FUNCTIONAL MEDICINE FAST TRACK

A NEW THINKING • A NEW LIFE

Pattern Recognition
In Organix Comprehensive

With RupaHealth

Presented by:
Garric Vosloo
Functional Medicine Fast Track
www.fm-ft.com

Pattern Recognition In Organix Comprehensive

- Organic acid testing (OAT) has become very popular amongst functional medicine practitioners
- This urine-based test provides a wealth of information about the functioning of various bodily systems and can be used to identify possible nutrient deficiencies, gut dysbiosis, and more.

FUNCTIONAL MEDICINE FAST TRACK

Pattern Recognition In Organix Comprehensive

What Is an Organic Acid?

In humans, organic acids are byproducts or intermediates of chemical reactions that occur within the body (1).

The quantity (and sometimes the type) of organic acids produced are unique to each individual and can be influenced by a variety of factors.

Some factors that can influence organic acid production within the body include (2, 3):

- Diet
- Environmental toxins
- Gut microbes
- Genetics
- Kidney and liver function
- Medications
- Nutrient status
- Oxidative stress

Pattern Recognition
In Organix Comprehensive

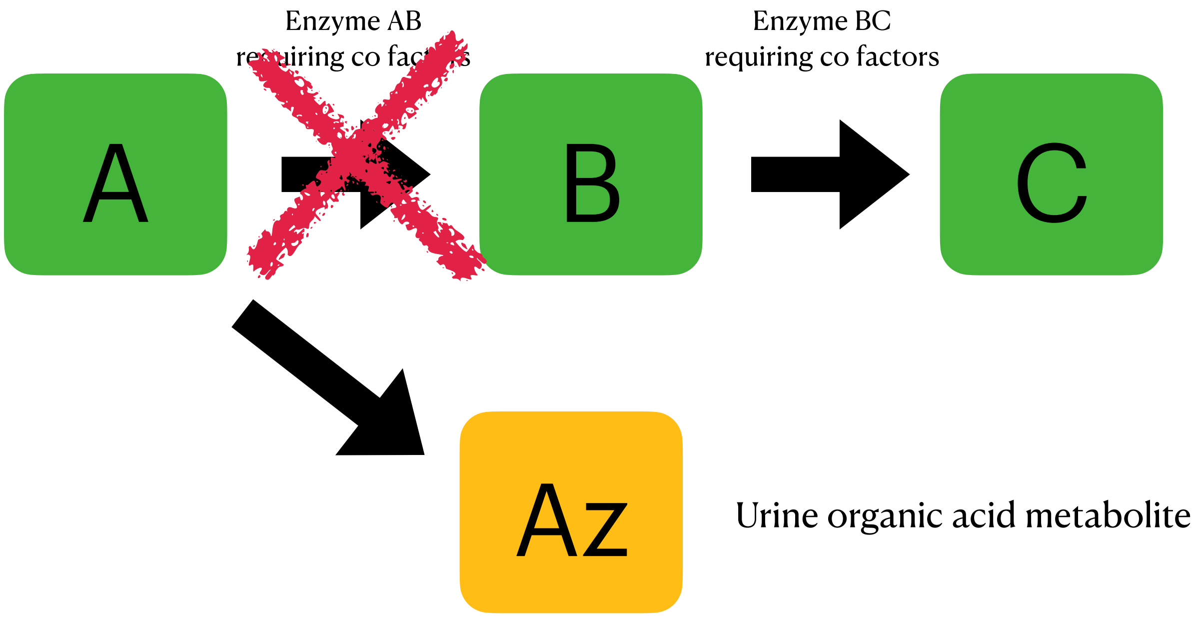
What Is an Organic Acid?

In order for the body to run effectively, it needs proper amounts of vitamins and minerals to act as cofactors for enzymatic reactions.

Without enough of these nutritional cofactors (or if someone has genetic mutations that affect how well their enzymes work), these chemical pathways are unable to proceed at their normal pace.

As a result, organic acids begin to build up and are excreted in the urine:

Pattern Recognition
In Organix Comprehensive



Urine organic acid metabolite

Pattern Recognition In Organix Comprehensive

Reasons for Abnormal OAT Results

When the body isn’t functioning optimally, organic acids in the urine can become elevated or depleted, depending on what is occurring.

The main reasons for abnormal urinary organic acid results include:

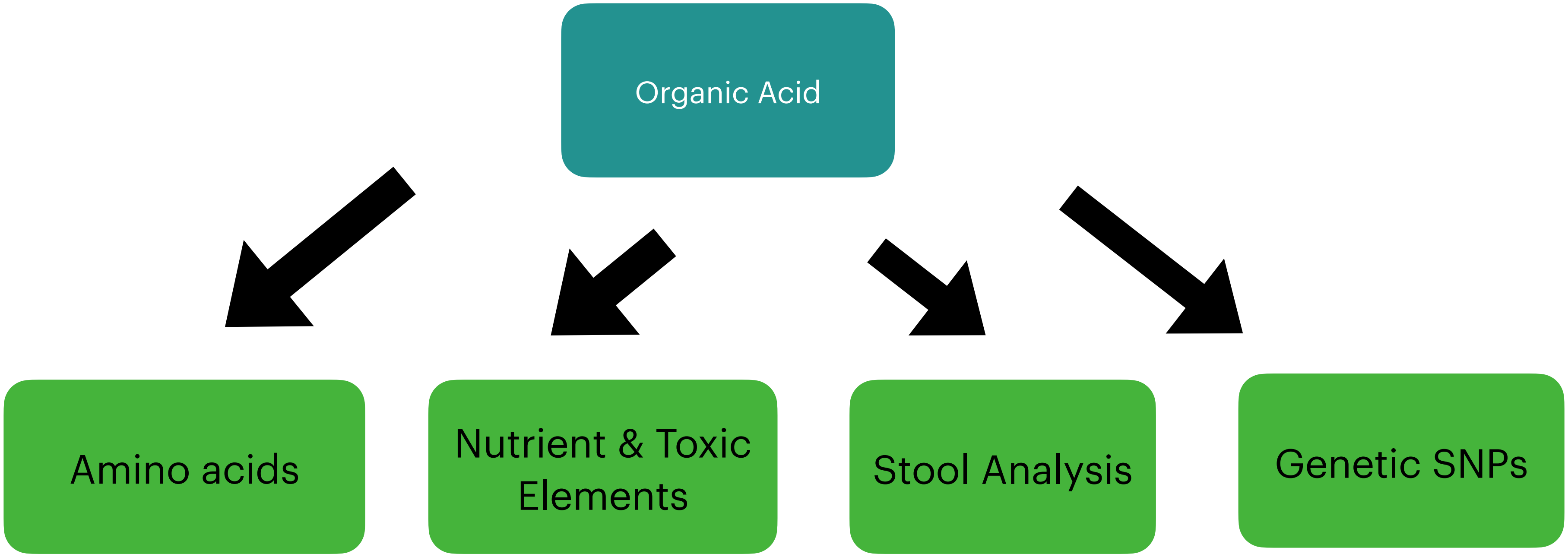
1. Inborn errors of metabolism
2. B-vitamin deficiencies
3. Gut dysbiosis
4. Impaired fatty acid metabolism
5. Ketosis or poor carbohydrate metabolism
6. Neurotransmitter metabolism
7. Mitochondrial dysfunction
8. Oxidative stress
9. Poor detoxification
10. Inflammation

FUNCTIONAL MEDICINE FAST TRACK

5 Examples of Pattern Recognitions In Organix Comprehensive

1. Low patterns
2. High patterns
3. Glutathione Status patterns
4. Kynunerine Patterns
5. Lipogenesis patterns

Pattern Recognition
In Organix Comprehensive: Confirming with other tests



Organic Acid

Amino acids

Nutrient & Toxic Elements

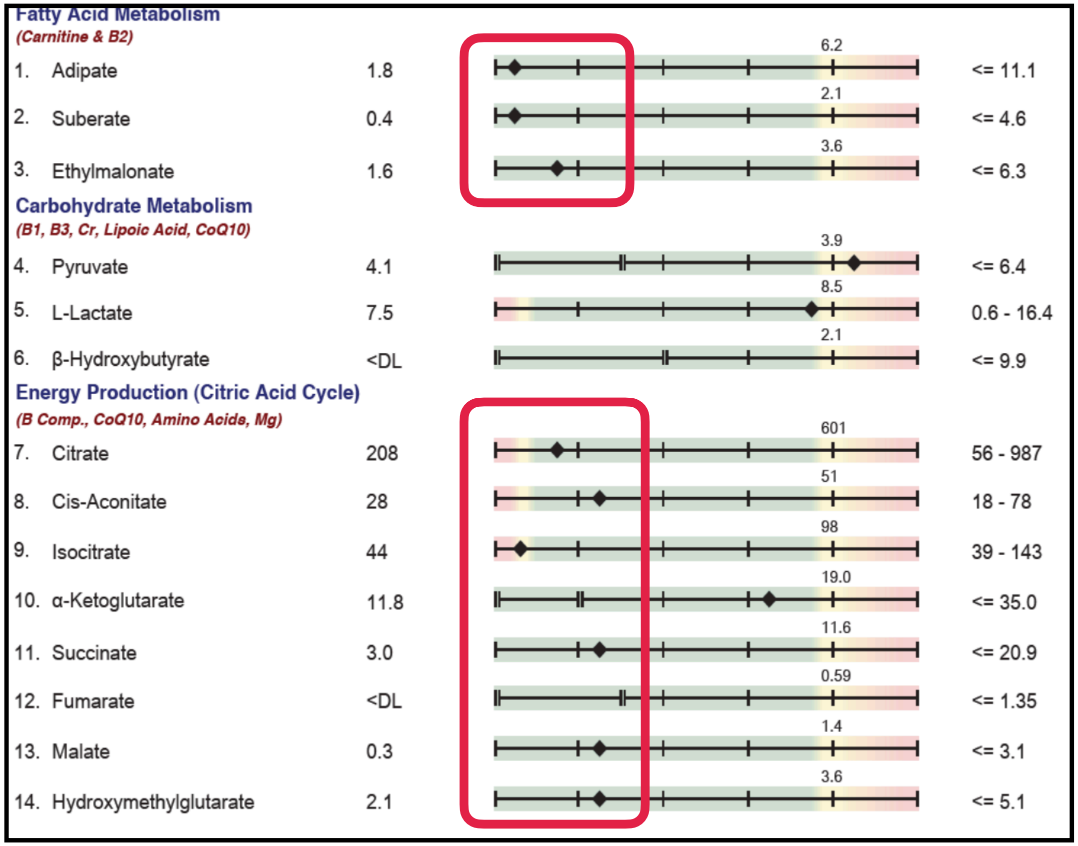
Stool Analysis

Genetic SNPs

Pattern #1: Dominant LOW Markers

Patient A:

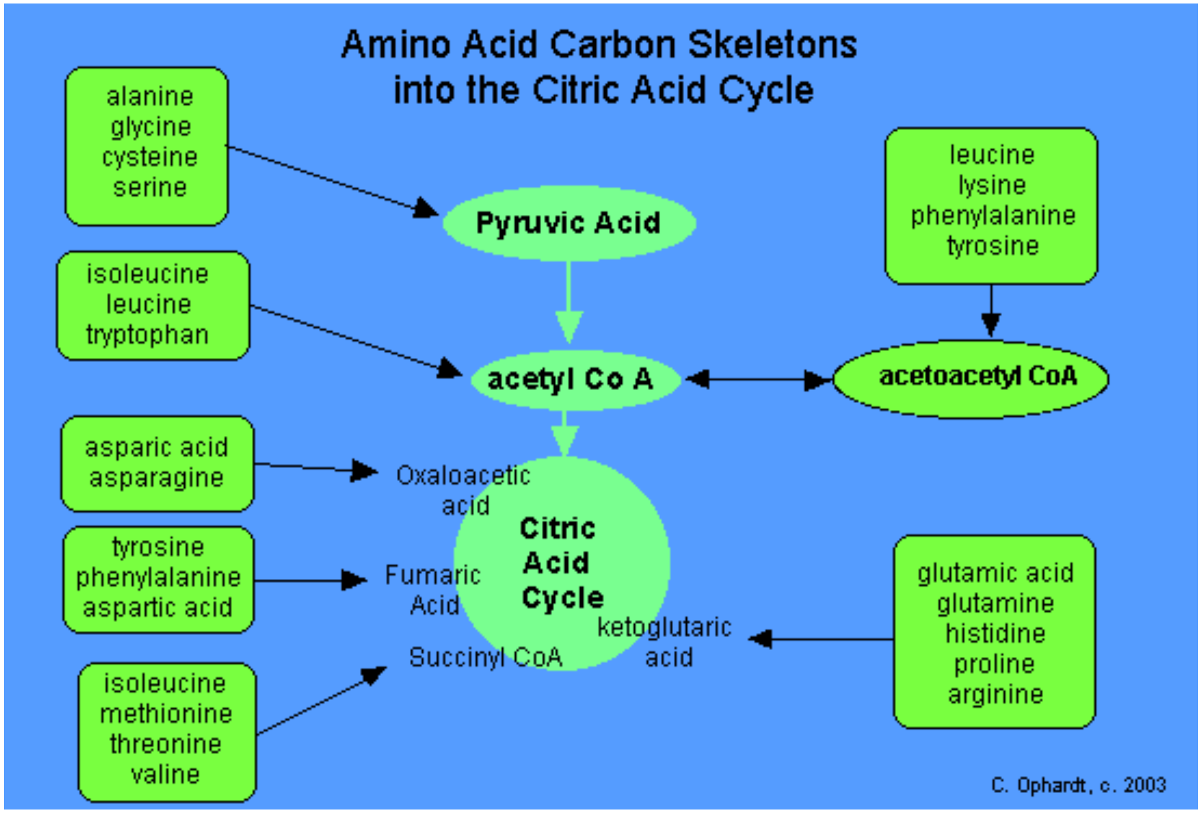
24 yo Female
Weight gain
Chronic Fatigue
Brain Fog
IBS
Acne



