The GI Effects & NutrEval: Making Clinical Connections

Stephen L. Goldman, DC
Medical Education Specialist
Genova Diagnostics

July 25, 2018

GENOVA DIAGNOSTICS

Warren Brown, ND

Clinical Science Liaison

Moderator

GENOVA DIAGNOSTICS

Stephen L. Goldman, DC

Medical Education Specialist

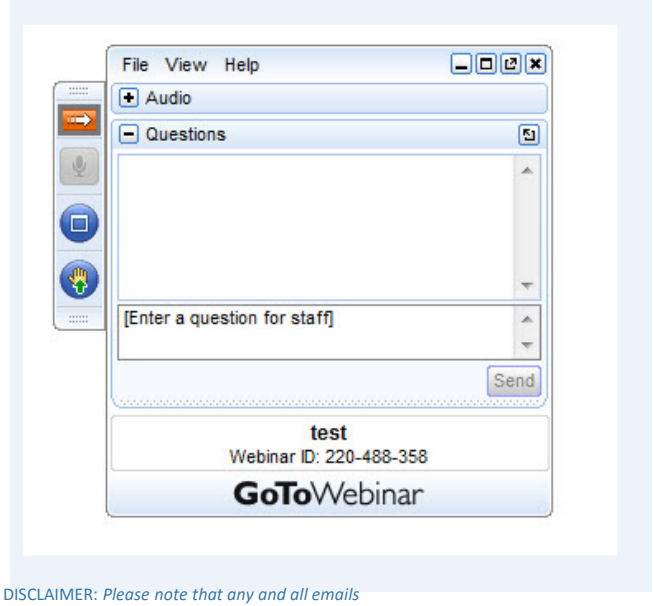
Presenter

GENOVA DIAGNOSTICS

Technical Issues & Clinical Questions

- Please type any technical issue or clinical question into either the "Chat" or "Questions" boxes, making sure to send them to "Organizer" at any time during the webinar

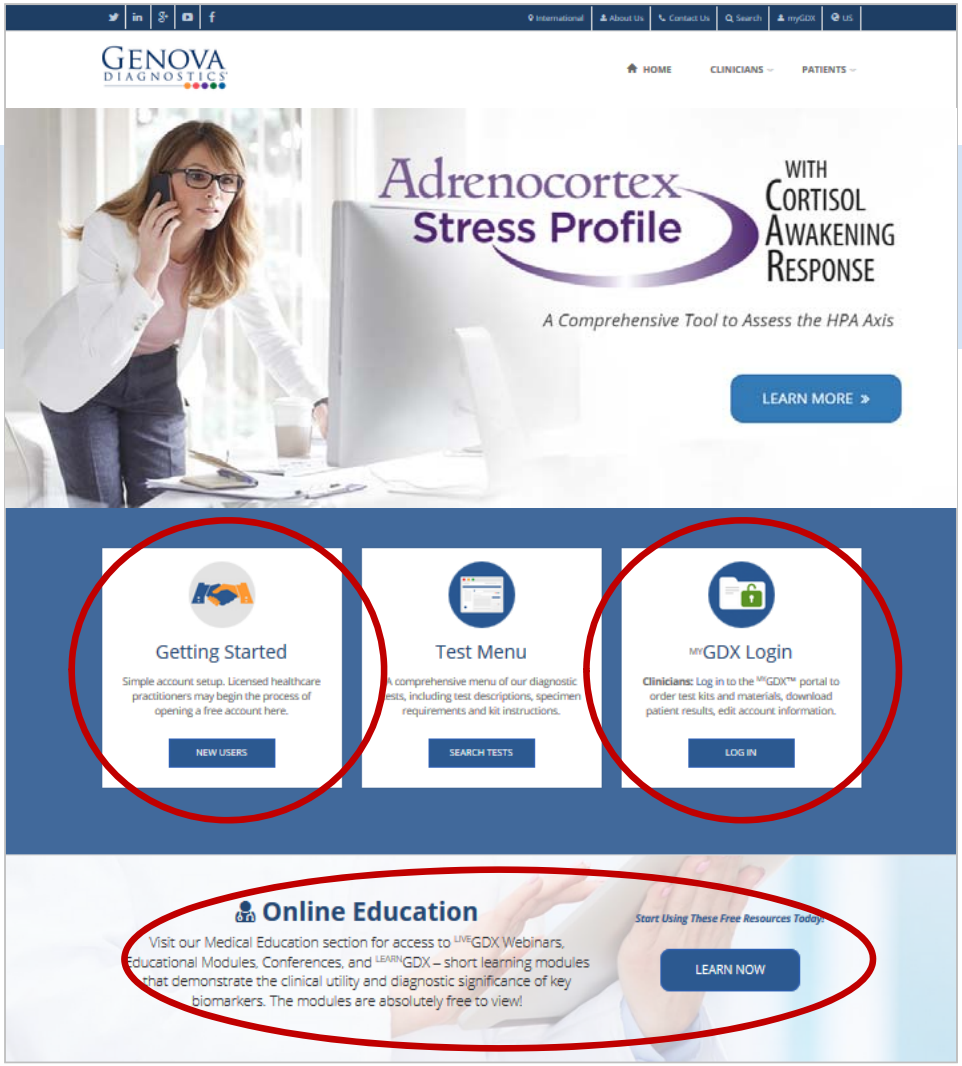
- We will be compiling your clinical questions and answering as many as we can the final 15 minutes of the webinar



