The Great Plains Laboratory, Inc

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Requisition #:	838923	***Physician:***	RN LABS
Patient Name:	Marja Gibbons	***Date of Collection:***	08/30/2020
Patient Age:	34	***Time of Collection:***	08:50 AM
Patient Sex:	F	***Print Date:***	09/21/2020

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	0.74	0.74
2 5-Hydroxymethyl-2-furoic *(Aspergillus)*	≤ 14	0.28	0.28
3 3-Oxoglutaric	≤ 0.33	0	0.00
4 Furan-2,5-dicarboxylic *(Aspergillus)*	≤ 16	0.53	0.53
5 Furancarbonylglycine *(Aspergillus)*	≤ 1.9	0.08	0.08
6 Tartaric *(Aspergillus)*	≤ 4.5	3.7	3.7
7 Arabinose	≤ 29	H 34	34
8 Carboxycitric	≤ 29	0.07	0.07
9 Tricarballylic *(Fusarium)*	≤ 0.44	0.10	0.10
Bacterial Markers			
10 Hippuric	≤ 613	381	381
11 2-Hydroxyphenylacetic	0.06 - 0.66	0.21	0.21
12 4-Hydroxybenzoic	≤ 1.3	0.19	0.19
13 4-Hydroxyhippuric	0.79 - 17	2.7	2.7
14 DHPPA (Beneficial Bacteria)	≤ 0.38	0.21	0.21
Clostridia Bacterial Markers			
15 4-Hydroxyphenylacetic *(C. difficile, C. stricklandii, C. lituseburense & others)*	≤ 19	4.7	4.7
16 HPHPA *(C. sporogenes, C. caloritolerans, C. botulinum & others)*	≤ 208	39	39
17 4-Cresol *(C. difficile)*	≤ 75	23	23
18 3-Indoleacetic *(C. stricklandii, C. lituseburense, C. subterminale & others)*	≤ 11	0.41	0.41

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.

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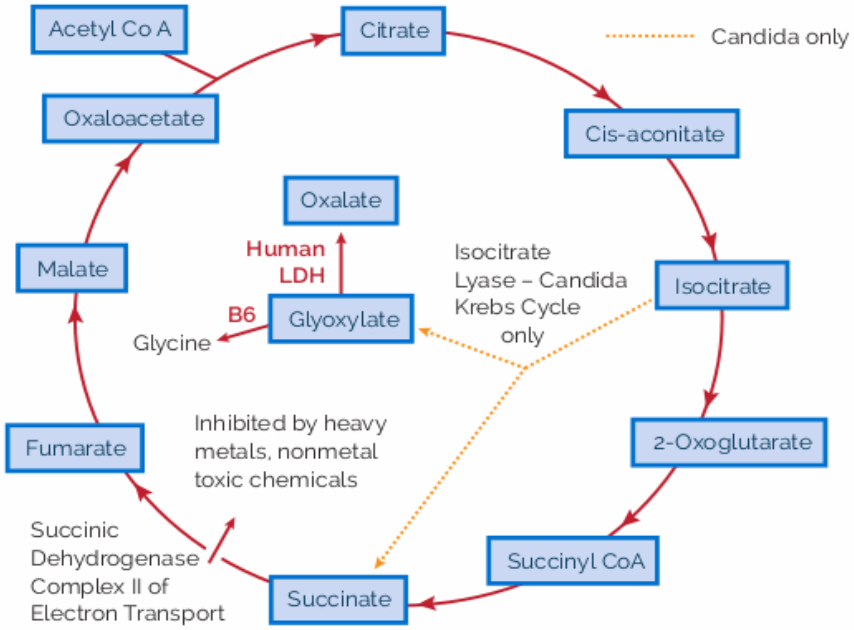
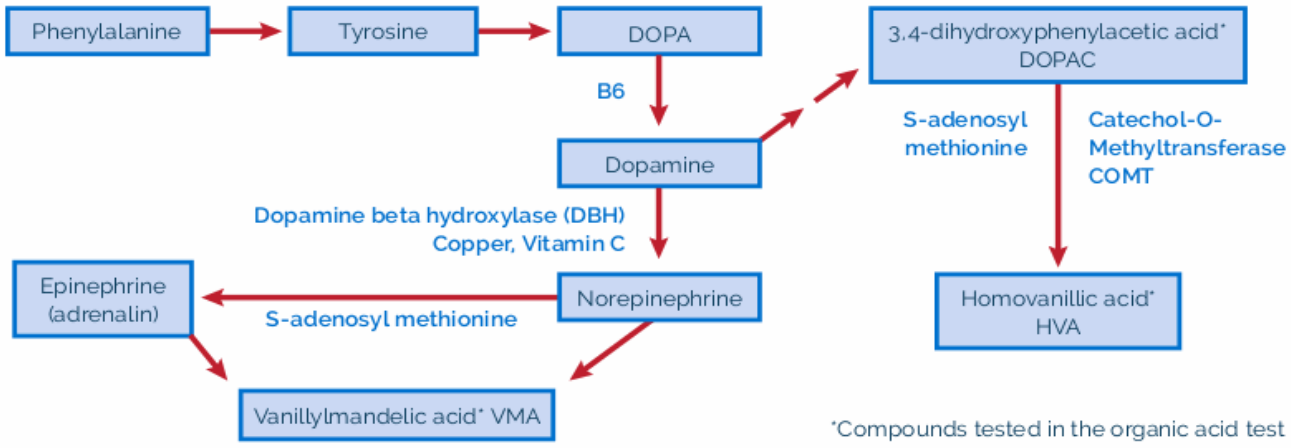
Human Krebs Cycle showing Candida Krebs Cycle variant that causes excess Oxalate via Glyoxylate

