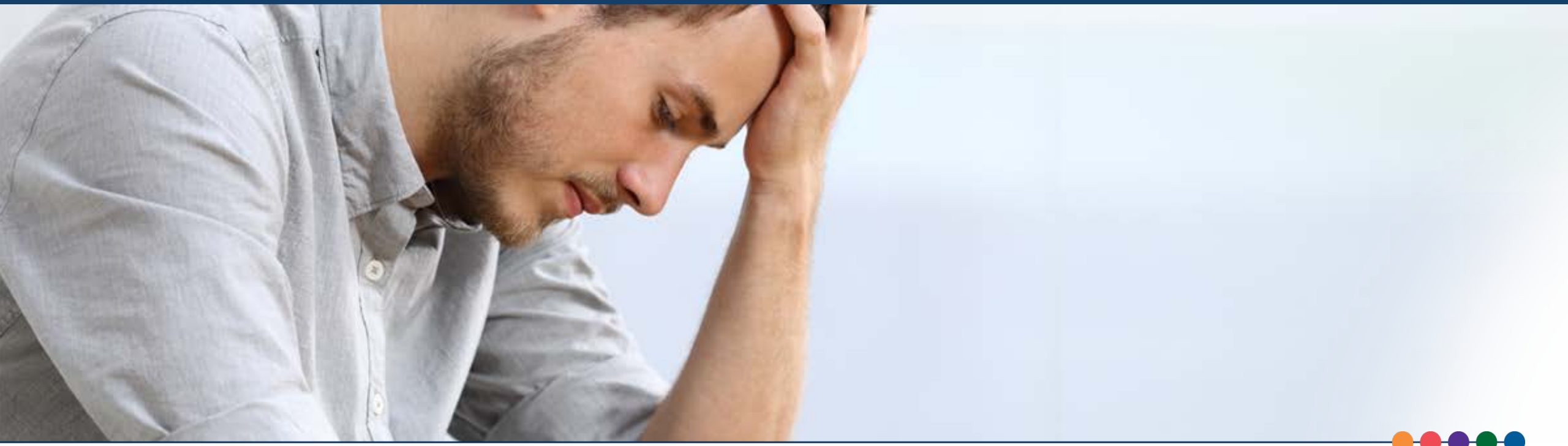


Lab Based Treatments for Fatigue and Depression

Measuring Mitochondrial Function

Daniel Kalish, DC, IFMCP
Founder Kalish Institute

GENOVA DIAGNOSTICS

Lahnor Powell, ND, MPH

Medical Education Specialist - Atlanta

GENOVA DIAGNOSTICS

Daniel Kalish, DC, IFMCP

Lead faculty for IFMs Practice Implementation Program
Principle investigator in research study with Mayo Clinic on The Kalish Method
Partnering with industry leading experts developing curriculum for lab interpretation skills development
IFM Certified practitioner 28 years clinical experience

GENOVA DIAGNOSTICS

Need More Resources?

Explore

WWW.GDX.NET

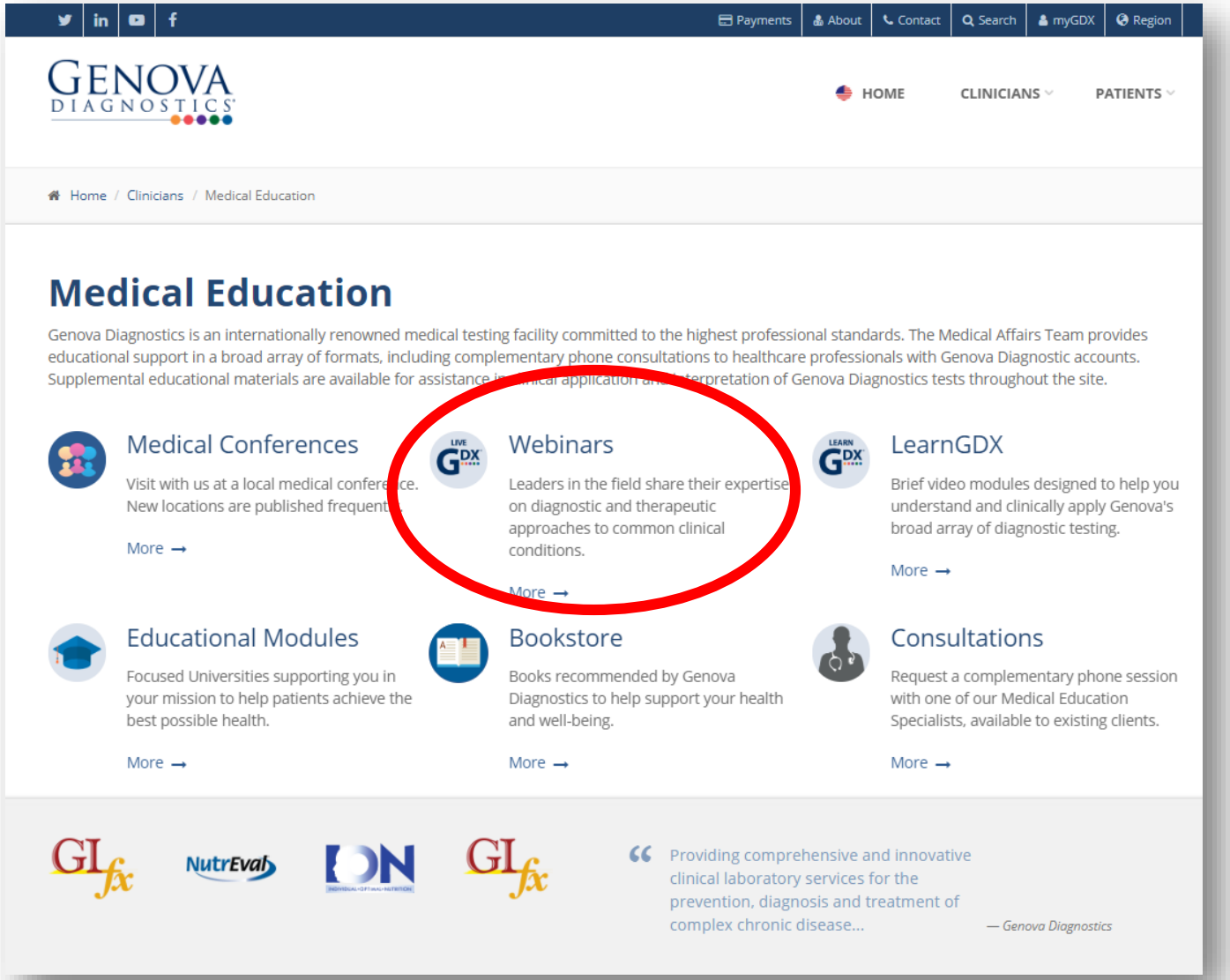
for more information and educational resources, including…

LEARN GDX – Brief video modules

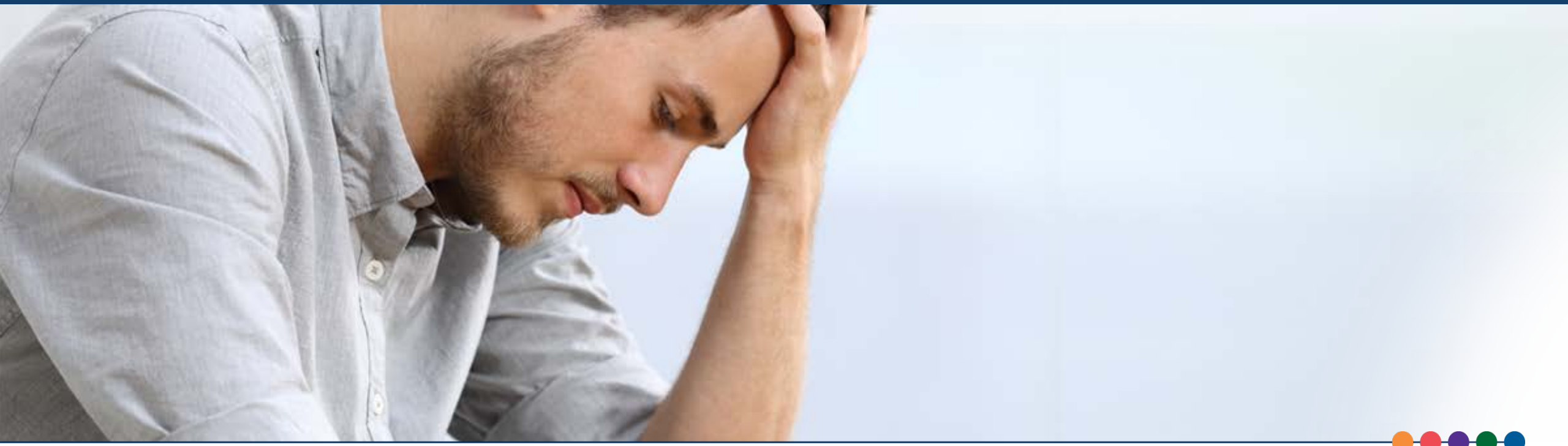
LIVE GDX – Previous webinar recordings

GI University – Focused learning modules

MY GDX – Order materials and get results



GENOVA DIAGNOSTICS



Lab Based Treatments for Fatigue and Depression

Measuring Mitochondrial Function

Daniel Kalish, DC, IFMCP

Objectives for This Presentation

- Learn meaning of high and low mitochondrial markers on organic acids
- Understand role of oxidative stress, toxins, nutrient depletion and medication induced depletion in mitochondrial damage
- Review most commonly used supplement programs to restore healthy mitochondrial energy production

GENOVA DIAGNOSTICS

Who Do We Use Organic Acids Testing and ION Panels With?

EVERYONE…

- Complex patients
- Simple patients
- Annual health assessment for long term maintenance
- Prenatal nutritional programs
- Chemotherapy and radiation recovery programs
- Weight loss
- Fatigue
- Depression/anxiety

