



# The Great Plains Laboratory, Inc.

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Requisition #: 784796

Physician: BIOLAB

Patient Name:  

Date of Collection: 02/26/2020

Patient Age: 23

Time of Collection: Not Given

Patient Sex: M

Print Date: 03/13/2020



## 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

Marker	Reference Range (mmol/mol creatinine)	Patient Value	Reference Population - Males Age 13 and Over
1 Citramalic	0.11 - 2.0	1.4	
2 5-Hydroxymethyl-2-furoic (Aspergillus)	≤ 18	15	
3 3-Oxoglutaric	≤ 0.11	0.05	
4 Furan-2,5-dicarboxylic (Aspergillus)	≤ 13	6.9	
5 Furancarboxylglycine (Aspergillus)	≤ 2.3	0.28	
6 Tartaric (Aspergillus)	≤ 5.3	0.17	
7 Arabinose	≤ 20	<b>H</b> 44	
8 Carboxycitric	≤ 20	3.7	
9 Tricarballic (Fusarium)	≤ 0.58	0.07	

#### Bacterial Markers

10 Hippuric	≤ 241	35	
11 2-Hydroxyphenylacetic	0.03 - 0.47	0.29	
12 4-Hydroxybenzoic	≤ 0.73	0.29	
13 4-Hydroxyhippuric	≤ 14	1.4	
14 DHPPA (Beneficial Bacteria)	≤ 0.23	0.04	

#### Clostridia Bacterial Markers

15 4-Hydroxyphenylacetic (C. difficile, C. stricklandii, C. lituseburensis & others)	≤ 18	14	
16 HPPHA (C. sporogenes, C. caloritolerans, C. botulinum & others)	≤ 102	5.3	
17 4-Cresol (C. difficile)	≤ 39	3.2	
18 3-Indoleacetic (C. stricklandii, C. lituseburensis, C. subterminale & others)	≤ 6.8	0.54	

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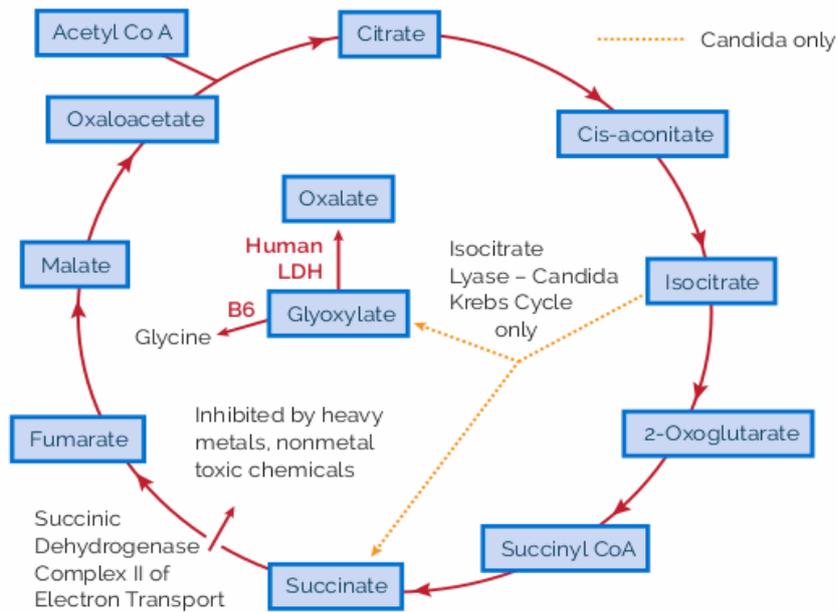
Requisition #: 784796  
 Patient Name: Alex MacClean