DISCLAIMER: *Please note that any and all emails provided may be used for follow up correspondence and/or for further communication.*

GENOVA DIAGNOSTICS

Need More Resources?



GENOVA DIAGNOSTICS

The GI Effects & NutrEval: Making Clinical Connections

Stephen L. Goldman, DC
Medical Education Specialist
Genova Diagnostics

July 25, 2018

GENOVA DIAGNOSTICS

Objectives for This Presentation

- Identify concepts that connect nutritional assessments and stool testing results
- Provide interpretation and application of laboratory results
- Discuss strategies helpful for treatment plan creation

GENOVA DIAGNOSTICS

Format: Abstract

Send to

Front Genet. 2018 Jun 13;9:212. doi: 10.3389/fgene.2018.00212. eCollection 2018.

Microbiome Research Is Becoming the Key to Better Understanding Health and Nutrition.

Hadrich D[1].

Author information

Abstract

The human microbiome has emerged as the crucial moderator in the interactions between food and our body. It is increasingly recognised that the microbiome can change our mind and health status, or switch on a wide range of diseases including cancer, cardio-metabolic diseases, allergies, and obesity. The causes of diseases are often only partially understood. However, nutrients, metabolites, and microbes are increasingly regarded as key players, even where the complete disease mechanisms remain unclear.

the next level. The EU has already funded 216 projects under the 7th Framework Programme and Horizon 2020 programmes to promote metagenomics and to advance our knowledge of microbes. This support started with the catalysing MetaHIT project that has produced a catalogue of gut microbes, and has arrived now at the very multi-disciplinary SYSCID action looking at how the microbiome is driving its resilience potential and our health. Together, these projects involve an investment of more than €498 M. However, in Horizon 2020, the new EU Health and Food Work Programmes for 2018-2020 go even further by setting new goals to find applications and to generate more knowledge on the microbiome, nutrition, various hosts of microbes, and their relation to health and disease. The big vision is to modulate health and diseases via the microbiome and nutrition, while at the same time other factors such as omics, molecular signatures, and lifestyle are constant. In this way, microbiome and nutrition research is moving from an isolated and despised offside position to a beacon of hope with a lot of potential and possibilities.