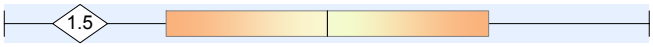
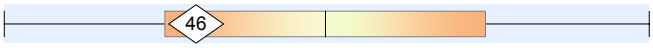
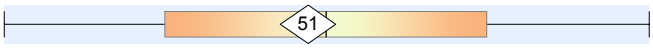
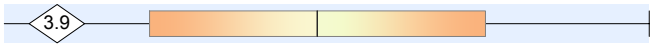
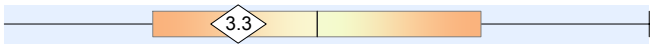
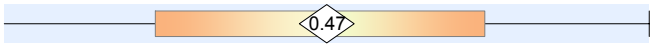
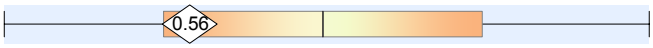
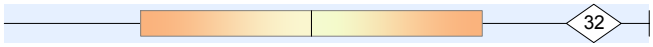
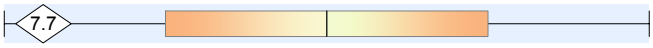
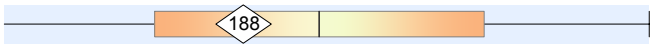
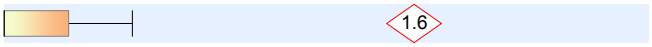
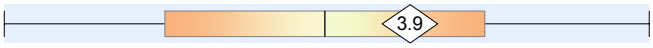
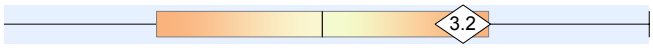
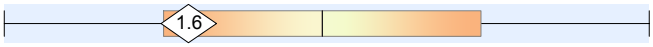
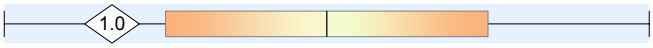
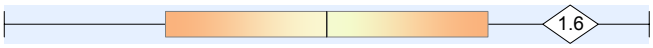
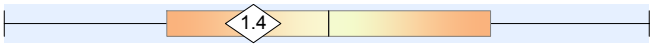
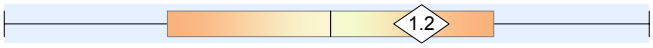
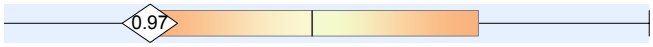
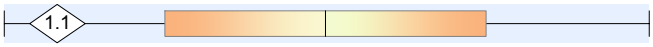
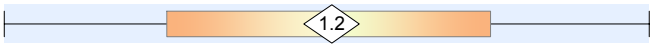