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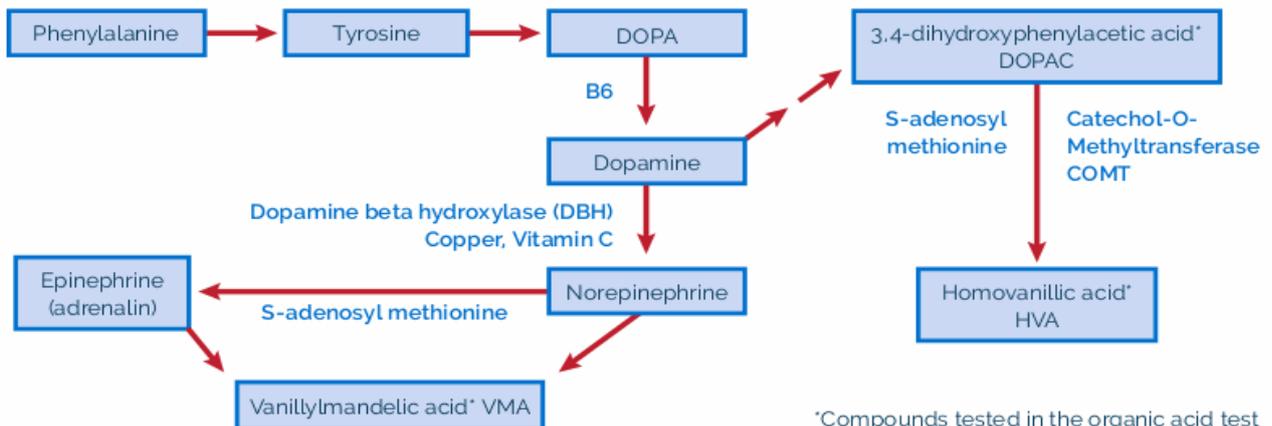


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## Human Krebs Cycle showing Candida Krebs Cycle variant that causes excess Oxalate via Glyoxylate



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



\*Compounds tested in the organic acid test

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## Oxalate Metabolites

19	Glyceric	0.21 - 4.9	1.7	
20	Glycolic	18 - 81	70	
21	Oxalic	8.9 - 67	33	

## Glycolytic Cycle Metabolites

22	Lactic	0.74 - 19	16	
23	Pyruvic	0.28 - 6.7	5.5	

## Mitochondrial Markers - Krebs Cycle Metabolites

24	Succinic	≤ 5.3	0.55	
25	Fumaric	≤ 0.49	0.08	
26	Malic	≤ 1.1	0.62	
27	2-Oxoglutaric	≤ 18	5.8	
28	Aconitic	4.1 - 23	8.4	
29	Citric	2.2 - 260	48	

## Mitochondrial Markers - Amino Acid Metabolites

30	3-Methylglutaric	0.02 - 0.38	0.30	
31	3-Hydroxyglutaric	≤ 4.6	3.7	
32	3-Methylglutaconic	0.38 - 2.0	1.2	

## Neurotransmitter Metabolites

### Phenylalanine and Tyrosine Metabolites

33	Homovanillic (HVA) <i>(dopamine)</i>	0.39 - 2.2	1.3	
34	Vanillylmandelic (VMA) <i>(norepinephrine, epinephrine)</i>	0.53 - 2.2	0.81	
35	HVA / VMA Ratio	0.32 - 1.4	<b>H</b> 1.6	
36	Dihydroxyphenylacetic (DOPAC) <i>(dopamine)</i>	0.27 - 1.9	1.2	
37	HVA/ DOPAC Ratio	0.17 - 1.6	1.1	

### Tryptophan Metabolites

38	5-Hydroxyindoleacetic (5-HIAA) <i>(serotonin)</i>	≤ 2.9	2.1	
39	Quinolinic	0.52 - 2.4	1.5	
40	Kynurenic	0.12 - 1.8	0.96	

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## Pyrimidine Metabolites - Folate Metabolism

41	Uracil	≤ 6.9	3.7	
42	Thymine	≤ 0.36	0.14	

## Ketone and Fatty Acid Oxidation

43	3-Hydroxybutyric	≤ 1.9	0.97	
44	Acetoacetic	≤ 10	0.67	
45	Ethylmalonic	0.13 - 2.7	0.62	
46	Methylsuccinic	≤ 2.3	0.52	
47	Adipic	≤ 2.9	0.70	
48	Suberic	≤ 1.9	1.0	
49	Sebacic	≤ 0.14	0.14	

## Nutritional Markers

### Vitamin B12

50	Methylmalonic *	≤ 2.3	1.1	
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### Vitamin B6

51	Pyridoxic (B6)	≤ 26	0.34	
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### Vitamin B5

52	Pantothenic (B5)	≤ 5.4	0.76	
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### Vitamin B2 (Riboflavin)

53	Glutaric *	≤ 0.43	0.16	
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### Vitamin C

54	Ascorbic	10 - 200	L 0.20	
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### Vitamin Q10 (CoQ10)

55	3-Hydroxy-3-methylglutaric *	≤ 26	3.2	
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### Glutathione Precursor and Chelating Agent

56	N-Acetylcysteine (NAC)	≤ 0.13	0.03	
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### Biotin (Vitamin H)

57	Methylcitric *	0.15 - 1.7	0.52	
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\* A high value for this marker may indicate a deficiency of this vitamin.

