The Great Plains Laboratory, Inc.

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

Requisition #:	927954	***Physician:***	RN LABS
Patient Name:	Vera Zadniprovska	***Date of Collection:***	04/20/2021
Patient Age:	33	***Time of Collection:***	08:30 AM
Patient Sex:	F	***Print Date:***	05/11/2021

Organic Acids Test - Nutritional and Metabolic Profile

Metabolic Markers in Urine	Reference Range *(mmol/mol creatinine)*	Patient Value	Reference Population - Females Age 13 and Over
Intestinal Microbial Overgrowth			
Yeast and Fungal Markers			
1 Citramalic	≤ 3.6	1.0	1.0
2 5-Hydroxymethyl-2-furoic *(Aspergillus)*	≤ 14	0.32	0.32
3 3-Oxoglutaric	≤ 0.33	0	0.00
4 Furan-2,5-dicarboxylic *(Aspergillus)*	≤ 16	0.54	0.54
5 Furancarbonylglycine *(Aspergillus)*	≤ 1.9	0.03	0.03
6 Tartaric *(Aspergillus)*	≤ 4.5	0.31	0.31
7 Arabinose	≤ 29	14	14
8 Carboxycitric	≤ 29	0.03	0.03
9 Tricarballylic *(Fusarium)*	≤ 0.44	0.07	0.07
Bacterial Markers			
10 Hippuric	≤ 613	147	147
11 2-Hydroxyphenylacetic	0.06 - 0.66	0.18	0.18
12 4-Hydroxybenzoic	≤ 1.3	0.53	0.53
13 4-Hydroxyhippuric	0.79 - 17	1.5	1.5
14 DHPPA (Beneficial Bacteria)	≤ 0.38	0.07	0.07
Clostridia Bacterial Markers			
15 4-Hydroxyphenylacetic *(C. difficile, C. stricklandii, C. lituseburense & others)*	≤ 19	5.8	5.8
16 HPHPA *(C. sporogenes, C. caloritolerans, C. botulinum & others)*	≤ 208	10.0	10
17 4-Cresol *(C. difficile)*	≤ 75	1.3	1.3
18 3-Indoleacetic *(C. stricklandii, C. lituseburense, C. subterminale & others)*	≤ 11	0.87	0.87

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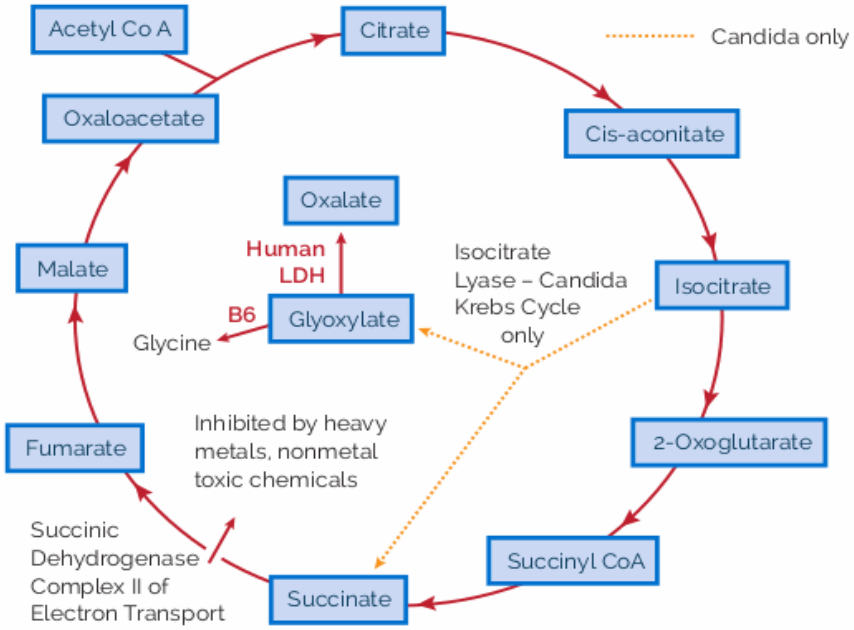
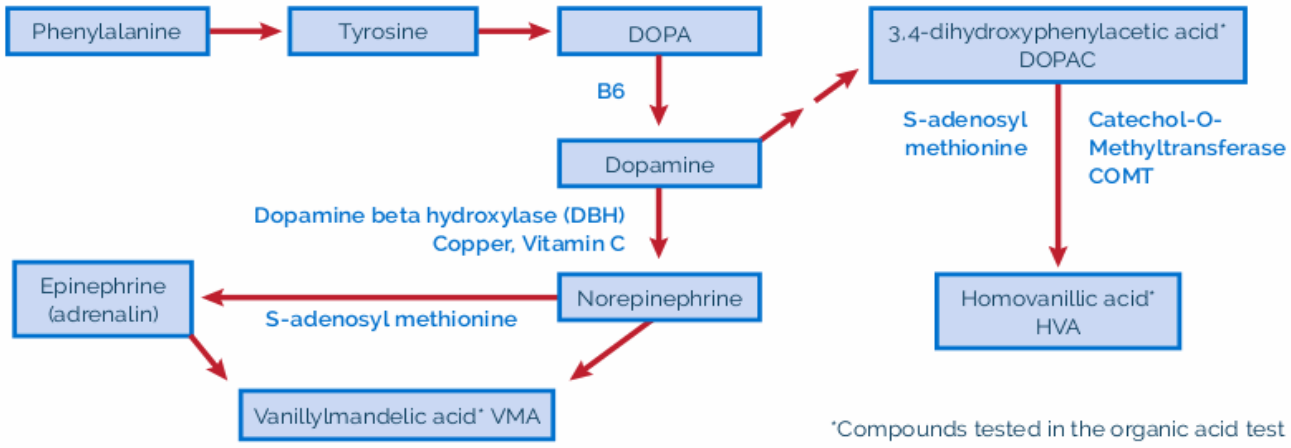
Human Krebs Cycle showing Candida Krebs Cycle variant that causes excess Oxalate via Glyoxylate