Major pathways in the synthesis and breakdown of **catecholamine neurotransmitters** in the absence of microbial inhibitors



Requisition #: 838923 *Physician:* RN LABS

Patient Name: Marja Gibbons *Date of Collection:* 08/30/2020

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	1.5	
20 Glycolic	16 - 117	46	
21 Oxalic	6.8 - 101	51	
Glycolytic Cycle Metabolites			
22 Lactic	≤ 48	3.9	
23 Pyruvic	≤ 9.1	3.3	
Mitochondrial Markers - Krebs Cycle Metabolites			
24 Succinic	≤ 9.3	6.0	
25 Fumaric	≤ 0.94	0.47	
26 Malic	0.06 - 1.8	0.56	
27 2-Oxoglutaric	≤ 35	32	
28 Aconitic	6.8 - 28	7.7	
29 Citric	≤ 507	188	
Mitochondrial Markers - Amino Acid Metabolites			
30 3-Methylglutaric	≤ 0.76	H 1.6	
31 3-Hydroxyglutaric	≤ 6.2	3.9	
32 3-Methylglutaconic	≤ 4.5	3.2	
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	1.0	
35 HVA / VMA Ratio	0.16 - 1.8	1.6	
36 Dihydroxyphenylacetic (DOPAC) *(dopamine)*	0.08 - 3.5	1.4	
37 HVA/ DOPAC Ratio	0.10 - 1.8	1.2	
Tryptophan Metabolites			
38 5-Hydroxyindoleacetic (5-HIAA) *(serotonin)*	≤ 4.3	0.97	
39 Quinolinic	0.85 - 3.9	1.1	
40 Kynurenic	0.17 - 2.2	1.2	

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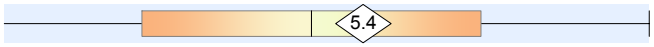
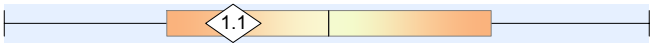
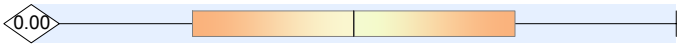
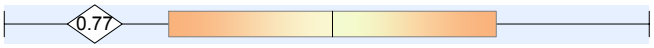
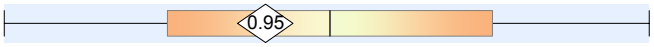
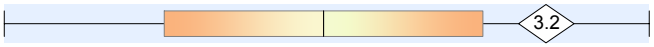
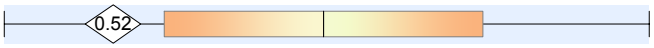
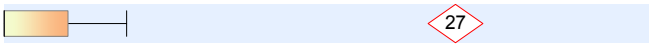
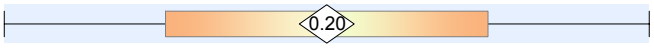
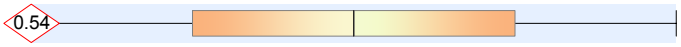
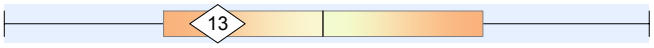
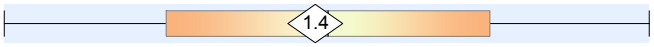
Patient Name:	Marja Gibbons	*Date of Collection:*	08/30/2020

