The Great Plains Laboratory, Inc.

William Shaw, Ph.D., Director | 11813 West 77th Street, Lenexa, KS 66214 | (913) 341-8949 | Fax (913) 341-6207

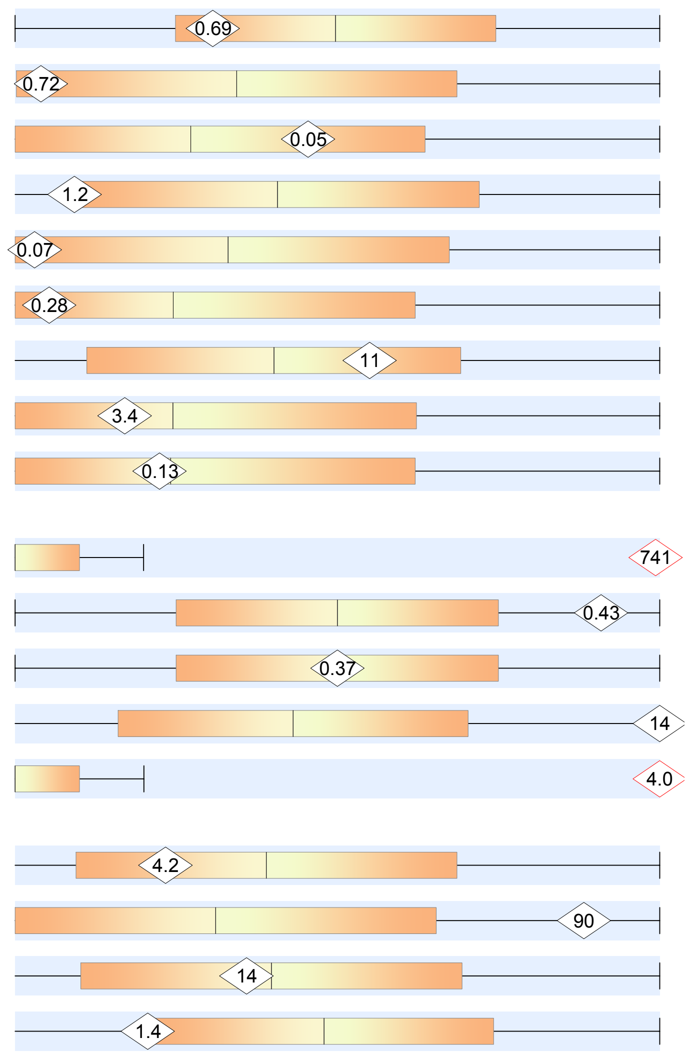
Requisition #:	431860	***Physician:***	TRACI GILES
Patient Name:	Derrek Hooyman	***Date of Collection:***	3/23/2016
Patient Age:	21	***Time of Collection:***	08:40 AM
Patient Sex:	M	***Print Date:***	03/31/2016

Organic Acids Test - Nutritional and Metabolic Profile

Intestinal Microbial Overgrowth

Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)		Patient Value
Yeast and Fungal Markers			
1 Citramalic	0.11 - 2.0		0.69
2 5-Hydroxymethyl-2-furoic	≤ 18		0.72
3 3-Oxoglutaric	≤ 0.11		0.05
4 Furan-2,5-dicarboxylic	≤ 13		1.2
5 Furancarbonylglycine	≤ 2.3		0.07
6 Tartaric	≤ 5.3		0.28
7 Arabinose	≤ 20		11
8 Carboxycitric	≤ 20		3.4
9 Tricarballylic	≤ 0.58		0.13
Bacterial Markers			
10 Hippuric	≤ 241	H	741
11 2-Hydroxyphenylacetic	0.03 - 0.47		0.43
12 4-Hydroxybenzoic	0.01 - 0.73		0.37
13 4-Hydroxyhippuric	≤ 14		14
14 DHPPA (Beneficial Bacteria)	≤ 0.23	H	4.0
Clostridia Bacterial Markers			
15 4-Hydroxyphenylacetic *(C. difficile, C. stricklandii, C. lituseburense & others)*	≤ 18		4.2
16 HPHPA *(C. sporogenes, C. caloritolerans, C. botulinum & others)*	≤ 102		90
17 4-Cresol *(C. difficile)*	≤ 39		14
18 3-Indoleacetic *(C. stricklandii, C. lituseburense, C. subterminale & others)*	≤ 6.8		1.4

Reference Population - Males Age 13 and Over



Testing performed by The Great Plains Laboratory, Inc., Lenexa, Kansas. The Great Plains Laboratory has developed and determined the performance characteristics of this test. This test has not been evaluated by the U.S. FDA; the FDA does not currently regulate such testing.

