



The Great Plains Laboratory, Inc.

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Requisition #: 440870

Physician: REGENERUS LAB

Patient Name: Jack Lunn

Date of Collection: 5/16/2016

Patient Age: 24

Time of Collection: 00:00 AM

Patient Sex: M

Print Date: 05/25/2016



Organic Acids Test - Nutritional and Metabolic Profile

Metabolic Markers in Urine

Reference Range
(mmol/mol creatinine)

Patient
Value

Reference Population - Males Age 13 and Over

Intestinal Microbial Overgrowth

Yeast and Fungal Markers

1	Citramalic	0.11 - 2.0	0.59	
2	5-Hydroxymethyl-2-furoic	≤ 18	1.8	
3	3-Oxoglutaric	≤ 0.11	0.03	
4	Furan-2,5-dicarboxylic	≤ 13	2.6	
5	Furancarbonylglycine	≤ 2.3	2.2	
6	Tartaric	≤ 5.3	0.85	
7	Arabinose	≤ 20	H 33	
8	Carboxycitric	≤ 20	0.51	
9	Tricarballic	≤ 0.58	0.14	

Bacterial Markers

10	Hippuric	≤ 241	71	
11	2-Hydroxyphenylacetic	0.03 - 0.47	0.26	
12	4-Hydroxybenzoic	0.01 - 0.73	0.52	
13	4-Hydroxyhippuric	≤ 14	4.3	
14	DHPPA (Beneficial Bacteria)	≤ 0.23	0.06	

Clostridia Bacterial Markers

15	4-Hydroxyphenylacetic (<i>C. difficile</i> , <i>C. stricklandii</i> , <i>C. lituseburens</i> & others)	≤ 18	H 28	
16	HPHPA (<i>C. sporogenes</i> , <i>C. caloritolerans</i> , <i>C. botulinum</i> & others)	≤ 102	16	
17	4-Cresol (<i>C. difficile</i>)	≤ 39	20	
18	3-Indoleacetic (<i>C. stricklandii</i> , <i>C. lituseburens</i> , <i>C. subterminale</i> & others)	≤ 6.8	0.36	

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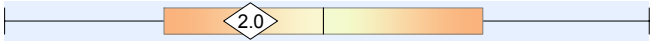
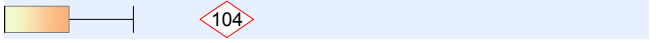
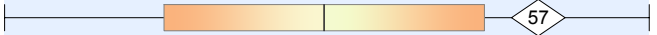
Physician: REGENERUS LAB

Patient Name: Jack Lunn

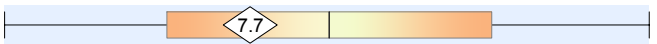
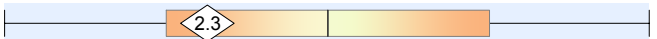
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Metabolic Markers in Urine Reference Range (mmol/mol creatinine) Patient Value Reference Population - Males Age 13 and Over

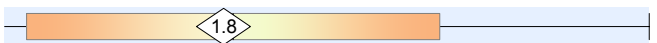


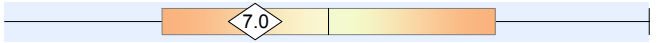
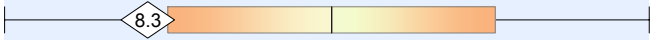
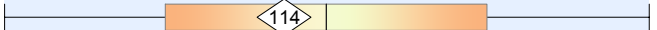
Oxalate Metabolites

19	Glyceric	0.21 - 4.9	2.0	
20	Glycolic	18 - 81	H 104	
21	Oxalic	8.9 - 67	57	

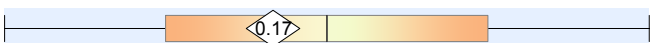
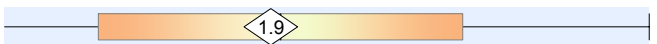
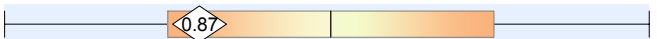
Glycolytic Cycle Metabolites

