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 #:	293081	***Physician:***	
Patient Name:	Jonathan Barnett	***Date of Collection:***	2/25/2013
Patient Age:	56	***Time of Collection:***	04:00 AM
Patient Sex:	M	***Print Date:***	03/02/2013

Organic Acids Test - Nutritional and Metabolic Profile

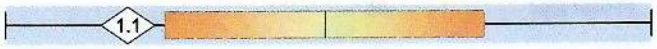
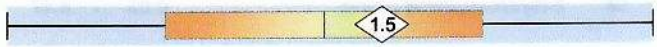
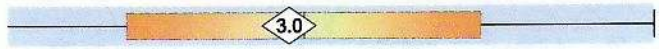
Metabolic Markers in Urine		Reference Range (mmol/mol creatinine)		Patient	Reference Population - Males Age 13 and Over
Intestinal Microbial Overgrowth					
Yeast and Fungal Markers					
1	Citramalic	0.11 - 2.0		0.98	0.98
2	5-Hydroxymethyl-2-furoic	≤ 18	H	27	27
3	3-Oxoglutaric	≤ 0.11		0.09	0.09
4	Furan-2,5-dicarboxylic	≤ 13	H	16	16
5	Furancarbonylglycine	≤ 2.3		0.22	0.22
6	Tartaric	≤ 5.3		0.30	0.30
7	Arabinose	≤ 20	H	135	135
8	Carboxycitric	≤ 20		7.1	7.1
9	Tricarballylic	≤ 0.58		0.25	0.25
Malabsorption and Bacterial Markers					
10	2-Hydroxyphenylacetic	0.03 - 0.47		0.27	0.27
11	4-Hydroxyphenylacetic	≤ 18		15	15
12	4-Hydroxybenzoic	0.01 - 0.73		0.47	0.47
13	4-Hydroxyhippuric	≤ 14		13	13
14	Hippuric	≤ 241		234	234
15	3-Indoleacetic	≤ 6.8		1.7	1.7
16	Succinic	≤ 5.3		3.1	3.1
17	HPHPA (Clostridia Marker)	≤ 102	H	112	112
18	4-Cresol (C. difficile)	≤ 39		7.5	7.5
19	DHPPA (Beneficial Bacteria)	≤ 0.23		0.06	0.06

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 #: 293081 **Physician:**

Patient Name: Jonathan Barnett **Date of Collection:** 2/25/2013

Metabolic Markers in Urine		Reference Range (mmol/mol creatinine)		Patient		Reference Population - Males Age 13 and Over
Oxalate Metabolites						
20	Glyceric	0.21	- 4.9	1.1		
21	Glycolic	18	- 81	41		
22	Oxalic	8.9	- 67	66		
Glycolytic Cycle Metabolites						
23	Lactic	0.74	- 19	10		
24	Pyruvic	0.28	- 6.7	5.8		
25	2-Hydroxybutyric		≤ 1.2	0.74		
Krebs Cycle Metabolites						
26	Succinic		≤ 5.3	3.1		
27	Fumaric		≤ 0.49	0.40		
28	Malic		≤ 1.1	0.32		
29	2-Oxoglutaric		≤ 18	H 19		
30	Aconitic	4.1	- 23	14		
31	Citric	2.2	- 260	H 354		
Neurotransmitter Metabolites						
32	Homovanillic (HVA) *(dopamine)*	0.39	- 2.2	1.6		
33	Vanillylmandelic (VMA) *(norepinephrine, epinephrine)*	0.53	- 2.2	1.5		
34	HVA / VMA Ratio	0.32	- 1.4	1.1		
35	5-Hydroxyindoleacetic (5-HIAA) *(serotonin)*		≤ 2.9	0.91		
36	Quinolinic	0.52	- 2.4	2.2		
37	Kynurenic	0.12	- 1.8	1.6		
38	Quinolinic / 5-HIAA Ratio		≤ 2.5	2.4		
Pyrimidine Metabolites - Folate Metabolism						
39	Uracil		≤ 6.9	3.0		
40	Thymine		≤ 0.36	0.21		

The Great Plains Laboratory, Inc.