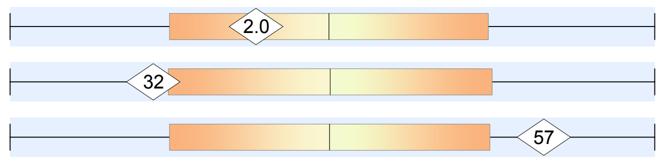
The Great Plains Laboratory, Inc.

Requisition #:	431860	*Physician:*	TRACI GILES
Patient Name:	Derrek Hooyman	*Date of Collection:*	3/23/2016

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

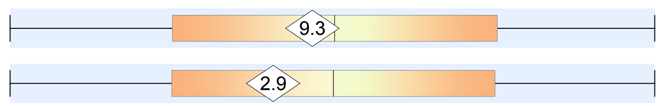
Oxalate Metabolites

19	Glyceric	0.21 - 4.9		2.0
20	Glycolic	18 - 81		32
21	Oxalic	8.9 - 67		57



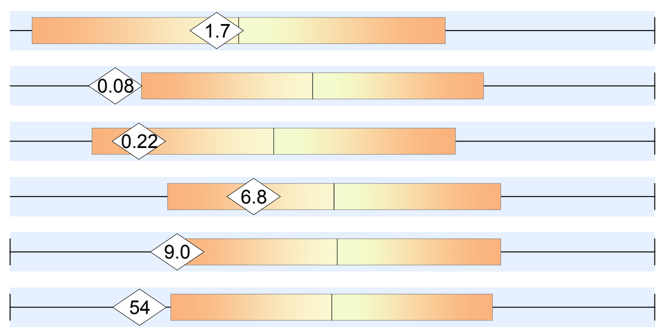
Glycolytic Cycle Metabolites

22	Lactic	0.74 - 19		9.3
23	Pyruvic	0.28 - 6.7		2.9



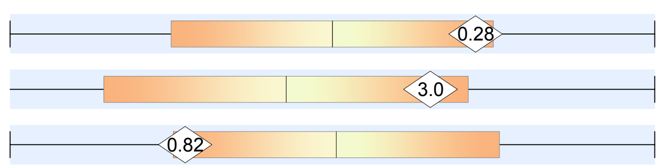
Mitochondrial Markers - Krebs Cycle Metabolites

24	Succinic	≤ 5.3		1.7
25	Fumaric	≤ 0.49		0.08
26	Malic	≤ 1.1		0.22
27	2-Oxoglutaric	≤ 18		6.8
28	Aconitic	4.1 - 23		9.0
29	Citric	2.2 - 260		54



Mitochondrial Markers - Amino Acid Metabolites

30	3-Methylglutaric	0.02 - 0.38		0.28
31	3-Hydroxyglutaric	≤ 4.6		3.0
32	3-Methylglutaconic	0.38 - 2.0		0.82



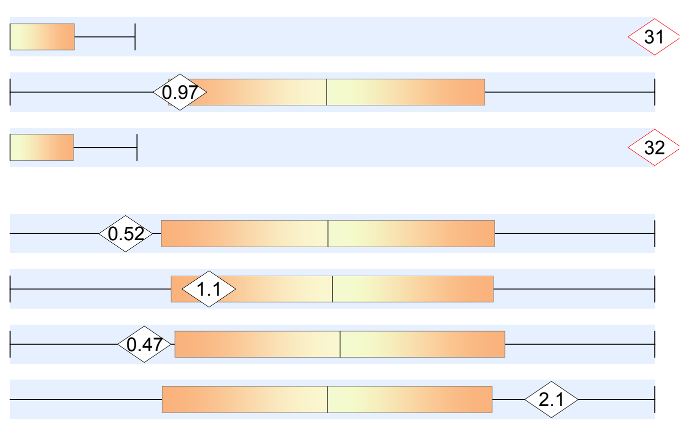
Neurotransmitter Metabolites

Phenylalanine and Tyrosine Metabolites

33	Homovanillic (HVA) *(dopamine)*	0.39 - 2.2	H	31
34	Vanillylmandelic (VMA) *(norepinephrine, epinephrine)*	0.53 - 2.2		0.97
35	HVA / VMA Ratio	0.32 - 1.4	H	32