Fatty Acid Metabolism			
(Carnitine & B2)			
1. Adipate	1.8	6.2	<= 11.1
2. Suberate	0.4	2.1	<= 4.6
3. Ethylmalonate	1.6	3.6	<= 6.3
Carbohydrate Metabolism			
(B1, B3, Cr, Lipoic Acid, CoQ10)			
4. Pyruvate	4.1	3.9	<= 6.4
5. L-Lactate	7.5	8.5	0.6 - 16.4
6. β-Hydroxybutyrate	<DL	2.1	<= 9.9
Energy Production (Citric Acid Cycle)			
(B Comp., CoQ10, Amino Acids, Mg)			
7. Citrate	208	601	56 - 987
8. Cis-Aconitate	28	51	18 - 78
9. Isocitrate	44	98	39 - 143
10. α-Ketoglutarate	11.8	19.0	<= 35.0
11. Succinate	3.0	11.6	<= 20.9
12. Fumarate	<DL	0.59	<= 1.35
13. Malate	0.3	1.4	<= 3.1
14. Hydroxymethylglutarate	2.1	3.6	<= 5.1

FUNCTIONAL MEDICINE FAST TRACK

Pattern Recognition
In Organix Comprehensive



Amino Acid Carbon Skeletons
into the Citric Acid Cycle

C. Ophardt, c. 2003

Pattern Recognition
In Organix Comprehensive

Origins of low adipate, suberate or ethylmalonate

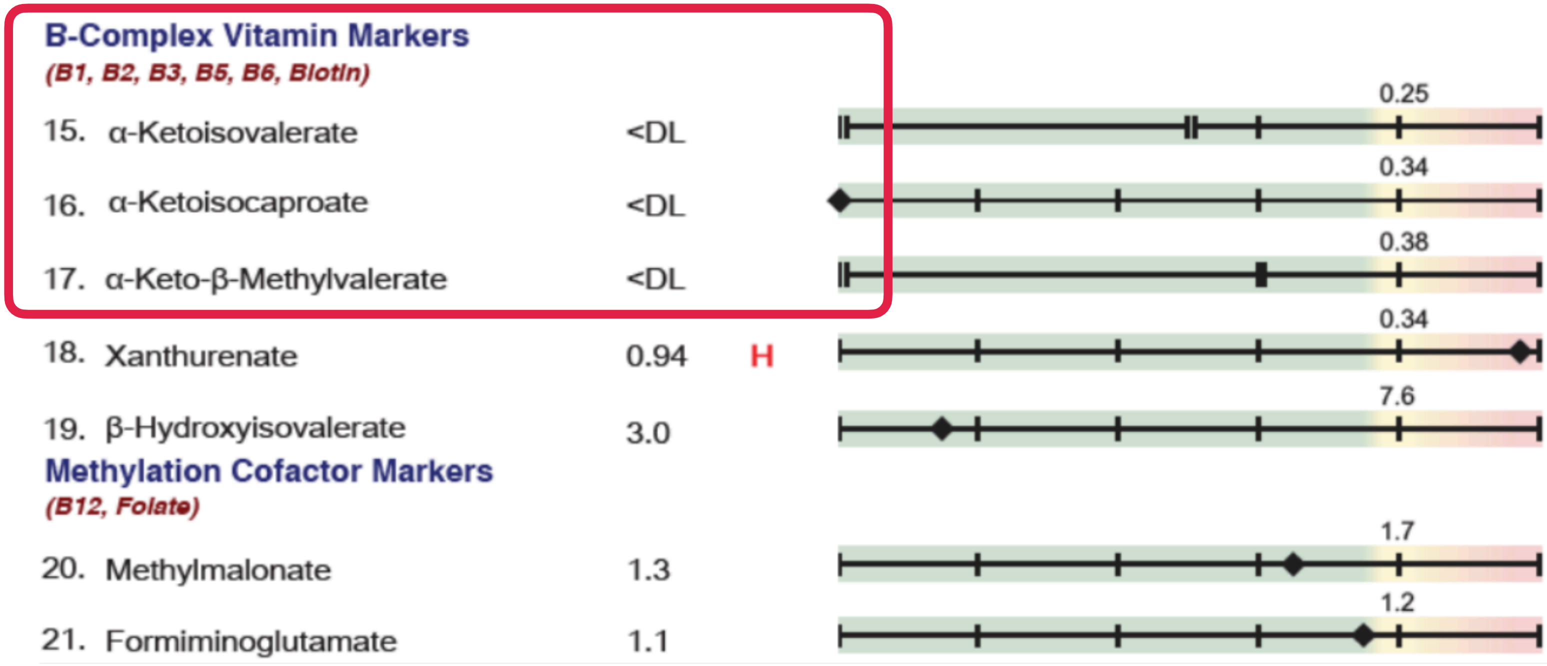
Low ethylmalonate is not directly associated like adipate and suberate with mitochondrial retracted states, but rather with pathways of amino acid catabolism. However, it is quite common to find ethylmalonate low along with low adipate and suberate. The linking factor is cellular free amino acid concentrations that are directly correlated with both amino acid catabolic flux and mitochondriogenesis via mTOR activation.

Excerpt From: Richard S. Lord. “Paths to Health: Organic Acids.” Arrowhead Bioscience, 2018. Apple Books. https://books.apple.com/us/book/paths-to-health-organic-acids/id143949298

Low Amino Acid Patterns in Organic Acids

Patient A:

24 yo Female
Weight gain
Chronic Fatigue
Brain Fog
IBS
Acne



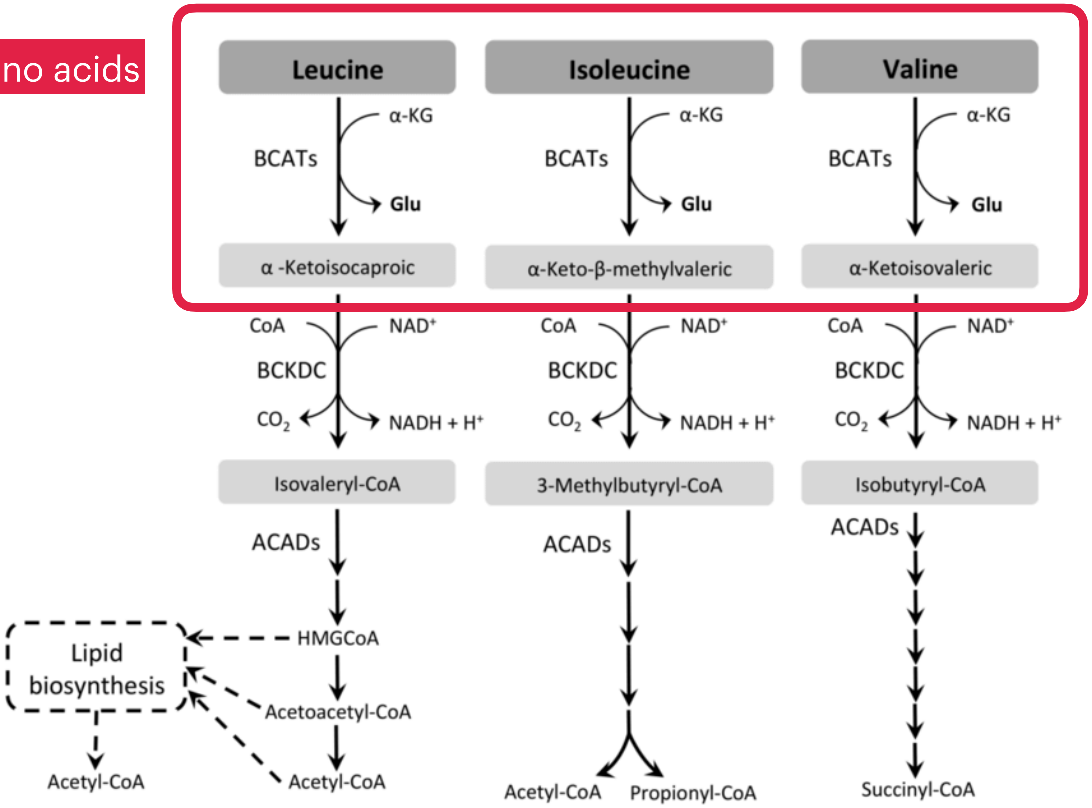
B-Complex Vitamin Markers
(B1, B2, B3, B5, B6, Biotin)

15.	α-Ketoisovalerate	<DL		0.25
16.	α-Ketoisocaproate	<DL		0.34
17.	α-Keto-β-Methylvalerate	<DL		0.38
18.	Xanthurenate	0.94	H	0.34
19.	β-Hydroxyisovalerate	3.0		7.6

Methylation Cofactor Markers
(B12, Folate)

20.	Methylmalonate	1.3		1.7
21.	Formiminoglutamate	1.1		1.2

Branched Chain Amino Acid Metabolism



Low levels of amino acids

Leucine
BCATs
α-KG
Glu
α -Ketoisocaproic
CoA
NAD⁺
BCKDC
CO_2
NADH + H⁺
Isovaleryl-CoA
ACADs
HMGCoA
Acetoacetyl-CoA
Acetyl-CoA
Lipid biosynthesis
Acetyl-CoA

Isoleucine
BCATs
α-KG
Glu
α-Keto-β-methylvaleric
CoA
NAD⁺
BCKDC
CO_2
NADH + H⁺
3-Methylbutyryl-CoA
ACADs
Acetyl-CoA
Propionyl-CoA

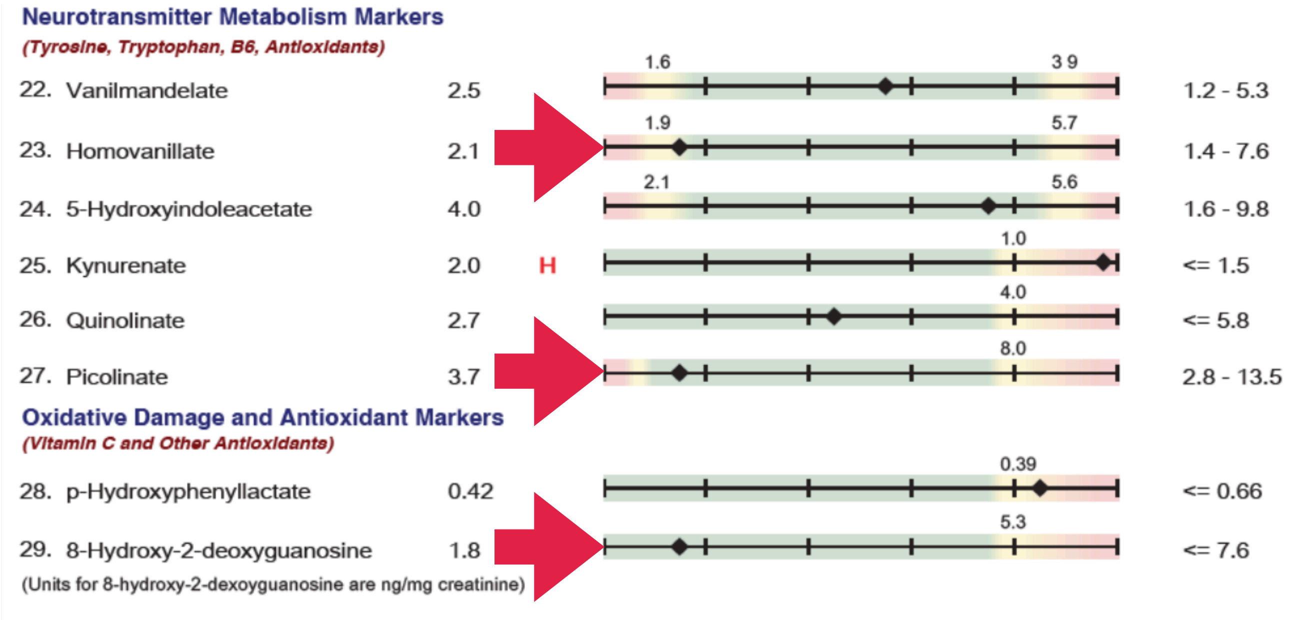
Valine
BCATs
α-KG
Glu
α-Ketoisovaleric
CoA
NAD⁺
BCKDC
CO_2
NADH + H⁺
Isobutyryl-CoA
ACADs
Succinyl-CoA

FUNCTIONAL MEDICINE FAST TRACK

Low Amino Acid Patterns in Organic Acids

Patient A:

24 yo Female
Weight gain
Chronic Fatigue
Brain Fog
IBS
Acne



Neurotransmitter Metabolism Markers

(Tyrosine, Tryptophan, B6, Antioxidants)

22.	Vanilmandelate	2.5		1.2 - 5.3
23.	Homovanillate	2.1		1.4 - 7.6
24.	5-Hydroxyindoleacetate	4.0		1.6 - 9.8
25.	Kynurenate	2.0	H	<= 1.5
26.	Quinolinate	2.7		<= 5.8
27.	Picolinate	3.7		2.8 - 13.5

Oxidative Damage and Antioxidant Markers

(Vitamin C and Other Antioxidants)

28.	p-Hydroxyphenyllactate	0.42		<= 0.66
29.	8-Hydroxy-2-deoxyguanosine	1.8		<= 7.6

(Units for 8-hydroxy-2-dexoyguanosine are ng/mg creatinine)