Organic Acids

Organic acid testing checks mitochondrial function

Organic acid testing measures detoxification capacity

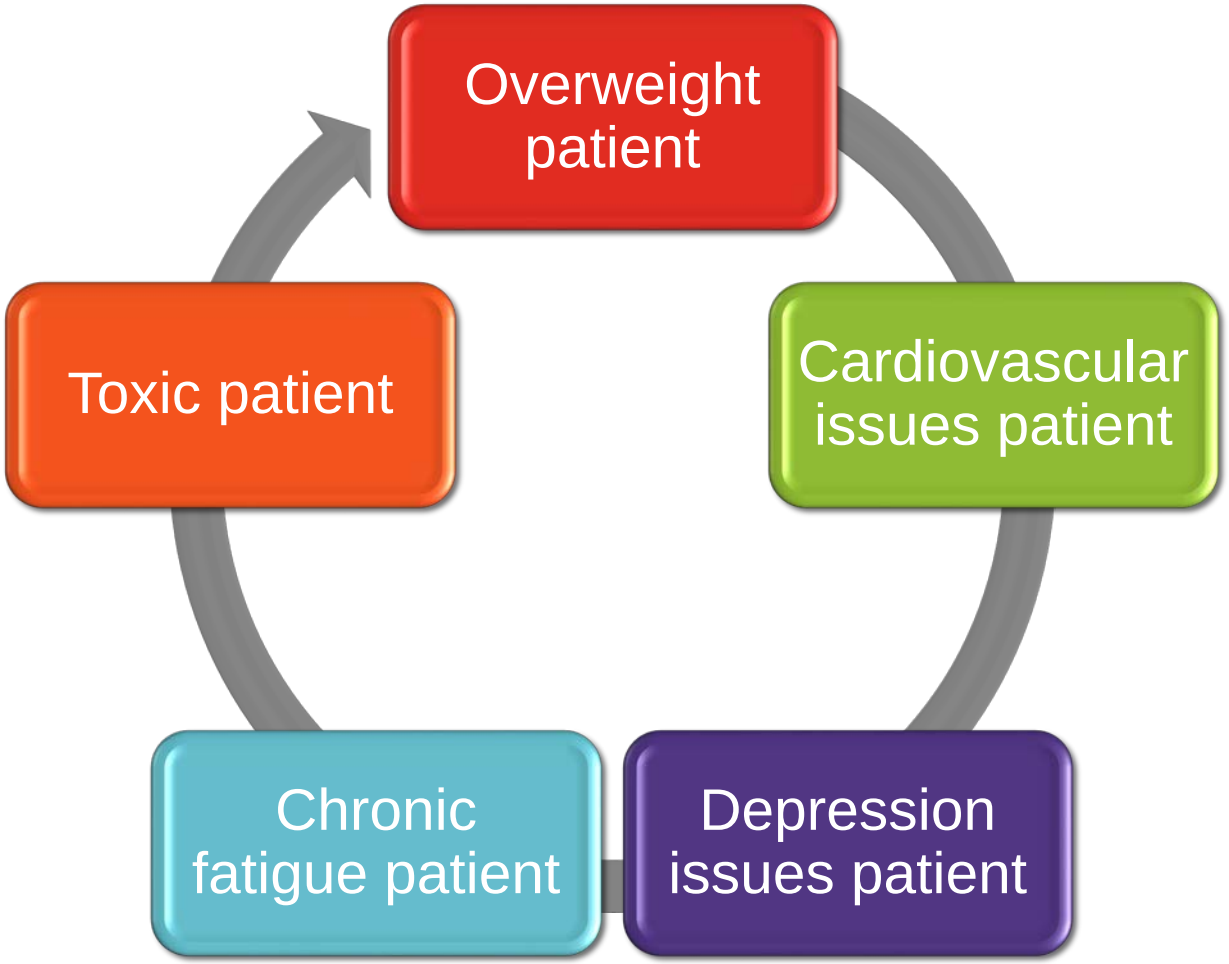
(toxin build up = mito damage)

Also measures oxidative stress markers

(high oxidative stress = mito damage)

GENOVA DIAGNOSTICS

Many Patient Presentations From Mitochondrial Issues



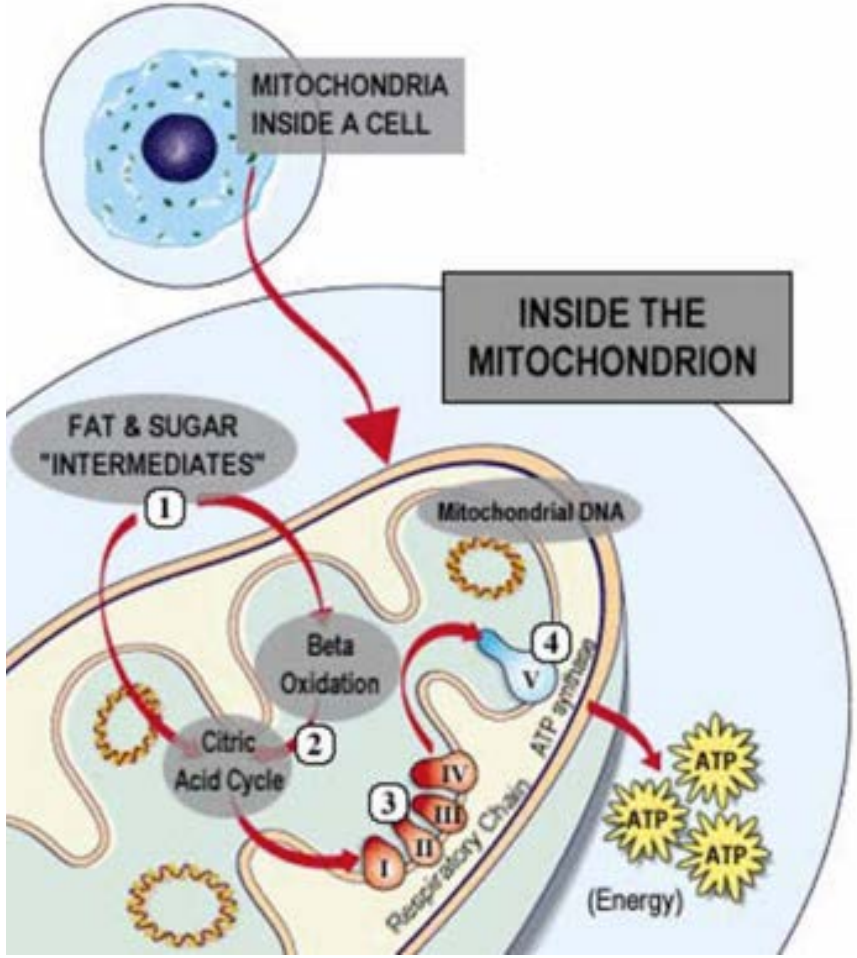
GENOVA DIAGNOSTICS

Chronically Ill Patients

- The more complicated a patient is, the more the basics become essential
- Most chronically ill patients have major metabolic imbalances
- May not be respond to treatment because the underlying metabolic issues are still present, even though the proximate immediate issue has been resolved

Essential to Life – Mitochondria – Why we Breathe

- Mitochondria consumes about 90% of the oxygen used by the body for oxidative phosphorylation
- Oxygen serves as the ultimate electron receptor from the electron transport chain, allowing ATP to be generated



GENOVA DIAGNOSTICS

Photo Credit: https://www.mda.org/disease/mitochondrial-myopathies/causes-inheritance

Mitochondrial Marker Patterns

- Most organic acids are intermediates or end stage metabolism of energy production
- High levels of intermediates indicates nutrient deficiencies
- Key nutrients include CoQ10, Magnesium, Carnitine, B Vitamins