Tryptophan Metabolites

36	5-Hydroxyindoleacetic (5-HIAA) *(serotonin)*	≤ 2.9		0.52
37	Quinolinic	0.52 - 2.4		1.1
38	Kynurenic	0.12 - 1.8		0.47
39	Quinolinic / 5-HIAA Ratio	≤ 2.5		2.1



The Great Plains Laboratory, Inc.

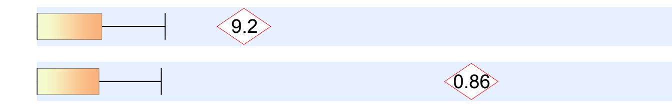
Requisition #: 431860 | **Physician:** TRACI GILES

Patient Name: Derrek Hooyman | **Date of Collection:** 3/23/2016

Pyrimidine Metabolites - Folate Metabolism

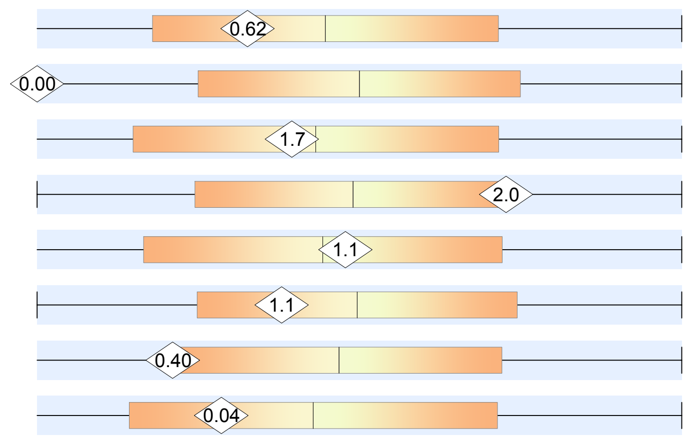
#	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)		Patient Value
40	Uracil	≤ 6.9	H	9.2
41	Thymine	≤ 0.36	H	0.86

Reference Population - Males Age 13 and Over



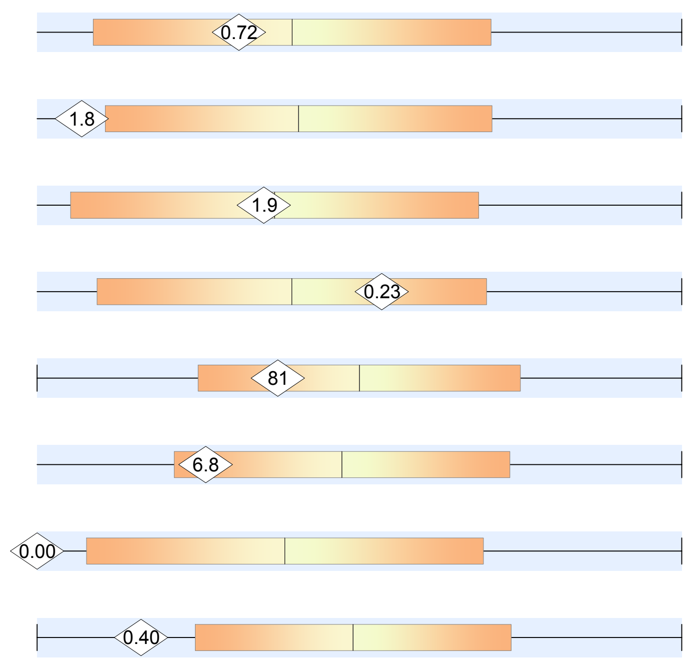
Ketone and Fatty Acid Oxidation

#	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Value
42	3-Hydroxybutyric	≤ 1.9	0.62
43	Acetoacetic	≤ 10	0
44	4-Hydroxybutyric	≤ 4.3	1.7
45	Ethylmalonic	0.13 - 2.7	2.0
46	Methylsuccinic	≤ 2.3	1.1
47	Adipic	≤ 2.9	1.1
48	Suberic	≤ 1.9	0.40
49	Sebacic	≤ 0.14	0.04