22	Lactic	0.74 - 19	7.7	
23	Pyruvic	0.28 - 6.7	2.3	

Mitochondrial Markers - Krebs Cycle Metabolites

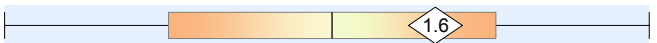
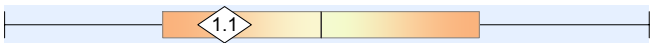
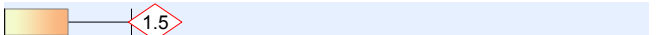
24	Succinic	≤ 5.3	1.8	
25	Fumaric	≤ 0.49	0.18	
26	Malic	≤ 1.1	0.20	
27	2-Oxoglutaric	≤ 18	7.0	
28	Aconitic	4.1 - 23	8.3	
29	Citric	2.2 - 260	114	

Mitochondrial Markers - Amino Acid Metabolites

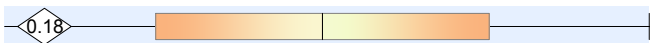
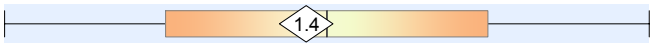
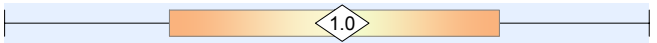
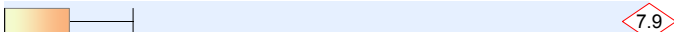
30	3-Methylglutaric	0.02 - 0.38	0.17	
31	3-Hydroxyglutaric	≤ 4.6	1.9	
32	3-Methylglutaconic	0.38 - 2.0	0.87	

Neurotransmitter Metabolites

Phenylalanine and Tyrosine Metabolites

33	Homovanillic (HVA) (dopamine)	0.39 - 2.2	1.6	
34	Vanillylmandelic (VMA) (norepinephrine, epinephrine)	0.53 - 2.2	1.1	
35	HVA / VMA Ratio	0.32 - 1.4	H 1.5	

Tryptophan Metabolites

36	5-Hydroxyindoleacetic (5-HIAA) (serotonin)	≤ 2.9	0.18	
37	Quinolinic	0.52 - 2.4	1.4	
38	Kynurenic	0.12 - 1.8	1.0	
39	Quinolinic / 5-HIAA Ratio	≤ 2.5	H 7.9	

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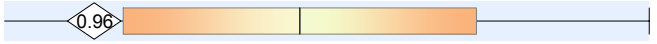
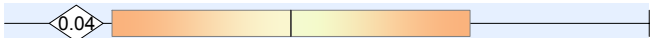
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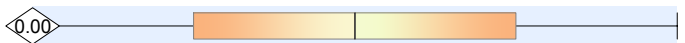
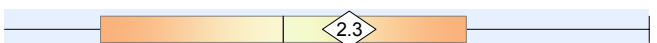
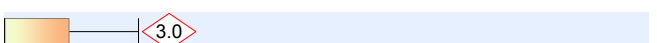
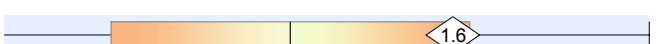
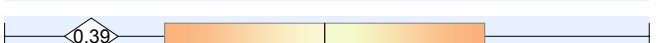
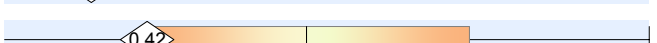
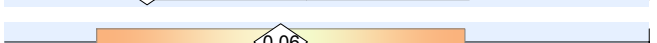
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Metabolic Markers in Urine Reference Range (mmol/mol creatinine) Patient Value Reference Population - Males Age 13 and Over

Pyrimidine Metabolites - Folate Metabolism

40	Uracil	≤ 6.9	0.96	
41	Thymine	≤ 0.36	0.04	

Ketone and Fatty Acid Oxidation

42	3-Hydroxybutyric	≤ 1.9	0.63	
43	Acetoacetic	≤ 10	0	
44	4-Hydroxybutyric	≤ 4.3	2.3	
45	Ethylmalonic	0.13 - 2.7	H 3.0	
46	Methylsuccinic	≤ 2.3	1.6	
47	Adipic	≤ 2.9	0.39	
48	Suberic	≤ 1.9	0.42	
49	Sebacic	≤ 0.14	0.06	