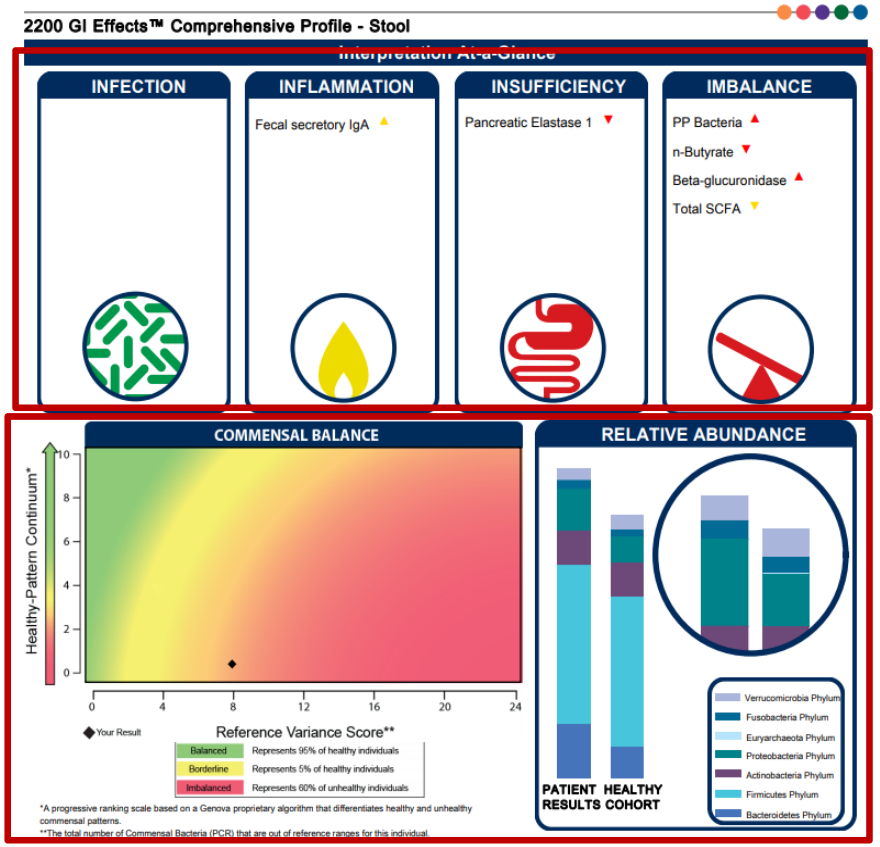
Case Example #1

- 42 y/o female
- Loose stools x 18 months
- Endoscopy and colonoscopy were unremarkable
- Rapid transit time
- Dry skin with brittle nails
- Stress is moderate-to-high
