Fish oils and milk thistle have been shown to suppress interleukin production directly, which in part accounts for their anti-inflammatory actions in the body.
- If signs and symptoms of chronic inflammation are present, consider the use of botanical anti-inflammatories like boswellia (frankincense), glycyrrhiza (licorice), ginger, hesperedin and curcumin (tumeric).
- A combination of cod liver oil (or fish oils), vitamin C and the bioflavanoid quercetin may help normalize mast cell responsiveness to antigen and reduce histamine production and release.
- Beta-sitosterols and beta-sitosterol glycosides extracted from pine trees have been shown to reduce IL-6 production.
- Botanical support of adrenal function and stress reduction should be considered. Herbs to consider include ashwaganda, bacopa, cordycaps, licorice and American, Korean or Siberian ginseng.

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Pharmaceutical Considerations

This section offers **pharmaceutical considerations** based on your unique genetic makeup. These are provided for educational purposes only and are not intended to diagnose or to treat any specific condition. Please consult with your healthcare practitioner for specific interpretation and therapeutic options.

- If signs and symptoms of acute or uncontrolled inflammation are present, consider the short-term use of corticosteroids like cortisol or prednisone.
- Interferon-gamma therapy has been shown to suppress TH-2 immune response and may be considered, especially if asthma symptoms are severe and you have been refractory to other therapies.
- IL-4 receptor therapy (Nuvance or Immunex), while still experimental, is showing promising results in clinical trials and should be available on the market soon. Its use should be considered for severe asthma, especially if other therapies have been unsuccessful.

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Genomic/Functional Laboratory Testing

This section offers **genomic/functional laboratory testing** considerations based on your unique genetic makeup. These are provided for educational purposes only and are not intended to diagnose or to treat any specific condition. Please consult with your healthcare practitioner for specific interpretation and therapeutic options.

- This individual has polymorphisms that increase his or her risk of developing heart disease. A full CardioGenomic profile may reveal more personalized therapeutics as a preventative strategy.
- This individual may have polymorphisms that increase his or her risk of increased bone resorption and of developing osteopenia and osteoporosis. A full OsteoGenomic profile may reveal more personalized therapeutics as a preventative strategy.
- IL-1B polymorphisms are associated with H. pylori infection and gastric ulcers; screening for serum H. pylori antibodies is recommended, especially if signs and symptoms of ulcers are present.
- A bone resorption profile to assess the rate at which bone is being lost is indicated. This test may be run sequentially to assess effectiveness of your therapeutic protocol. A baseline bone density scan may also be indicated.
- Consider an intestinal permeability assessment of GI barrier function and a food and inhalant antibody assessment.