FUNCTIONAL MEDICINE FAST TRACK

Connecting Organic Acid to Amino Acid

Essential Amino Acids

Limiting Amino Acids

1. Lysine	70		[illegible]	183	63 - 220
2. Methionine	11		12	28	10 - 33
3. Tryptophan	30		28	45	24 - 52

Branched Chain Amino Acids

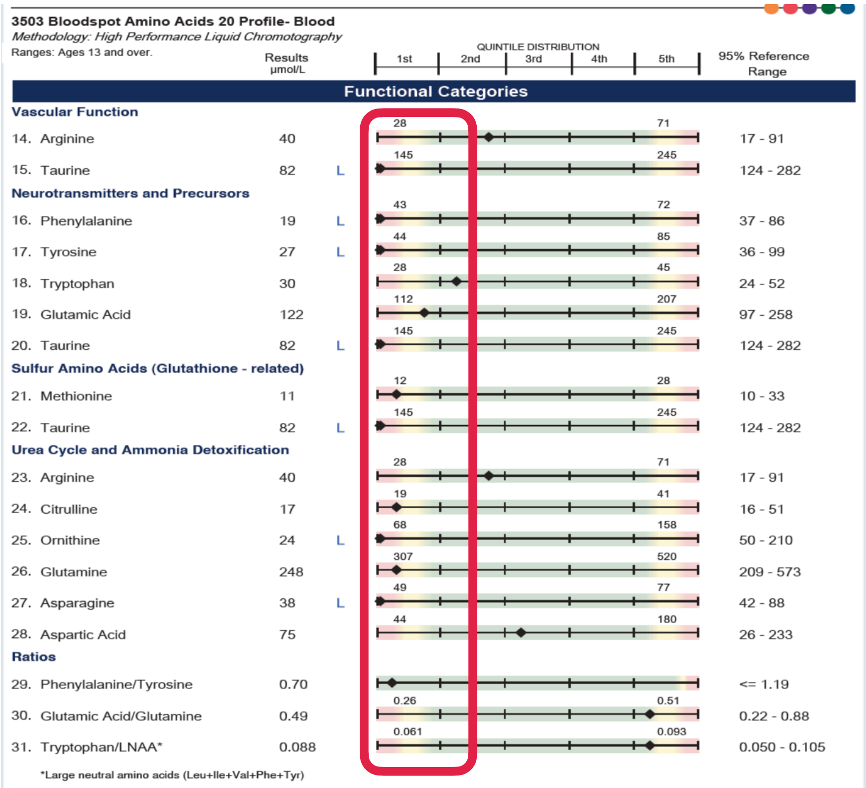
4. Isoleucine	40		35	77	28 - 96
5. Leucine	77		71	139	59 - 162
6. Valine	179		126	229	105 - 266

Other Essential Amino Acids

7. Phenylalanine	19	L	43	72	37 - 86
8. Histidine	35		31	84	22 - 99
9. Threonine	124		67	143	54 - 169

Conditionally Essential Amino Acids

10. Arginine	40		28	71	17 - 91
11. Taurine	82	L	145	245	124 - 282
12. Glycine	129	L	243	449	207 - 559
13. Serine	71	L	95	219	79 - 310



3503 Bloodspot Amino Acids 20 Profile- Blood

Methodology: High Performance Liquid Chromatography

Ranges: Ages 13 and over.

Functional Categories

	Results µmol/L		QUINTILE DISTRIBUTION 1st	5th	95% Reference Range
Vascular Function					
14. Arginine	40		28	71	17 - 91
15. Taurine	82	L	145	245	124 - 282
Neurotransmitters and Precursors					
16. Phenylalanine	19	L	43	72	37 - 86
17. Tyrosine	27	L	44	85	36 - 99
18. Tryptophan	30		28	45	24 - 52
19. Glutamic Acid	122		112	207	97 - 258
20. Taurine	82	L	145	245	124 - 282
Sulfur Amino Acids (Glutathione - related)					
21. Methionine	11		12	28	10 - 33
22. Taurine	82	L	145	245	124 - 282
Urea Cycle and Ammonia Detoxification					
23. Arginine	40		28	71	17 - 91
24. Citrulline	17		19	41	16 - 51
25. Ornithine	24	L	68	158	50 - 210
26. Glutamine	248		307	520	209 - 573
27. Asparagine	38	L	49	77	42 - 88
28. Aspartic Acid	75		44	180	26 - 233
Ratios					
29. Phenylalanine/Tyrosine	0.70				<= 1.19
30. Glutamic Acid/Glutamine	0.49		0.26	0.51	0.22 - 0.88
31. Tryptophan/LNAA*	0.088		0.061	0.093	0.050 - 0.105

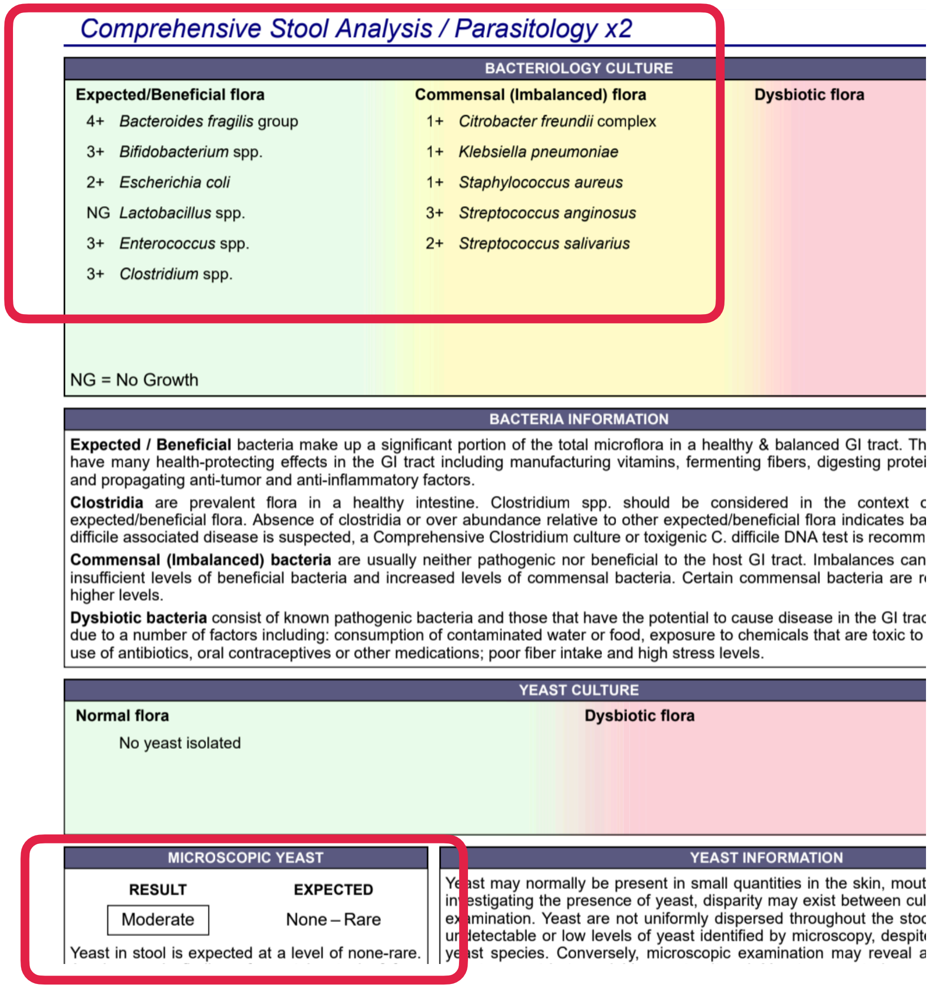
*Large neutral amino acids (Leu+Ile+Val+Phe+Tyr)

FUNCTIONAL MEDICINE FAST TRACK

Connecting Organic Acid connection to CSAP

Patient A:

24 yo Female
Weight gain
Chronic Fatigue
Brain Fog
IBS
Acne



Comprehensive Stool Analysis / Parasitology x2

BACTERIOLOGY CULTURE

Expected/Beneficial flora	**Commensal (Imbalanced) flora**	**Dysbiotic flora**
4+ *Bacteroides fragilis* group	1+ *Citrobacter freundii* complex	
3+ *Bifidobacterium* spp.	1+ *Klebsiella pneumoniae*	
2+ *Escherichia coli*	1+ *Staphylococcus aureus*	
NG *Lactobacillus* spp.	3+ *Streptococcus anginosus*	
3+ *Enterococcus* spp.	2+ *Streptococcus salivarius*	
3+ *Clostridium* spp.		

NG = No Growth

BACTERIA INFORMATION

Expected / Beneficial bacteria make up a significant portion of the total microflora in a healthy & balanced GI tract. Th have many health-protecting effects in the GI tract including manufacturing vitamins, fermenting fibers, digesting protei and propagating anti-tumor and anti-inflammatory factors.

Clostridia are prevalent flora in a healthy intestine. Clostridium spp. should be considered in the context c expected/beneficial flora. Absence of clostridia or over abundance relative to other expected/beneficial flora indicates ba difficile associated disease is suspected, a Comprehensive Clostridium culture or toxigenic C. difficile DNA test is recomm

Commensal (Imbalanced) bacteria are usually neither pathogenic nor beneficial to the host GI tract. Imbalances can insufficient levels of beneficial bacteria and increased levels of commensal bacteria. Certain commensal bacteria are r higher levels.

Dysbiotic bacteria consist of known pathogenic bacteria and those that have the potential to cause disease in the GI trac due to a number of factors including: consumption of contaminated water or food, exposure to chemicals that are toxic to use of antibiotics, oral contraceptives or other medications; poor fiber intake and high stress levels.

YEAST CULTURE

Normal flora	**Dysbiotic flora**
No yeast isolated	

MICROSCOPIC YEAST

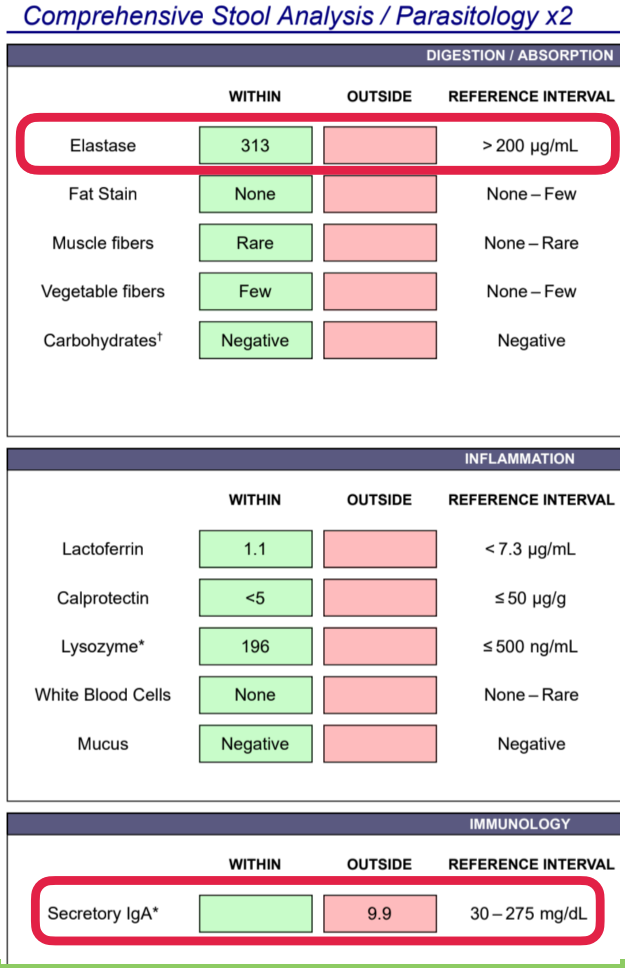
RESULT	**EXPECTED**
Moderate	None – Rare

Yeast in stool is expected at a level of none-rare.

YEAST INFORMATION

Yeast may normally be present in small quantities in the skin, mout investigating the presence of yeast, disparity may exist between cul examination. Yeast are not uniformly dispersed throughout the stoc undetectable or low levels of yeast identified by microscopy, despit yeast species. Conversely, microscopic examination may reveal a

Connecting Organic Acid to CSAP



Comprehensive Stool Analysis / Parasitology x2

DIGESTION / ABSORPTION

	WITHIN	OUTSIDE	REFERENCE INTERVAL
Elastase	313		> 200 µg/mL
Fat Stain	None		None – Few
Muscle fibers	Rare		None – Rare
Vegetable fibers	Few		None – Few
Carbohydrates†	Negative		Negative

INFLAMMATION

	WITHIN	OUTSIDE	REFERENCE INTERVAL
Lactoferrin	1.1		< 7.3 µg/mL
Calprotectin	<5		≤ 50 µg/g
Lysozyme*	196		≤ 500 ng/mL
White Blood Cells	None		None – Rare
Mucus	Negative		Negative

IMMUNOLOGY

	WITHIN	OUTSIDE	REFERENCE INTERVAL
Secretory IgA*		9.9	30 – 275 mg/dL

Patient A:

24 yo Female
Chronic Fatigue
Brain Fog
IBS
Acne

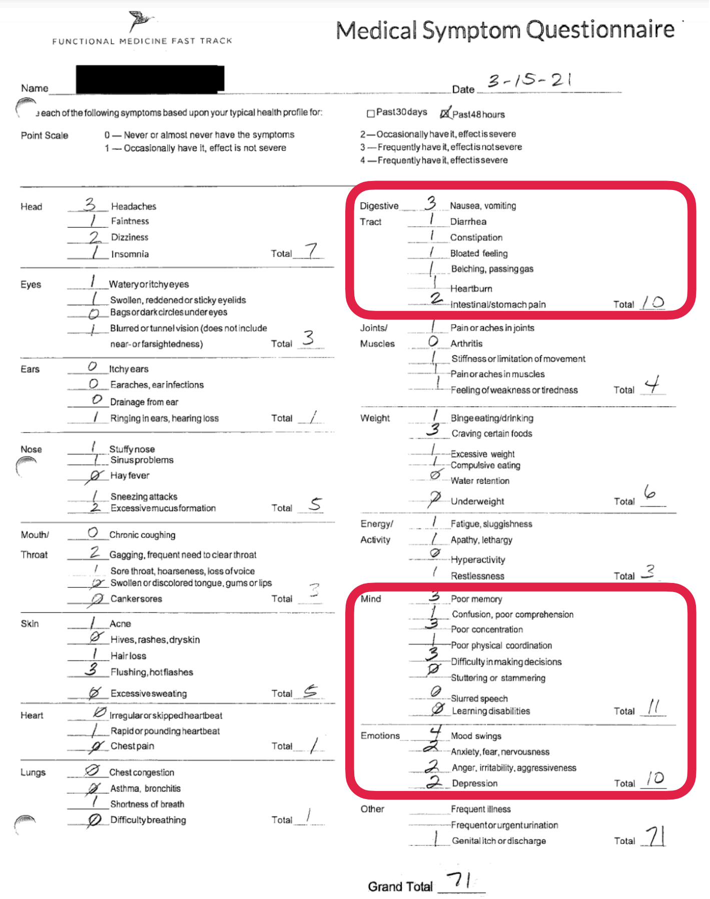
Clinical Application

1. Essential Amino Acids
2. Improve maldigestion and malabsorption
3. Use betaine HCL testing for optimal stomach acidity
4. Add digestive enzymes to aid low pancreatic function