- Standard American Diet, craves sweets
- Medications: occasional loperamide for diarrhea

GENOVA DIAGNOSTICS

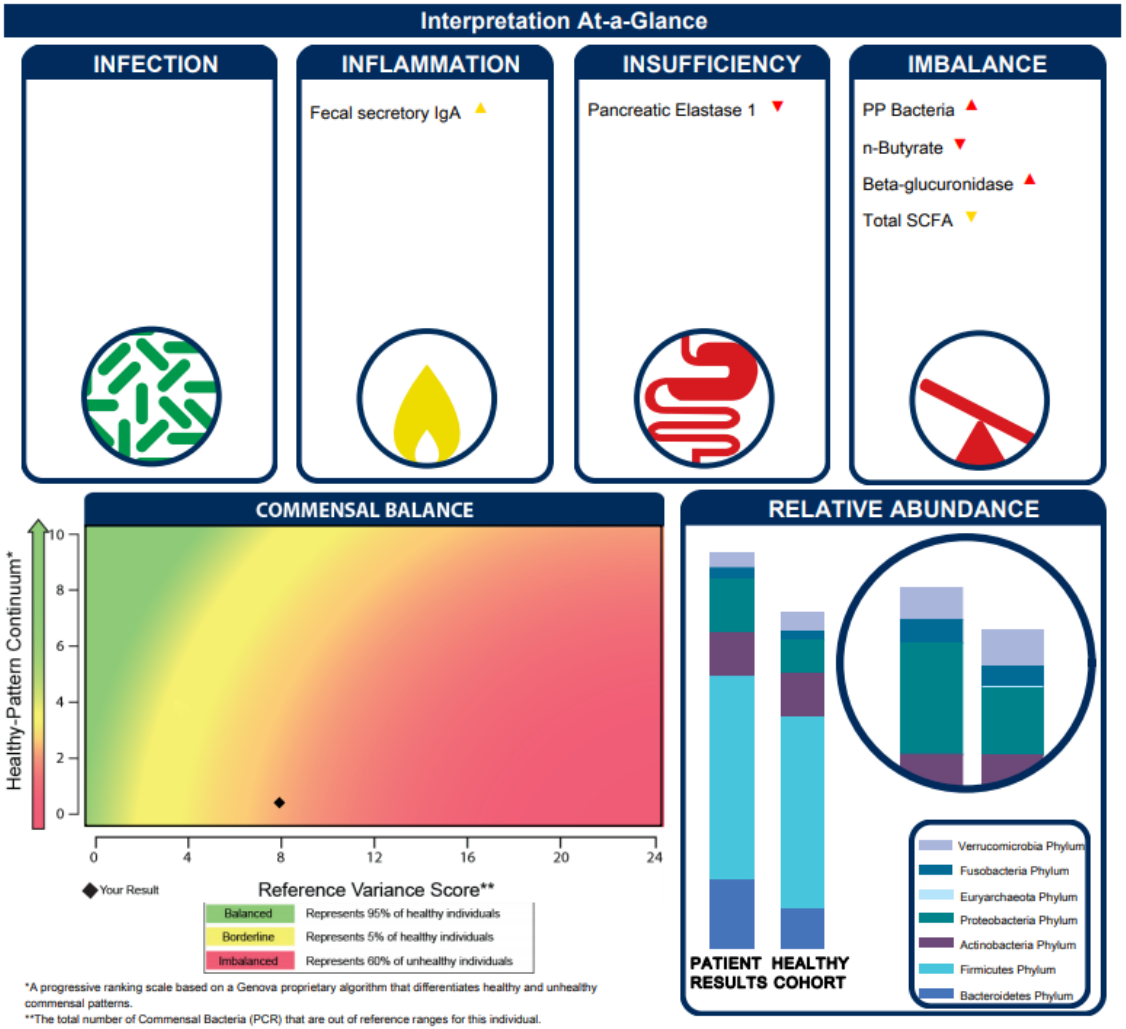
Interpretation-at-a-Glance: Developed using Evidence-based Rules and Weighted Algorithms