Nutritional Markers

Vitamin B12

50	Methylmalonic *	≤ 2.3	2.0	
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Vitamin B6

51	Pyridoxic (B6)	≤ 26	23	
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Vitamin B5

52	Pantothenic (B5)	≤ 5.4	5.2	
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Vitamin B2 (Riboflavin)

53	Glutaric *	≤ 0.43	0.13	
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Vitamin C

54	Ascorbic	10 - 200	31	
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Vitamin Q10 (CoQ10)

55	3-Hydroxy-3-methylglutaric *	≤ 26	13	
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Glutathione Precursor and Chelating Agent

56	N-Acetylcysteine (NAC)	≤ 0.13	0	
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Biotin (Vitamin H)

57	Methylcitric *	0.15 - 1.7	0.72	
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* A high value for this marker may indicate a deficiency of this vitamin.

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Metabolic Markers in Urine Reference Range (mmol/mol creatinine) Patient Value Reference Population - Males Age 13 and Over

Indicators of Detoxification

Glutathione

58	Pyroglutamic *	5.7 - 25	8.9	
59	2-Hydroxybutyric *	≤ 1.2	1.1	

Ammonia Excess

60	Orotic	≤ 0.46	0.13	
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Aspartame, salicylates, or GI bacteria

61	2-Hydroxyhippuric	≤ 0.86	0.34	
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* A high value for this marker may indicate a Glutathione deficiency.

Amino Acid Metabolites

62	2-Hydroxyisovaleric	≤ 0.41	H 1.6	
63	2-Oxoisovaleric	≤ 1.5	0	
64	3-Methyl-2-oxovaleric	≤ 0.56	0.38	
65	2-Hydroxyisocaproic	≤ 0.39	0	
66	2-Oxoisocaproic	≤ 0.34	0.07	
67	2-Oxo-4-methiolbutyric	≤ 0.14	0.01	
68	Mandelic	≤ 0.09	0	
69	Phenyllactic	≤ 0.10	0	
70	Phenylpyruvic	0.02 - 1.4	0.90	
71	Homogentisic	≤ 0.23	0.02	
72	4-Hydroxyphenyllactic	≤ 0.62	H 0.72	
73	N-Acetylaspartic	≤ 2.5	0	
74	Malonic	≤ 9.9	3.5	

Mineral Metabolism

75	Phosphoric	1 000 - 4 900	1 664	
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Indicator of Fluid Intake

76 *Creatinine

209 mg/dL

*The creatinine test is performed to adjust metabolic marker results for differences in fluid intake. Urinary creatinine has limited diagnostic value due to variability as a result of recent fluid intake. Samples are rejected if creatinine is below 20 mg/dL unless the client requests results knowing of our rejection criteria.

Explanation of Report Format

The reference ranges for organic acids were established using samples collected from typical individuals of all ages with no known physiological or psychological disorders. The ranges were determined by calculating the mean and standard deviation (SD) and are defined as $\pm 2SD$ of the mean. Reference ranges are age and gender specific, consisting of Male Adult (≥ 13 years), Female Adult (≥ 13 years), Male Child (< 13 years), and Female Child (< 13 years).

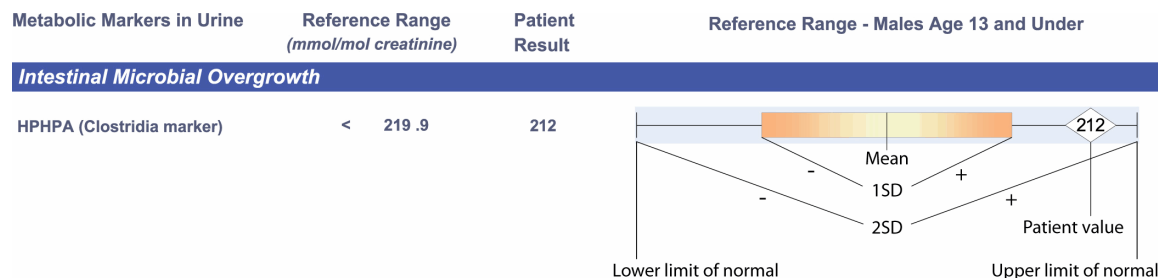
There are two types of graphical representations of patient values found in the new report format of both the standard Organic Acids Test and the Microbial Organic Acids Test.

The first graph will occur when the value of the patient is within the reference (normal) range, defined as the mean plus or minus two standard deviations.