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## Indicators of Detoxification

### Glutathione



### Methylation, Toxic exposure



### Ammonia Excess



### Aspartame, salicylates, or GI bacteria



\* A high value for this marker may indicate a Glutathione deficiency.  
 \*\* High values may indicate methylation defects and/or toxic exposures.

## Amino Acid Metabolites



## Mineral Metabolism



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## Indicator of Fluid Intake

77 \*Creatinine 152 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 ( $\geq 13$  years), Female Adult ( $\geq 13$  years), Male Child ( $< 13$  years), and Female Child ( $< 13$  years).

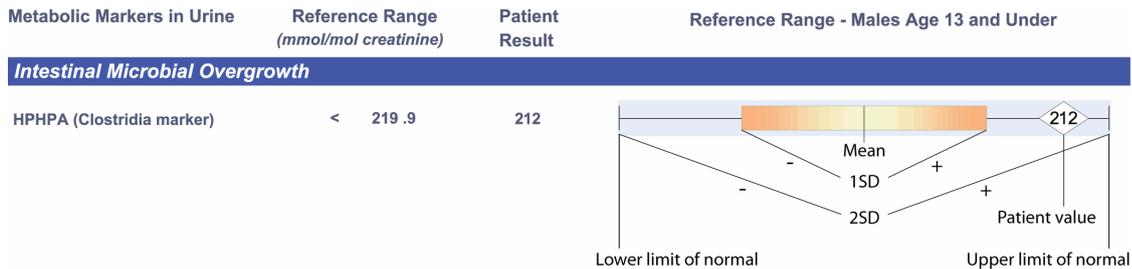
There are two types of graphical representations of patient values found in the new report format of both the standard Organic Acids Test and the Microbial Organic Acids Test.

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.

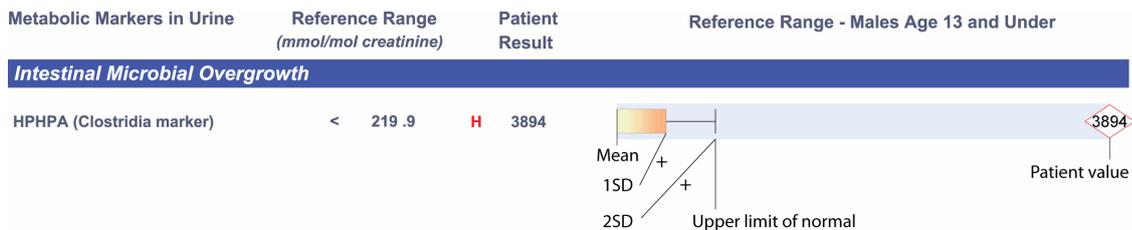
The second graph will occur when the value of the patient exceeds the upper limit of normal. In such cases, the graphical reference range is "shrunk" so that the degree of abnormality can be appreciated at a glance. In this case, the lower limits of normal are not shown, only the upper limit of normal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