- **Functional Pillars of Health**
  - Infection
  - Inflammation
  - Insufficiency (Digestive)
  - Imbalance (Metabolic)
- **Global Gut Health Markers**
  - Based on DNA Commensal findings
  - Commensal Balance
  - Relative Abundance



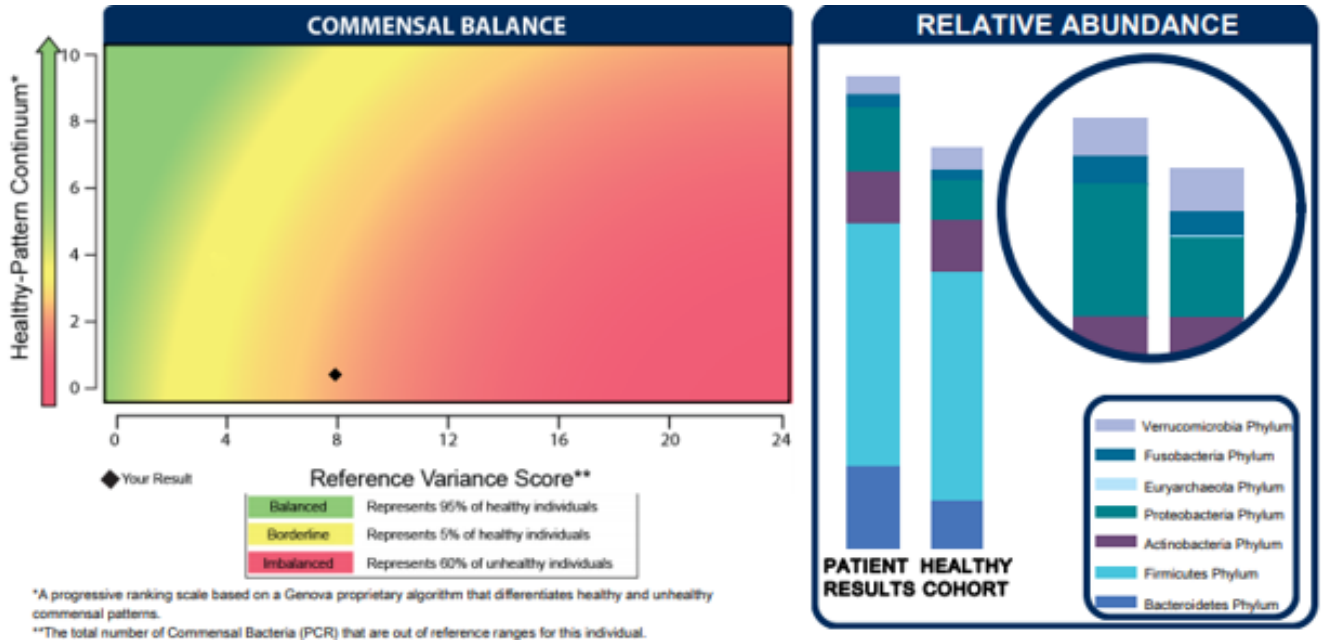
GENOVA DIAGNOSTICS

2200 GI Effects™ Comprehensive Profile - Stool



GENOVA DIAGNOSTICS

Commensal Balance and Relative Abundance Graphics Serve as General Markers of Gut Health

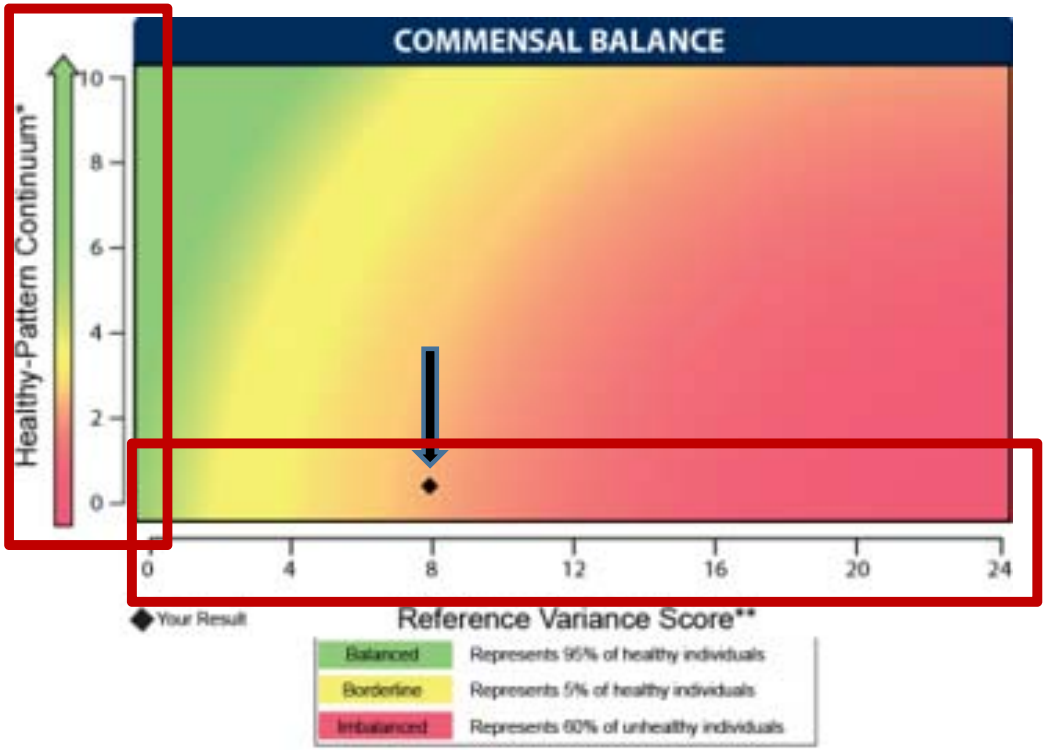


Commensal Balance (CB): Healthy-Pattern Continuum & Reference Variance Score

Relative Abundance (RA): Identifies the level of growth of select bacterial phyla