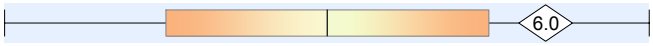
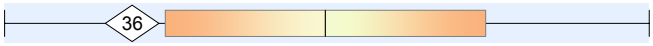
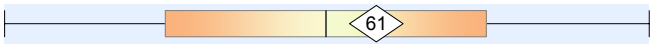
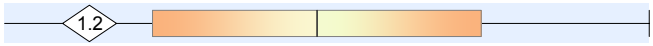
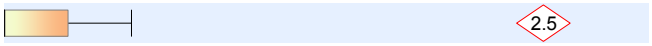
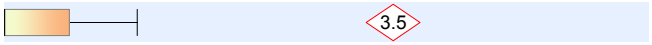
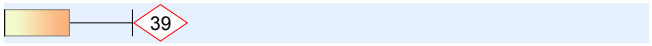
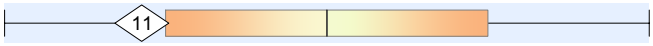
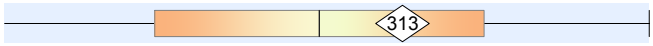
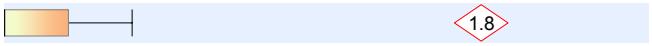
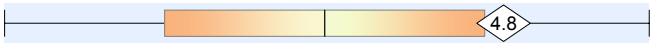
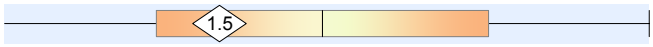
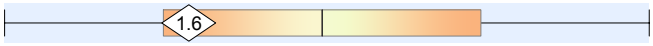
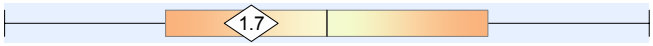
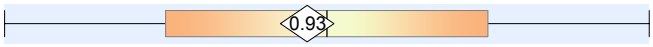
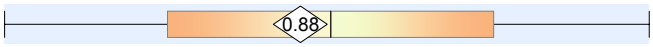
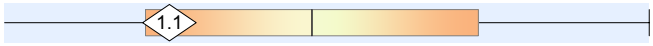
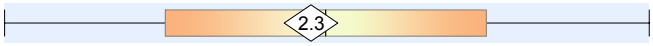
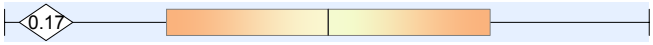


Major pathways in the synthesis and breakdown of **catecholamine neurotransmitters** in the absence of microbial inhibitors