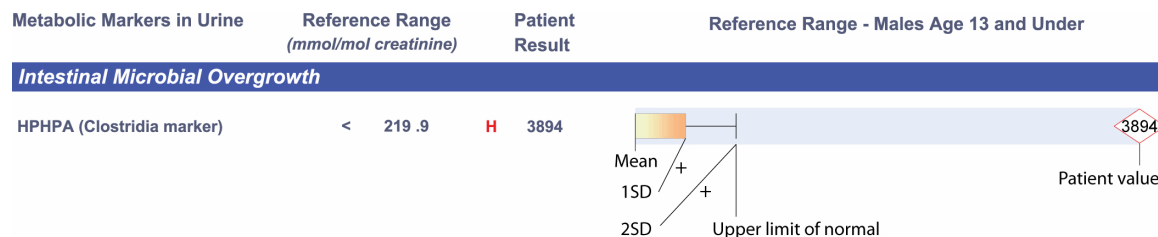
The second graph will occur when the value of the patient exceeds the upper limit of normal. In such cases, the graphical reference range is "shrunk" so that the degree of abnormality can be appreciated at a glance. In this case, the lower limits of normal are not shown, only the upper limit of normal is shown.

In both cases, the value of the patient is given to the left of the graph and is repeated on the graph inside a diamond. If the value is within the normal range, the diamond will be outlined in black. If the value is high or low, the diamond will be outlined in red.