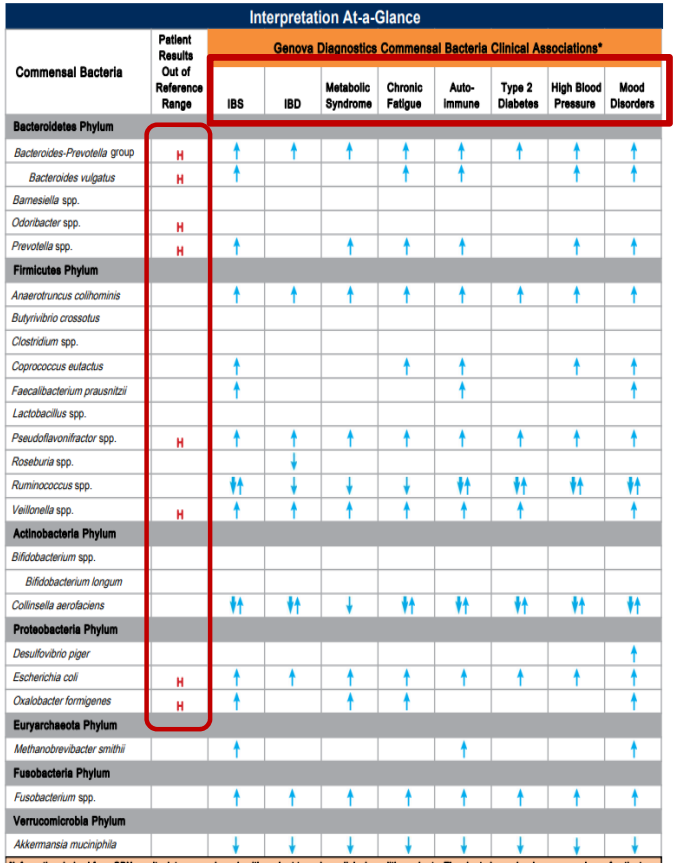
GENOVA DIAGNOSTICS

- The **Commensal Balance** is a composite of two measures:
  - 'X-axis': The **Reference Variance Score** reflects the total number of an individual patient's commensal bacteria (PCR) results that are out of reference range
  - 'Y-axis': The **Healthy-Pattern Continuum** (formerly known as the *Diversity Association Index*) is a progressive ranking scale which differentiates healthy and unhealthy commensal patterns



GENOVA DIAGNOSTICS

Biomarker Clinical Association Chart



Interpretation At-a-Glance									
Commensal Bacteria	Patient Results Out of Reference Range	Genova Diagnostics Commensal Bacteria Clinical Associations*							
		IBS	IBD	Metabolic Syndrome	Chronic Fatigue	Auto-immune	Type 2 Diabetes	High Blood Pressure	Mood Disorders
Bacteroidetes Phylum									
Bacteroides-Prevotella group	H	↑	↑	↑	↑	↑	↑	↑	↑
Bacteroides vulgatus	H	↑			↑	↑		↑	↑
Barnesiella spp.									
Odoribacter spp.	H								
Prevotella spp.	H	↑		↑	↑	↑		↑	↑
Firmicutes Phylum									
Anaerotruncus colihominis		↑	↑	↑	↑	↑	↑	↑	↑
Butyrivibrio crossotus									
Clostridium spp.									
Coprococcus eutactus		↑			↑	↑		↑	↑
Faecalibacterium prausnitzii		↑				↑			↑
Lactobacillus spp.									
Pseudoflavonifractor spp.	H	↑	↑	↑	↑	↑	↑	↑	↑
Roseburia spp.			↓						
Ruminococcus spp.		↑↑	↓	↓	↓	↑↑	↑↑	↑↑	↑↑
Veillonella spp.	H	↑	↑	↑	↑	↑	↑		↑
Actinobacteria Phylum									
Bifidobacterium spp.									
Bifidobacterium longum									
Collinsella aerofaciens		↑↑	↑↑	↓	↑↑	↑↑	↑↑	↑↑	↑↑
Proteobacteria Phylum									
Desulfovibrio piger									↑
Escherichia coli	H	↑	↑	↑	↑	↑	↑	↑	↑
Oxalobacter formigenes	H	↑		↑	↑				↑
Euryarchaeota Phylum									
Methanobrevibacter smithii		↑				↑			↑
Fusobacteria Phylum									
Fusobacterium spp.		↑	↑	↑	↑	↑	↑	↑	↑
Verrucomicrobia Phylum									
Akkermansia muciniphila		↓	↓	↓	↓	↓	↓	↓	↓