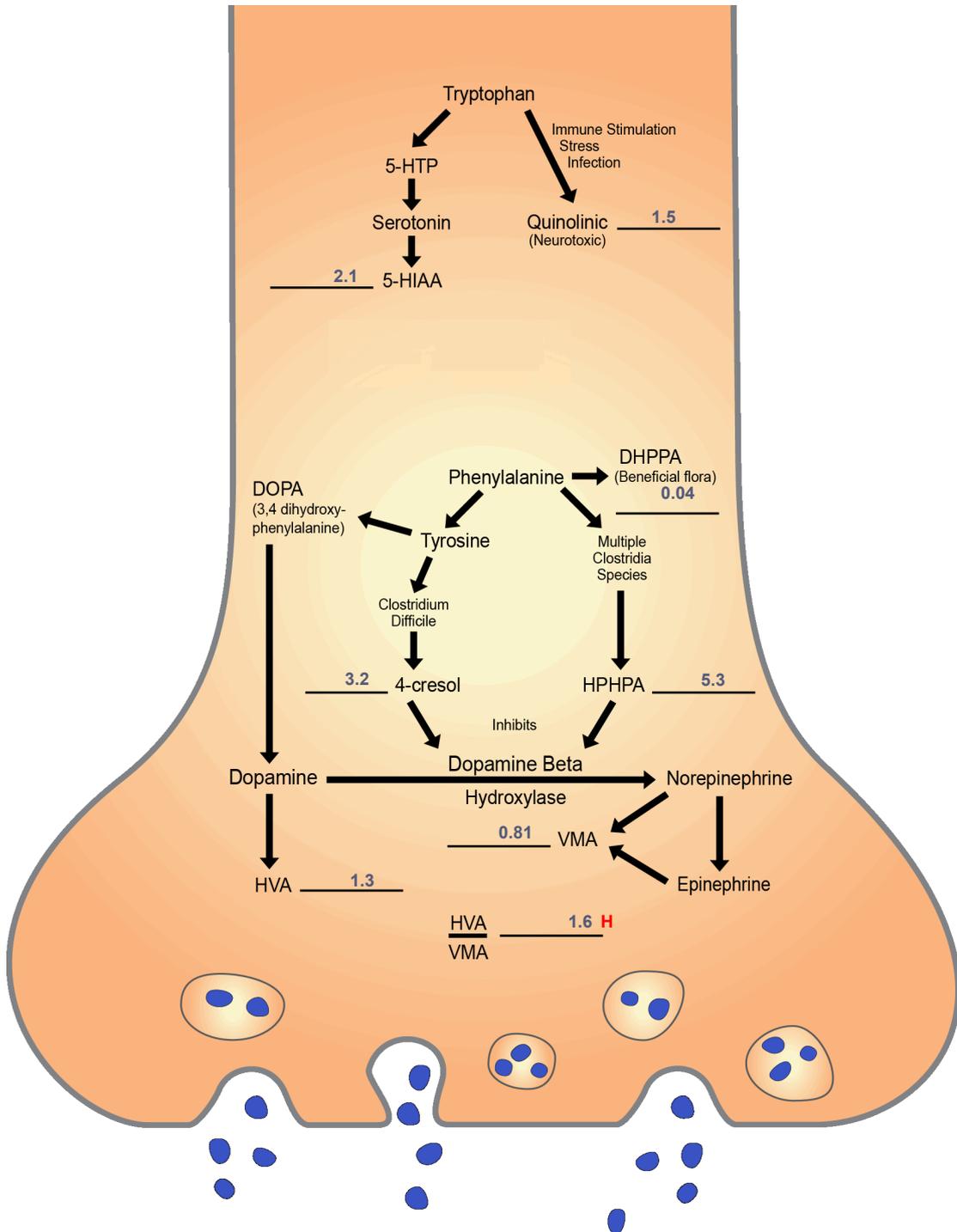
### Example of Elevated Value



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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 (1-8)** Elevations of one or more metabolites indicate a yeast/fungal overgrowth of the gastrointestinal (GI) tract. Prescription or natural (botanical) anti-fungals, along with supplementation of high potency multi-strain probiotics, may reduce yeast/fungal levels.

**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. This DBH test is now available at The Great Plains Laboratory on blood serum. Patients with low VMA due to Clostridia metabolites or genetic DBH deficiency should not be supplemented with phenylalanine, tyrosine, or L-DOPA.

**High HVA/VMA ratio (35)** the HVA/VMA ratio reflects the balance between dopamine and norepinephrine/epinephrine production by catecholamine producing neurons in the central nervous system, sympathetic nervous system, and adrenal gland. The most common reason for an elevation of the HVA/VMA ratio is a decreased conversion of dopamine to norepinephrine. The enzyme responsible for this conversion, dopamine beta-hydroxylase (DBH), is copper and vitamin C dependent so an elevated ratio could be due to deficiencies of these cofactors. **The most common reason** for this elevated ratio is inhibition of this enzyme by Clostridia byproducts including HPPHA, 4-cresol, or 4-hydroxyphenylacetic acid. Other causes of an increased ratio include inhibition of DBH by the mold metabolite fusaric acid, pharmaceuticals such as disulfiram, or food additives like aspartame. Another cause for an elevated ratio is a genetic variation (single nucleotide polymorphism or SNP) of the DBH enzyme. Alternatively, the activity of the DBH enzyme can be measured on blood serum. Individuals with low DBH activity can be treated with the drug Droxidopa™, which provides adequate norepinephrine by an alternate biochemical pathway. This DBH test on blood serum is now available at The Great Plains Laboratory. High ratios are common in a large number of neuropsychiatric diseases regardless of the reason for DBH deficiency.

**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-hydroxyisovaleric acid and/or 2-hydroxyisocaproic acid (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 thiamine.\* Individuals high in all MSUD metabolites and have values that exceed 20 times the upper limit may benefit from very high doses (5-20 mg/kg/day) of thiamine.