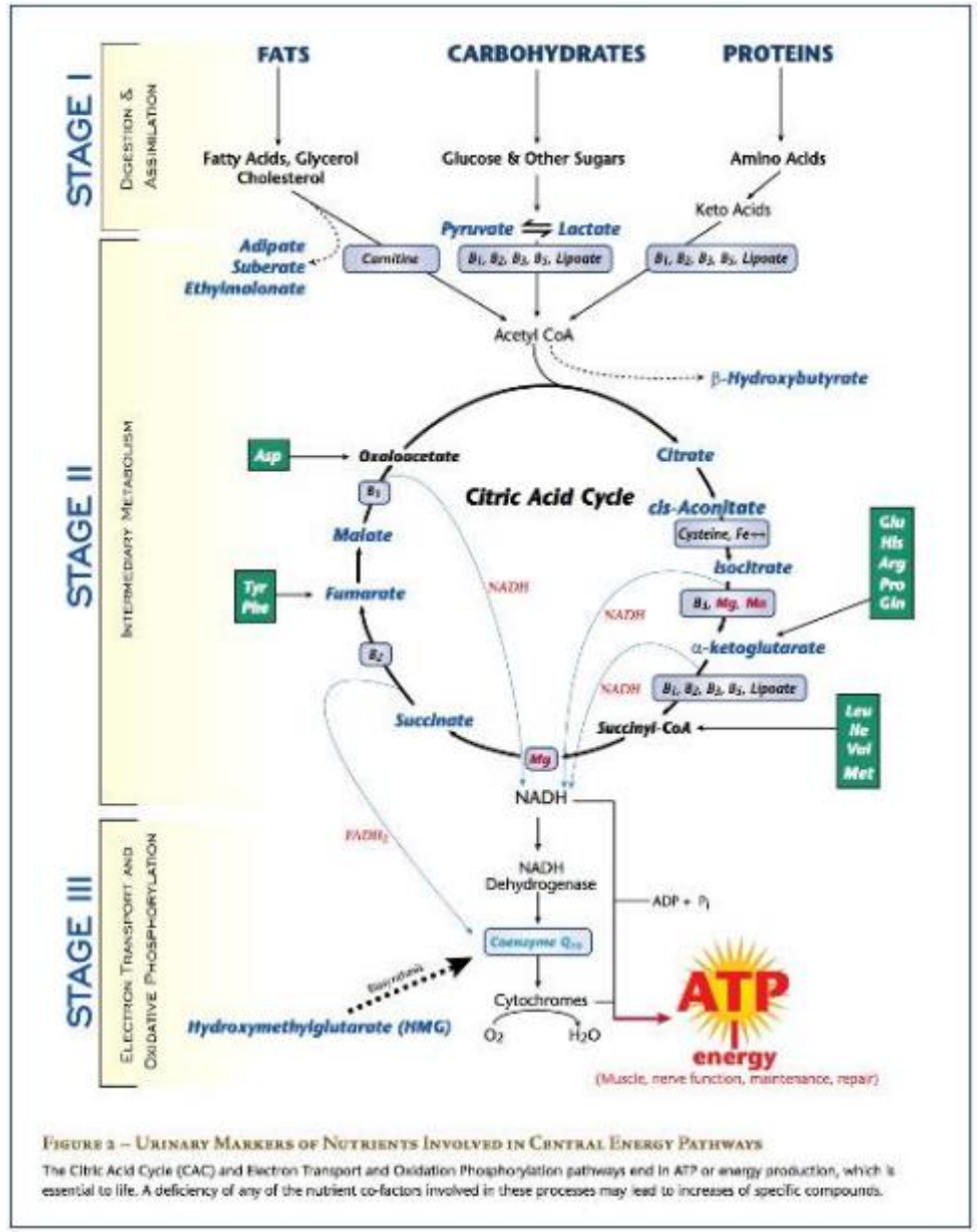


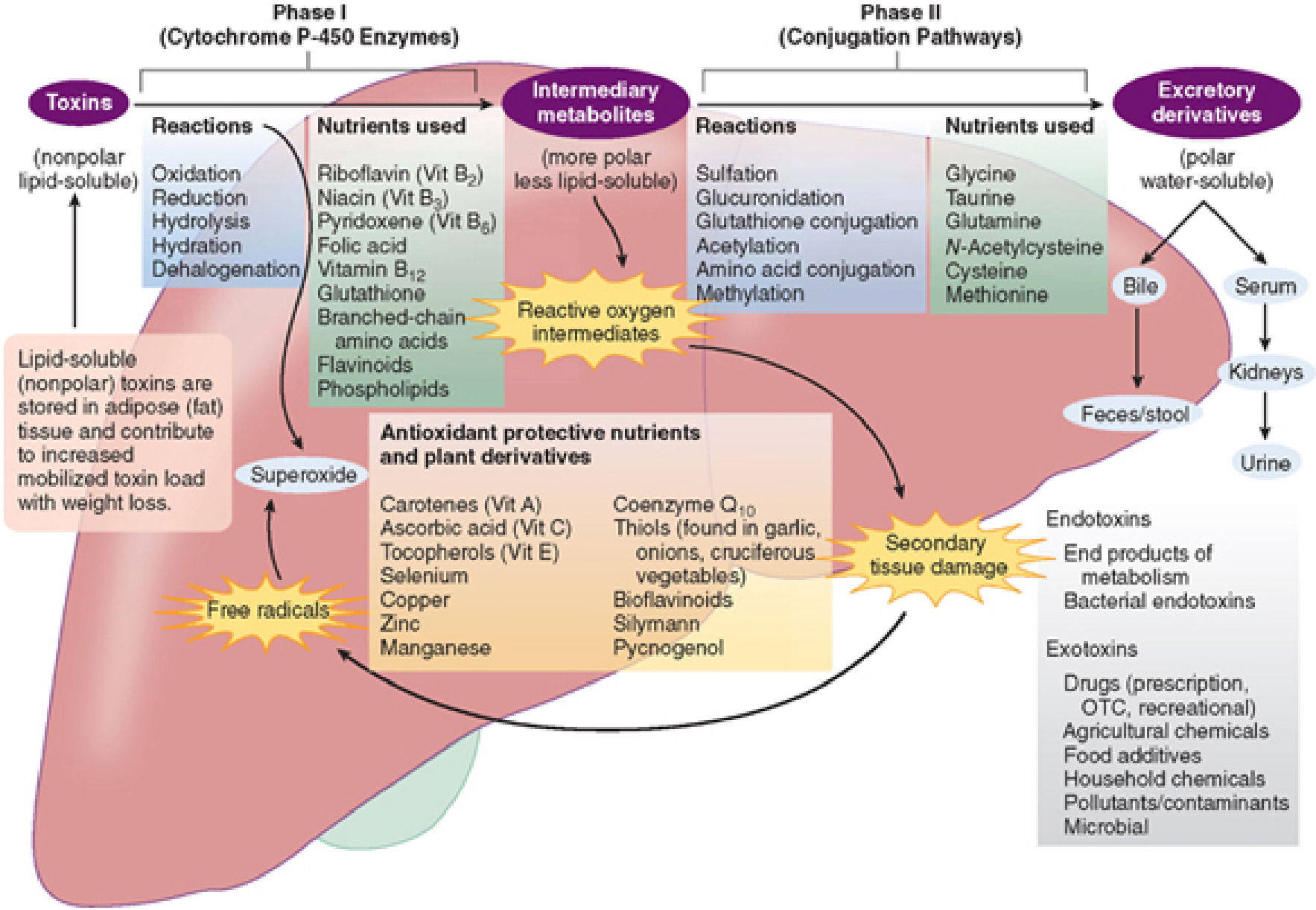
Figure 2 – Urinary Markers of Nutrients Involved in Central Energy Pathways

The Citric Acid Cycle (CAC) and Electron Transport and Oxidation Phosphorylation pathways end in ATP or energy production, which is essential to life. A deficiency of any of the nutrient co-factors involved in these processes may lead to increases of specific compounds.

GENOVA DIAGNOSTICS

How Mitochondria Damaged Our Toxic World

- Nearly **80,000** new synthetic chemicals have been released into the environment
- Over **350** different pesticides are used on the food we eat
- Newborn babies typically contain 50-70 dangerous toxins at birth
- In the U.S. alone, over 4 billion pounds of pesticides are used every year
- There are at least **5,000 chemical ingredients** in cosmetics
- DEPLETION OF MAGNESIUM, GLUTATHIONE, RUINATION OF DETOX PATHWAYS AND BUILD UP OF OXIDATIVE STRESS CONTRIBUTE TO MITOCHONDRIAL DAMAGE



GENOVA DIAGNOSTICS

Photo Credit: https://www.drkirkjohnson.com/single-post/2018/03/06/Liver-detoxification

Oxidative Stress

- Free radicals cause severe damage to the normal cells of the body, which can manifest into diseases such as heart disease and cancer
- DNA damage is induced by oxidative stress
- Inflammation and free radical activity go hand in hand
- Excessive oxidative stress can cause liver damage
- Oxidation markers don’t tell you where the oxidation is coming from, but more how the person is handling the oxidative stress

Oxidative Stress

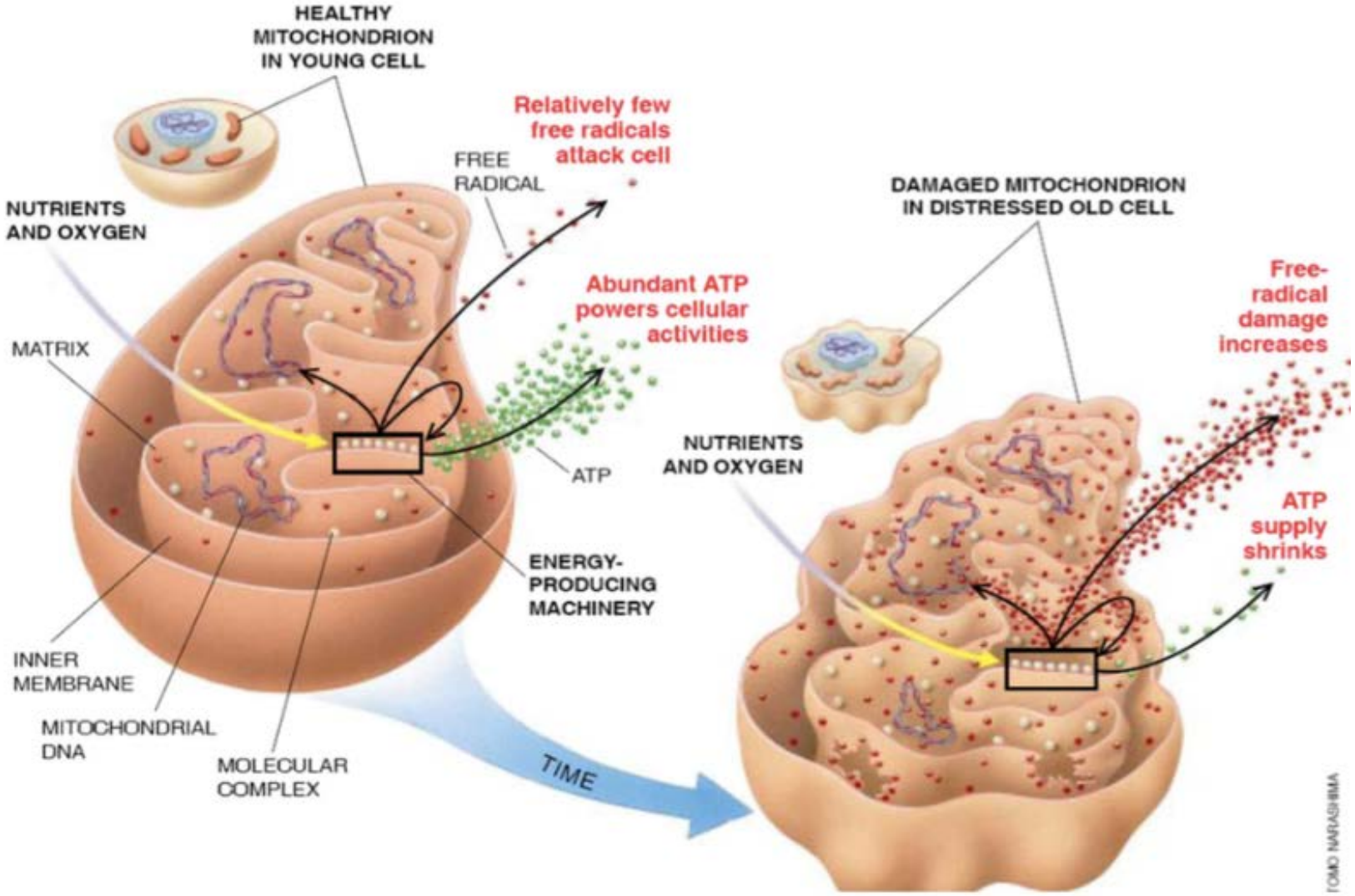


Photo Credit: https://www.covingtonpediatrics.com/blog/fix-your-mitochondria-fix-your-brain

Mitochondrial Retracted States

- Mitochondrial retraction is defined here as sustained reduction in the number mitochondrial functional units per cell to compensate for chronically reduced levels of enzymes and cofactors necessary to complete the transfer of electrons to oxygen, thereby allowing cell survival under conditions of oxidative stress

Hypometabolic Patterns

- High levels of intermediates is typically trouble
- Low levels mean there are not enough amino acids, which means there are not enough components to convert into metabolites
- Patients are tired with:
  - High levels of organic acid markers
  - Even more tired and depressed when levels are extraordinarily low
  - Thyroid often involved also as are amino acids

Major Depression, Chronic Fatigue Syndrome

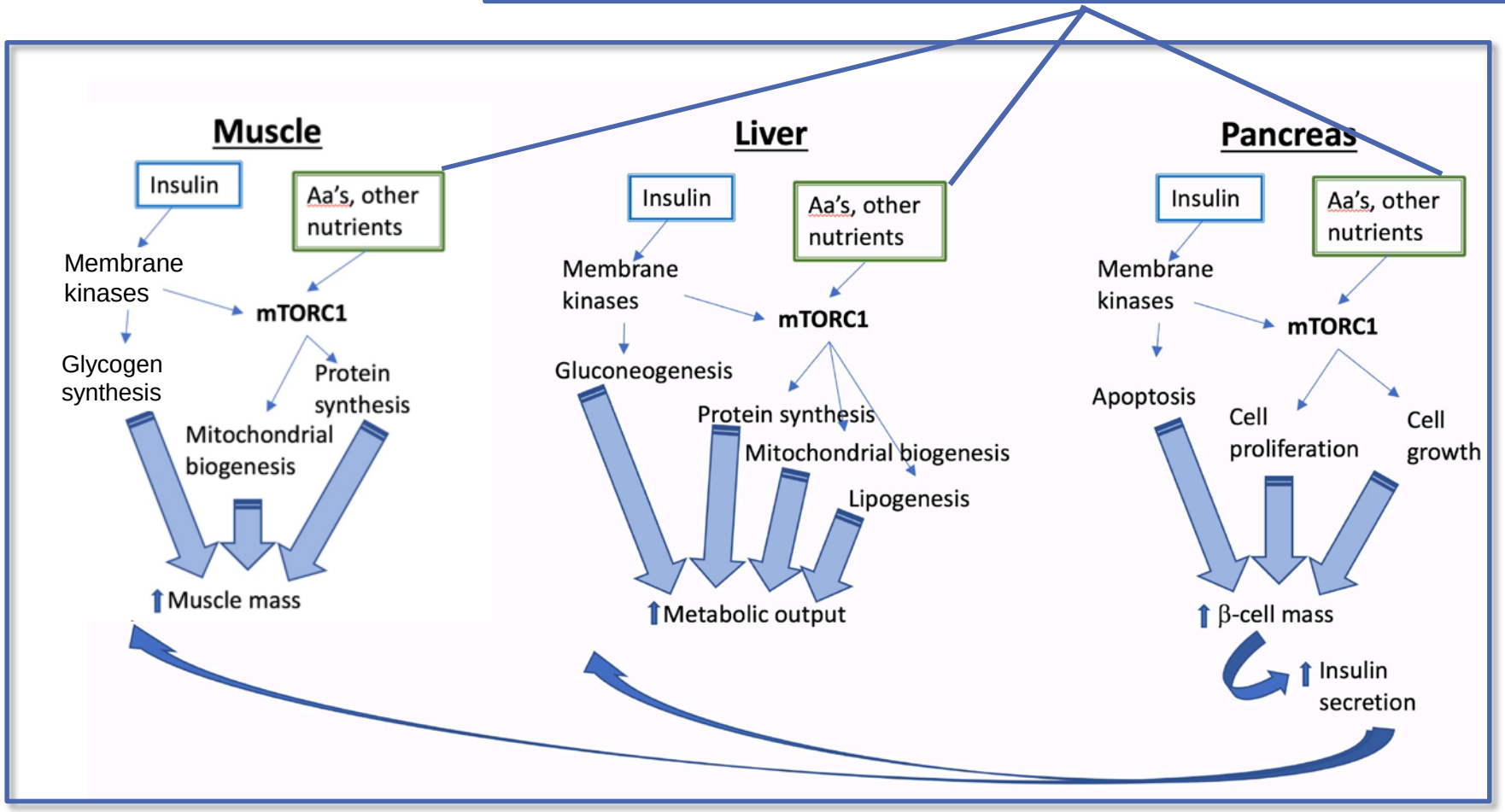
- Chronic Compensatory States (Mitochondrial-Retracted)
- Reversed by ffAA mTOR Activation
- Low Organic Acids markers CAN be reversed by stimulating mTOR, this is different than using amino acids for low amino acids on a test
- We can use the same supplement to replace something missing or for stimulation of a specific process pathway or cell signaling system

mTOR

- Mammalian target of rapamycin and/or mechanistic target of rapamycin
- Discovery began in 1960's on EASTER ISLAND (Rapa Nui)
  - I'm not making this up!
- Integrates input from upstream pathways INSULIN, growth factors and AMINO ACIDS
- Central regulator of mammalian metabolism
- Inhibited by rapamycin, stimulated by large bolus of ffAA