Pattern #2: Dominant High Markers

Patient B:

57 yo Male
Depression
Anxiety
Brain Fog
Memory issues



FUNCTIONAL MEDICINE FAST TRACK

Medical Symptom Questionnaire

Name [redacted] Date 3-15-21

…e each of the following symptoms based upon your typical health profile for: ☐ Past 30 days ☒ Past 48 hours

Point Scale
0 — Never or almost never have the symptoms
1 — Occasionally have it, effect is not severe
2 — Occasionally have it, effect is severe
3 — Frequently have it, effect is not severe
4 — Frequently have it, effect is severe

Head	3	Headaches
	1	Faintness
	2	Dizziness
	1	Insomnia
	Total 7	
Eyes	1	Watery or itchy eyes
	1	Swollen, reddened or sticky eyelids
	0	Bags or dark circles under eyes
	1	Blurred or tunnel vision (does not include near- or farsightedness)
	Total 3	
Ears	0	Itchy ears
	0	Earaches, ear infections
	0	Drainage from ear
	1	Ringing in ears, hearing loss
	Total 1	
Nose	1	Stuffy nose
	1	Sinus problems
	0	Hay fever
	1	Sneezing attacks
	2	Excessive mucus formation
	Total 5	
Mouth/ Throat	0	Chronic coughing
	2	Gagging, frequent need to clear throat
	1	Sore throat, hoarseness, loss of voice
	0	Swollen or discolored tongue, gums or lips
	0	Canker sores
	Total 3	
Skin	1	Acne
	0	Hives, rashes, dry skin
	1	Hair loss
	3	Flushing, hot flashes
	0	Excessive sweating
	Total 5	
Heart	0	Irregular or skipped heartbeat
	1	Rapid or pounding heartbeat
	0	Chest pain
	Total 1	
Lungs	0	Chest congestion
	0	Asthma, bronchitis
	1	Shortness of breath
	0	Difficulty breathing
	Total 1	
Digestive Tract	3	Nausea, vomiting
	1	Diarrhea
	1	Constipation
	1	Bloated feeling
	1	Belching, passing gas
	1	Heartburn
	2	Intestinal/stomach pain
	Total 10	
Joints/ Muscles	1	Pain or aches in joints
	0	Arthritis
	1	Stiffness or limitation of movement
	1	Pain or aches in muscles
	1	Feeling of weakness or tiredness
	Total 4	
Weight	1	Binge eating/drinking
	3	Craving certain foods
	1	Excessive weight
	1	Compulsive eating
	0	Water retention
	0	Underweight
	Total 6	
Energy/ Activity	1	Fatigue, sluggishness
	1	Apathy, lethargy
	0	Hyperactivity
	1	Restlessness
	Total 3	
Mind	3	Poor memory
	1	Confusion, poor comprehension
	3	Poor concentration
	1	Poor physical coordination
	3	Difficulty in making decisions
	0	Stuttering or stammering
	0	Slurred speech
	0	Learning disabilities
	Total 11	
Emotions	4	Mood swings
	2	Anxiety, fear, nervousness
	2	Anger, irritability, aggressiveness
	2	Depression
	Total 10	
Other		Frequent illness
		Frequent or urgent urination
	1	Genital itch or discharge
	Total 71	

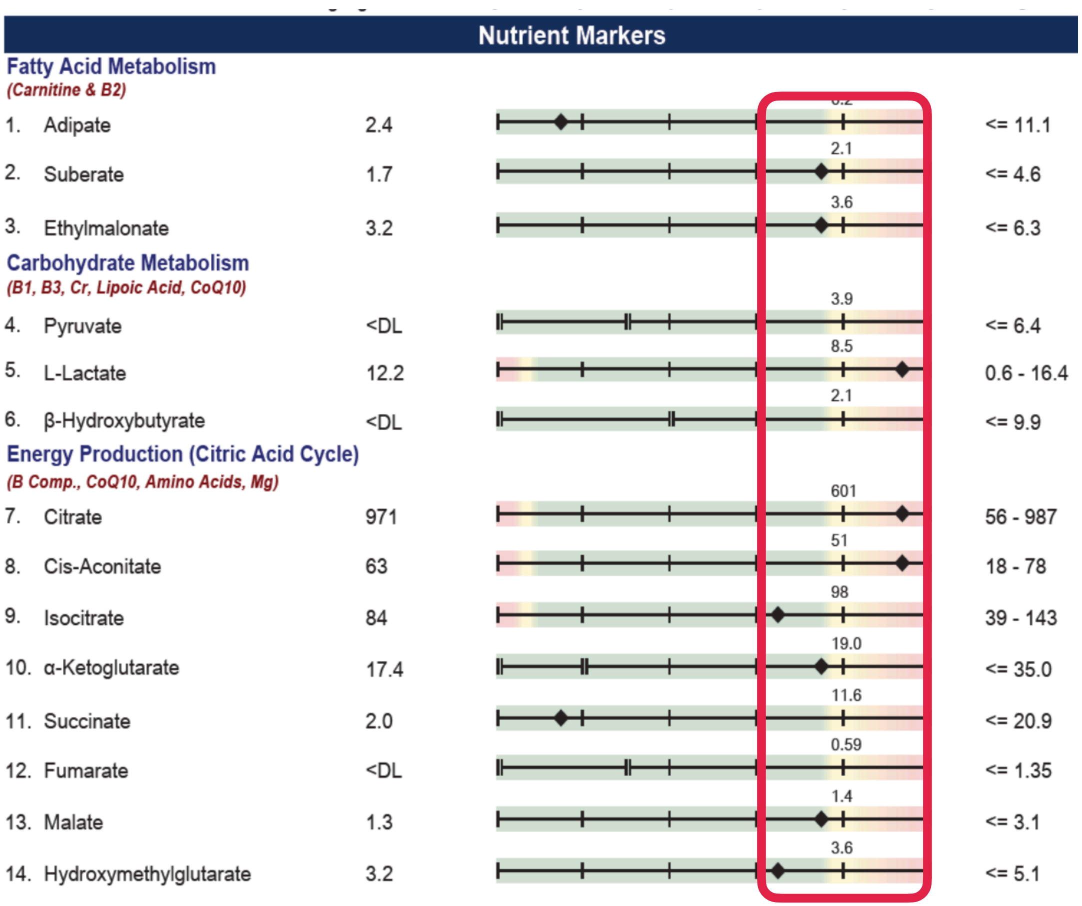
Grand Total 71

FUNCTIONAL MEDICINE FAST TRACK

Pattern #2: Dominant High Markers

Patient B:

57 yo Male
Depression
Anxiety
Brain Fog
Memory issues



Nutrient Markers

Fatty Acid Metabolism
(Carnitine & B2)

1.	Adipate	2.4	<= 11.1
2.	Suberate	1.7	<= 4.6
3.	Ethylmalonate	3.2	<= 6.3

Carbohydrate Metabolism
(B1, B3, Cr, Lipoic Acid, CoQ10)

4.	Pyruvate	<DL	<= 6.4
5.	L-Lactate	12.2	0.6 - 16.4
6.	β-Hydroxybutyrate	<DL	<= 9.9

Energy Production (Citric Acid Cycle)
(B Comp., CoQ10, Amino Acids, Mg)

7.	Citrate	971	56 - 987
8.	Cis-Aconitate	63	18 - 78
9.	Isocitrate	84	39 - 143
10.	α-Ketoglutarate	17.4	<= 35.0
11.	Succinate	2.0	<= 20.9
12.	Fumarate	<DL	<= 1.35
13.	Malate	1.3	<= 3.1
14.	Hydroxymethylglutarate	3.2	<= 5.1

Pattern #2: Dominant High Markers

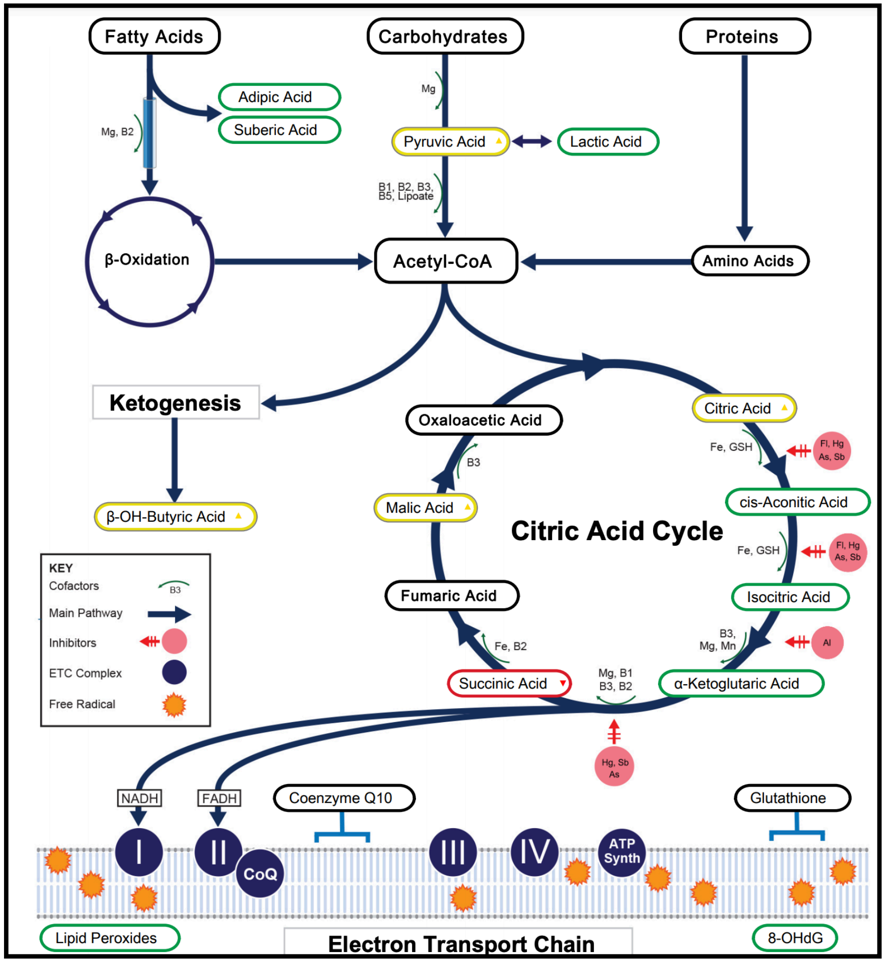
Reason #1:
Main Co factors:

Vitamins B 1,2,3,5
Magnesium
Iron
Manganese
Lipoic acid

Reason #2:
Main Heavy
Metal Inhibitors:

Fluoride
Arsenic
Mercury
Lead
Aluminium
Antimony

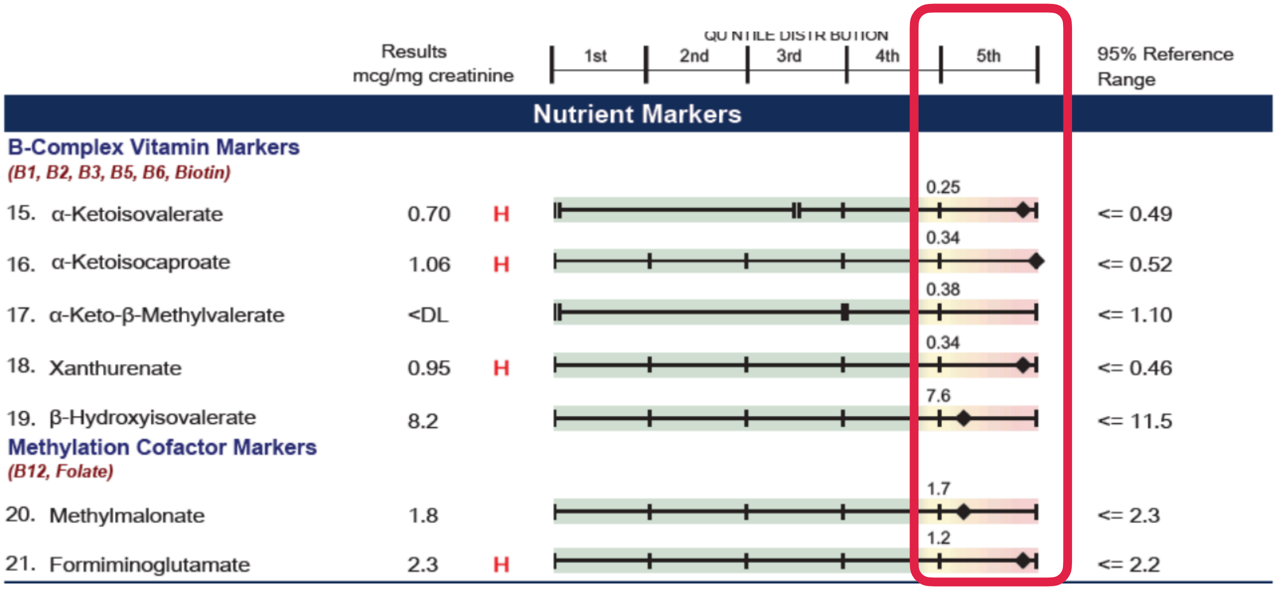
Reason #3:
Genetic SNPs



High B Vitamin markers

Patient B:

57 yo Male
Depression
Anxiety
Brain Fog
Memory issues

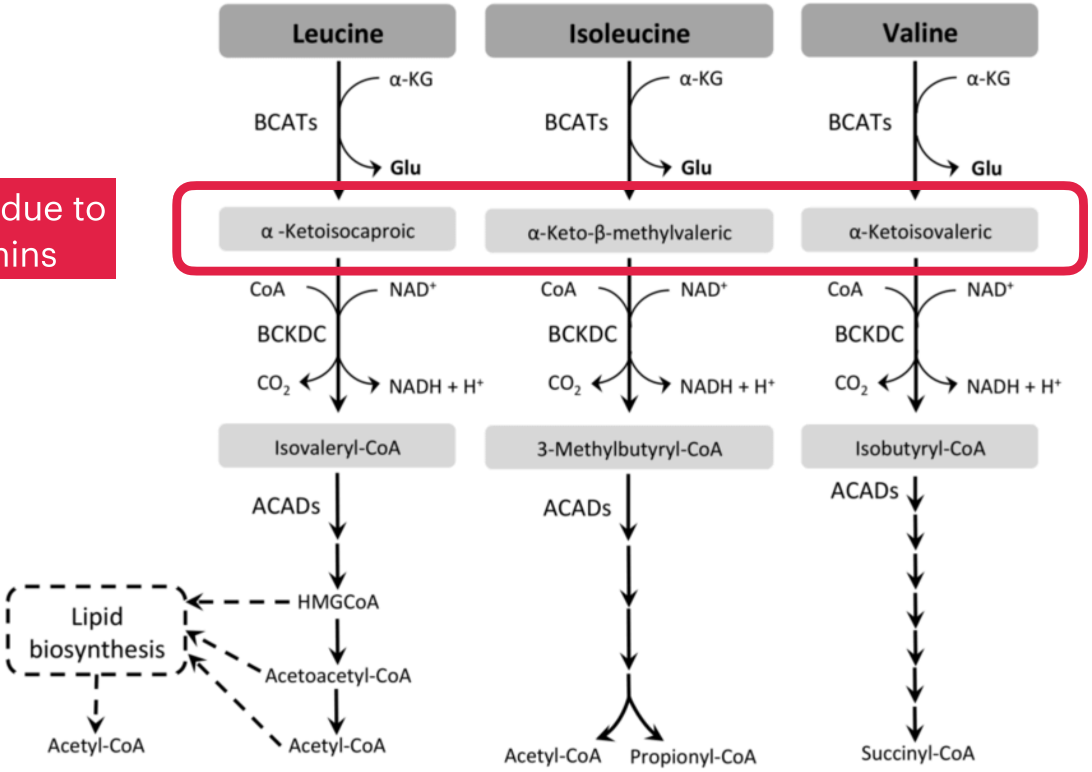


	Results mcg/mg creatinine		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Nutrient Markers				
B-Complex Vitamin Markers *(B1, B2, B3, B5, B6, Biotin)*				
15. α-Ketoisovalerate	0.70	H	0.25	<= 0.49
16. α-Ketoisocaproate	1.06	H	0.34	<= 0.52
17. α-Keto-β-Methylvalerate	<DL		0.38	<= 1.10
18. Xanthurenate	0.95	H	0.34	<= 0.46
19. β-Hydroxyisovalerate	8.2		7.6	<= 11.5
Methylation Cofactor Markers *(B12, Folate)*				
20. Methylmalonate	1.8		1.7	<= 2.3
21. Formiminoglutamate	2.3	H	1.2	<= 2.2

FUNCTIONAL MEDICINE FAST TRACK

Branched Chain Amino Acid Metabolism

Accumulation due to Low B vitamins



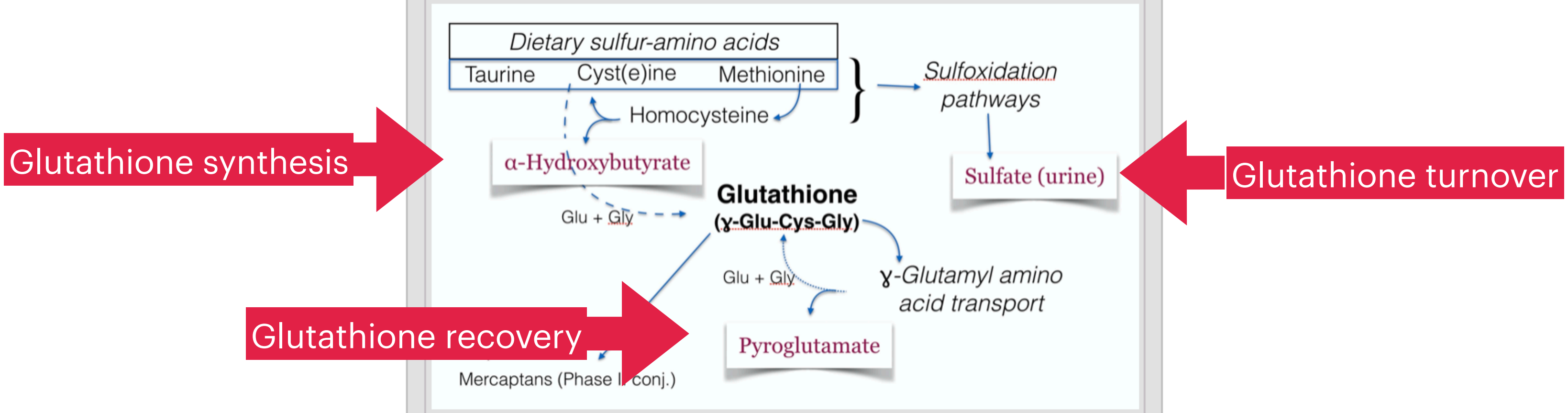
FUNCTIONAL MEDICINE FAST TRACK

Clinical Application

1. B Vitamin Complex
2. Optimize gut health
3. Use 5R program
4. Multimineral
5. Possibly additional magnesium and iron

Pattern Recognition #3: Glutathione Status

Figure 4.9 Pathways to biomarkers of glutathione status



Glutathione synthesis

Glutathione turnover

Glutathione recovery

The biomarkers (bold, red font) are by-products or end-products of multipel pathways used for glutathione formation and utlization.

Pattern Recognition #3:
Glutathione Status

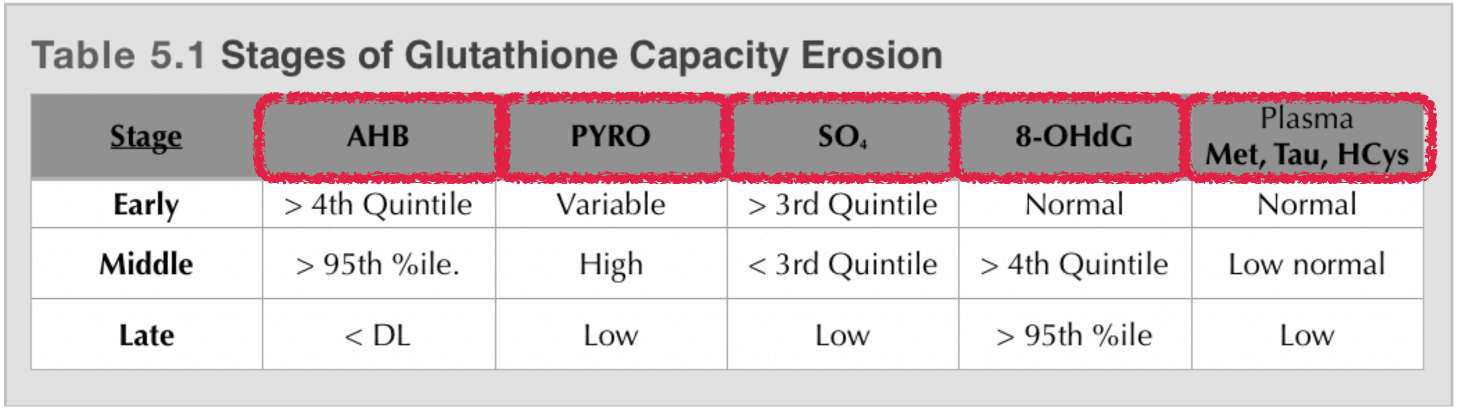


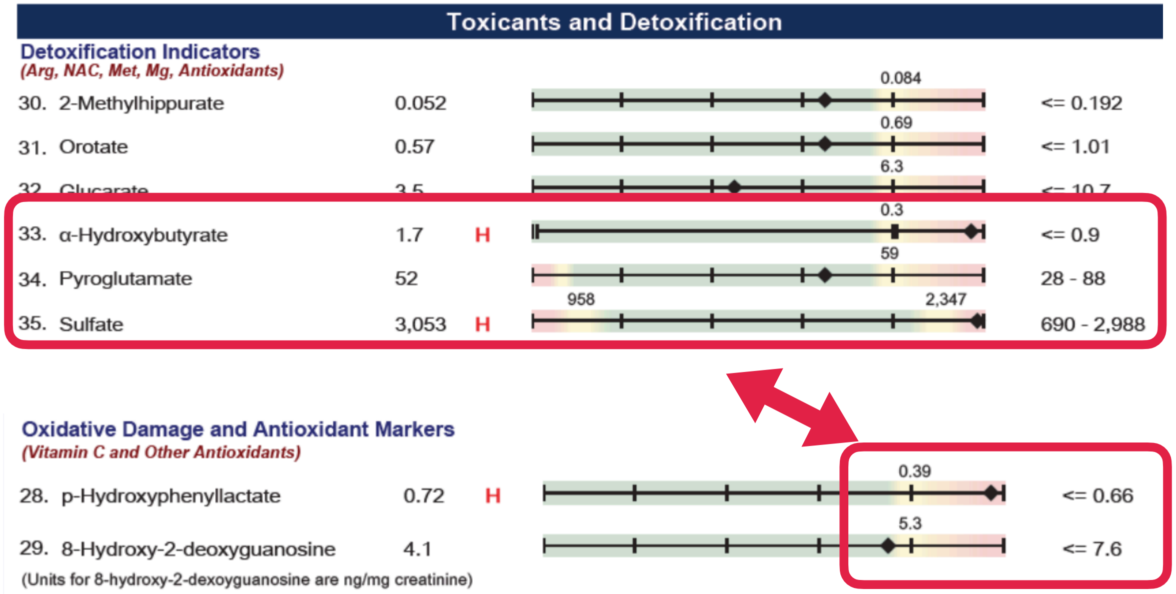
Table 5.1 Stages of Glutathione Capacity Erosion

Stage	AHB	PYRO	SO_4	8-OHdG	Plasma Met, Tau, HCys
Early	> 4th Quintile	Variable	> 3rd Quintile	Normal	Normal
Middle	> 95th %ile.	High	< 3rd Quintile	> 4th Quintile	Low normal
Late	< DL	Low	Low	> 95th %ile	Low

Mid Stage Glutathione Depletion

Patient B:

57 yo Male
Depression
Anxiety
Brain Fog
Memory issues



Toxicants and Detoxification

Detoxification Indicators
(Arg, NAC, Met, Mg, Antioxidants)

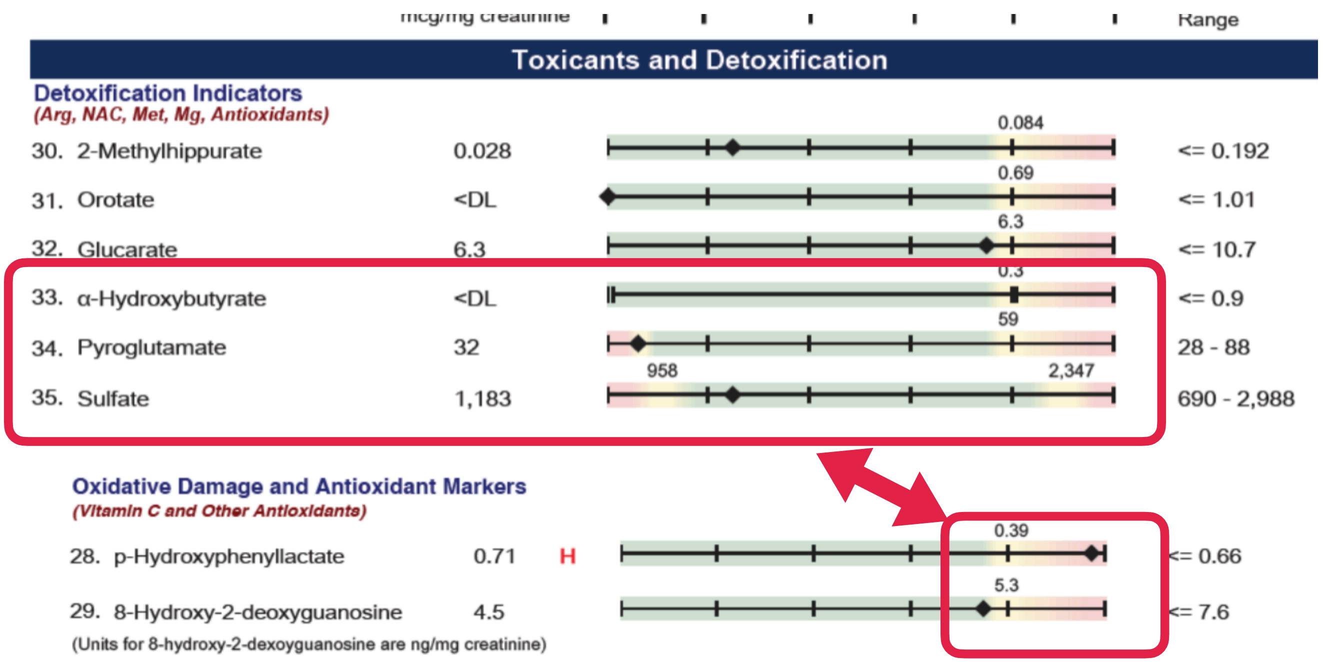
30.	2-Methylhippurate	0.052		0.084	<= 0.192
31.	Orotate	0.57		0.69	<= 1.01
32.	Glucarate	3.5		6.3	<= 10.7
33.	α-Hydroxybutyrate	1.7	H	0.3	<= 0.9
34.	Pyroglutamate	52		59	28 - 88
35.	Sulfate	3,053	H	958 2,347	690 - 2,988

Oxidative Damage and Antioxidant Markers
(Vitamin C and Other Antioxidants)

28.	p-Hydroxyphenyllactate	0.72	H	0.39	<= 0.66
29.	8-Hydroxy-2-deoxyguanosine	4.1		5.3	<= 7.6

(Units for 8-hydroxy-2-dexoyguanosine are ng/mg creatinine)