Example of Value Within Reference Range



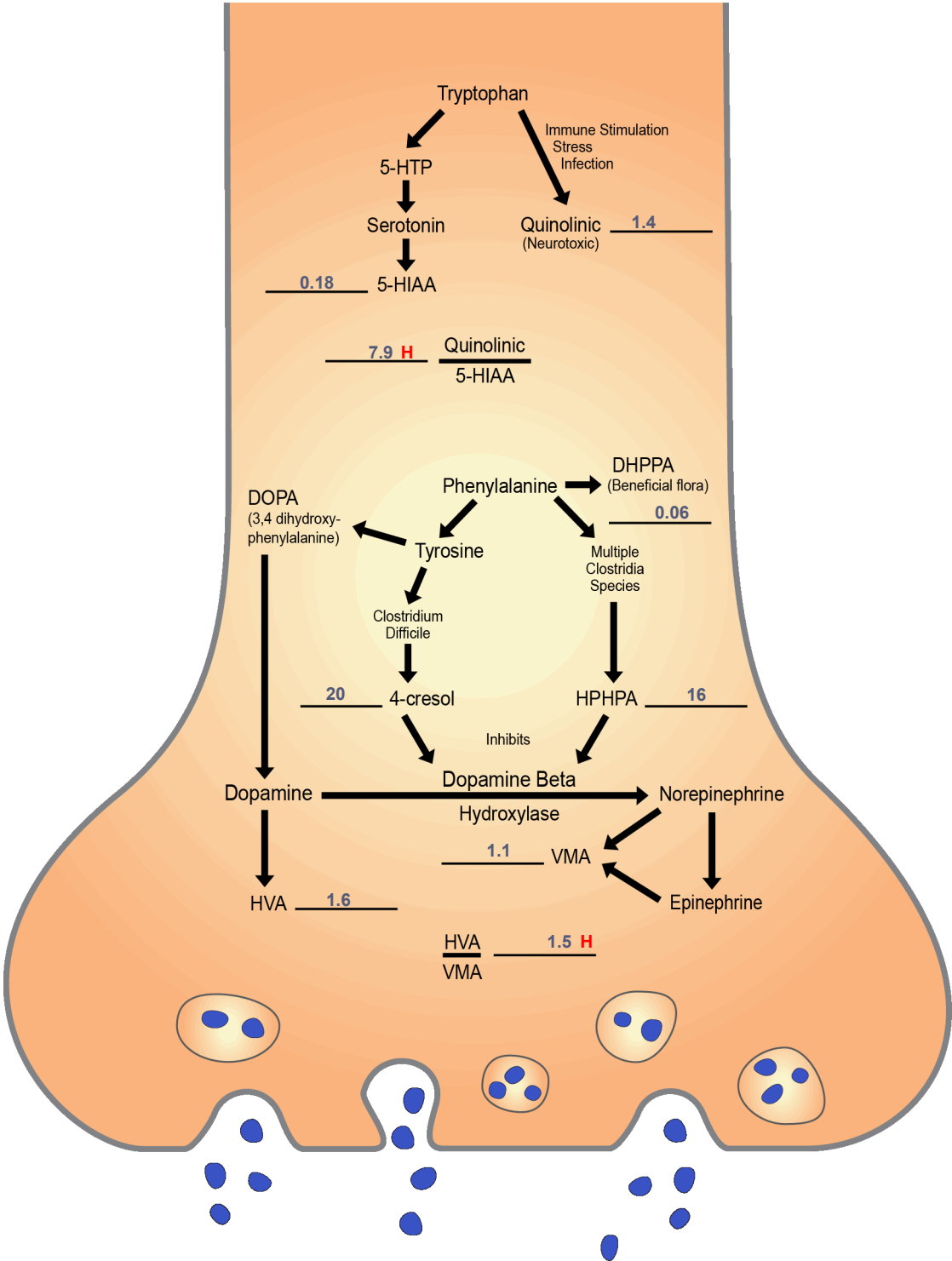
Example of Elevated Value



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Neurotransmitter Metabolism Markers



The diagram contains the patient's test results for neurotransmitter metabolites and shows their relationship with key biochemical pathways within the axon terminal of nerve cells. The effect of microbial byproducts on the blockage of the conversion of dopamine to norepinephrine is also indicated.

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Interpretation

High yeast/fungal metabolites (Markers 1,2,3,4,5,6,7,8) indicate a yeast/fungal overgrowth of the gastrointestinal tract. Prescription or natural (botanical) anti-fungals, along with supplementation of high potency multi-strain probiotics (20-50 billion cfu's), may reduce yeast/fungal levels.

High 4-hydroxyphenylacetic acid (Marker 15) is associated with small intestinal bacteria overgrowth due to its production by the following Clostridia bacteria: *C. difficile*, *C. stricklandii*, *C. lituseburens*, *C. subterminale*, *C. putrefaciens*, and *C. propionicum*. *C. difficile* can be distinguished from the other species by its production of 4-cresol which none of the other species produce. No information on the pathogenicity of the other species producing 4-hydroxyphenylacetic acid is available. It is likely that the phenol 4-hydroxyphenylacetic is an inhibitor of dopamine-beta-hydroxylase and that patients with high values may have elevated dopamine and HVA/VMA ratios. Elevated values are common in celiac disease and cystic fibrosis and have been reported as elevated in jejuna web, transient lactose intolerance, Giardia infection, ileal resection, ileocolic intussusception, septicemia, and projectile vomiting. Treatment with probiotics or antibiotics may be clinically useful.

Extremely elevated levels of at least 100 mmol/mol creatinine are associated with tyrosinemia, which can be due to immature development of enzymes in infants or to genetic deficiencies.

High glyceric or glycolic acid with low/normal oxalic acid (Markers 19,20,21) may result from a different metabolic pathway and have no known health consequences or genetic implications.

VMA levels below the mean (Marker 34) may indicate lower production of the neurotransmitter norepinephrine or the hormone adrenaline, perhaps due to low dietary intake of the amino acid precursors phenylalanine or tyrosine. Vanilylmandelic acid (VMA) is a metabolite of norepinephrine or adrenaline. Low VMA may also result from blocked conversion of dopamine to norepinephrine by *Clostridia* metabolites. Supplementation with phenylalanine or tyrosine may be beneficial. Enzyme cofactors magnesium, B6 (pyridoxine) or bipterin may also be deficient and respond to supplementation.

High HVA/VMA ratio (Marker 35) The most common reason for an elevation of the HVA/VMA ratio is the decreased conversion of dopamine to norepinephrine and epinephrine. The enzyme responsible for this conversion, dopamine beta-hydroxylase, is copper and vitamin C dependent, so an elevated ratio could be due to deficiencies of these cofactors. Another common factor is inhibition of this enzyme by *Clostridia* byproducts. A high HPPHA, 4-Cresol, or other elevations of metabolites would be consistent with the latter explanation.