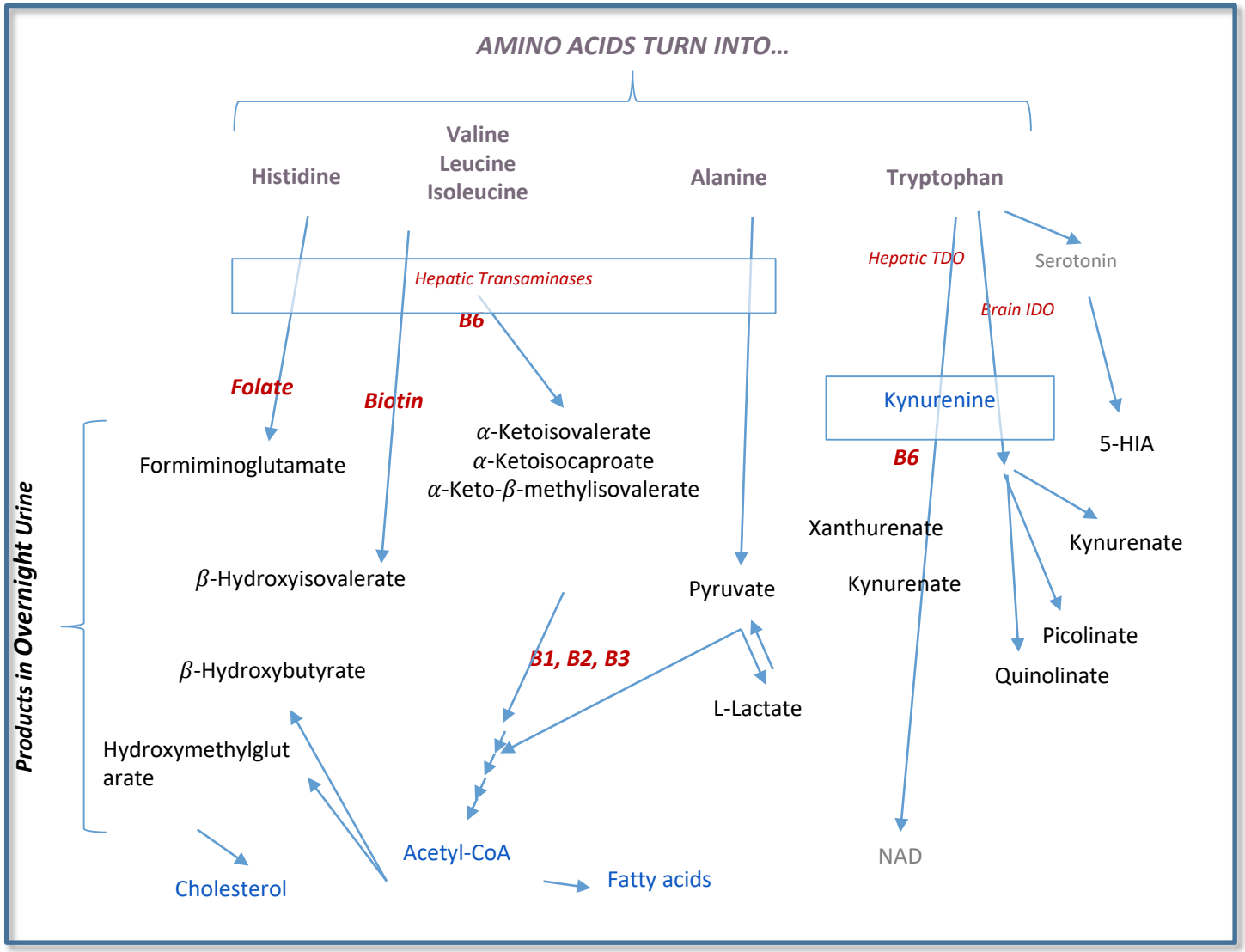
Tissue Regulation by Mechanistic Target of Rapamycin

Here we find the mechanistic explanation of major depression and CFS response to free-form amino acids



GENOVA DIAGNOSTICS

Amino Acids To Organic Acids



GENOVA DIAGNOSTICS

Early evidence of free-form amino acid corrections

1994 - Chronic Fatigue Syndrome

JOURNAL OF APPLIED NUTRITION, VOLUME 46, NUMBER 3, 1994 ORIGINAL REPORT

TREATMENT OF CHRONIC FATIGUE SYNDROME WITH SPECIFIC AMINO ACID SUPPLEMENTATION

J. Alexander Bralley, Ph.D. and Richard S. Lord, Ph.D.

ABSTRACT: Chronic fatigue syndrome (CFS), is rapid onset of debilitating fatigue with no clearly defined origin or effective therapy . In an open trial, fasting plasma amino acid levels were measured in 25 CFS subjects. Amino acid mixtures were formulated based upon individual test results. Twenty subjects completed the study by taking 15 grams of the formulation daily for three months. Near complete symptom resolution was seen in 75% of subjects, 15% had moderate and 10% had little or no relief. Follow-up testing showed improved amino acid levels. Specific amino acids may affect metabolic processes increasing energy production in CFS patients.

Table 1. Base Amino Acid Formulation

Amino Acid	Percentage per weight
L-Valine	11.00
L-Leucine	12.70
L-Isoleucine	9.40
L-Phenylalanine	12.70
L-Tryptophan	2.00
L-Methionine	7.60
L-Threonine	6.80
L-Lysine	9.30
L-Histidine	10.50
L-Arginine	9.30
Pyridoxal-5-Phosphate	0.30
Alpha-ketoglutaric acid	8.40

Table 2. Percentage frequency of amino acids below reference range in 25 CFS subjects

Amino Acid	Percentage
L-Histidine	0.
L-Valine	4.
L-Threonine	4.
L-Lysine	8.
L-Methionine	20.
L-Arginine	24.
L-Leucine	52.
L-Isoleucine	60.
Taurine	64.
L-Phenylalanine	72.
L-Tryptophan	80.

GENOVA DIAGNOSTICS

Early evidence of free-form amino acid corrections

2007 – Major depression subjects on Remeron

Eur Arch Psychiatry Clin Neurosci (2007) 257:222–229 DOI 10.1007/s00406-007-0711-9

ORIGINAL PAPER

Rottraut Ille · Jürgen Spona · Michaela Zickl · Peter Hofmann · Theresa Lahousen
Nina Dittrich · Götz Bertha · Karin Hasiba · Franz Alfons Mahnert · Hans-Peter Kapfham

"Add-On"-therapy with an individualized preparation
of free amino acids for patients with a major depress

Abstract The efficacy of a deficit oriented add-on therapy with free amino acids in depressive patients treated with the antidepressant Remeron® was evaluated. About 40 in-patients were investigated by a randomised double-blind placebo-controlled study during 4 weeks. Plasma levels of 20 amino acids and measures of depression, suicidal behaviour and aggression were surveyed on admission and after a 4 weeks' therapy with Remeron® plus an individualized amino acid mixture or placebo. The preparation of the amino acid mixture was based on an aminogram and consisted of essential amino acids plus vitamins and trace elements as co-factors for the amino acid metabolism. Patients of the experimental group showed a significantly better improvement of depression and a higher responder rate than those of the placebo group. The results suggest that oral application of a deficit oriented amino acid mixture can improve the therapeutic outcome of an antidepressant. Furthermore, lacking side effects of the amino acids resulting also in a better patient compliance may improve the benefit/risk ratio.

Table 3 Mean values of the psychometric tests for the experimental and the control group at the term of admission (T1) and after a 4-week therapy (T2)

	T1		T2	
	Amino acids $n = 20$	Placebo $n = 20$	Amino acids $n = 20$	Placebo $n = 20$
BDI *M* (SD)	26.9 (10.2)	21.7 (11.4)	9.9 (9.2)	12.7 (11.2)
HAM-D *M* (SD)	26.7 (5.9)	20.7 (3.6)	7.7 (5.0)	12.2 (8.7)
Auto-aggressions	6.6 (1.5)	5.4 (2.1)	5.6 (2.0)	5.0 (2.1)
CGI	5.4 (0.8)	5.1 (0.8)	3.1 (1.1)	3.4 (0.8)

M = mean, SD = standard deviation
* Age- and gender-related norm values (stanines) [22]

48.0%

-30.6%

17.4 % greater or 57 % > Placebo

GENOVA DIAGNOSTICS

How Hypometabolic States Get Started

- Tryptophan depletion enhanced by SSRI therapy
- Low glutathione, low magnesium, low CoQ10
- Toxin exposure, oxidative stress load high
- GI issues poor protein absorption, low amino acids

Tryptophan depletion is enhanced by SSRI therapy

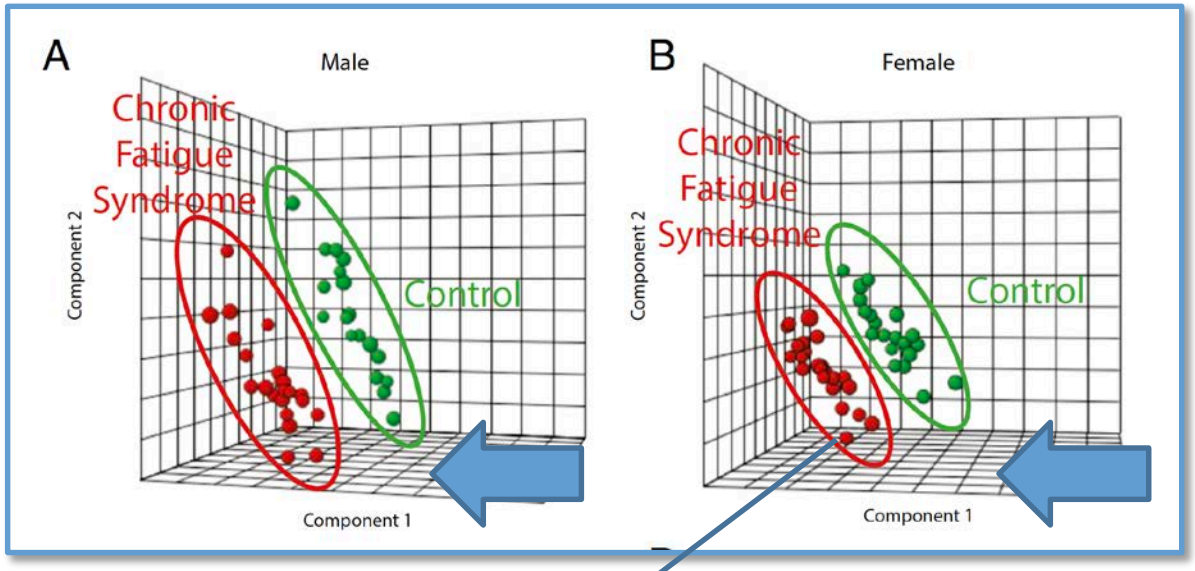
- TD was significantly related to increased scores on clinician-rated depression and anxiety scales, and on self-rated depression, anxiety, and somatic symptoms
  - Spillmann MK, et al. Tryptophan depletion in SSRI-recovered depressed outpatients. *Psychopharmacology.* 2001;155(2):123-127.
- Significant increase of anxiety
  - Argyropoulos SV, at al. Tryptophan depletion reverses the therapeutic effect of selective serotonin reuptake inhibitors in social anxiety disorder. *Biol Psychiatry*. 2004;56(7):503-509.
- TD: significant decrease in perceived control and increase in interfering thoughts
  - Hood SD, et al. Effects of tryptophan depletion on selective serotonin reuptake inhibitor-remitted patients with obsessive compulsive disorder. *J Psychopharmacol*. 2017;31(12):1615-1623.
- **Conclusion**: Compensatory responses to the diet restriction commonly seen in depression and CFS are accelerated by SSRI therapy. WHY IS TRYPTOPHAN EVEN RELATED TO MITOCHONDRIA???? PROTEIN SYNTHESIS

