Patient Guide

designs for health

Comprehensive Metabolic Profile™

Basic plus FA Profile™

Basic Metabolic Profile™

Laboratory Evaluations by

Metametrix® Clinical Laboratory

Introduction

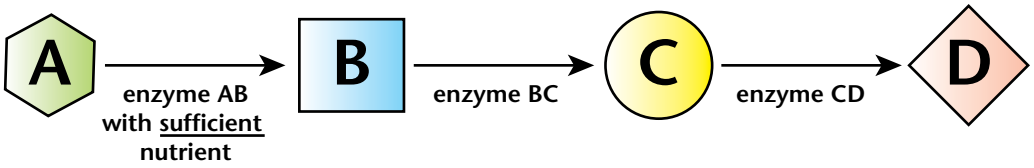
The systems of the body work together, not in isolation, so it is often difficult to know where to begin to treat a complex process. The Designs for Health™ Metabolic Profiles provide a roadmap that recognizes these interactions and can point to metabolic blockages that lead to disease. The Designs for Health Metabolic Profiles show essential nutrient and digestive system abnormalities that reveal root causes of symptoms. This metabolic map allows the targeted use of vitamins, minerals, and other essential nutrients, putting you more quickly on your journey to wellness by providing specific correction of nutritional imbalances. Avoiding costly, time-consuming, trial and error processes allow for nutritional support that is tuned to your individual needs.

The ABCs of Organic Acids

Your Designs for Health Organix™ Profile is like an emission test performed on your car. The exhaust is examined to see how efficiently the engine is burning fuel. Similarly, certain compounds called "organic acids" in your urine reveal the efficiency of your body's machinery.

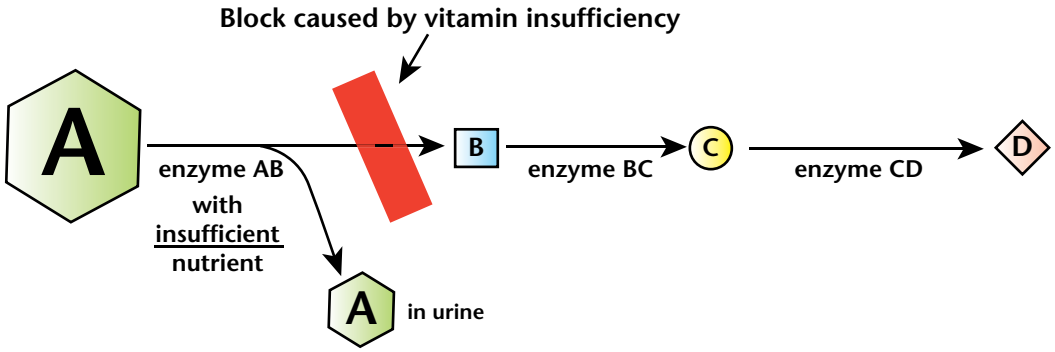
Many organic acids result from the metabolic pathways, or chemical reactions, your body uses to transform food into energy, growth, maintenance, and repair of body tissue. Like spark plugs that ignite fuel in a car engine, vitamins and other essential nutrients are necessary for these chemical reactions that power your metabolic machinery. Thousands of these reactions occur in your body every second and are the basis of your level of health and vitality.

The figure below illustrates a well-functioning metabolic pathway. Molecule A is converted to Molecule B by the enzyme AB. Molecule B is converted to Molecule C by the enzyme BC and so on all the way down the metabolic pathway. Many enzymes require nutrients such as specific vitamins and minerals in order to perform their functions in converting one molecule to another.



If specific nutrients are not available in adequate amounts, important reactions cannot occur as well as they should. The illustration below shows what happens when the nutrient is not present in adequate amounts causing enzyme AB to function inefficiently. A smaller amount of Molecule A is converted to Molecule B and the remainder builds up and spills into the urine. Notice that Molecules B through D downstream are also affected.