Requisition #: 927954 **Physician:** RN LABS

Patient Name: Vera Zadniprovska **Date of Collection:** 04/20/2021

Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)		Patient Value	Reference Population - Females Age 13 and Over
Oxalate Metabolites				
19 Glyceric	0.77	- 7.0	6.0	
20 Glycolic	16	- 117	36	
21 Oxalic	6.8	- 101	61	
Glycolytic Cycle Metabolites				
22 Lactic		≤ 48	24	
23 Pyruvic		≤ 9.1	1.2	
Mitochondrial Markers - Krebs Cycle Metabolites				
24 Succinic		≤ 9.3	7.2	
25 Fumaric		≤ 0.94	H 2.5	
26 Malic	0.06	- 1.8	H 3.5	
27 2-Oxoglutaric		≤ 35	H 39	
28 Aconitic	6.8	- 28	11	
29 Citric		≤ 507	313	
Mitochondrial Markers - Amino Acid Metabolites				
30 3-Methylglutaric		≤ 0.76	H 1.8	
31 3-Hydroxyglutaric		≤ 6.2	4.8	
32 3-Methylglutaconic		≤ 4.5	1.5	
Neurotransmitter Metabolites				
Phenylalanine and Tyrosine Metabolites				
33 Homovanillic (HVA) *(dopamine)*	0.80	- 3.6	1.6	
34 Vanillylmandelic (VMA) *(norepinephrine, epinephrine)*	0.46	- 3.7	1.7	
35 HVA / VMA Ratio	0.16	- 1.8	0.93	
36 Dihydroxyphenylacetic (DOPAC) *(dopamine)*	0.08	- 3.5	1.8	
37 HVA/ DOPAC Ratio	0.10	- 1.8	0.88	
Tryptophan Metabolites				
38 5-Hydroxyindoleacetic (5-HIAA) *(serotonin)*		≤ 4.3	1.1	
39 Quinolinic	0.85	- 3.9	2.3	
40 Kynurenic		≤ 2.2	0.17	

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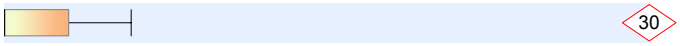
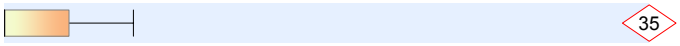
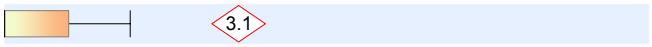
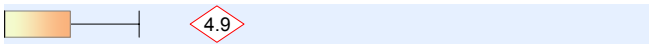
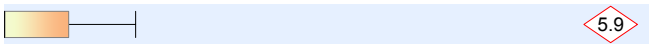
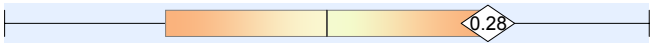
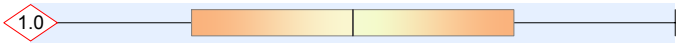
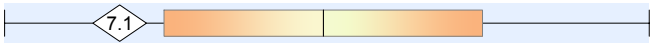
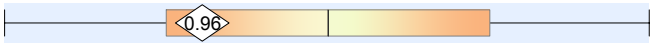
Patient Name: Vera Zadniprovska **Date of Collection:** 04/20/2021

Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Value	Reference Population - Females Age 13 and Over
Pyrimidine Metabolites - Folate Metabolism			
41 Uracil	≤ 9.7	4.5	
42 Thymine	≤ 0.56	0.21	
Ketone and Fatty Acid Oxidation			
43 3-Hydroxybutyric	≤ 3.1	H 30	
44 Acetoacetic	≤ 10	H 35	
45 Ethylmalonic	0.44 - 2.8	H 4.4	
46 Methylsuccinic	0.10 - 2.2	H 3.1	
47 Adipic	0.04 - 3.8	H 4.9	
48 Suberic	0.18 - 2.2	H 5.9	
49 Sebacic	≤ 0.24	0.12	
Nutritional Markers			
Vitamin B12			
50 Methylmalonic ✱	≤ 2.3	0.99	
Vitamin B6			
51 Pyridoxic (B6)	≤ 34	3.5	
Vitamin B5			
52 Pantothenic (B5)	≤ 10	0.70	
Vitamin B2 (Riboflavin)			
53 Glutaric ✱	0.04 - 0.36	0.28	
Vitamin C			
54 Ascorbic	10 - 200	L 1.0	
Vitamin Q10 (CoQ10)			
55 3-Hydroxy-3-methylglutaric ✱	0.17 - 39	7.1	
Glutathione Precursor and Chelating Agent			
56 N-Acetylcysteine (NAC)	≤ 0.28	0	
Biotin (Vitamin H)			
57 Methylcitric ✱	0.19 - 2.7	0.96	