Mitochondrial Retracted States

- Mitochondrial retraction is defined here as sustained reduction in the number mitochondrial functional units per cell to compensate for chronically reduced levels of enzymes and cofactors necessary to complete the transfer of electrons to oxygen, thereby allowing cell survival under conditions of oxidative stress

Metabolites Correlated with the Clinical Severity of CFS

Patients with CFS display underlying changes that cause multiple central energy pathway intermediates to fall significantly below levels in the healthy cohort.



Downward shifts of metabolites in subjects, gave CFS diagnostic accuracies of 94% and 96%, respectively

No.	Pathway name	Measured metabolites	No. in top 61 predictive metabolites	Increased	Decreased
1	Sphingolipids	72	30	0	30
2	Phospholipids	76	9	2	7
3	P5C, Arg, Ornithine, Pro	6	4	3	1
4	Glycosphingolipids	13	3	0	3
5	Cholest., nongonad. steroids	15	3	0	3
6	Branched-chain amino acids	10	3	0	3
7	Purines	19	2	0	2
8	Microbiome metabolism	20	1	0	1
9	Vitamin B2 (riboflavin)	2	1	0	1
10	Serine, 1-C metabolism	5	1	1	0
11	SAM, SAH, Met, GSH	13	1	1	0
12	VLCFA oxidation	2	1	0	1
13	Propiogenic amino acids	2	1	0	1
14	Threonine metabolism	4	1	1	0
	Total	259	61	8	53

GENOVA DIAGNOSTICS

Naviaux, RK, et al. *Proc Natl Acad Sci USA.* 2016;113(37):E5472-80.

Correcting High Mitochondrial Markers Patterns

- CoQ10
- Magnesium
- B Vitamins
- Carnitine

CORRECTING HYPOMETABOLIC PATTERNS

- Free Form Amino acids
- CoQ10
- Magnesium
- PQQ
- B Vitamins
- Generalized mitochondrial support
- Additional Tryptophan

Free-form Amino Acid Formulas

- Base of 8 essential amino acids + a-Ketoglutarate and P-5-P to assure hepatic transamination cofactors
- Levels adjusted according to plasma amino levels found below mid-normal
- Crystalline pure amino acid mixture compounded and set as 300 g monthly supply
- Usual adult dosing: rounded tsp. (~5g) bid
- Usually continues for 3-6 months with other cofactors indicated by testing for optimal tissue regeneration

Conclusions

- Mitochondria sustain damage from a variety of sources
- Once damaged mitochondria lack ability to produce sufficient ATP for basic energy needs of the body impacting the liver, heart, muscle tissues
- These metabolic disturbances result in fatigue, weight gain, depression and many other common symptoms that may be non-responsive to treatments (i.e. adrenals, thyroid)
- Free-form essential amino acid formulas have been safely and successfully implemented for several decades, and their mechanism of action is found in stimulation of the master regulator mTOR
  - Caveat: use only when clinical and laboratory evidence is indicative of stages in metabolic slowdown because long-term mTor stimulation can be pro-carcinogenic

Case Study #1

GENOVA DIAGNOSTICS
3425 Corporate Way
Duluth, GA 30096

ION
INDIVIDUAL • OPTIMAL • NUTRITIONAL

Case 1: 37 Year-Old Male

3102 ION® Profile with Amino Acids 40 - Blood/Urine

Amino Acids 40 Profile - Plasma

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

	Results µmol/L	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Essential Amino Acids			
Limiting Amino Acids			
1. Lysine	253	147 – 263	120 - 318
2. Methionine	22	17 – 34	14 - 48
3. Tryptophan	41	39 – 69	31 - 83
Branched Chain Amino Acids			
4. Isoleucine	65	40 – 82	35 - 104
5. Leucine	163	87 – 164	74 - 196
6. Valine	283	167 – 316	146 - 370
Other Essential Amino Acids			
7. Phenylalanine	76	48 – 77	42 - 95
8. Histidine	91	63 – 97	57 - 114
9. Threonine	132	88 – 172	73 - 216
Conditionally Essential Amino Acids			
10. Arginine	123	43 – 107	29 - 137
11. Taurine	55	36 – 99	29 - 136
12. Glycine	332	192 – 418	155 - 518
13. Serine	152	74 – 139	60 - 172

neurotransmitters

Amino Acids 40 Profile - Plasma

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

	Results µmol/L	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Functional Categories			
Vitamin B6 Status Markers			
14. α-aminoadipic acid	<0.5	0.5	<= 1.5
15. α-Amino-n-butyric acid (α-ANB)	35	28	<= 39
16. γ-aminobutyric acid (GABA)	<0.6	0.6	<= 1.5
17. Cystathionine	<0.3	0.3	<= 0.3
Vascular Function			
18. Arginine	123	43 – 107	29 - 137
19. Taurine	55	36 – 99	29 - 136
20. α-aminoadipic acid	<0.5	0.5	<= 1.5
Neurotransmitters and Precursors			
21. Phenylalanine	76	48 – 77	42 - 95
22. Tyrosine	46	45 – 87	38 - 110
23. Tryptophan	41	39 – 69	31 - 83
24. Glutamic Acid	77	33 – 136	24 - 214
25. Taurine	55	36 – 99	29 - 136
Sulfur Amino Acids (Glutathione - related)			
26. Methionine	22	17 – 34	14 - 48
27. Cystathionine	<0.3	0.3	<= 0.3
28. Homocystine	<0.6	0.6	<= 0.6
29. Cystine	2.8	1.6 – 16.3	0.8 - 27.5
30. Taurine	55	36 – 99	29 - 136

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

	Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Functional Categories				
Urea Cycle and Ammonia Detoxification				
31. Arginine	123		43 – 107	29 - 137
32. Citrulline	36		22 – 45	18 - 57
33. Ornithine	81		36 – 86	28 - 117
34. Glutamine	759		458 – 771	372 - 876
35. Asparagine	67		39 – 71	31 - 90
36. Aspartic Acid	24.8	H	3.5 – 8.6	2.9 - 12.6
Glycine, Serine and Related Amino Acids				
37. Alanine	392		284 – 559	230 - 681
38. Glycine	332		192 – 418	155 - 518
39. Sarcosine	1.7		12.1	<= 19.5
40. Serine	152		74 – 139	60 - 172
41. Phosphoserine	<0.5		0.5	<= 0.8
42. Ethanolamine	9.4		9.3	<= 11.6
43. Phosphoethanolamine	<1.0		4.6	<= 7.4
Collagen - Related Amino Acids				
44. Proline	125		119 – 279	99 - 363
45. Hydroxyproline	8		16	<= 26
46. Lysine	253		147 – 263	120 - 318
47. Hydroxylysine	<0.6		0.6	<= 0.6

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

	Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Functional Categories				
β -Amino Acids and Derivatives				
48. β-Alanine	4.8		2.8	<= 5.0
49. Histidine	91		63 – 97	57 - 114
50. Carnosine	5.4		4.8	<= 6.3
51. 1-Methylhistidine	5.0		7.2	<= 9.8
52. Anserine	23		36	<= 43
DNA (Thymine) Degradation				
53. β-Aminoisobutyric Acid	<0.3		1.5	<= 3.2
Muscle-Specific Amino Acids				
54. 3-Methylhistidine	30		37	<= 52
Ratios				
55. Phenylalanine/Tyrosine	1.65	H		<= 1.10
56. Glutamic Acid/Glutamine	0.10		0.07 – 0.17	0.06 - 0.23
57. Hydroxyproline/Proline	0.064			<= 0.152
58. α-ANB/Leucine	0.21			<= 0.22
59. Tryptophan/LNAA*	0.065	L	0.096 – 0.101	0.090 - 0.102

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

NR = Not Reportable

		Results	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Homocysteine Assay - Plasma				
Methodology: Enzymatic Assay				
Ranges: Ages 13 and over.				
1.	Homocysteine	8.8	4.0 – 10.0	3.0 - 14.0 nmol/mL

Nutrient & Toxic Elements Profile - Blood
Methodology: Inductively Coupled Plasma/Mass Spectrometry

		Results		
Nutrient Elements				
Erythrocytes (packed cells)				
1.	Potassium	3,068	2,672	2,303 - 3,374 ppm
2.	Magnesium	40	44	34 - 63 ppm
3.	Calcium*	35	44	24 - 65 ppm
Plasma				
4.	Zinc	791	815	643 - 1,594 ppb
5.	Copper	913	929	753 - 1,920 ppb
Whole Blood				
6.	Selenium	0.15	0.16	0.13 - 0.32 ppm
Toxic Elements				
Whole Blood				
7.	Aluminum	24	45	<= 113 ppb
8.	Arsenic	2.8	5.1	<= 10.0 ppb
9.	Cadmium	0.32	0.60	<= 1.10 ppb
10.	Lead	6	18	<= 29 ppb
11.	Mercury	1.3	4.3	<= 9.8 ppb

*Relevant to membrane permeability, not nutritional status.

Results for whole blood toxic elements that are within normal limits do not rule out metal accumulation in other tissues.

NR = Not Reportable

		Results	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Coenzyme Q10 Plus Vitamins Profile - Serum				
Methodology: High Performance Liquid Chromotography				
Ranges: Ages 13 and over.		mg/L		
1.	Coenzyme Q10	1.01	0.64 – 2.16	0.48 - 3.04
2.	alpha-Tocopherol	8.3	9.8 – 25.1	6.8 - 31.7
3.	gamma-Tocopherol	0.59	0.26 – 2.06	0.06 - 2.99
4.	Vitamin A (Retinol)	0.47	0.36 – 0.74	0.29 - 1.05
5.	β-Carotene	0.38	0.15 – 1.70	0.10 - 2.71
Lipid Peroxides Assay - Serum				
Methodology: High Performance Liquid Chromotography				
		Results nmol/mL		
6.	Lipid Peroxides	1.64	1.72	<= 2.60
DNA/Oxidative Stress Marker (8-OHdG) Assay - Urine				
Methodology: LC/Tandem Mass Spectrometry, Colorimetric				
Ranges: Ages 13 and over.		Results ng/mg creatinine		
7.	8-Hydroxy-2-deoxyguanosine	1.8	5.3	<= 7.6

		Results ng/mL	Reference Range
Vitamin D Profile - Serum			
Methodology: Chemiluminescent			
8.	25-Hydroxyvitamin D •	44	30 - 100 ng/mL

Deficiency:	<20 ng/mL
Insufficiency:	20-29 ng/mL
Sufficient:	30-100 ng/mL
Recommended:	50-80 ng/mL
Excessive:	>100 ng/mL

There is no consensus in the literature regarding optimal levels of 25-Hydroxyvitamin D. Higher levels of 25-Hydroxyvitamin D may be concerning in some patient populations, such as renal failure. Levels below 30 ng/mL are considered insufficient by most medical associations. Treatment is at the discretion of the treating clinician.