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	5.4	
42 Thymine	≤ 0.56	0.15	
Ketone and Fatty Acid Oxidation			
43 3-Hydroxybutyric	≤ 3.1	1.1	
44 Acetoacetic	≤ 10	0	
45 Ethylmalonic	0.44 - 2.8	0.77	
46 Methylsuccinic	0.10 - 2.2	0.95	
47 Adipic	0.04 - 3.8	3.2	
48 Suberic	0.18 - 2.2	0.52	
49 Sebacic	≤ 0.24	0.03	
Nutritional Markers			
Vitamin B12			
50 Methylmalonic ✱	≤ 2.3	1.0	
Vitamin B6			
51 Pyridoxic (B6)	≤ 34	1.1	
Vitamin B5			
52 Pantothenic (B5)	≤ 10	H 27	
Vitamin B2 (Riboflavin)			
53 Glutaric ✱	0.04 - 0.36	0.20	
Vitamin C			
54 Ascorbic	10 - 200	L 0.54	
Vitamin Q10 (CoQ10)			
55 3-Hydroxy-3-methylglutaric ✱	0.17 - 39	13	
Glutathione Precursor and Chelating Agent			
56 N-Acetylcysteine (NAC)	≤ 0.28	0	
Biotin (Vitamin H)			
57 Methylcitric ✱	0.19 - 2.7	1.4	

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

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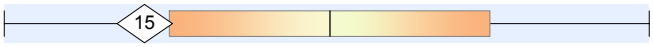
Patient Name:	Marja Gibbons	*Date of Collection:*	08/30/2020

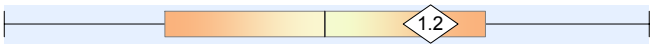
Metabolic Markers in Urine	Reference Range (mmol/mol creatinine)	Patient Value	Reference Population - Females Age 13 and Over

Indicators of Detoxification

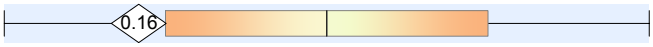
Glutathione

58	Pyroglutamic ✱	10 - 33	15	

Methylation, Toxic exposure

59	2-Hydroxybutyric ✱✱	0.03 - 1.8	1.2	

Ammonia Excess

60	Orotic	0.06 - 0.54	0.16	

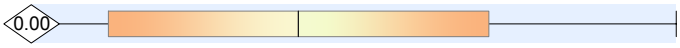
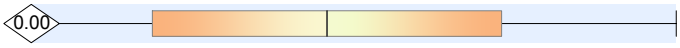
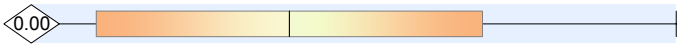
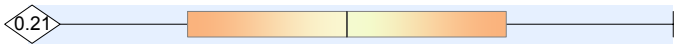
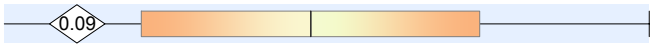
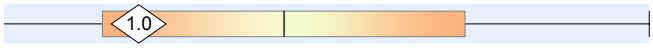
Aspartame, salicylates, or GI bacteria

61	2-Hydroxyhippuric	≤ 1.3	0.23	

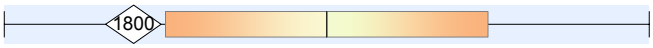
✱ ***A high value for this marker may indicate a Glutathione deficiency.***

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

Amino Acid Metabolites

62	2-Hydroxyisovaleric	≤ 0.42	0	
63	2-Oxoisovaleric	≤ 2.1	0	
64	3-Methyl-2-oxovaleric	≤ 0.87	0.74	
65	2-Hydroxyisocaproic	≤ 0.48	0	
66	2-Oxoisocaproic	≤ 0.37	0.14	
67	2-Oxo-4-methiolbutyric	≤ 0.16	0	
68	Mandelic	≤ 0.21	0.04	
69	Phenyllactic	≤ 0.20	0	
70	Phenylpyruvic	0.20 - 1.9	0.21	
71	Homogentisic	≤ 0.36	0.01	
72	4-Hydroxyphenyllactic	≤ 0.80	0.09	
73	N-Acetylaspartic	≤ 3.0	0.56	
74	Malonic	≤ 9.7	0.78	
75	4-Hydroxybutyric	≤ 4.8	1.0	

Mineral Metabolism

76	Phosphoric	1,000 - 5,000	1,800	

Requisition #:	838923	*Physician:*	RN LABS
Patient Name:	Marja Gibbons	*Date of Collection:*	08/30/2020

Indicator of Fluid Intake

77	*Creatinine	254	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.