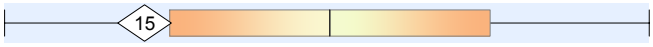
✱ ***A high value for this marker may indicate a deficiency of this vitamin.***

Requisition #:	927954	***Physician:***	RN LABS
Patient Name:	Vera Zadniprovska	***Date of Collection:***	04/20/2021

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

Indicators of Detoxification

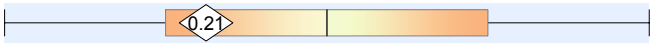
Glutathione

58	Pyroglutamic ✱	10 - 33		15	

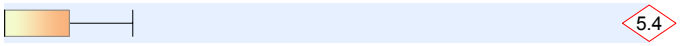
Methylation, Toxic exposure

59	2-Hydroxybutyric ✱✱	0.03 - 1.8	H	3.2	

Ammonia Excess

60	Orotic	0.06 - 0.54		0.21	

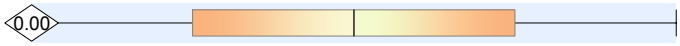
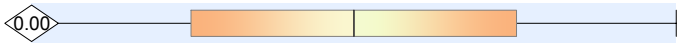
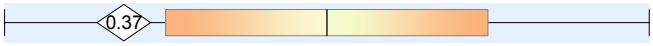
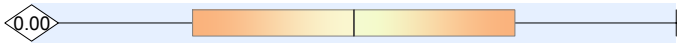
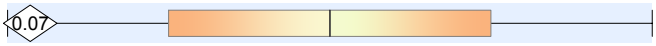
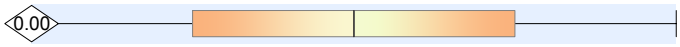
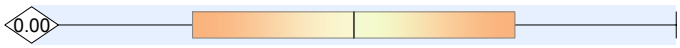
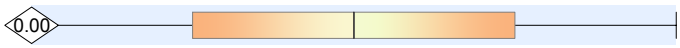
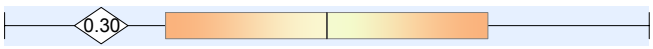
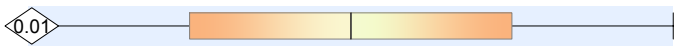
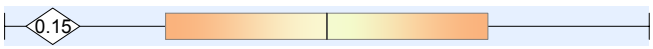
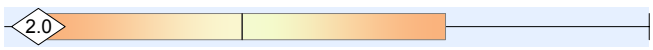
Aspartame, salicylates, or GI bacteria

61	2-Hydroxyhippuric	≤ 1.3	H	5.4	

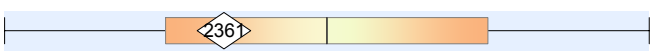
✱ ***A high value for this marker may indicate a Glutathione deficiency.***

✱✱ ***High values may indicate methylation defects and/or toxic exposures.***

Amino Acid Metabolites

62	2-Hydroxyisovaleric	≤ 2.0	0	
63	2-Oxoisovaleric	≤ 2.1	0	
64	3-Methyl-2-oxovaleric	≤ 2.0	0.37	
65	2-Hydroxyisocaproic	≤ 2.0	0	
66	2-Oxoisocaproic	≤ 2.0	0.07	
67	2-Oxo-4-methiolbutyric	≤ 2.0	0	
68	Mandelic	≤ 2.0	0	
69	Phenyllactic	≤ 2.0	0	
70	Phenylpyruvic	≤ 2.0	0.30	
71	Homogentisic	≤ 2.0	0.01	
72	4-Hydroxyphenyllactic	≤ 2.0	0.15	
73	N-Acetylaspartic	≤ 38	2.0	
74	Malonic	≤ 9.7	5.3	
75	4-Hydroxybutyric	≤ 4.8	0	

Mineral Metabolism

76	Phosphoric	1,000 - 5,000		2,361 

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Indicator of Fluid Intake

77	*Creatinine	82	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.