Visualize this process as a dam blocking a stream: very little water flowing downstream and an overflow occurring upstream. The Organix Profile measures the overflow of certain organic acids in your urine to determine what blockages may be occurring in your metabolic pathways due to nutrient insufficiencies or other issues.



High levels of certain organic acids on your report indicate specific nutrient insufficiencies that may be affecting your health. Other organic acids come from toxins you have been exposed to, and still others show how your body is responding to toxins. When these are high on your Designs for Health Organix Profile, you may benefit from therapies that support your body's detoxification processes. A few organic acids are significant at low levels and are discussed below. Your healthcare practitioner can use this profile to design an individual nutritional support program tuned to your unique biochemical needs.

The following is a discussion of the compounds measured in five categories on your Designs for Health Organix Profile. The organic acids are numbered as they appear on your test report.

B-Vitamin Insufficiency

Insufficiency of B-vitamins tends to be common since they are not stored as efficiently as other vitamins in the body. B-vitamins are involved in many critical processes including energy production, digestion, and muscle and nerve function. For example, production of stomach acid requires large amounts of energy. Even modest B-vitamin insufficiencies can compromise adequate energy production, leading to poor acid secretion and digestive disturbances commonly experienced as indigestion.

1. Pyruvate may be elevated when B-vitamins, particularly B_1 and B_5, are insufficient. When both lactate (#13 below) and pyruvate are high, there may be insufficient lipoic acid, a type of B-vitamin. Lipoic acid is an important antioxidant, so low levels can lead to aging-related illnesses. Many studies have shown that lipoic acid is helpful in treating diabetes and for assisting the liver with removing toxins from the body.

2, 3, 4, 5. α-Ketoglutarate, α-Ketoisovalerate, α-Ketoisocaproate, and α-Keto-ß-methylvalerate require vitamins B_1, B_2, B_3, B_5 and lipoic acid to be metabolized. Elevations of these organic acids indicate insufficiency of these B-vitamins, especially B_1 and B_5. These B-vitamins are involved in neurological function and are critical for childhood development and learning. A variety of disorders have been associated with a lack of these vitamins, including memory loss, anemia, and dermatitis.

6. Xanthurenate is formed from an amino acid that comes from protein in your diet. High levels can indicate an insufficiency of B_6, a vitamin critical for all protein metabolism. Use of medications (*e.g.*, oral contraceptives, anti-hypertensives, and bronchodilators) and exposure to tobacco smoke, pesticides, and other agricultural products can all contribute to insufficiency of vitamin B_6. Problems with balance, fatigue, and mental/emotional stability (such as PMS and ADHD) are frequently found in patients with inadequate vitamin B_6. Research has shown that symptoms of autism can be ameliorated with vitamin B_6 supplementation. Additionally, xanthurenate can prevent insulin from performing its vital role in blood sugar regulation, which can contribute to diabetes.

7. ß-Hydroxyisovalerate is a sensitive indicator of biotin deficiency. Biotin deficiencies develop for a number of reasons, including pregnancy, antibiotic use, and anticonvulsant therapy. Symptoms can include hair loss, skin rash, dermatitis, immune deficiencies, and muscle weakness.

8. Methylmalonate requires vitamin B_{12} for its metabolism. High levels indicate insufficient vitamin B_{12} that can contribute to nervous system dysfunction. Anemia and the associated symptoms of fatigue result from low vitamin B_{12}. Even mild insufficiencies cause elevation of a well-known cardiovascular disease risk factor, homocysteine. Absorption of vitamin B_{12} requires normal digestive function.

9. Formiminoglutamate (FIGLU) is a sensitive marker of insufficiency of folic acid, another B-vitamin. Pregnant women especially need to have adequate folic acid to prevent birth defects. Folic acid insufficiency can play a role in childhood development problems, depression, immune function, and is a risk factor for cardiovascular disease.

Cellular Energy

Although B-vitamins also impact energy production, this category measures compounds that relate most directly to how efficiently your cellular engines (called "mitochondria") produce energy. All body processes depend on this key activity. Inadequate energy production at the cellular level can affect any aspect of your body's function and can have dramatic impact on a wide range of health conditions.