Nutritional Markers

#	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Value
	Vitamin B12		
50	Methylmalonic ✱	≤ 2.3	0.72
	Vitamin B6		
51	Pyridoxic (B6)	≤ 26	1.8
	Vitamin B5		
52	Pantothenic (B5)	≤ 5.4	1.9
	Vitamin B2 (Riboflavin)		
53	Glutaric ✱	≤ 0.43	0.23
	Vitamin C		
54	Ascorbic	10 - 200	81
	Vitamin Q10 (CoQ10)		
55	3-Hydroxy-3-methylglutaric ✱	≤ 26	6.8
	Glutathione Precursor and Chelating Agent		
56	N-Acetylcysteine (NAC)	≤ 0.13	0
	Biotin (Vitamin H)		
57	Methylcitric ✱	0.15 - 1.7	0.40



✱ ***A high value for this marker may indicate a deficiency of this vitamin.***

The Great Plains Laboratory, Inc.

Requisition #: 431860 | **Physician:** TRACI GILES

Patient Name: Derrek Hooyman | **Date of Collection:** 3/23/2016

	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	18	
59	2-Hydroxybutyric ✱	≤ 1.2	1.0	
	Ammonia Excess			
60	Orotic	≤ 0.46	0.21	
	Aspartame, salicylates, or GI bacteria			
61	2-Hydroxyhippuric	≤ 0.86	0.85	

✱ ***A high value for this marker may indicate a Glutathione deficiency.***

Amino Acid Metabolites

	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Value	Reference Population - Males Age 13 and Over
62	2-Hydroxyisovaleric	≤ 0.41	0	
63	2-Oxoisovaleric	≤ 1.5	0.19	
64	3-Methyl-2-oxovaleric	≤ 0.56	0.20	
65	2-Hydroxyisocaproic	≤ 0.39	0.01	
66	2-Oxoisocaproic	≤ 0.34	0.07	
67	2-Oxo-4-methiolbutyric	≤ 0.14	0.04	
68	Mandelic	≤ 0.09	0	
69	Phenyllactic	≤ 0.10	0.02	
70	Phenylpyruvic	0.02 - 1.4	0.28	
71	Homogentisic	≤ 0.23	0.03	
72	4-Hydroxyphenyllactic	≤ 0.62	0.27	
73	N-Acetylaspartic	≤ 2.5	1.7	
74	Malonic	≤ 9.9	1.5	

Mineral Metabolism

	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Value	Reference Population - Males Age 13 and Over
75	Phosphoric	1 000 - 4 900	1 104	

The Great Plains Laboratory, Inc.

Requisition #:	431860	*Physician:*	TRACI GILES
Patient Name:	Derrek Hooyman	*Date of Collection:*	3/23/2016

Indicator of Fluid Intake

76	*Creatinine	47	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 ± 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.

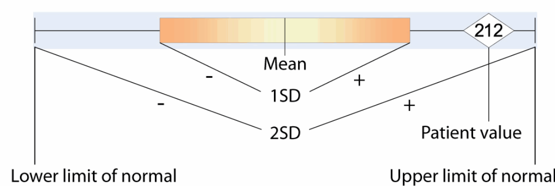
The first graph will occur when the value of the patient is within the reference (normal) range, defined as the mean plus or minus two standard deviations.

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.

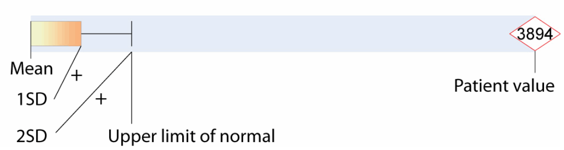
Example of Value Within Reference Range

Metabolic Markers in Urine	Reference Range *(mmol/mol creatinine)*		Patient Result	Reference Range - Males Age 13 and Under
Intestinal Microbial Overgrowth				
HPHPA (Clostridia marker)	<	219 .9	212	