End Stage Glutathione Depletion



	mcg/mg creatinine			Range
Toxicants and Detoxification				
Detoxification Indicators *(Arg, NAC, Met, Mg, Antioxidants)*				
30. 2-Methylhippurate	0.028		0.084	<= 0.192
31. Orotate	<DL		0.69	<= 1.01
32. Glucarate	6.3		6.3	<= 10.7
33. α-Hydroxybutyrate	<DL		0.3	<= 0.9
34. Pyroglutamate	32		59	28 - 88
35. Sulfate	1,183		958 2,347	690 - 2,988
Oxidative Damage and Antioxidant Markers *(Vitamin C and Other Antioxidants)*				
28. p-Hydroxyphenyllactate	0.71	H	0.39	<= 0.66
29. 8-Hydroxy-2-deoxyguanosine	4.5		5.3	<= 7.6

(Units for 8-hydroxy-2-dexoyguanosine are ng/mg creatinine)

Glutathione response insufficiency confirmatory tests:

1. ***LOW AMINO ACID*** markers:

    - Amino acids, plasma Sulfur-containing amino acids Met, Tau, HCys

    - GSH precursor amino acids: Gly, Ser,

2. Markers of ***OXIDATIVE STRESS*** protection will be ***HIGH***

    - DNA oxidative damage - 8-OHdG - High

    - Membrane PUFA damage - Lipid peroxides - High

Hypometabolic Compensatory States (HCS)

Compensatory responses, broadly defined, include hormonal secretions and cytokine responses that act to slow or reverse deviations from median or normal physiologic states. (Garcia-Fontana et al. 2016)

Hypometabolic State Pattern Recognition

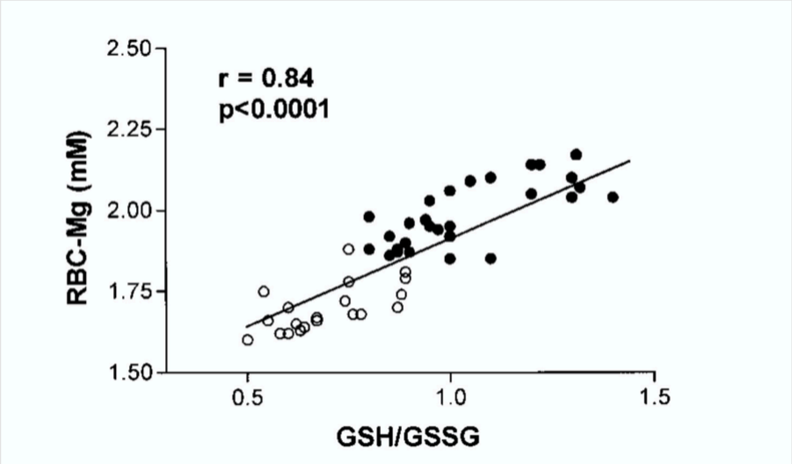
“The Glutathione - Magnesium Dyad”

Because assimilation of magnesium produces immediate stimulation of mitochondrial ROS production, it is resisted by inadequate capacity for glutathione generation to offset the oxidative stress”

Excerpt From: Richard S. Lord. “Paths to Health: Organic Acids.” Arrowhead Bioscience, 2018. Apple Books. https://books.apple.com/us/book/paths-to-health-organic-acids/id1439492989

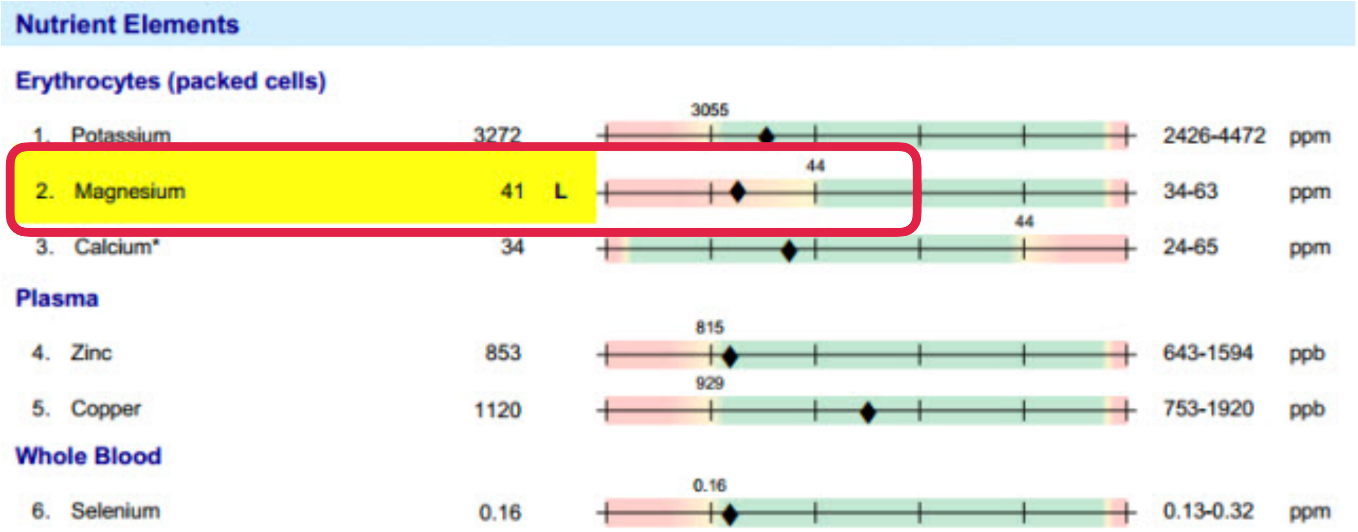
Pattern Recognition
In Organix Comprehensive

Figure 6.1 **RBC Magnesium Determines GSH Redox Status**



Hypertensive (open circles) and normotensive (closed circles) humans fall on a continuum of GSH redox status that varies directly with RBC magnesium. A common clinical outcome is that oral Mg therapy fails to correct low RBC Mg for individuals with poor GSH status. And, when GSH status is normalized, Mg levels may correct without added oral Mg.

Glutathione corrosion pattern associated with low magnesium



Nutrient Elements

Erythrocytes (packed cells)