Requisition #: 293081 **Physician:**

Patient Name: Jonathan Barnett **Date of Collection:** 2/25/2013

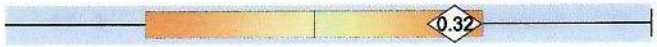
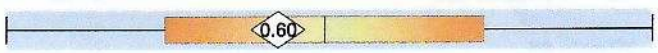
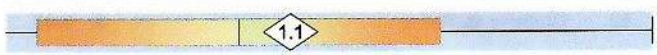
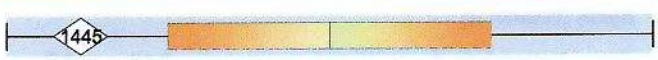
	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)		Patient	Reference Population - Males Age 13 and Over
Ketone and Fatty Acid Oxidation					
41	3-Hydroxybutyric	≤ 1.9		0.94	
42	Acetoacetic	≤ 10		0.65	
43	4-Hydroxybutyric	≤ 4.3		1.7	
44	Ethylmalonic	0.13 - 2.7		1.5	
45	Methylsuccinic	≤ 2.3		2.1	
46	Adipic	≤ 2.9		1.7	
47	Suberic	≤ 1.9	H	2.1	
48	Sebacic	≤ 0.14	H	0.18	
Nutritional Markers					
Vitamin B12					
49	Methylmalonic ✱	≤ 2.3		1.9	
Vitamin B6					
50	Pyridoxic (B6)	≤ 26		5.7	
Vitamin B5					
51	Pantothenic (B5)	≤ 5.4	H	11	
Vitamin B2 (Riboflavin)					
52	Glutaric ✱	≤ 0.43		0.27	
Vitamin C					
53	Ascorbic	10 - 200	L	4.7	
Vitamin Q10 (CoQ10)					
54	3-Hydroxy-3-methylglutaric ✱	≤ 26		7.8	
Glutathione Precursor and Chelating Agent					
55	N-Acetylcysteine (NAC)	≤ 0.13		0.07	
Biotin (Vitamin H)					
56	Methylcitric ✱	0.15 - 1.7	H	2.1	

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

The Great Plains Laboratory, Inc.

Requisition #: 293081 **Physician:**

Patient Name: Jonathan Barnett **Date of Collection:** 2/25/2013

	Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient	Reference Population - Males Age 13 and Over
Indicators of Detoxification				
57	Pyroglutamic	5.7 - 25	20	
58	Orotic	≤ 0.46	0.32	
59	2-Hydroxyhippuric	≤ 0.86	0.45	
Amino Acid Metabolites				
60	2-Hydroxyisovaleric	≤ 0.41	0	
61	2-Oxoisovaleric	≤ 1.5	0.31	
62	3-Methyl-2-oxovaleric	≤ 0.56	0.46	
63	2-Hydroxyisocaproic	≤ 0.39	0.01	
64	2-Oxoisocaproic	≤ 0.34	0.08	
65	2-Oxo-4-methiolbutyric	≤ 0.14	0.13	
66	Mandelic	≤ 0.09	0.07	
67	Phenyllactic	≤ 0.10	0.03	
68	Phenylpyruvic	0.02 - 1.4	0.60	
69	Homogentisic	≤ 0.23	0.03	
70	4-Hydroxyphenyllactic	≤ 0.62	0.44	
71	N-Acetylaspartic	≤ 2.5	1.1	
72	Malonic	≤ 9.9	0.85	
73	3-Methylglutaric	0.02 - 0.38	0.35	
74	3-Hydroxyglutaric	≤ 4.6	0.85	
75	3-Methylglutaconic	0.38 - 2.0	1.2	
Bone Metabolites				
76	Phosphoric	1 000 - 4 900	1 445	

The Great Plains Laboratory, Inc.

Requisition #:	293081	**Physician:**	
Patient Name:	Jonathan Barnett	**Date of Collection:**	2/25/2013

Indicator of Fluid Intake

77	*Creatinine	130	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.