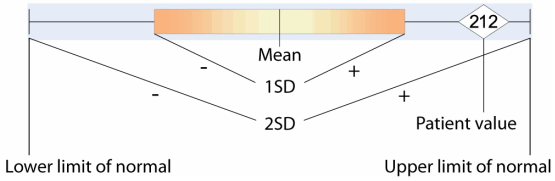
The first graph will occur when the value of the patient is within the reference (normal) range, defined as the mean plus or minus two standard deviations.

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.

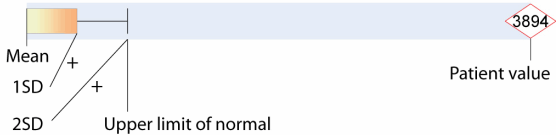
Example of Value Within Reference Range

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	



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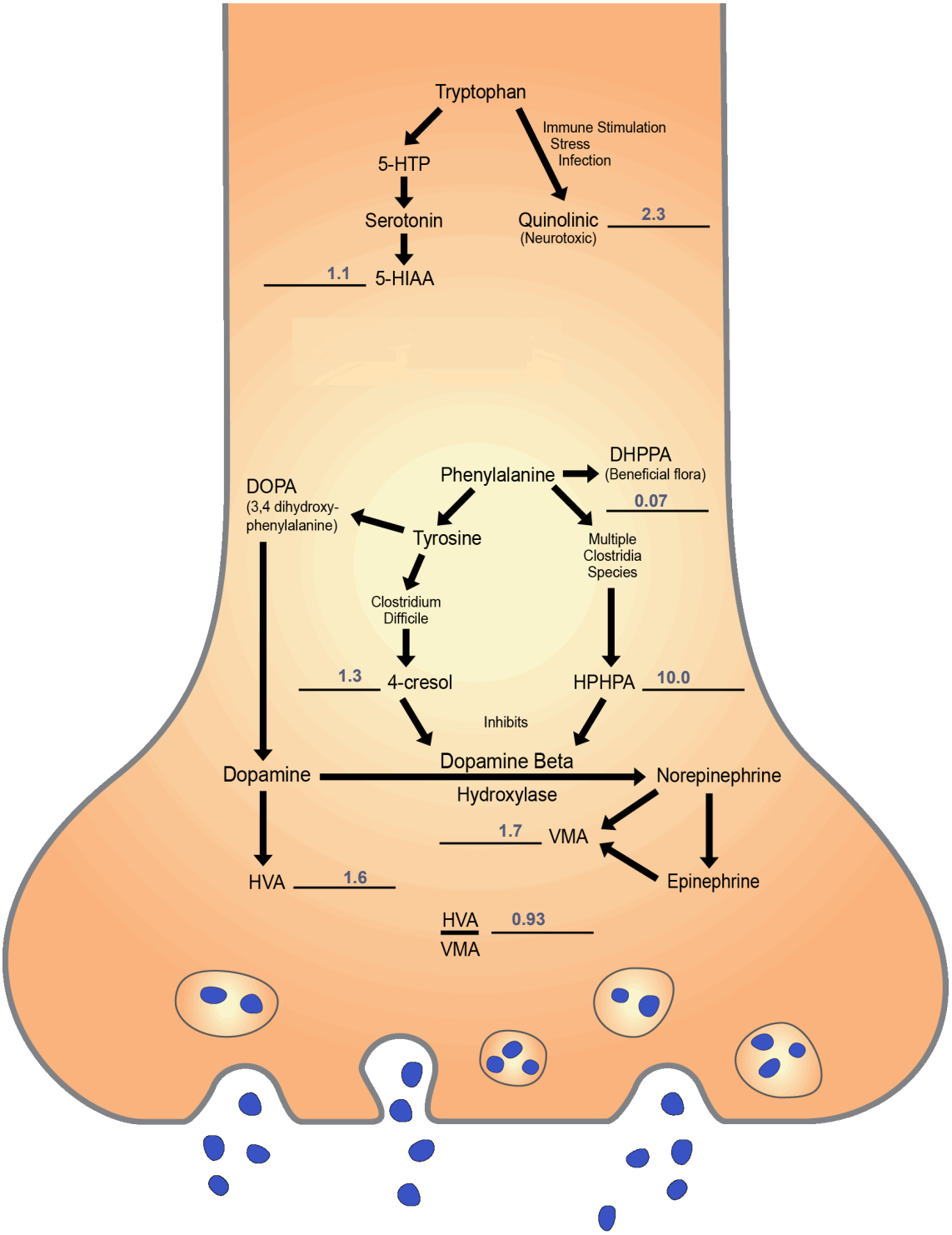
Neurotransmitter Metabolism Markers



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 fumaric acid (25) may be due to impaired Krebs cycle function, defect of the enzyme fumarase or a defect in mitochondrial function. Recommendations for supporting mitochondrial function include supplementation with coenzyme Q10, L-carnitine or acetyl-L-carnitine, riboflavin, nicotinamide, and vitamin E.* All of these supplements are known to improve mitochondrial dysfunction.