Holick MF, et al. *J Clin Endocrinol Metab.* 2011;96(7):1911-1930.
Vitamin D Council: https://www.vitamindcouncil.org/

<DL = less than detection limit
NR = Not Reportable

25-Hydroxyvitamin D testing performed by Genova Diagnostics, Inc. 63 Zillicoa St., Asheville, NC 28801-0174. A. L. Peace-Brewer, PhD, D(ABMLI), Lab Director - CLIA Lic. #34D0655571 - Medicare Lic. #34-8475.

Fatty Acids Profile - Plasma

Methodology: Capillary Gas Chromatography/Mass Spectrometry

Ranges: Ages 13 and over

		Results µmol/L	QUINTILE DISTRIBUTION 1st–5th	95% Reference Range
Polyunsaturated Omega-3				
1.	Alpha Linolenic (18:3n3)	16	20	13 - 80
2.	Eicosapentaenoic (20:5n3)	10	17	5 - 210
3.	Docosapentaenoic (22:5n3)	18	16	11 - 50
4.	Docosahexaenoic (22:6n3)	55	59	31 - 213
Polyunsaturated Omega-6				
5.	Linoleic (18:2n6)	1,044	930 – 1,669	821 - 2,032
6.	Gamma Linolenic (18:3n6)	13	7 – 33	5 - 46
7.	Eicosadienoic (20:2n6)	7.2	6.4 – 15.3	5.2 - 22.5
8.	Dihomogamma Linolenic (20:3n6)	38	34 – 102	27 - 140
9.	Arachidonic (20:4n6)	277	201 – 451	158 - 521
10.	Docosadienoic (22:2n6)	1.1	0.9	<= 2.0
11.	Docosatetraenoic (22:4n6)	8.0	3.7 – 13.8	2.6 - 18.1
Polyunsaturated Omega-9				
12.	Mead (20:3n9)	3.7	5.3	<= 8.3
Monounsaturated				
13.	Myristoleic (14:1n5)	0.8	1.2 – 6.1	0.8 - 9.7
14.	Palmitoleic (16:1n7)	35	40 – 155	30 - 256
15.	Vaccenic (18:1n7)	61	48 – 93	40 - 122
16.	Oleic (18:1n9)	847	555 – 1,182	466 - 1,470
17.	11-Eicosenoic (20:1n9)	5.6	4.6 – 10.3	3.7 - 18.1
18.	Nervonic (24:1n9)	1.6	1.1 – 2.2	1.1 - 2.7

Fatty Acids Profile - Plasma

Methodology: Capillary Gas Chromatography/Mass Spectrometry

Ranges: Ages 13 and over

		Results µmol/L		QUINTILE DISTRIBUTION 1st–5th	95% Reference Range
Saturated					
19.	Capric (10:0)	1.2		1.4 – 4.0	0.8 - 6.2
20.	Lauric (12:0)	1.5	L	3.3 – 14.5	2.2 - 27.3
21.	Myristic (14:0)	15		20 – 87	15 - 139
22.	Palmitic (16:0)	860		792 – 1,794	667 - 2,526
23.	Stearic (18:0)	364		294 – 511	250 - 629
24.	Arachidic (20:0)	1.9		1.5 – 3.2	1.3 - 4.7
25.	Behenic (22:0)	1.3		0.8 – 2.0	0.6 - 2.9
26.	Lignoceric (24:0)	1.27		0.84 – 1.66	0.63 - 2.45
27.	Hexacosanoic (26:0)	<0.27		0.36	<= 0.43
Odd Chain					
28.	Pentadecanoic (15:0)	7.6		14.5	<= 20.6
29.	Heptadecanoic (17:0)	14.2		19.3	<= 24.4
30.	Nonadecanoic (19:0)	0.93		1.51	<= 1.89
31.	Heneicosanoic (21:0)	<0.38		0.50	<= 0.74
32.	Tricosanoic (23:0)	0.75		0.62	<= 0.78
Trans					
33.	Palmitelaidic (16:1n7t)	<0.4		0.4	<= 1.8
34.	Total C:18 Trans	6		42	<= 59
Ratios					
35.	LA/DGLA	27		30	11 - 46
36.	EPA/DGLA	0.26		0.24	0.07 - 5.98
37.	AA/EPA	28		20	1 - 57
38.	Triene/Tetraene	0.013		0.016	<= 0.023

NR = Not Reportable

Methodology: LC/Tandem Mass Spectrometry, Colorimetric
This report is not intended for the diagnosis of neonatal inborn errors of metabolism.
Ranges: Ages 13 and over

		Results mcg/mg creatinine	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Nutrient Markers				
Fatty Acid Metabolism *(Carnitine & B2)*				
1.	Adipate	1.4	6.2	<= 11.1
2.	Suberate	0.4	2.1	<= 4.6
3.	Ethylmalonate	1.1	3.6	<= 6.3
Carbohydrate Metabolism *(B1, B3, Cr, Lipoic Acid, CoQ10)*				
4.	Pyruvate	<DL	3.9	<= 6.4
5.	L-Lactate	1.6	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	260	601	56 - 987
8.	Cis-Aconitate	26	51	18 - 78
9.	Isocitrate	54	98	39 - 143
10.	α-Ketoglutarate	<DL	19.0	<= 35.0
11.	Succinate	3.3	11.6	<= 20.9
12.	Fumarate	<DL	0.59	<= 1.35
13.	Malate	<DL	1.4	<= 3.1
14.	Hydroxymethylglutarate	1.7	3.6	<= 5.1
B-Complex Vitamin Markers *(B1, B2, B3, B5, B6, Biotin)*				
15.	α-Ketoisovalerate	<DL	0.25	<= 0.49
16.	α-Ketoisocaproate	0.16	0.34	<= 0.52
17.	α-Keto-β-Methylvalerate	0.37	0.38	<= 1.10
18.	Xanthurenate	0.14	0.34	<= 0.46
19.	β-Hydroxyisovalerate	4.3	7.6	<= 11.5

Methodology: LC/Tandem Mass Spectrometry, Colorimetric
This report is not intended for the diagnosis of neonatal inborn errors of metabolism.
Ranges: Ages 13 and over

		Results mcg/mg creatinine	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Nutrient Markers				
Methylation Cofactor Markers *(B12, Folate)*				
20.	Methylmalonate	0.6	1.7	<= 2.3
21.	Formiminoglutamate	0.4	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	2.3	1.9 5.7	1.4 - 7.6
24.	5-Hydroxyindoleacetate	2.3	2.1 5.6	1.6 - 9.8
25.	Kynurenate	0.7	1.0	<= 1.5
26.	Quinolinate	1.5	4.0	<= 5.8
27.	Picolinate	3.1	8.0	2.8 - 13.5
Oxidative Damage and Antioxidant Markers *(Vitamin C and Other Antioxidants)*				
28.	p-Hydroxyphenyllactate	0.17	0.39	<= 0.66
29.	8-Hydroxy-2-deoxyguanosine	1.8	5.3	<= 7.6
(Units for 8-hydroxy-2-dexoyguanosine are ng/mg creatinine)				
Toxicants and Detoxification				
Detoxification Indicators *(Arg, NAC, Met, Mg, Antioxidants)*				
30.	2-Methylhippurate	<DL	0.084	<= 0.192
31.	Orotate	0.35	0.69	<= 1.01
32.	Glucarate	2.7	6.3	<= 10.7
33.	α-Hydroxybutyrate	<DL	0.3	<= 0.9
34.	Pyroglutamate	62	59	28 - 88
35.	Sulfate	1,278	958 2,347	690 - 2,988

© Genova Diagnostics · Robert M. David, PhD, Lab Director · CLIA Lic. #11D0255349 · Medicare Lic. #34-8475 · Georgia Lab Lic. Code #067-007
New York Clinical Lab PFI #4578 · Florida Clinical Lab Lic. #800008124

Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.

Ranges: Ages 13 and over

		Results mcg/mg creatinine	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Compounds of Bacterial or Yeast/Fungal Origin				
Bacterial - General				
36.	Benzoate	<DL	0.6	<= 9.3
37.	Hippurate	48	548	<= 1,070
38.	Phenylacetate	0.09	0.11	<= 0.18
39.	Phenylpropionate	<DL		<= 0.06
40.	p-Hydroxybenzoate	0.7	1.1	<= 1.8
41.	p-Hydroxyphenylacetate	7	19	<= 34
42.	Indican	24	64	<= 90
43.	Tricarballylate	0.25	0.73	<= 1.41
L. acidophilus / General Bacterial				
44.	D-Lactate	1.0	2.0	<= 4.1
Clostridial Species				
45.	3,4-Dihydroxyphenylpropionate	<DL		<= 0.05
Yeast / Fungal				
46.	D-Arabinitol	24	36	<= 73

Creatinine = 167 mg/dL

<DL = less than detection limit
>UL = greater than upper linearity limit
NR = Not Reportable

GENOVA DIAGNOSTICS

Case Study #2

GENOVA DIAGNOSTICS

3425 Corporate Way
Duluth, GA 30096

ION INDIVIDUAL • OPTIMAL • NUTRITIONAL

Case 2: 49 Year-Old Male

3102 ION® Profile with Amino Acids 40 - Blood/Urine

Amino Acids 40 Profile - Plasma

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

		Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Essential Amino Acids					
Limiting Amino Acids					
1.	Lysine	162		147 – 263	120 - 318
2.	Methionine	14		17 – 34	14 - 48
3.	Tryptophan	36		39 – 69	31 - 83
Branched Chain Amino Acids					
4.	Isoleucine	46		40 – 82	35 - 104
5.	Leucine	109		87 – 164	74 - 196
6.	Valine	204		167 – 316	146 - 370
Other Essential Amino Acids					
7.	Phenylalanine	45		48 – 77	42 - 95
8.	Histidine	53	L	63 – 97	57 - 114
9.	Threonine	79		88 – 172	73 - 216
Conditionally Essential Amino Acids					
10.	Arginine	71		43 – 107	29 - 137
11.	Taurine	88		36 – 99	29 - 136
12.	Glycine	144	L	192 – 418	155 - 518
13.	Serine	68		74 – 139	60 - 172

Amino Acids 40 Profile - Plasma

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

		Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Functional Categories					
Vitamin B6 Status Markers					
14.	α-aminoadipic acid	<0.5		0.5	<= 1.5
15.	α-Amino-n-butyric acid (α-ANB)	17		28	<= 39
16.	γ-aminobutyric acid (GABA)	<0.6		0.6	<= 1.5
17.	Cystathionine	<0.3		0.3	<= 0.3
Vascular Function					
18.	Arginine	71		43 – 107	29 - 137
19.	Taurine	88		36 – 99	29 - 136
20.	α-aminoadipic acid	<0.5		0.5	<= 1.5
Neurotransmitters and Precursors					
21.	Phenylalanine	45		48 – 77	42 - 95
22.	Tyrosine	35	L	45 – 87	38 - 110
23.	Tryptophan	36		39 – 69	31 - 83
24.	Glutamic Acid	60		33 – 136	24 - 214
25.	Taurine	88		36 – 99	29 - 136
Sulfur Amino Acids (Glutathione - related)					
26.	Methionine	14		17 – 34	14 - 48
27.	Cystathionine	<0.3		0.3	<= 0.3
28.	Homocystine	<0.6		0.6	<= 0.6
29.	Cystine	2.6		1.6 – 16.3	0.8 - 27.5
30.	Taurine	88		36 – 99	29 - 136