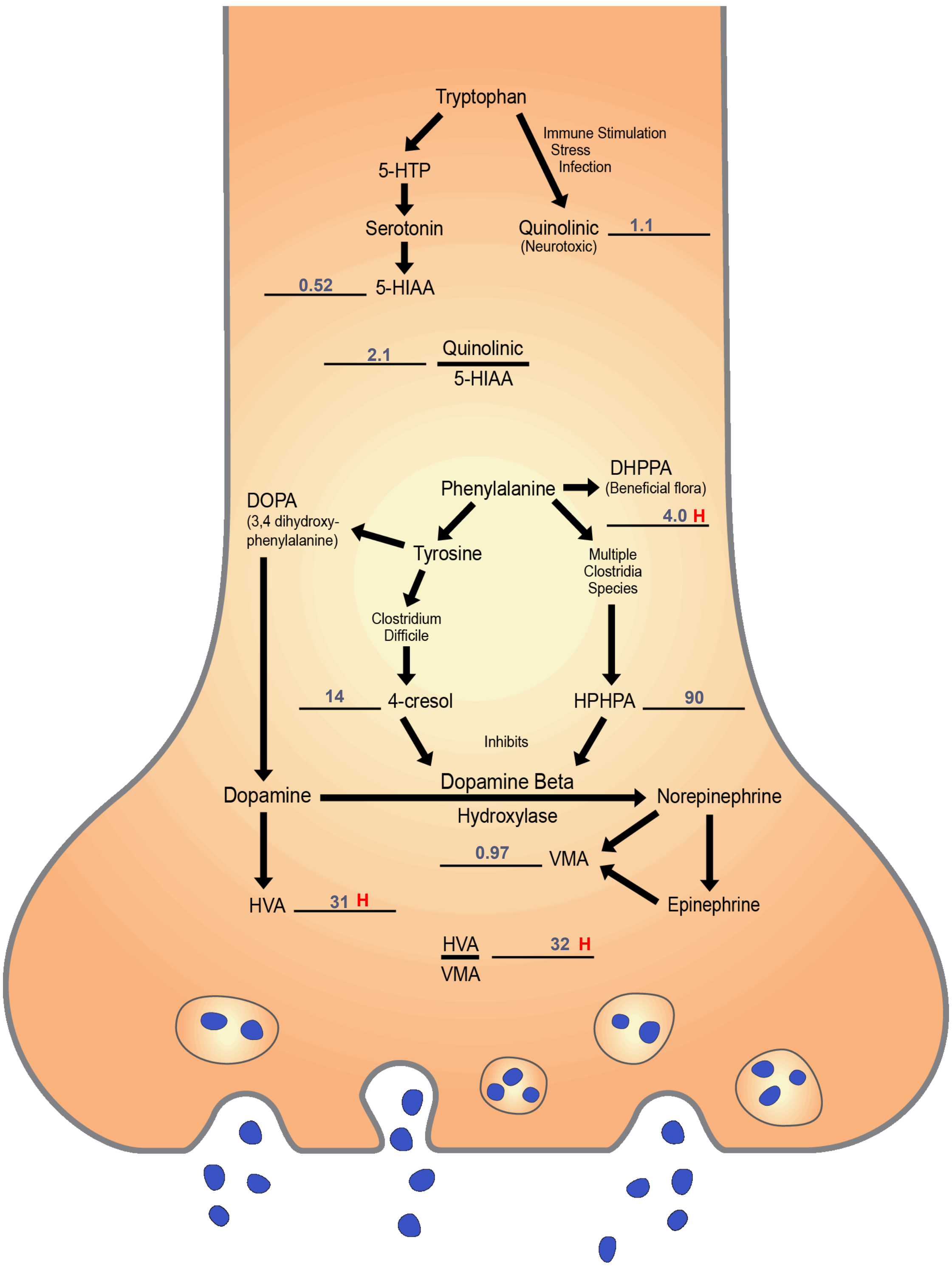
Example of Elevated Value

Metabolic Markers in Urine	Reference Range *(mmol/mol creatinine)*			Patient Result	Reference Range - Males Age 13 and Under
Intestinal Microbial Overgrowth					
HPHPA (Clostridia marker)	<	219 .9	H	3894	



Requisition #:	431860	*Physician:*	TRACI GILES
Patient Name:	Derrek Hooyman	*Date of Collection:*	3/23/2016

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.