High malic acid (26) indicates a greater requirement for the nutrients niacin and coenzyme Q10.* Malic acid simultaneously elevated with citric, fumaric and alpha-ketoglutaric acids may indicate a possible Cytochrome C Oxidase deficiency. Mitochondrial energy pathway dysfunction would be expected.

High 2-oxoglutaric acid (alpha-ketoglutaric acid) (27) 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), 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 consultation with a biochemical genetics specialist.

High 3-methylglutaric and/or high 3-methylglutaconic acids (30, 32) may be due to reduced capacity to metabolize the amino acid leucine. This abnormality is found in the genetic disease methylglutaconic aciduria and in mitochondrial disorders in which there are severe deficiencies of the respiratory complexes (Complex I, NADH ubiquinone oxidoreductase and complex IV, cytochrome c oxidase.). Small elevations may be due to impairment of mitochondrial function and may respond to the recommended supplements below. Typical results found in genetic defects are above 10 mmol/mol creatinine. A few non-genetic conditions including pregnancy and kidney failure may also produce elevation of these organic acids in urine. Confirmation of the genetic disease requires enzymes and/ or DNA testing. Multiple genetic defects can cause the biochemical abnormality. Confirmation of mitochondrial disorder usually requires tissue biopsy for mitochondria testing. Symptoms differ within different types of genetic disorders, but in severe cases may include speech delay, delayed development of both mental and motor skills (psychomotor delay), metabolic acidosis, abnormal muscle tone (dystonia), and spasms and weakness affecting the arms and legs (spastic quadriparesis). Recommendations include supplementation with coenzyme Q-10, L-carnitine and acetyl-L-carnitine, riboflavin, nicotinamide, and vitamin E.

Homovanillic acid (HVA) levels (33) below the mean indicate low production and/or decreased metabolism of the neurotransmitter dopamine. Homovanillic acid is a metabolite of the neurotransmitter dopamine. Low production of HVA can be due to decreased intake or absorption of dopamine's precursor amino acids such as phenylalanine and/or tyrosine, decreased quantities of cofactors needed for biosynthesis of dopamine such as tetrahydrobiopterin and vitamin B6 coenzyme or decreased amounts of cofactors such as S-adenosylmethionine (Sam-e) needed to convert dopamine to HVA. In addition, a number of genetic variations such as single nucleotide polymorphisms (SNPs) or mutations can cause reduced production of HVA due to enzymes with decreased function. HVA values below the mean but which are much higher than VMA values are usually due to impairment of dopamine beta hydroxylase due to excessive Clostridia metabolites, the mold metabolite fusaric acid, pharmaceuticals such as disulfiram, or food additives like aspartame or deficiencies of cofactors such as vitamin C or copper. Values may also be decreased in patients on monoamine oxidase (MAO) inhibitors. In addition, a number of genetic variations such as single nucleotide polymorphisms (SNPs) or mutations in MAO or COMT genes can cause reduced production of HVA. Such SNPs are available on **The Great Plains DNA methylation pathway test** which can be performed on a cheek swab.