Amino Acids 40 Profile - Plasma

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

	Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Functional Categories				
Urea Cycle and Ammonia Detoxification				
31. Arginine	71		43 – 107	29 - 137
32. Citrulline	31		22 – 45	18 - 57
33. Ornithine	42		36 – 86	28 - 117
34. Glutamine	497		458 – 771	372 - 876
35. Asparagine	36		39 – 71	31 - 90
36. Aspartic Acid	2.6	L	3.5 – 8.6	2.9 - 12.6
Glycine, Serine and Related Amino Acids				
37. Alanine	228	L	284 – 559	230 - 681
38. Glycine	144	L	192 – 418	155 - 518
39. Sarcosine	5.9		12.1	<= 19.5
40. Serine	68		74 – 139	60 - 172
41. Phosphoserine	<0.5		0.5	<= 0.8
42. Ethanolamine	4.1		9.3	<= 11.6
43. Phosphoethanolamine	5.1		4.6	<= 7.4
Collagen - Related Amino Acids				
44. Proline	80	L	119 – 279	99 - 363
45. Hydroxyproline	10		16	<= 26
46. Lysine	162		147 – 263	120 - 318
47. Hydroxylysine	<0.6		0.6	<= 0.6

Amino Acids 40 Profile - Plasma

Methodology: High Performance Liquid Chromotography

Ranges: Ages 13 and over.

	Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Functional Categories				
β -Amino Acids and Derivatives				
48. β-Alanine	4.0		2.8	<= 5.0
49. Histidine	53	L	63 – 97	57 - 114
50. Carnosine	2.8		4.8	<= 6.3
51. 1-Methylhistidine	7.0		7.2	<= 9.8
52. Anserine	20		36	<= 43
DNA (Thymine) Degradation				
53. β-Aminoisobutyric Acid	<0.3		1.5	<= 3.2
Muscle-Specific Amino Acids				
54. 3-Methylhistidine	49		37	<= 52
Ratios				
55. Phenylalanine/Tyrosine	1.29	H		<= 1.10
56. Glutamic Acid/Glutamine	0.12		0.07 – 0.17	0.06 - 0.23
57. Hydroxyproline/Proline	0.125			<= 0.152
58. α-ANB/Leucine	0.16			<= 0.22
59. Tryptophan/LNAA*	0.082	L	0.096 – 0.101	0.090 - 0.102

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

NR = Not Reportable

© Genova Diagnostics · Robert M. David, PhD, Lab Director · CLIA Lic. #11D0255349 · Medicare Lic. #34-8475 · Georgia Lab Lic. Code #067-007
New York Clinical Lab PFI #4578 · Florida Clinical Lab Lic. #800008124

C0490

		Results	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Homocysteine Assay - Plasma				
Methodology: Enzymatic Assay				
Ranges: Ages 13 and over.				
1.	Homocysteine	7.1	4.0 – 10.0	3.0 - 14.0 nmol/mL

Nutrient & Toxic Elements Profile - Blood
Methodology: Inductively Coupled Plasma/Mass Spectrometry

		Results		
Nutrient Elements				
Erythrocytes (packed cells)				
1.	Potassium	2,523	2,672	2,303 - 3,374 ppm
2.	Magnesium	38	44	34 - 63 ppm
3.	Calcium*	34	44	24 - 65 ppm
Plasma				
4.	Zinc	1,423	815	643 - 1,594 ppb
5.	Copper	1,426	929	753 - 1,920 ppb
Whole Blood				
6.	Selenium	0.19	0.16	0.13 - 0.32 ppm
Toxic Elements				
Whole Blood				
7.	Aluminum	24	45	<= 113 ppb
8.	Arsenic	6.6	5.1	<= 10.0 ppb
9.	Cadmium	0.42	0.60	<= 1.10 ppb
10.	Lead	20	18	<= 29 ppb
11.	Mercury	5.2	4.3	<= 9.8 ppb

*Relevant to membrane permeability, not nutritional status.

Results for whole blood toxic elements that are within normal limits do not rule out metal accumulation in other tissues.

NR = Not Reportable

		Results mg/L	QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Coenzyme Q10 Plus Vitamins Profile - Serum				
Methodology: High Performance Liquid Chromatography				
Ranges: Ages 13 and over.				
1.	Coenzyme Q10	0.67	0.64 – 2.16	0.48 - 3.04
2.	alpha-Tocopherol	10.2	9.8 – 25.1	6.8 - 31.7
3.	gamma-Tocopherol	0.45	0.26 – 2.06	0.06 - 2.99
4.	Vitamin A (Retinol)	0.50	0.36 – 0.74	0.29 - 1.05
5.	β-Carotene	0.09 L	0.15 – 1.70	0.10 - 2.71

		Results nmol/mL		
Lipid Peroxides Assay - Serum				
Methodology: High Performance Liquid Chromatography				
6.	Lipid Peroxides	0.41	1.72	<= 2.60

		Results ng/mg creatinine		
DNA/Oxidative Stress Marker (8-OHdG) Assay - Urine				
Methodology: LC/Tandem Mass Spectrometry, Colorimetric				
Ranges: Ages 13 and over.				
7.	8-Hydroxy-2-deoxyguanosine	5.2	5.3	<= 7.6

		Results ng/mL	Reference Range
Vitamin D Profile - Serum			
Methodology: Chemiluminescent			
8.	25-Hydroxyvitamin D *	49	30 - 100 ng/mL

Deficiency: <20 ng/mL
Insufficiency: 20-29 ng/mL
Sufficient: 30-100 ng/mL
Recommended: 50-80 ng/mL
Excessive: >100 ng/mL

There is no consensus in the literature regarding optimal levels of 25-Hydroxyvitamin D. Higher levels of 25-Hydroxyvitamin D may be concerning in some patient populations, such as renal failure. Levels below 30 ng/mL are considered insufficient by most medical associations. Treatment is at the discretion of the treating clinician.

Holick MF, et al. *J Clin Endocrinol Metab.* 2011;96(7):1911-1930.
Vitamin D Council: https://www.vitamindcouncil.org/

<DL = less than detection limit
NR = Not Reportable

25-Hydroxyvitamin D testing performed by Genova Diagnostics, Inc. 63 Zillicoa St., Asheville, NC 28801-0174. A. L. Peace-Brewer, PhD, D(ABMLI), Lab Director - CLIA Lic. #34D0656571 - Medicare Lic. #34-8475.

Fatty Acids Profile- Plasma

Methodology: Capillary Gas Chromatography/Mass Spectrometry

Ranges: Ages 13 and over

		Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Polyunsaturated Omega-3					
1.	Alpha Linolenic (18:3n3)	22		20	13 - 80
2.	Eicosapentaenoic (20:5n3)	54		17	5 - 210
3.	Docosapentaenoic (22:5n3)	17		16	11 - 50
4.	Docosahexaenoic (22:6n3)	112		59	31 - 213
Polyunsaturated Omega-6					
5.	Linoleic (18:2n6)	671	L	930 1,669	821 - 2,032
6.	Gamma Linolenic (18:3n6)	3	L	7 33	5 - 46
7.	Eicosadienoic (20:2n6)	5.3		6.4 15.3	5.2 - 22.5
8.	Dihomogamma Linolenic (20:3n6)	19	L	34 102	27 - 140
9.	Arachidonic (20:4n6)	119	L	201 451	158 - 521
10.	Docosadienoic (22:2n6)	1.9		0.9	<= 2.0
11.	Docosatetraenoic (22:4n6)	2.3	L	3.7 13.8	2.6 - 18.1
Polyunsaturated Omega-9					
12.	Mead (20:3n9)	2.2		5.3	<= 8.3
Monounsaturated					
13.	Myristoleic (14:1n5)	5.8		1.2 6.1	0.8 - 9.7
14.	Palmitoleic (16:1n7)	75		40 155	30 - 256
15.	Vaccenic (18:1n7)	55		48 93	40 - 122
16.	Oleic (18:1n9)	850		555 1,182	466 - 1,470
17.	11-Eicosenoic (20:1n9)	7.3		4.6 10.3	3.7 - 18.1
18.	Nervonic (24:1n9)	<1.1	L	1.1 2.2	1.1 - 2.7

Fatty Acids Profile - Plasma

Methodology: Capillary Gas ChromatographyMass Spectrometry

Ranges: Ages 13 and over

		Results µmol/L		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Saturated					
19.	Capric (10:0)	1.3		1.4 4.0	0.8 - 6.2
20.	Lauric (12:0)	2.2		3.3 14.5	2.2 - 27.3
21.	Myristic (14:0)	11	L	20 87	15 - 139
22.	Palmitic (16:0)	866		792 1,794	667 - 2,526
23.	Stearic (18:0)	312		294 511	250 - 629
24.	Arachidic (20:0)	1.9		1.5 3.2	1.3 - 4.7
25.	Behenic (22:0)	0.7		0.8 2.0	0.6 - 2.9
26.	Lignoceric (24:0)	0.80		0.84 1.66	0.63 - 2.45
27.	Hexacosanoic (26:0)	<0.27		0.36	<= 0.43
Odd Chain					
28.	Pentadecanoic (15:0)	5.5		14.5	<= 20.6
29.	Heptadecanoic (17:0)	9.5		19.3	<= 24.4
30.	Nonadecanoic (19:0)	1.04		1.51	<= 1.89
31.	Heneicosanoic (21:0)	<0.38		0.50	<= 0.74
32.	Tricosanoic (23:0)	<0.37		0.62	<= 0.78
Trans					
33.	Palmitelaidic (16:1n7t)	<0.4		0.4	<= 1.8
34.	Total C:18 Trans	4		42	<= 59
Ratios					
35.	LA/DGLA	24		30	11 - 46
36.	EPA/DGLA	1.41		0.24	0.07 - 5.98
37.	AA/EPA	4		20	1 - 57
38.	Triene/Tetraene	0.016		0.016	<= 0.023

NR = Not Reportable

Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.

Ranges: Ages 13 and over

		Results mcg/mg creatinine		QUINTILE DISTRIBUTION 1st / 2nd / 3rd / 4th / 5th	95% Reference Range
Nutrient Markers					
Fatty Acid Metabolism *(Carnitine & B2)*					
1.	Adipate	1.3		6.2	<= 11.1
2.	Suberate	0.6		2.1	<= 4.6
3.	Ethylmalonate	1.6		3.6	<= 6.3
Carbohydrate Metabolism *(B1, B3, Cr, Lipoic Acid, CoQ10)*					
4.	Pyruvate	<DL		3.9	<= 6.4
5.	L-Lactate	6.9		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	520		601	56 - 987
8.	Cis-Aconitate	35		51	18 - 78
9.	Isocitrate	70		98	39 - 143
10.	α-Ketoglutarate	4.2		19.0	<= 35.0
11.	Succinate	8.3		11.6	<= 20.9
12.	Fumarate	0.17		0.59	<= 1.35
13.	Malate	0.6		1.4	<= 3.1
14.	Hydroxymethylglutarate	2.2		3.6	<= 5.1
B-Complex Vitamin Markers *(B1, B2, B3, B5, B6, Biotin)*					
15.	α-Ketoisovalerate	<DL		0.25	<= 0.49
16.	α-Ketoisocaproate	0.18		0.34	<= 0.52
17.	α-Keto-β-Methylvalerate	0.16		0.38	<= 1.10
18.	Xanthurenate	0.67	H	0.34	<= 0.46
19.	β-Hydroxyisovalerate	5.4		7.6	<= 11.5

Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.