1. Potassium	3272		3055	2426-4472	ppm
2. Magnesium	41	L	44	34-63	ppm
3. Calcium*	34		44	24-65	ppm

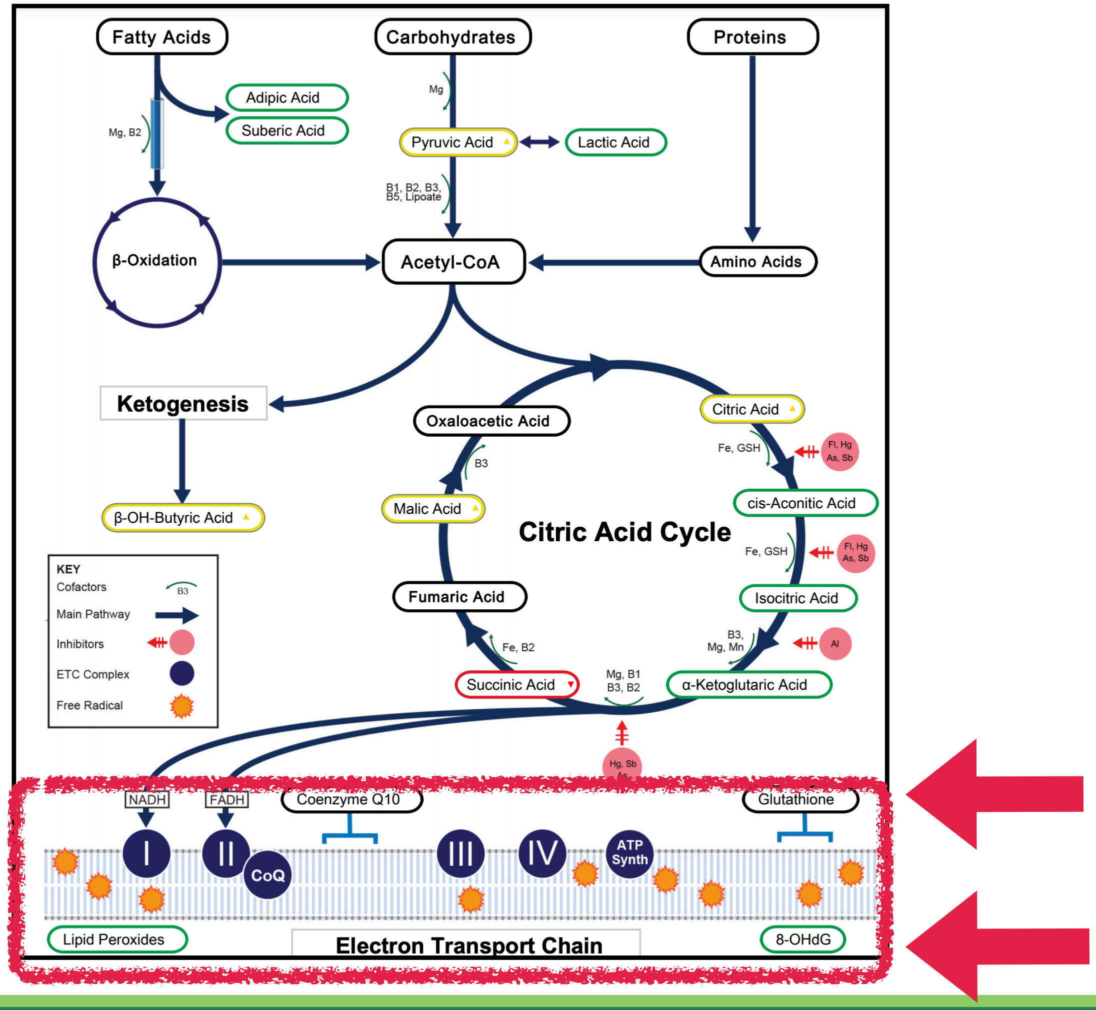
Plasma

4. Zinc	853		815	643-1594	ppb
5. Copper	1120		929	753-1920	ppb

Whole Blood

6. Selenium	0.16		0.16	0.13-0.32	ppm

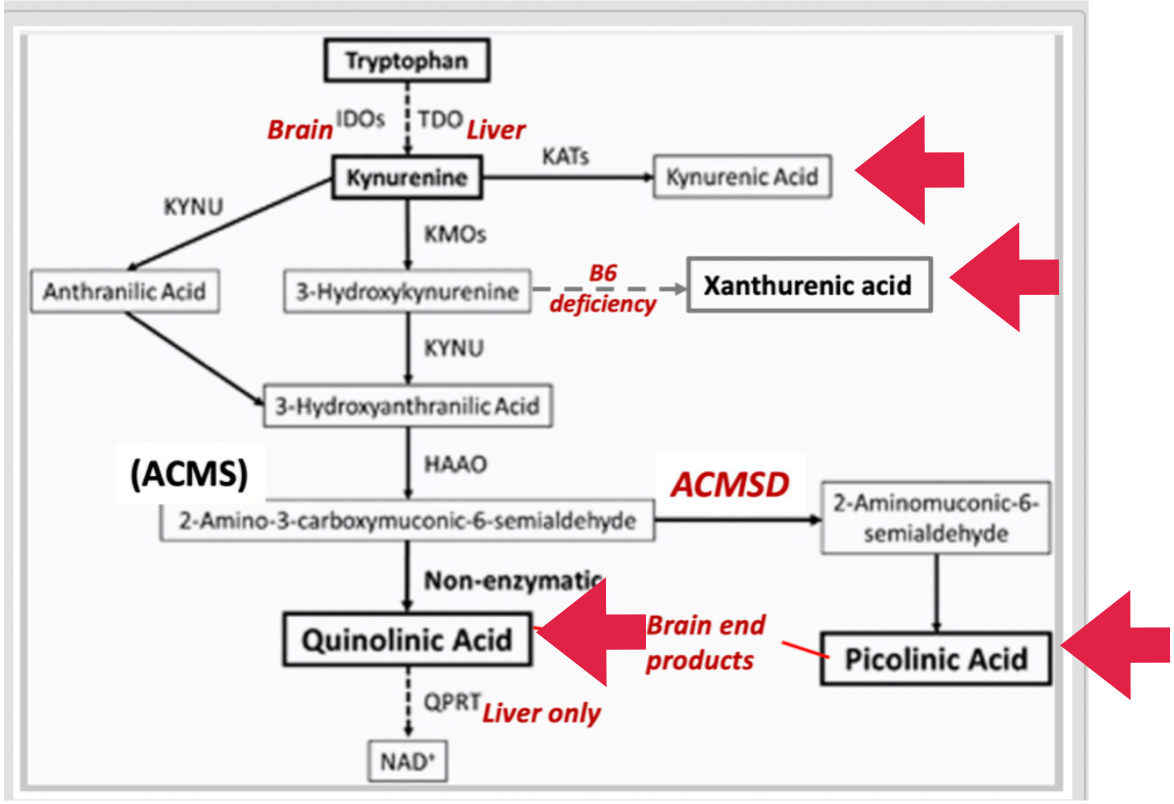
Glutathione and Krebs cycle



Clinical Application for Glutathione Depletion with Low Magnesium

1. NAC 600mg-1200mg
2. Glutathione
3. Methylation support
4. Magnesium glycinate
5. Amino acid

Pattern Recognition #4: Kynurenate and Xanthurenate



Pattern Recognition #4 : B6 vs INFg

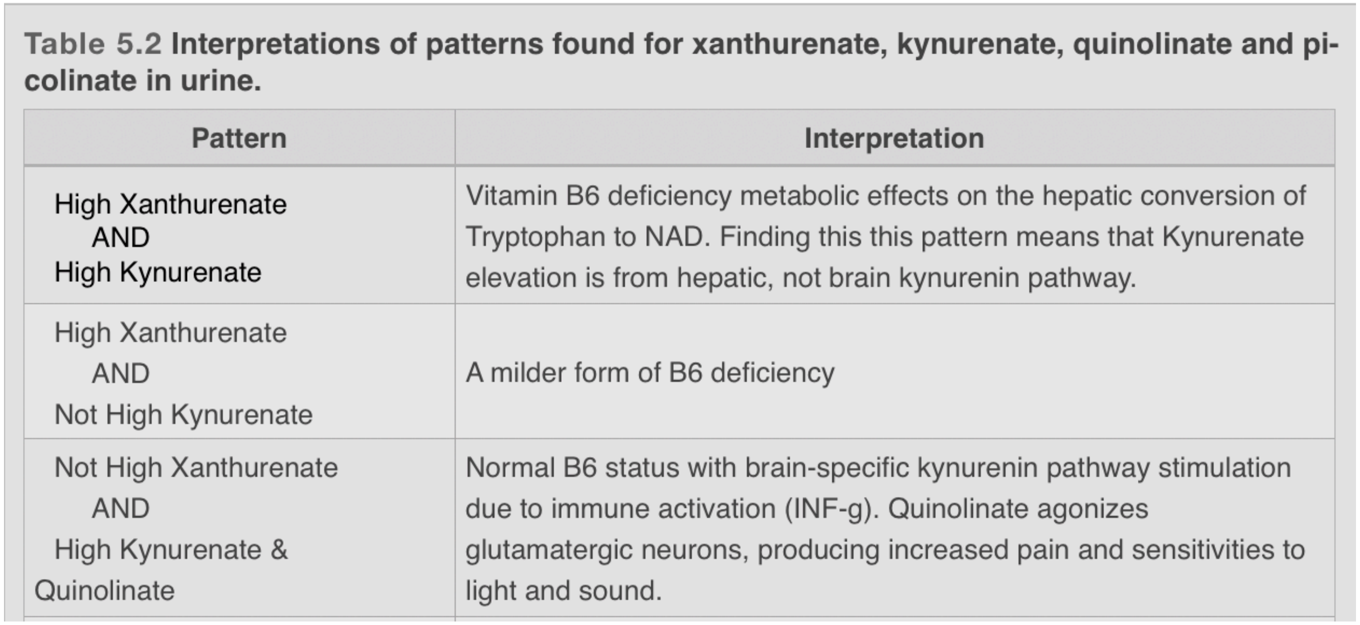


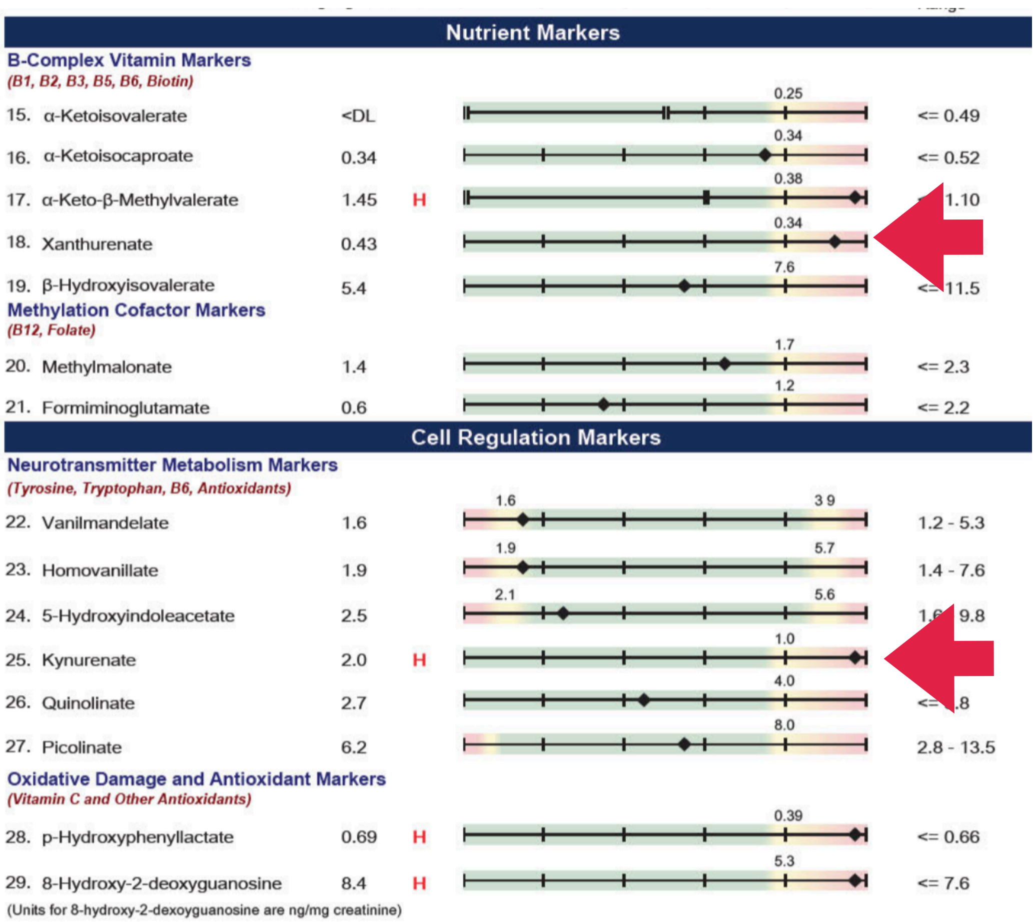
Table 5.2 Interpretations of patterns found for xanthurenate, kynurenate, quinolinate and picolinate in urine.

Pattern	Interpretation
High Xanthurenate AND High Kynurenate	Vitamin B6 deficiency metabolic effects on the hepatic conversion of Tryptophan to NAD. Finding this this pattern means that Kynurenate elevation is from hepatic, not brain kynurenin pathway.
High Xanthurenate AND Not High Kynurenate	A milder form of B6 deficiency
Not High Xanthurenate AND High Kynurenate & Quinolinate	Normal B6 status with brain-specific kynurenin pathway stimulation due to immune activation (INF-g). Quinolinate agonizes glutamatergic neurons, producing increased pain and sensitivities to light and sound.

Pattern Recognition of B6 Deficient Status: Kynurenate and Xanthurenate

Patient C:

58 yo Female
Weight gain
Fatigue
Lethargy
Apathy
Anxiety
MSQ: 79



Nutrient Markers

B-Complex Vitamin Markers
(B1, B2, B3, B5, B6, Biotin)

15.	α-Ketoisovalerate	<DL		0.25	<= 0.49
16.	α-Ketoisocaproate	0.34		0.34	<= 0.52
17.	α-Keto-β-Methylvalerate	1.45	H	0.38	1.10
18.	Xanthurenate	0.43		0.34	
19.	β-Hydroxyisovalerate	5.4		7.6	<= 11.5

Methylation Cofactor Markers
(B12, Folate)

20.	Methylmalonate	1.4		1.7	<= 2.3
21.	Formiminoglutamate	0.6		1.2	<= 2.2

Cell Regulation Markers

Neurotransmitter Metabolism Markers
(Tyrosine, Tryptophan, B6, Antioxidants)

22.	Vanilmandelate	1.6		1.6 / 3 9	1.2 - 5.3
23.	Homovanillate	1.9		1.9 / 5.7	1.4 - 7.6
24.	5-Hydroxyindoleacetate	2.5		2.1 / 5.6	1.6 9.8
25.	Kynurenate	2.0	H	1.0	
26.	Quinolinate	2.7		4.0	<= .8
27.	Picolinate	6.2		8.0	2.8 - 13.5

Oxidative Damage and Antioxidant Markers
(Vitamin C and Other Antioxidants)

28.	p-Hydroxyphenyllactate	0.69	H	0.39	<= 0.66
29.	8-Hydroxy-2-deoxyguanosine	8.4	H	5.3	<= 7.6

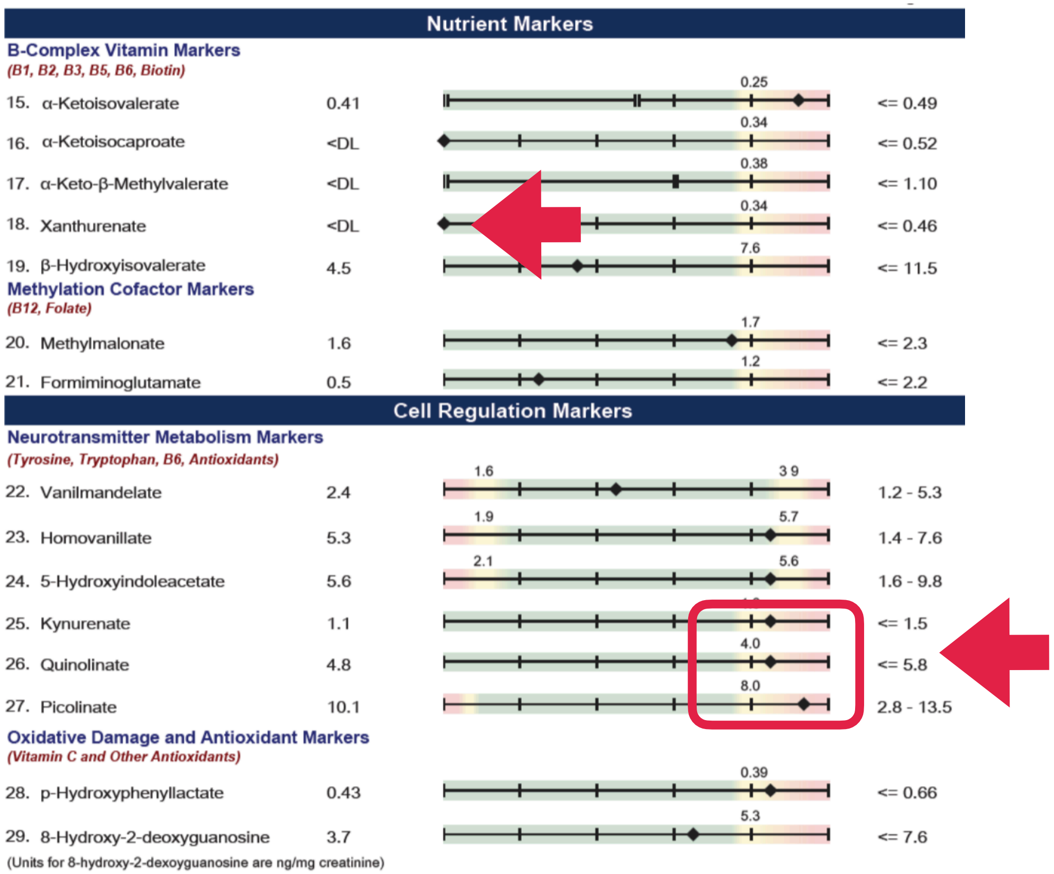
(Units for 8-hydroxy-2-deoxyguanosine are ng/mg creatinine)

FUNCTIONAL MEDICINE FAST TRACK

Pattern Recognition of Immune Activation: Kynurenate and Xanthurenate

Patient D:

23 yo Female
Migraines 8+/mnth
Brain fog
Chronic Pain
Fatigue



Nutrient Markers

B-Complex Vitamin Markers
(B1, B2, B3, B5, B6, Biotin)

15. α-Ketoisovalerate	0.41	<= 0.49
16. α-Ketoisocaproate	<DL	<= 0.52
17. α-Keto-β-Methylvalerate	<DL	<= 1.10
18. Xanthurenate	<DL	<= 0.46
19. β-Hydroxyisovalerate	4.5	<= 11.5

Methylation Cofactor Markers
(B12, Folate)

20. Methylmalonate	1.6	<= 2.3
21. Formiminoglutamate	0.5	<= 2.2

Cell Regulation Markers

Neurotransmitter Metabolism Markers
(Tyrosine, Tryptophan, B6, Antioxidants)

22. Vanilmandelate	2.4	1.2 - 5.3
23. Homovanillate	5.3	1.4 - 7.6
24. 5-Hydroxyindoleacetate	5.6	1.6 - 9.8
25. Kynurenate	1.1	<= 1.5
26. Quinolinate	4.8	<= 5.8
27. Picolinate	10.1	2.8 - 13.5

Oxidative Damage and Antioxidant Markers
(Vitamin C and Other Antioxidants)

28. p-Hydroxyphenyllactate	0.43	<= 0.66
29. 8-Hydroxy-2-deoxyguanosine	3.7	<= 7.6

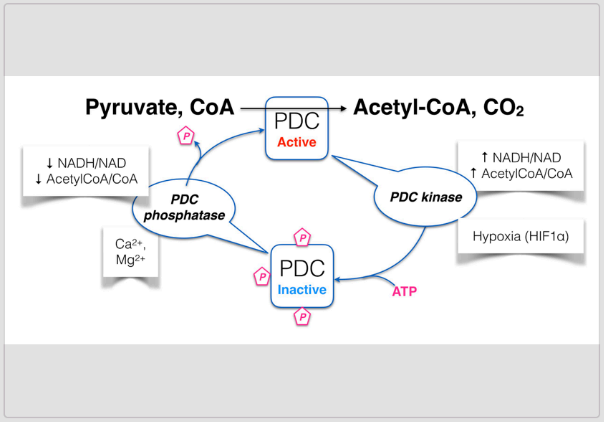
(Units for 8-hydroxy-2-dexoyguanosine are ng/mg creatinine)

Pattern Recognition #5: BMI / Lipogeneisis

Lipogenesis

Lipogenesis is the metabolic process through which acetyl-CoA is converted to triglyceride for storage in fat. The triglycerides in fat are packaged within cytoplasmic lipid droplets. The process begins with acetyl-CoA, which is an organic compound used to transfer energy from metabolism of carbohydrates, fatty acids, and ethanol.

Figure 6.2 Regulation of Acetyl-CoA formation and mitochondrial activity



Hypoxia, coenzyme A, and magnesium determine the moment-by-moment activity of the pyruvate dehydrogenase complex (PDC) signalling long term mitochondrial plasticity.

Pattern Recognition
In Organix Comprehensive

“CoA-restriction Adaptive Hypometabolic Responses
The rate of lipogenesis falls when mitochondrial CoA is diverted to hippurate formation from benzoate”

“the available CoA in a given cell determines rates of metabolic activity. Surges in a given pathway tend to “soak up” available CoA, causing transient slowing of multiple other CoA-dependent processes.”

Excerpt From: Richard S. Lord. “Paths to Health: Organic Acids.” Arrowhead Bioscience, 2018. Apple Books. https://books.apple.com/us/book/paths-to-health-organic-acids/id1439492989

FUNCTIONAL MEDICINE FAST TRACK

Pattern Recognition
In Organix Comprehensive

“benzoate is the only one identified to date that can deplete available mitochondrial Coenzyme A to such an extent that slowing is demonstrable in the flux of energetic substrates and lipogenesis. Interrupted lipogenesis leads to slower rates of adipose fat deposition and lower BMI. In other words, people with sufficient intake of dietary polyphenols to produce post-prandial surges of benzoate have lower BMI than those with low urinary benzoate and hippurate.”