10, 11, 12. Adipate, Suberate, and Ethylmalonate elevations indicate metabolic blocks. Carnitine is needed to move fatty acids into the mitochondria where they are converted to energy using vitamin B_2. When insufficient levels of carnitine or vitamin B_2 slow down this process, other parts of the cellular machinery take over and make adipate and suberate. A similar block in another pathway causes high ethylmalonate. Since most of your body's energy is produced from the burning of fatty acids, your muscles and brain suffer when this cellular energy pathway is blocked. Supplementation of carnitine and vitamin B_2 may be needed when these compounds are too high. Insufficiency of vitamin B_2 is implicated in impaired carbohydrate metabolism, migraines, and dementia. Carnitine supplementation has been documented to improve Alzheimer's, age-related cognitive decline, and cardiac function.

13. Lactate is a product of muscle use, so it is constantly produced in normal daily activity. Low lactate is seen in people with very little physical activity and in highly trained athletes. High lactate can cause muscle cramping, fatigue and brain fog. It indicates insufficiency of coenzyme Q10 (CoQ10), a nutrient that enables the body to use oxygen to generate large amounts of energy. It is important for athletes in order to maintain intense muscular activity. CoQ10 is also a potent antioxidant helping to slow the aging process and prevent a variety of degenerative diseases. Risk for certain kinds of heart disease, cancer, and hypertension are increased when CoQ10 is insufficient.

14. ß-Hydroxybutyrate is a byproduct of ketosis. Ketosis occurs when cells do not get a steady supply of sugar from dietary carbohydrate, so they burn fat instead. If you do not eat carbohydrate-rich foods or if your insulin is not working, then you can have metabolic ketosis. It is not necessarily a serious matter, but your doctor may need to find out just what is causing ketosis. If your insulin is not working well enough, its action may be improved by increasing your intake of chromium, vanadium, and lipoic acid.

15, 16, 17. Succinate, Fumarate, and Malate are used in the body's metabolic pathway that generates cellular energy – the Citric Acid Cycle. This cycle critically supports organ maintenance and neurological function. Higher levels of these compounds in urine indicate inefficiencies in energy production. Low levels can indicate a general amino acid insufficiency. If α-ketoglutarate (see #2) is elevated along with succinate, malate, and fumarate, you may need additional CoQ10, a nutrient that enables the body to use oxygen to generate large amounts of energy.

18. Hydroxymethylglutarate (HMG) is used by your cells to make CoQ10, a nutrient that enables the body to use oxygen to generate large amounts of energy. Cholesterol-lowering statin drugs block this process, causing HMG to become elevated and inhibiting the production by the cells of CoQ10. While there can be other causes for this metabolic block, high levels of HMG generally indicate need for CoQ10 supplementation.

Neural Function

This category relates to neurotransmitters, the chemicals your nervous system uses to function and communicate with your body. The first three compounds in this category are significant if they are either low or high. Abnormalities in this area can relate to symptoms of mental, emotional, and behavioral problems.

19, 20. Vanilmandelate (VMA) & Homovanillate (HVA) are breakdown products from neurotransmitters involved in hormone and nerve impulse transmission. When these compounds are low, it indicates your body is not making enough of these neurotransmitters. Symptoms associated with this condition are depression, sleep disturbances, inability to deal

with stress, and fatigue. Treatments to improve digestion, along with supplementation of tyrosine or phenylalanine, can help improve the ability to keep up with demand for these neurotransmitters. Elevations of VMA and HVA indicate an over-activation of nervous system function involving these neurotransmitters. This can be for various reasons, but is most commonly associated with stress – both internal (e.g., mental/emotional) and external (e.g., environmental toxins). Addressing the source of stress and improving the body's ability to handle stress are useful in these cases.