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Vanillylmandelic acid (VMA) levels (34) below the mean indicate low production and/or decreased metabolism of the neurotransmitters norepinephrine and epinephrine. Vanillylmandelic acid is a metabolite of the neurotransmitters norepinephrine and epinephrine. Low production of VMA can be due to decreased intake or absorption of norepinephrine's and epinephrine's precursor amino acids such as phenylalanine and/or tyrosine, decreased quantities of cofactors needed for biosynthesis of norepinephrine and epinephrine such as tetrahydrobiopterin and vitamin B6 coenzyme or decreased amounts of cofactors such as S-adenosylmethionine (Sam-e) needed to convert norepinephrine and epinephrine to VMA. In addition, a number of genetic variations such as single nucleotide polymorphisms (SNPs) or mutations in MAO or COMT genes can cause reduced production of VMA. Such SNPs are available on **The Great Plains DNA methylation pathway test** which can be performed on a cheek swab. VMA values below the mean but which are much lower than HVA values are usually due to impairment of dopamine beta hydroxylase due to Clostridia metabolites, the mold metabolite fusaric acid, pharmaceuticals such as disulfiram, or food additives like aspartame or deficiencies of cofactors such as vitamin C or copper. Values may be decreased in patients on monoamine oxidase (MAO) inhibitors. Another cause for a low VMA value is a genetic variation (single nucleotide polymorphism or SNP) of the DBH enzyme. Patients with low VMA due to Clostridia metabolites or genetic DBH deficiency should not be supplemented with phenylalanine, tyrosine, or L-DOPA.

5-hydroxyindoleacetic acid (5HIAA) (38) levels below the mean may indicate lower production and/or decreased metabolism of the neurotransmitter serotonin. 5-hydroxy-indoleacetic acid is a metabolite of serotonin. Low values have been correlated with symptoms of depression. Low production of 5 HIAA can be due to decreased intake or absorption of serotonin's precursor amino acid tryptophan, decreased quantities of cofactors needed for biosynthesis of serotonin such as tetrahydrobiopterin and vitamin B6 coenzyme. In addition, a number of genetic variations such as single nucleotide polymorphisms (SNPs) or mutations can cause reduced production of 5HIAA. Such SNPs are available on **The Great Plains DNA methylation pathway test** which can be performed on a cheek swab. Values may be decreased in patients on monoamine oxidase (MAO) inhibitors that are drugs or foods that contain tyramine such such as Chianti wine and vermouth, fermented foods such as cheeses, fish, bean curd, sausage, bologna, pepperoni, sauerkraut, and salami.

High 3-hydroxybutyric acids (43) and/or acetoacetic acids (44) indicate increased metabolic utilization of fatty acids. These ketones are associated with diabetes mellitus, fasting, dieting (ketogenic or SCD diet), or illness such as nausea or flu, among many other causes.

High ethylmalonic, methylsuccinic, adipic, suberic, or sebacic acids (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 may be beneficial.

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

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

Ascorbic acid (vitamin C) levels below the mean (54) may indicate a less than optimum level of the antioxidant vitamin C. Individuals who consume large amounts of vitamin C can still have low values if the sample is taken 12 or more hours after intake. Supplementation with buffered vitamin C taken 2 or 3 times a day is suggested.

High 2-hydroxybutyric acid (59) This organic acid is elevated when there is increased production of sulfur amino acids derived from homocysteine. The reasons for an increase can be due to the following reasons (which are not mutually exclusive):

1. There is increased need for glutathione to detoxify a host of toxic chemicals, resulting in increased shunting of homocysteine into the production of cysteine for glutathione. This is the most common reason.
2. There are genetic variants of the DNA such that methylation of homocysteine by betaine homocysteine methyl transferase or methionine synthase is impaired. . SNPs of genes in the methylation cycle are available on **The Great Plains DNA methylation pathway test** which can be performed on a cheek swab.
3. There are nutritional deficiencies of betaine, methylcobalamin, or methyltetrahydrofolate that reduce the enzyme activities of the enzymes in #2 above.
4. There is a genetic variant in cystathionine beta synthase (CBS) enzyme such that there is excessive shunting of homocysteine into cysteine production that results in excessive 2-hydroxybutyric acid formation.
5. Onset of diabetes mellitus or excessive alcohol use.
6. Presence of certain genetic diseases such as lactic acidosis, glutaric aciduria type II, dihydrolipoyl dehydrogenase (E3) deficiency, and propionic aciduria.

High 2-hydroxyhippuric acid (61) may result from ingestion of aspartame (Nutrasweet®), salicylates (aspirin), dietary salicylates, or from GI bacteria converting tyrosine or phenylalanine to salicylic acid. For more information about salicylates in foods go to <http://www.feingold.org/salicylate.php>. 2-Hydroxyhippuric acid is a conjugate of hydroxybenzoic acid (salicylic acid) and glycine. Very high 2-hydroxyhippuric also inhibits dopamine beta-hydroxylase resulting in elevated HVA, decreased VMA, and elevated HVA/VMA ratio.

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.

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