Excerpt From: Richard S. Lord. “Paths to Health: Organic Acids.” Arrowhead Bioscience, 2018. Apple Books. https://books.apple.com/us/book/paths-to-health-organic-acids/id1439492989

Pattern Recognition
In Organix Comprehensive

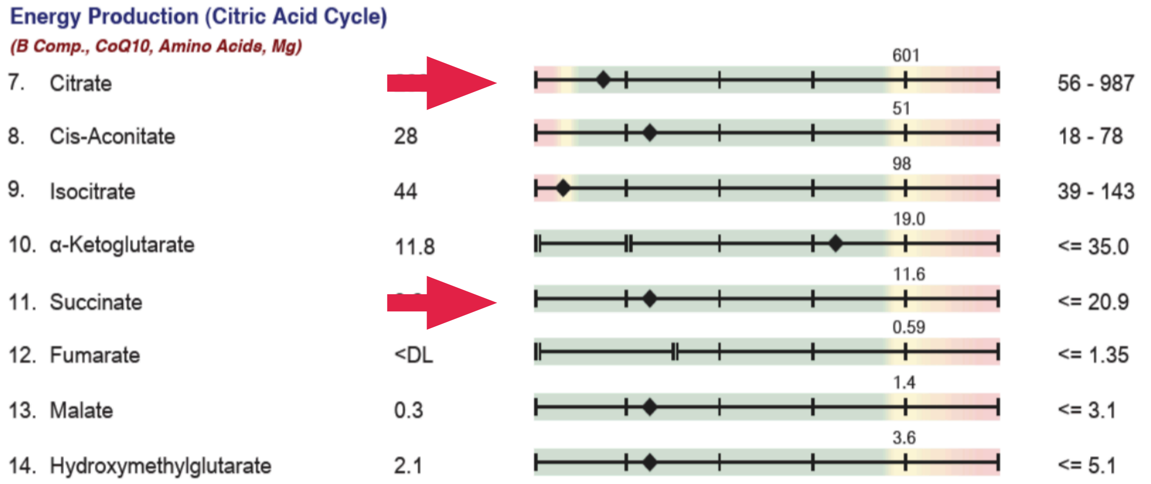
“The principal metabolite pattern in people with higher BMI included low hippurate, citrate and succinate in addition to other compounds that are not organic acids. This is an example of a beneficial hypometabolic state transiently produced during postprandial intervals in healthy individuals”

Excerpt From: Richard S. Lord. “Paths to Health: Organic Acids.” Arrowhead Bioscience, 2018. Apple Books. https://books.apple.com/us/book/paths-to-health-organic-acids/id1439492989

Pattern Recognition
High BMI

Patient A:

24 yo Female
Weight gain
Chronic Fatigue
Brain Fog
IBS
Acne



Energy Production (Citric Acid Cycle)

(B Comp., CoQ10, Amino Acids, Mg)

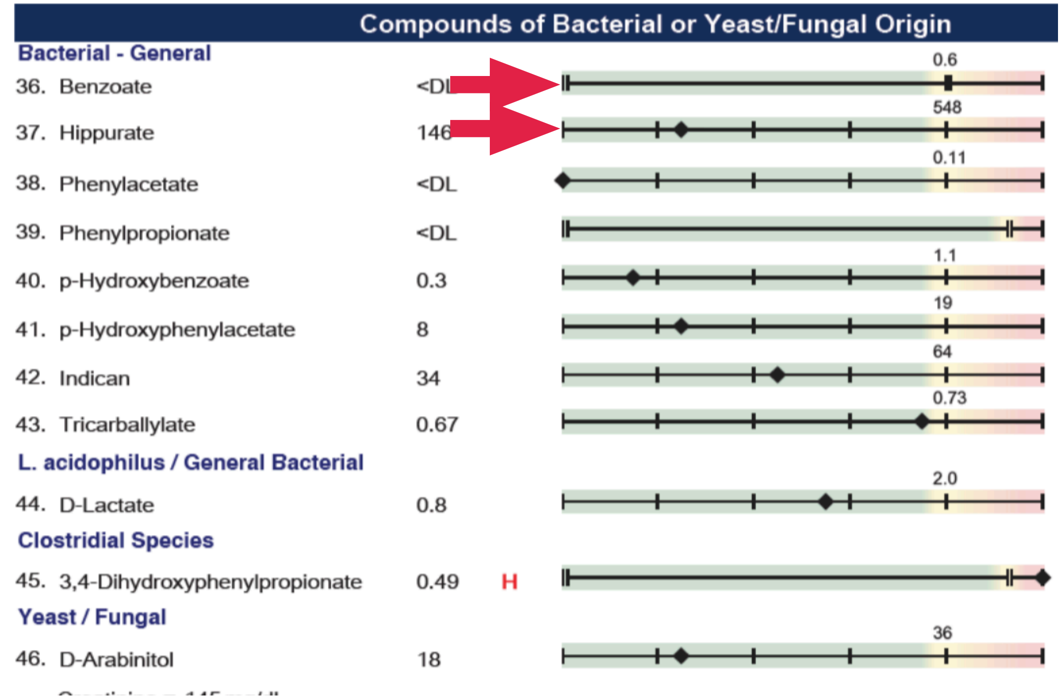
7.	Citrate	[illegible]	601	56 - 987
8.	Cis-Aconitate	28	51	18 - 78
9.	Isocitrate	44	98	39 - 143
10.	α-Ketoglutarate	11.8	19.0	<= 35.0
11.	Succinate	[illegible]	11.6	<= 20.9
12.	Fumarate	<DL	0.59	<= 1.35
13.	Malate	0.3	1.4	<= 3.1
14.	Hydroxymethylglutarate	2.1	3.6	<= 5.1

FUNCTIONAL MEDICINE FAST TRACK

Pattern Recognition
High BMI

Patient A:

24 yo Female
Weight gain
Chronic Fatigue
Brain Fog
IBS
Acne



Compounds of Bacterial or Yeast/Fungal Origin

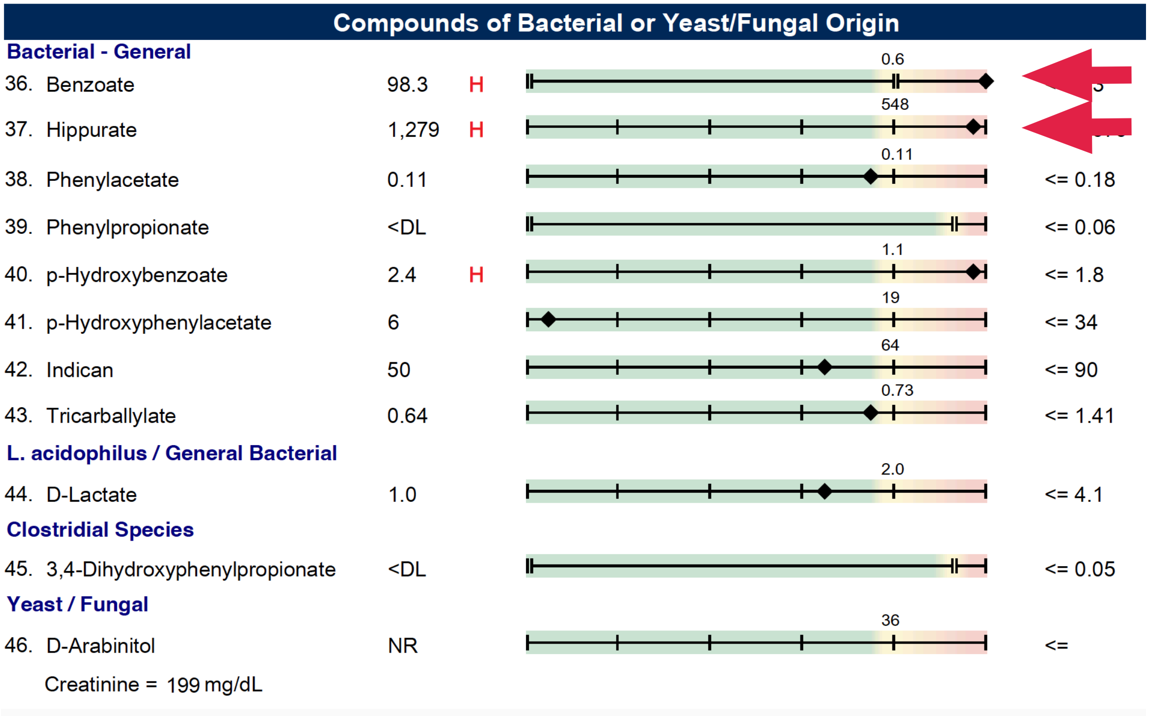
Bacterial - General			
36. Benzoate	<DL		0.6
37. Hippurate	146		548
38. Phenylacetate	<DL		0.11
39. Phenylpropionate	<DL		
40. p-Hydroxybenzoate	0.3		1.1
41. p-Hydroxyphenylacetate	8		19
42. Indican	34		64
43. Tricarballylate	0.67		0.73
L. acidophilus / General Bacterial			
44. D-Lactate	0.8		2.0
Clostridial Species			
45. 3,4-Dihydroxyphenylpropionate	0.49	H	
Yeast / Fungal			
46. D-Arabinitol	18		36

FUNCTIONAL MEDICINE FAST TRACK

Pattern Recognition:
Low BMI and High Hippurate / Benzoate

Patient D:

42 yo Male
Ex pro cyclist
BMI 21
Seasonal allergies



Compounds of Bacterial or Yeast/Fungal Origin

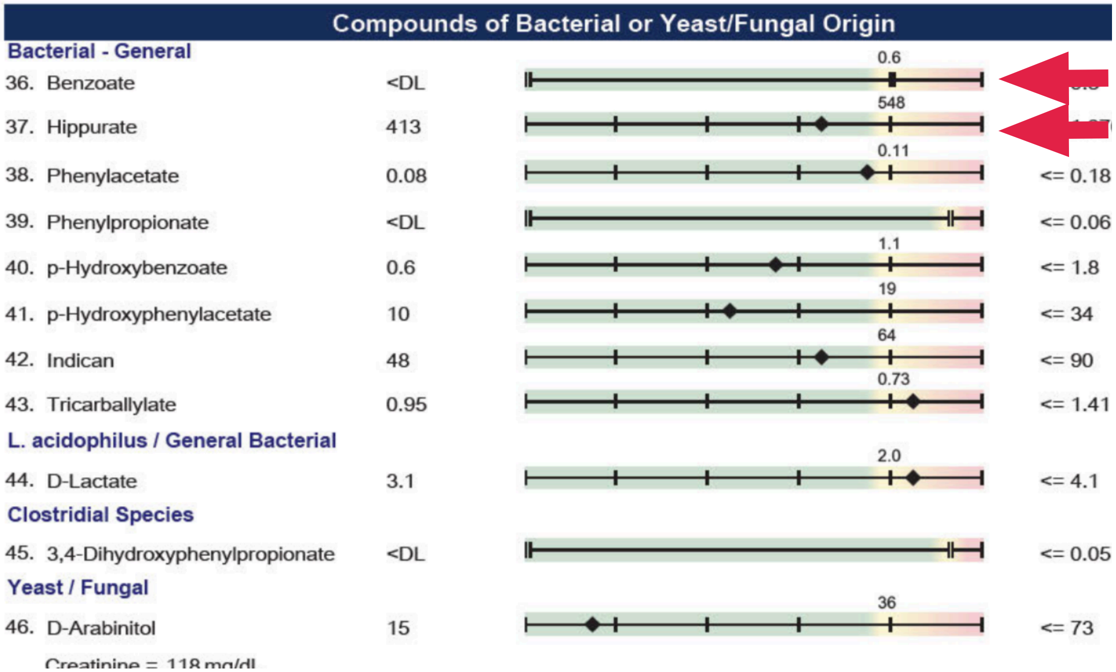
Bacterial - General			
36. Benzoate	98.3	H	[illegible]
37. Hippurate	1,279	H	[illegible]
38. Phenylacetate	0.11		<= 0.18
39. Phenylpropionate	<DL		<= 0.06
40. p-Hydroxybenzoate	2.4	H	<= 1.8
41. p-Hydroxyphenylacetate	6		<= 34
42. Indican	50		<= 90
43. Tricarballylate	0.64		<= 1.41
L. acidophilus / General Bacterial			
44. D-Lactate	1.0		<= 4.1
Clostridial Species			
45. 3,4-Dihydroxyphenylpropionate	<DL		<= 0.05
Yeast / Fungal			
46. D-Arabinitol	NR		<=

Creatinine = 199 mg/dL

Pattern Recognition:
Low BMI and High Hippurate / Benzoate

Patient E:

63 yo Male
Age group athlete
BMI 22



Compounds of Bacterial or Yeast/Fungal Origin

Bacterial - General		
36. Benzoate	<DL	[illegible]
37. Hippurate	413	[illegible]
38. Phenylacetate	0.08	<= 0.18
39. Phenylpropionate	<DL	<= 0.06
40. p-Hydroxybenzoate	0.6	<= 1.8
41. p-Hydroxyphenylacetate	10	<= 34
42. Indican	48	<= 90
43. Tricarballylate	0.95	<= 1.41
L. acidophilus / General Bacterial		
44. D-Lactate	3.1	<= 4.1
Clostridial Species		
45. 3,4-Dihydroxyphenylpropionate	<DL	<= 0.05
Yeast / Fungal		
46. D-Arabinitol	15	<= 73

Creatinine = 118 mg/dl

Pattern Recognition
In Organix Comprehensive

“That subject was thoroughly reviewed by Jeremy Nicholson and coworkers (Lees et al. 2013) prior to their landmark metabolomic study revealing that human BMI is inversely related to urinary hippurate. ”

Pattern Recognition
In Organix Comprehensive

1. Low patterns - amino acids
2. High patterns - cofactors, inhibitors, genetics
3. Glutathione Status patterns - NAC, GSH, amino acids, magnesium
4. Kynunerine Patterns - B6 or immune support
5. Lipogenesis patterns - microbiome and polyphenols

The End - Thank you

www.functionalmedicinefasttrack.com

www.fm-ft.com