21. 5-Hydroxyindolacetate (5-HIA) is a breakdown product of the neurotransmitter, serotonin. Low 5-HIA indicates inadequate production of serotonin. Associated symptoms can include constipation, depression, fatigue, insomnia, and attention deficit and behavioral disorders. High 5-HIA may occur when there is an increased utilization and breakdown of serotonin. Many antidepressant medications can cause a significant increase in the amount of serotonin that is made and broken down. This stimulation will contribute to loss of the essential amino acid, L-tryptophan, from which serotonin is made. Dietary therapy should focus on protein digestion via stomach acid and pancreatic enzymes, and on consumption of foods high in tryptophan. Your doctor may talk with you about nutritional supplements that may be helpful.

22. Kynurenate can reduce the toxic effects of quinolinate (see #23). Elevations can indicate an insufficiency of vitamin B_6, especially when xanthurenate (see #6) is high.

23. Quinolinate elevations are caused by inflammatory processes induced by the immune system, such as during infection (especially viral). High quinolinate levels in the brain can cause insomnia, irritability, and nervousness. These effects may be improved by removing the source of inflammation and supplementation with magnesium.

Detoxification

Not only does the body use essential nutrients to actively build and maintain itself, it also must eliminate environmental toxins and certain chemicals created in the body itself. This process of detoxification is critical to health. Like a backed-up sewer, an impaired detoxification system can lead to many problems. Brain fog, headaches, insomnia, nausea, chemical sensitivities, and a variety of chronic health problems have been related to toxicity issues.

24, 25, 26. Citrate, cis-Aconitate, and Isocitrate are involved in both energy production and removal of toxic ammonia. High levels can indicate ammonia toxicity. Chronic loss of these valuable compounds can contribute to loss of organ reserve and disturbances in neurological function. If they are low they can indicate a need for essential amino acids, especially arginine.

27. 2-Methylhippurate is a byproduct of detoxification of the common solvent, xylene. Elevations indicate an exposure to this potentially toxic compound found in paint, varnishes, paint thinners, solvents, and many aerosols. Such exposures increase the burden on liver detoxification. An abundant supply of the amino acid, glycine, and vitamin B_5 are important for removing xylene from the body.

28. Orotate is a sensitive marker of your liver's capacity to convert toxic ammonia to non-toxic urea that you can excrete. That capacity can be increased by additional arginine. Ammonia toxicity can also be reduced by supplementation with α-ketoglutarate, magnesium, aspartic acid, and glutamic acid. Ammonia impairs brain function, causing difficulty with thinking, fatigue, headaches, and increased food sensitivities.

29. Glucarate is formed as your liver performs its important role in removing from your body many types of toxins such as pesticides, prescription drugs, food components, and intestinal bacteria. Enzymes create glucarate when they are stimulated to increase liver detoxification. High levels of glucarate indicate your liver is working to remove these toxins. Removing the source of exposure and supporting the liver's detoxification with nutrients such as glycine, glutathione, N-acetylcysteine, and liver-specific antioxidants are helpful.

30. α-Hydroxybutyrate is elevated when your body attempts to respond to metabolic stress by making additional glutathione. Because glutathione is critical for removing toxins and acts as a powerful antioxidant, your body is constantly making it in large amounts. Many disease processes can be adversely influenced by insufficiency of this vital nutrient. Elevated α-hydroxybutyrate indicates high cell demand for glutathione. Supplementation with various sulfur amino acids and glutathione can be used to support adequate levels of this compound.

31. Pyroglutamate elevation indicates the body is using up glutathione to keep from losing amino acids. Glutathione is important for protection of cells from oxidation. Various amino acids, especially methionine and glycine, can help rebuild total body glutathione. Pyroglutamate elevation can also indicate a glycine insufficiency; supplementation with this amino acid may be indicated.

32. Sulfate levels are reflective of your body's sulfur containing amino acid status. Nutrients frequently used to improve sulfate levels include N-acetylcysteine, methionine, glutathione, taurine and sodium sulfate. Sulfur containing amino acids are necessary to build a compound called glutathione. Glutathione functions as a critical antioxidant and plays a major role in chemical detoxification.