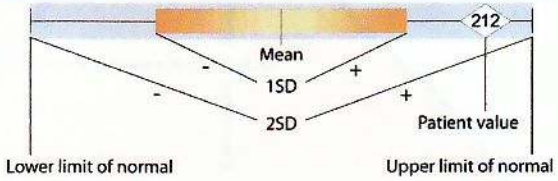
The first graph will occur when the value of the patient is within the reference (normal) range, defined as the mean plus or minus two standard deviations.

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.

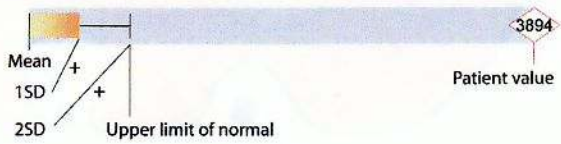
Example of Value Within Reference Range

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	

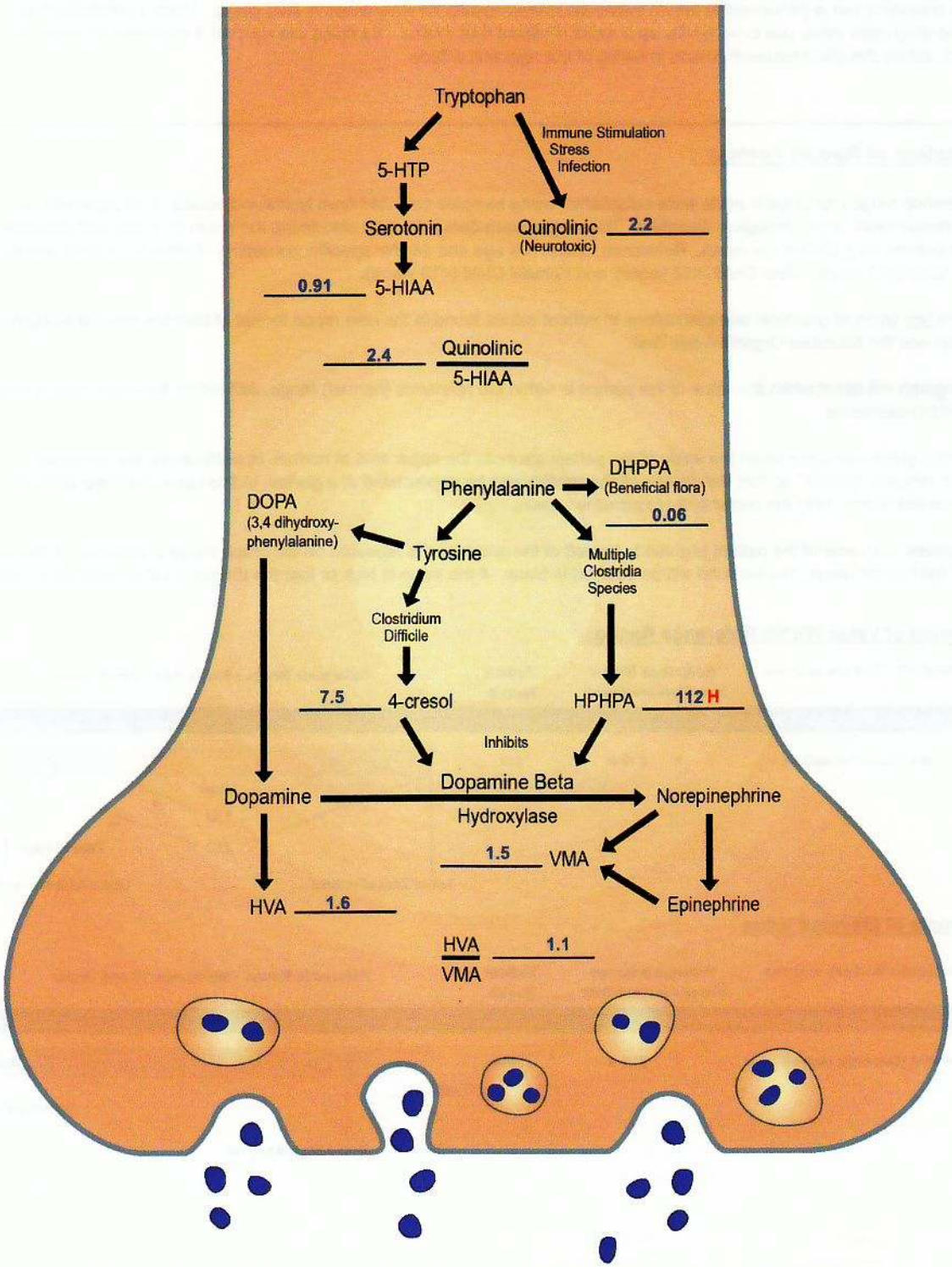


Example of Elevated Value

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	



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.