5-hydroxyindoleacetic acid (5-HIAA) levels below the mean (Marker 36) may indicate lower production of the neurotransmitter serotonin. 5-hydroxy-indoleacetic acid is a metabolite of serotonin. Low values have been correlated with symptoms of depression. Supplementation with the precursor 5-HTP (5-hydroxytryptophan) at 50-300 mg/day may be beneficial. Supplementation with tryptophan itself may form the neurotoxic metabolite quinolinic acid, however, 5-HTP is not metabolized to quinolinic acid. Excessive tryptophan supplementation has been associated with eosinophilia myalgia syndrome.

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High quinolinic acid / 5-HIAA ratio (Marker 39) indicates an imbalance of these organic acids and may be a sign of neural excitotoxicity. Quinolinic acid is an excitotoxic stimulant of certain brain cells that have NMDA-type receptors. Overstimulated nerve cells may die. Brain toxicity due to quinolinic acid has been implicated in Alzheimer's disease, autism, Huntington's disease, stroke, dementia of old age, depression, HIV-associated dementia, and schizophrenia. However, quinolinic acid is derived from the amino acid tryptophan and is an important intermediate that the body uses to make the essential nutritional cofactor nicotinamide adenine dinucleotide (NAD), which can also be derived from niacin (B3).

An elevated ratio is not specific for a particular medical condition and is commonly associated with excessive inflammation due to recurrent infections. If quinolinic acid is not elevated, low 5-HIAA from serotonin may be the source of the imbalance. Supplementation with 5-HTP may increase serotonin levels, but 5-HTP is not metabolized to quinolinic acid. Immune overstimulation, excess adrenal production of cortisol due to stress, or high exposure to phthalates may also increase the quinolinic acid/5-HIAA acid ratio.

The drug deprenyl or the dietary supplements carnitine, melatonin, capsaicin, turmeric (curcumin) and garlic may reduce brain damage caused by quinolinic acid. Niacin (nicotinic acid) and niacinamide may also reduce quinolinic acid production by decreasing tryptophan shunting to the quinolinic acid pathway. Inositol hexaniacinate as an adult dose of 500-1000 mg does not cause niacin flush.

High ethylmalonic, methylsuccinic, adipic, suberic, or sebacic acids (Markers 45,46,47,48,49) may be due to fatty acid oxidation disorders, carnitine deficiency, fasting, or to increased intake of the medium-chain triglycerides found in coconut oil, MCT oil, and some infant formulas. The fatty acid oxidation defects are associated with hypoglycemia, apnea episodes, lethargy, and coma. [An acyl carnitine profile (Duke University Biochemical Genetics Laboratory, <http://medgenetics.pediatrics.duke.edu>) can rule out fatty acid oxidation defects.] Regardless of cause, supplementation with L-carnitine or acetyl-L-carnitine (500-1000 mg per day) may be beneficial.

Ascorbic acid (vitamin C) levels below the mean (Marker 54) may indicate a less than optimum level of the antioxidant vitamin C. Suggested supplementation is 1000 mg/day of buffered vitamin C, divided into 2-3 doses.

High 2-hydroxyisovaleric acid and/or 2-hydroxyisocaproic acid (Markers 62,65) may be due to the genetic disease MSUD (maple syrup urine disease) or dihydrolipoyl dehydrogenase deficiency. Individuals with slight to moderate elevations may benefit from supplementing with high doses (5-20 mg/kg/day) of thiamine.

High 4-hydroxyphenyllactic acid (Marker 72) is associated with tyrosinemia, which can be due to immature development of enzymes in infants or to genetic deficiencies. Even a mild case would have levels at least of 100 mmol/mol creatinine. Values between the upper limit of normal and 100 mmol creatinine may be due to the heterozygous genetic carrier state, or mild disease or unknown physiological conditions.

Low values for amino acid metabolites (Markers 62-74) indicate the absence of genetic disorders of amino acid metabolism. These markers are deamination (ammonia removed) byproducts that are very elevated only when a key enzyme has low activity; slight elevations may indicate a genetic variation or heterozygous condition which may be mitigated with diet or supplementation. Low values are not associated with inadequate protein intake and have not been proven to indicate specific amino acid deficiencies.

High quality nutritional supplements can be purchased through your practitioner or at New Beginnings Nutritionals, www.NBNUS.com <<http://www.NBNUS.com>> , or call 877-575-2467.