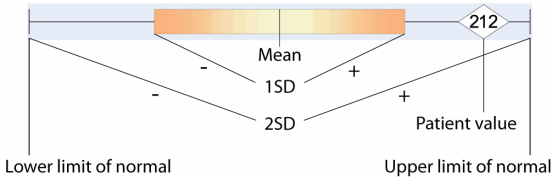
The first graph will occur when the value of the patient is within the reference (normal) range, defined as the mean plus or minus two standard deviations.

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

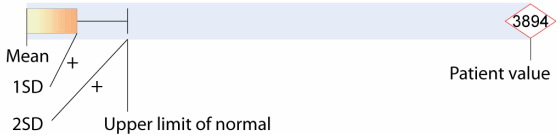
Example of Value Within Reference Range

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	



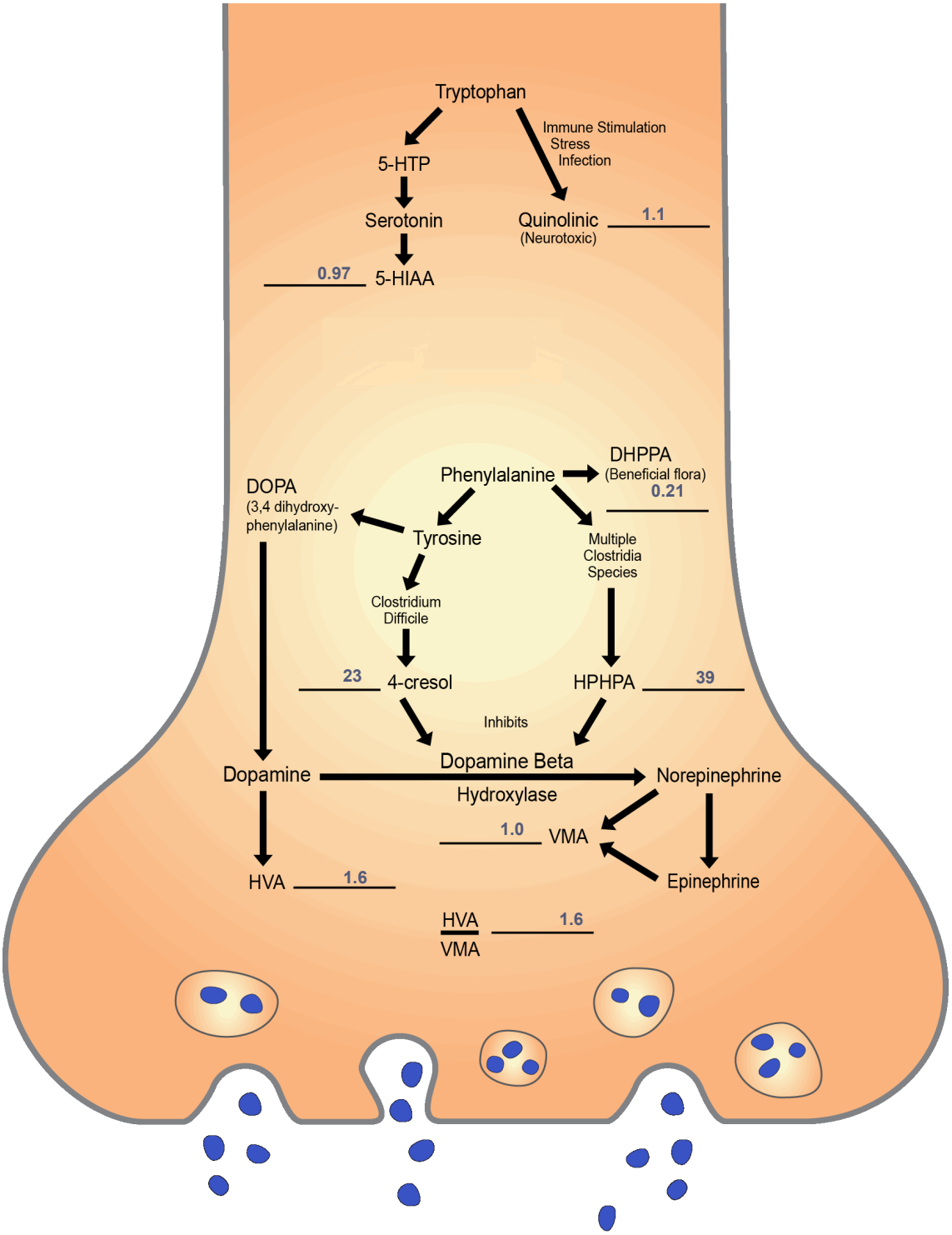
Example of Elevated Value

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 #:	838923	***Physician:***	RN LABS
Patient Name:	Marja Gibbons	***Date of Collection:***	08/30/2020

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 #:	838923	***Physician:***	RN LABS
Patient Name:	Marja Gibbons	***Date of Collection:***	08/30/2020

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.

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.

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.

Requisition #:	838923	***Physician:***	RN LABS
Patient Name:	Marja Gibbons	***Date of Collection:***	08/30/2020

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 5HIAA 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.

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.

High pantothenic acid (B5) (52) most commonly indicates recent intake of pantothenic acid as a supplement. Pantothenic acid is an essential B vitamin that is converted to coenzyme A (unrelated to vitamin A). Coenzyme A is needed for the synthesis of fatty acids, cholesterol, and acetyl choline and is also needed for the Krebs cycle and fatty acid catabolism. Because some individuals may require high doses of pantothenic acid, high values do not necessarily indicate the need to reduce pantothenic acid intake. However, if a patient who **does not take B-vitamin** supplements has high values of pantothenic acid, especially if the values are 20 or more times the upper limit of