Intestinal Microbial Balance Markers

The compounds in this category normally appear in urine only at low levels and are not normally produced in the cells of your body. However, unfriendly intestinal microorganisms can manufacture them in relatively high quantities. The compounds are then absorbed into the blood from the intestines and eventually appear in the urine. Microbial overgrowth can lead to a wide variety of symptoms due to reactions to the toxic products produced by bacteria, parasites, or fungi. Various patterns of the compounds listed below appear elevated in conditions of general intestinal microbial overgrowth.

33-40. Benzoate, Phenylacetate, Phenylpropionate, p-Hydroxybenzoate, p-Hydroxyphenylacetate, Indican, Tricarballylate and Dihydroxyphenylpropionate. In health, beneficial intestinal bacteria produce some B-vitamins and provide stimulus for proper immune function. However, if your stomach acid is not adequate, if you fail to digest protein, or if your diet does not supply sufficient fiber, the resulting overgrowth of unfavorable bacteria can release toxic products that your body must remove. These toxic products include: Benzoate, Phenylacetate, Phenylpropionate, p-Hydroxybenzoate, p-Hydroxyphenylacetate, Indican, Tricarballylate, and Dihydroxyphenylpropionate. Your potential to benefit from consuming extra sources of favorable organisms (called probiotics) may go up as the number of toxic compounds and their concentrations increase.

Urine Lipid Peroxides

During the process to produce the chemical energy to power your cells and fight infection, your body makes harmful chemicals called free radicals. Breakdown of the lipid components of cell membranes by free radicals leads to the formation of lipid peroxides. Antioxidant nutrients protect you against this process. The lipid peroxide test tells you if you are getting enough of these nutrients. High levels of lipid peroxides are associated with cancer, heart disease, stroke, and aging.

See the Lipid Peroxides laboratory report page for further discussion of their significance.

The following tests are part of the Comprehensive Metabolic Profile™ and the Basic plus FA Profile™ only.

Bloodspot Fatty Acids

To the vitamin, detoxification, and neurotransmitter information from the Organix™ profile, the Designs for Health Comprehensive Metabolic Profile and the Basic plus FA Profile add critical information about essential fatty acids. This is where the multiple system function assessment becomes very powerful for predicting weaknesses that impact your health.

Many profound clinical symptoms hinge on fatty acid status. While there is much discussion of the negative impact of fats on health, the positive benefits associated with "good fats," known as essential fatty acids, is often overlooked. Achieving the optimum balance of essential fatty acids minimizes inflammation, a major risk factor in heart disease and cancer. A balance of fatty acids is also necessary for proper brain development and function of the nervous system. The activity of every cell in your body is compromised when fatty acids are deficient. Cell membranes, made of fatty acids, serve as the door that regulates the flow of nutrients into the cell and removal of metabolic waste products out of the cell.

Blood spot levels of fatty acids reveal circulating levels in plasma as well as long-term balance in the tissue. By examining whole blood it is possible to gauge how well your body is utilizing the fatty acids you consume.

Polyunsaturated Omega-3 Fatty Acids

Eicosapentaenoic Acid (EPA) is involved in the regulation of inflammatory processes and prevention of blood clots. Insufficiency of EPA is the most prevalent fatty acid abnormality, and leads to arthritis, heart disease, hypertension, elevated cholesterol, and aging from unchecked inflammatory responses. Another omega-3 fatty acid, **Docosahexaenoic Acid (DHA)**, is integral to the growth and development of the central nervous system in fetuses and infants. Deficiencies in DHA can also lead to ADD/ADHD, mental retardation, and failures in visual development and function, including blindness from retinitis pigmentosa.

Polyunsaturated Omega-6 Fatty Acids

Linoleic Acid (LA) is by far the most abundant polyunsaturated fatty acid in most human tissues. Low levels indicate dietary insufficiency, which can lead to a variety of symptoms. Some of these symptoms result from lack of LA in cell membranes, where it plays a role in structural integrity. Dietary sources are abundant, especially from corn oil, so LA is more likely to be found above normal, which can contribute to inflammation.