Interpretation

High hippuric acid (Marker 10) may derive from food, GI bacterial activity, or exposure to the solvent toluene. Hippuric acid is a conjugate of glycine and benzoic acid formed in the liver. Most hippuric acid in urine is derived from microbial breakdown of chlorogenic acid to benzoic acid. Chlorogenic acid is a common substance in beverages and in many fruits and vegetables, including apples, pears, tea, coffee, sunflower seeds, carrots, blueberries, cherries, potatoes, tomatoes, eggplant, sweet potatoes, and peaches. Benzoic acid is present in high amounts in cranberry juice and is a food preservative. The workplace is the most common source of toluene exposure, but toluene may be absorbed from outgassing of new carpets and other building materials, or absorbed during recreational abuse of solvents such as glue-sniffing. Because most hippuric acid in urine is from GI sources, this marker is a poor indicator of toluene exposure and is being replaced by other markers in occupational safety testing. Bacterial overgrowth can be treated with natural anti-bacterial agents and/or probiotics (30-50 billion cfu's) that include *Lactobacillus rhamnosus*.

High DHPPA (3,4 dihydroxyphenylpropionic acid) (Marker 14) indicates excessive intake of chlorogenic acid, a common substance found in beverages and in many fruits and vegetables, including apples, pears, tea, coffee, sunflower seeds, carrots, blueberries, cherries, potatoes, tomatoes, eggplant, sweet potatoes, and peaches. Harmless or beneficial bacteria such as Lactobacilli, Bifidobacteria, and E. coli mediate the breakdown of chlorogenic acid to 3,4-dihydroxyphenylpropionic acid (DHPPA), and high values may indicate increased amounts of these species in the GI tract. In addition, one *Clostridia* species, *C. orbiscindens*, can convert the flavanoids luteolin and eriodictyol, occurring only in a relatively small food group that includes parsley, thyme, celery, and sweet red pepper to 3,4-dihydroxyphenylpropionic acid. The quantity of *Clostridia orbiscindens* in the GI tract is negligible (approximately 0.1% of the total bacteria) compared to the predominant flora of *Lactobacilli, Bifidobacteria,* and *E. coli*. Consequently, this marker is essentially useless as a general *Clostridia* marker but may be a good indicator of the presence of beneficial flora.

High HVA (Marker 33) may result from toxic metal exposure (including lead, aluminum, manganese, and mercury), presumably due to increased release of dopamine from neurons. Heavy metal testing (blood or hair) might be useful to determine if such exposure is significant. Homovanillic acid (HVA), a dopamine metabolite, is often elevated due to stress-induced catecholamine output from the adrenal gland which depletes vitamin C. Supplementation with vitamin C (ascorbate) may be helpful in such cases.

Elevated HVA may also result from the intake of L-DOPA, dopamine, phenylalanine, or tyrosine. If values are more than double the upper limit of normal, the possibility of catecholamine-secreting tumors can be ruled out by 24- hour VMA and/or HVA testing in urine. Even in this subgroup, the incidence of tumors is extremely rare. High HVA may be associated with *Clostridia* or toxoplasmosis infection. If HVA is elevated and VMA is normal, avoid supplementation with phenylalanine or tyrosine until *Clostridia* or toxoplasmosis is treated.

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. Vanylmandelic 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 biopterin 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 betahydroxylase, 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 HPHPA, 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.

High uracil with normal/elevated thymine (Markers 40, 41) is an abnormality that is found in about 10% of children with autism. Because folic acid is involved as a methyl donor in the conversion of uracil to thymine, this elevation may indicate a deficiency of folic acid or a defect in folic acid metabolism. Regardless of cause, supplementation with folic acid, folinic acid or methyl folate may be beneficial.

Pyridoxic acid (B6) levels below the mean (Marker 51) may be associated with less than optimum health conditions (low intake, malabsorption, or dysbiosis). Supplementation with B6 (20 - 50 mg/day) or a multivitamin may be beneficial.

Pantothenic acid (B5) levels below the mean (Marker 52) may be associated with less than optimum health conditions. Supplementation with B5 (250 mg/day) or a multivitamin 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.

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.

The nutritional recommendations in this test are not approved by the US FDA. Supplement recommendations are not intended to treat, cure, or prevent any disease and do not take the place of medical advice or treatment from a healthcare professional.