normal, the individual may have a genetic deficiency in the conversion of pantothenic acid to pantothenic acid-phosphate, which is the first step in the production of coenzyme A. It may be useful to retest after one week off all B-vitamin supplementation; individuals with PKAN would be expected to still have very elevated pantothenic acid levels even with no supplementation. This disease is called pantothenate kinase-associated neurodegeneration (PKAN), an inborn error of metabolism characterized by iron accumulation in the basal ganglia and by the presence of dystonia, dysarthria, Parkinson symptoms, and retinal degeneration. In mild variants of this disease, psychiatric illnesses such as schizoaffective disorder, hallucinations, obsessive compulsive disorder, speech defects, and depression are common. Mutations in pantothenate kinase 2 (PANK2), the rate-limiting enzyme in mitochondrial coenzyme A biosynthesis, represent the most common genetic cause of this disorder. Other biochemical abnormalities commonly found on the organic acid test in this disorder include elevated lactate, pyruvate, and Krebs cycle intermediates. Confirmation of mutant DNA requires special genetic testing. The University of Chicago does testing for PANK2 deletion for a price of $1000 in 2017.
The link is: <http://dnatesting.uchicago.edu/tests/pank2-deletionduplication-analysis>

Treatment for the illness is currently focused on giving high doses of pantothenic acid to stimulate any residual enzyme . Doses as high as 10 g per day have been ingested with few side effects. Other suggested therapies are increased supplementation with cholesterol, fat soluble vitamins, and bile salts. Since Lactobacillus species produce pantothenic acid phosphate, supplementation with high doses of probiotics might also 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 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.