Gamma Linolenic Acid (GLA) is the precursor of both **Dihomogamma Linolenic Acid (DGLA)**, an anti-inflammatory fatty acid, and **Arachidonic Acid (AA)**, a pro-inflammatory fatty acid. It can be produced in human tissues by action of desaturase enzymes on LA. DGLA is anti-inflammatory, so an insufficiency of this fatty acid impairs a wide range of cellular functions and tissue responses.

AA is the essential fatty acid least likely to be found insufficient because of its prevalence in the standard Western diet in foods such as corn, corn oil and red meats. It is a potent pro-inflammatory product which results in an increased incidence of degenerative diseases, heart disease, and cancer.

Total C:18 Trans Fatty Acids include elaidic acid, petroselaidic acid and transvaccenic acid. They are prevalent in most diets because of the widespread use of hydrogenated oils in margarines, bakery products, and peanut butters. They behave like saturated fats on the one hand, leading to higher cholesterol levels. They mimic unsaturated fats on the other hand, interfering with the normal conversions of unsaturated fatty acids. The net effect is to raise LDL (bad) cholesterol and lower HDL (good) cholesterol. The consensus among experts is that hydrogenated oils should be avoided.

LA/GLA Ratio is used to reveal a failure to convert LA into GLA. A zinc deficiency will cause this conversion to fail.

AA/EPA Ratio determines the balance of immune modulators in the body called eicosanoids. Different eicosanoids possess varying levels of inflammatory and anti-inflammatory potential. Having the right levels of each helps the immune system to achieve equilibrium, allowing effective immune stimulation to fight infection while preventing excessive inflammation. A blood spot AA/EPA ratio of 2.9 – 5.0 is considered to be ideal. This is equivalent to the ratios of less than 3.0 in blood serum measurements found in Japanese populations having the greatest longevity and lowest incidence of cardiovascular disease. While the average blood spot AA/EPA ratio of Americans is approximately 20, patients with inflammatory conditions and neurological disorders are frequently in excess of 32.

EPA/DGLA Ratio measures the balance between omega-3 and omega-6 polyunsaturated fatty acids. These 20-carbon fatty acids have special roles in production of eicosanoid hormones that control a host of cellular responses. A low ratio indicates a need for more EPA from sources like fish oil. When high, sources of DGLA precursors, like Borage oil, are indicated.

Index of Omega-3 Fatty Acids (EPA+DHA%) is the calculated total of the two most critical fatty acids for health. Although both EPA and DHA are supplied by fish oils, they are metabolized quite differently. One of them can be high while the other is still in the lower range, or vice versa. In clinical trials this index was an effective benchmark for cardiovascular risk. A bloodspot measurement greater than 1.6% was associated with a lower cardiovascular disease risk, while an index less than .75% was associated with a higher risk.

Bloodspot IgG Food Antibodies

Overview:

Now that we have assessed the status of vitamins, neurotransmitters, detoxification, microbial balance, and essential fatty acids, we move next to the extremely important question of food sensitivities. If antigens from food have become a chronic challenge to immune function, then steps may be needed to heal the gut. The barrier between the blood and the digested food and microbial mass in the gut must be strong to keep from overloading the immune system.

Please refer to the Bloodspot™ IgG Food Antibody Patient Guide for detailed information

Summary

Measuring markers of deficiency and food sensitivity is a quantum leap above trying to guess where support is needed just from signs and symptoms. The chosen markers cover most aspects of individual requirements for nutrients and dietary modification.

The laboratory measurements must be translated into specific corrections that can lead to improved function. The Designs for Health Metabolic Profiles provide clear recommendations of products and dosages that meet the individual needs indicated by the test results. Response times can be highly variable. Symptoms frequently improve in a matter of days to weeks. Abnormal metabolic markers may take longer to fully normalize, but they usually show changes toward normality in three months, so retesting may be done at that time. Abnormalities that persist may be due to toxins that have not been identified or to strong genetic factors.