Ranges: Ages 13 and over

		Results mcg/mg creatinine		QUINTILE DISTRIBUTION 1st / 2nd / 3rd / 4th / 5th	95% Reference Range
Nutrient Markers					
Methylation Cofactor Markers *(B12, Folate)*					
20.	Methylmalonate	1.5		1.7	<= 2.3
21.	Formiminoglutamate	1.0		1.2	<= 2.2
Cell Regulation Markers					
Neurotransmitter Metabolism Markers *(Tyrosine, Tryptophan, B6, Antioxidants)*					
22.	Vanilmandelate	3.2		1.6 / 3.9	1.2 - 5.3
23.	Homovanillate	2.0		1.9 / 5.7	1.4 - 7.6
24.	5-Hydroxyindoleacetate	3.6		2.1 / 5.6	1.6 - 9.8
25.	Kynurenate	2.0	H	1.0	<= 1.5
26.	Quinolinate	2.7		4.0	<= 5.8
27.	Picolinate	5.8		8.0	2.8 - 13.5
Oxidative Damage and Antioxidant Markers *(Vitamin C and Other Antioxidants)*					
28.	p-Hydroxyphenyllactate	0.66		0.39	<= 0.66
29.	8-Hydroxy-2-deoxyguanosine	4.9		5.3	<= 7.6
(Units for 8-hydroxy-2-dexoyguanosine are ng/mg creatinine)					
Toxicants and Detoxification					
Detoxification Indicators *(Arg, NAC, Met, Mg, Antioxidants)*					
30.	2-Methylhippurate	0.017		0.084	<= 0.192
31.	Orotate	0.56		0.69	<= 1.01
32.	Glucarate	1.7		6.3	<= 10.7
33.	α-Hydroxybutyrate	<DL		0.3	<= 0.9
34.	Pyroglutamate	33		59	28 - 88
35.	Sulfate	3,026	H	958 / 2,347	690 - 2,988

© Genova Diagnostics · Robert M. David, PhD, Lab Director · CLIA Lic. #11D0255349 · Medicare Lic. #34-8475 · Georgia Lab Lic. Code #067-007
New York Clinical Lab PFI #4578 · Florida Clinical Lab Lic. #800008124

Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.

Ranges: Ages 13 and over

		Results mcg/mg creatinine		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Compounds of Bacterial or Yeast/Fungal Origin					
Bacterial - General					
36.	Benzoate	10.7	H	0.6	<= 9.3
37.	Hippurate	145		548	<= 1,070
38.	Phenylacetate	<DL		0.11	<= 0.18
39.	Phenylpropionate	<DL			<= 0.06
40.	p-Hydroxybenzoate	3.0	H	1.1	<= 1.8
41.	p-Hydroxyphenylacetate	26		19	<= 34
42.	Indican	37		64	<= 90
43.	Tricarballylate	<DL		0.73	<= 1.41
L. acidophilus / General Bacterial					
44.	D-Lactate	3.2		2.0	<= 4.1
Clostridial Species					
45.	3,4-Dihydroxyphenylpropionate	<DL			<= 0.05
Yeast / Fungal					
46.	D-Arabinitol	14		36	<= 73

Creatinine = 124 mg/dL

<DL = less than detection limit
>UL = greater than upper linearity limit
NR = Not Reportable

GENOVA DIAGNOSTICS

Case Study #3

GENOVA DIAGNOSTICS

3425 Corporate Way
Duluth, GA 30096

Organix Urine Organic Acids

Case 3: 55 Year-Old Female

3301 Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.

Ranges: Ages 13 and over

		Results mcg/mg creatinine		QUINTILE DISTRIBUTION 1st 2nd 3rd 4th 5th	95% Reference Range
Nutrient Markers					
Fatty Acid Metabolism *(Carnitine & B2)*					
1.	Adipate	1.8		6.2	<= 11.1
2.	Suberate	0.3		2.1	<= 4.6
3.	Ethylmalonate	0.7		3.6	<= 6.3
Carbohydrate Metabolism *(B1, B3, Cr, Lipoic Acid, CoQ10)*					
4.	Pyruvate	<DL		3.9	<= 6.4
5.	L-Lactate	6.6		8.5	0.6 - 16.4
6.	β-Hydroxybutyrate	1.7		2.1	<= 9.9
Energy Production (Citric Acid Cycle) *(B Comp., CoQ10, Amino Acids, Mg)*					
7.	Citrate	35	L	601	56 - 987
8.	Cis-Aconitate	11	L	51	18 - 78
9.	Isocitrate	28	L	98	39 - 143
10.	α-Ketoglutarate	<DL		19.0	<= 35.0
11.	Succinate	2.3		11.6	<= 20.9
12.	Fumarate	<DL		0.59	<= 1.35
13.	Malate	<DL		1.4	<= 3.1
14.	Hydroxymethylglutarate	1.3		3.6	<= 5.1

3301 Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.

Ranges: Ages 13 and over

		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	<DL		0.25	<= 0.49
16.	α-Ketoisocaproate	<DL		0.34	<= 0.52
17.	α-Keto-β-Methylvalerate	<DL		0.38	<= 1.10
18.	Xanthurenate	0.56	H	0.34	<= 0.46
19.	β-Hydroxyisovalerate	2.8		7.6	<= 11.5
Methylation Cofactor Markers *(B12, Folate)*					
20.	Methylmalonate	0.2		1.7	<= 2.3
21.	Formiminoglutamate	0.3		1.2	<= 2.2
Cell Regulation Markers					
Neurotransmitter Metabolism Markers *(Tyrosine, Tryptophan, B6, Antioxidants)*					
22.	Vanilmandelate	0.8	L	1.6 3.9	1.2 - 5.3
23.	Homovanillate	2.8		1.9 5.7	1.4 - 7.6
24.	5-Hydroxyindoleacetate	>UL	H	2.1 5.6	1.6 - 9.8
25.	Kynurenate	1.5		1.0	<= 1.5
26.	Quinolinate	2.0		4.0	<= 5.8
27.	Picolinate	3.6		8.0	2.8 - 13.5
Oxidative Damage and Antioxidant Markers *(Vitamin C and Other Antioxidants)*					
28.	p-Hydroxyphenyllactate	0.13		0.39	<= 0.66
29.	8-Hydroxy-2-deoxyguanosine	2.2		5.3	<= 7.6

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

3301 Organix® Comprehensive Profile - Urine

Methodology: LC/Tandem Mass Spectrometry, Colorimetric

This report is not intended for the diagnosis of neonatal inborn errors of metabolism.
Ranges: Ages 13 and over

	Results mcg/mg creatinine		QUINTILE DISTRIBUTION (1st | 2nd | 3rd | 4th | 5th)	95% Reference Range
Toxicants and Detoxification				
Detoxification Indicators *(Arg, NAC, Met, Mg, Antioxidants)*				
30. 2-Methylhippurate	0.056		0.084	<= 0.192
31. Orotate	0.08		0.69	<= 1.01
32. Glucarate	1.9		6.3	<= 10.7
33. α-Hydroxybutyrate	<DL		0.3	<= 0.9
34. Pyroglutamate	26	L	59	28 - 88
35. Sulfate	983		958 – 2,347	690 - 2,988
Compounds of Bacterial or Yeast/Fungal Origin				
Bacterial - General				
36. Benzoate	<DL		0.6	<= 9.3
37. Hippurate	343		548	<= 1,070
38. Phenylacetate	0.12		0.11	<= 0.18
39. Phenylpropionate	<DL			<= 0.06
40. p-Hydroxybenzoate	0.7		1.1	<= 1.8
41. p-Hydroxyphenylacetate	9		19	<= 34
42. Indican	34		64	<= 90
43. Tricarballylate	<DL		0.73	<= 1.41
L. acidophilus / General Bacterial				
44. D-Lactate	<DL		2.0	<= 4.1
Clostridial Species				
45. 3,4-Dihydroxyphenylpropionate	<DL			<= 0.05
Yeast / Fungal				
46. D-Arabinitol	10		36	<= 73

Creatinine = 170 mg/dL

<DL = less than detection limit
>UL = greater than upper linearity limit

This test has been developed and its performance characteristics determined by Genova Diagnostics, Inc. It has not been cleared by the U.S. Food and Drug Administration.

GENOVA DIAGNOSTICS

Daniel Kalish, DC, IFMCP
Presenter

US Client Services: 800-522-4762

UK Client Services: 020.8336.7750

We look forward to hearing from you!

Questions?

GENOVA DIAGNOSTICS

Upcoming LIVE GDX Webinar Topics

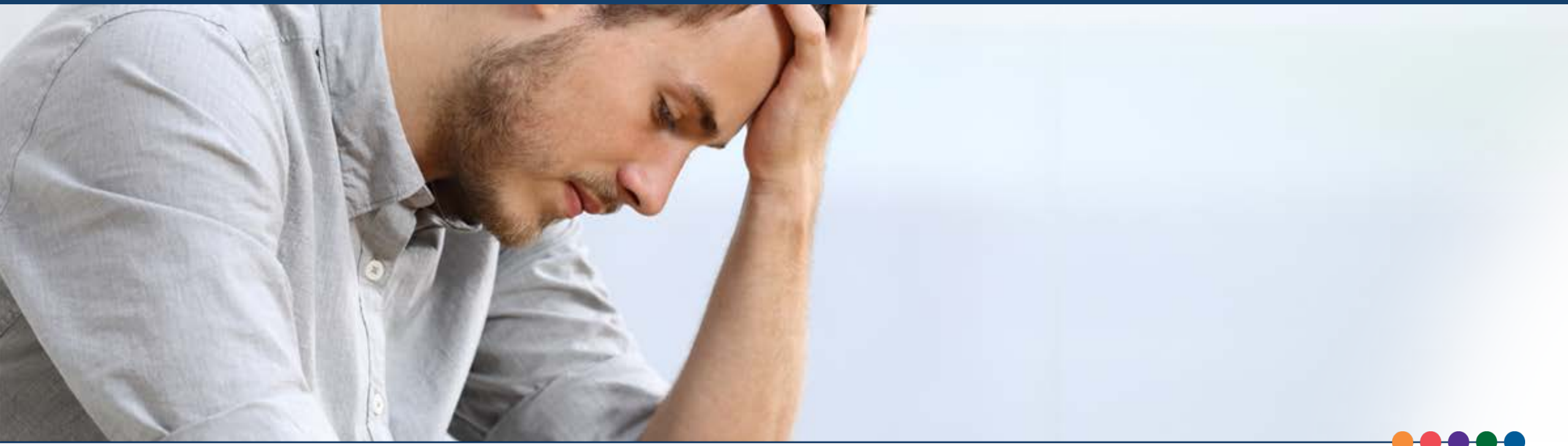
Register for upcoming LIVE GDX Webinars online at WWW.GDX.NET

Subscribe to our weekly Podcast at

WWW.GDX.NET/THE_LAB_REPORT

LIVE GDX

GENOVA DIAGNOSTICS



Lab Based Treatments for Fatigue and Depression

Measuring Mitochondrial Function

Daniel Kalish, DC, IFMCP
Founder Kalish Institute

GENOVA DIAGNOSTICS