Requisition #:	293081	**Physician:**	
Patient Name:	Jonathan Barnett	**Date of Collection:**	2/25/2013

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 HPHPA (3-(3-hydroxyphenyl)-3-hydroxypropionic acid) (Marker 17) is associated with behavioral, GI, and/or neuropsychiatric effects. GI symptoms may include diarrhea or constipation. Neuropsychiatric effects are more common when values exceed 500 mmol/mol creatinine. HPHPA is an abnormal phenylalanine metabolite produced by GI bacteria of the *Clostridia* genus, including *C. sporogenes, C. botulinum, C. caloritolerans, C. mangenoti, C. ghoni, C. bifermentans, C. difficile, and C. sordelli*. Phenylalanine or tyrosine supplements should be avoided because of the possibility of conversion to HPHPA or other toxic byproducts. In most cases, *Clostridia* overgrowth can be controlled by probiotics supplementation, with 30 billion cfu's/day or more of *Lactobacillus rhamnosus GG* (Culturelle) and/or at least 2-6 billion cfu's/day of *Saccharomyces boulardii.*

High 2-oxoglutaric acid (also called alpha-ketoglutaric acid) (Marker 29) may be due to dietary deficiencies of any of several enzyme cofactors or the intake of alpha-ketoglutaric acid (AKG) as a supplement. Conversion of 2-oxoglutaric acid to succinyl-CoA requires the cofactors coenzyme A (derived from pantothenic acid), lipoic acid, FAD derived from riboflavin, and thiamine. Increased conversion of glutamic acid to AKG is another possible explanation. Extremely high values (ten times the upper limit of normal) may be due to genetic enzyme deficiencies and indicate the need for follow-up consultation with a biochemical genetics specialist.

High citric acid (Marker 31) may be due to increased intake of citric acid-containing foods or as a result of intestinal yeast that either produce citric acid or perhaps inhibit the human citric acid cycle. Increased citric acid may also indicate depletion of glutathione, which is required for the enzyme aconitase to metabolize both aconitic and citric acids. If pyroglutamic acid is also high, consider supplements of reduced glutathione, n-acetyl cysteine (NAC), or lipoic acid.

5-hydroxyindoleacetic acid (5-HIAA) levels below the mean (Marker 35) 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 ethylmalonic, methylsuccinic, adipic, suberic, or sebacic acids (Markers 44,45,46,47,48) 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.

Pyridoxic acid (B6) levels below the mean (Marker 50) 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.

High pantothenic acid (B5) (Marker 51) indicates high recent intake of pantothenic acid. Pantothenic acid is an essential B vitamin. Since some individuals may require very high doses of pantothenic acid, high values do not necessarily indicate the need to reduce pantothenic acid intake.

Ascorbic acid (vitamin C) levels below the mean (Marker 53) 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.

Requisition #:	293081	***Physician:***	
Patient Name:	Jonathan Barnett	***Date of Collection:***	2/25/2013

High methylcitric acid (Marker 56) is commonly due to biotin deficiency. Biotin is an essential B vitamin. Biotin deficiency may be due to malabsorption, excessive intake of raw egg white, dietary deficiency, or dysbiosis. Methylcitric values greater than 100 mmol/mol creatinine may be due to inborn errors of metabolism involving biotin-dependent enzymes and may require biotin supplementation at very high doses. Methylcitric values of 12-100 mmol/mol creatinine may be due to biotin deficiency. A high quality multivitamin with a minimum of 300 mcg biotin per day is recommended.

Low values for amino acid metabolites (Markers 60-75) 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.