- Biomarkers found to have relevant associations with clinical conditions are displayed, along with the patient's results for these biomarkers
- These associations are:
  - Part of an ongoing research program
  - Will most likely evolve over time as data accrues and is refined
  - Reported for informational and clinical interest purposes only

GENOVA DIAGNOSTICS

Interpretation At-a-Glance

Commensal Bacteria	Patient Results Out of Reference Range	Genova Diagnostics Commensal Bacteria Cli					
		IBS	IBD	Metabolic Syndrome	Chronic Fatigue	Auto-immune	T D
Bacteroidetes Phylum							
Bacteroides-Prevotella group	H	↑	↑	↑	↑	↑	
Bacteroides vulgatus	H	↑			↑	↑	
Barnesiella spp.							
Odoribacter spp.	H						
Prevotella spp.	H	↑		↑	↑	↑	
Firmicutes Phylum							
Anaerotruncus colihominis		↑	↑	↑	↑	↑	
Butyrivibrio crossotus							
Clostridium spp.							
Coprococcus eutactus		↑			↑	↑	
Faecalibacterium prausnitzii		↑				↑	
Lactobacillus spp.							
Pseudoflavonifractor spp.	H	↑	↑	↑	↑	↑	
Roseburia spp.			↓				
Ruminococcus spp.		↑↓	↓	↓	↓	↑↓	
Veillonella spp.	H	↑	↑	↑	↑	↑	
Actinobacteria Phylum							
Bifidobacterium spp.							
Bifidobacterium longum							
Collinsella aerofaciens		↑↓	↑↓	↓	↑↓	↑↓	
Proteobacteria Phylum							
Desulfovibrio piger							
Escherichia coli	H	↑	↑	↑	↑	↑	
Oxalobacter formigenes	H	↑		↑	↑		
Euryarchaeota Phylum							
Methanobrevibacter smithii		↑				↑	
Fusobacteria Phylum							
Fusobacterium spp.		↑	↑	↑	↑	↑	
Verrucomicrobia Phylum							
Akkermansia muciniphila		↓	↓	↓	↓	↓	

Interpretation At-a-Glance

Biomarker	Patient Results Out of Reference Range	Genova Diagnostics Biomarker Clinical Associations*							
		IBS	IBD	Metabolic Syndrome	Chronic Fatigue	Auto-immune	Type 2 Diabetes	High Blood Pressure	Mood Disorders
Pancreatic Elastase	L	↓	↓	↓	↓	↓	↓	↓	↓
Products of Protein Breakdown (Total)							↑↓		
Fecal Fat (Total*)		↑		↑	↑	↑	↓↑	↑	↑
Triglycerides	H	↑			↑	↑	↑	↑	↑
Long-Chain Fatty Acids		↑			↑	↑	↓↑	↑	↑
Cholesterol	H						↓↑	↑	
Phospholipids		↑	↑	↑	↑	↑	↑	↑	↑
Calprotectin			↑					↑	
Eosinophil Protein X (EPX)			↑						
Fecal secretory IgA	H	↑	↑	↑	↑	↑	↑	↑	↑
Short-Chain Fatty Acids (SCFA) (Total)					↓	↓			
n-Butyrate Concentration	L			↓					
n-Butyrate %	L								
Acetate %					↑↓		↓↑		
Propionate %				↑			↑	↑	
Beta-glucuronidase	H					↑↓			↑↓

*Information derived from GDX results data comparing a healthy cohort to various clinical condition cohorts. The chart above showing a comparison of patient results to clincial conditions is meant for informational purposes only; it is not diagnostic, nor does it imply that the patient has a specific clinical diagnosis or condition.

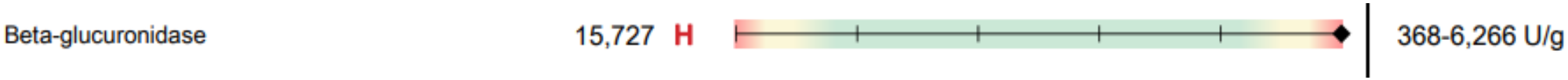
GI Effects™ Comprehensive Profile - Stool

Methodology: GC/MS, Automated Chemistry, EIA

	Results	QUINTILE DISTRIBUTION (1st 2nd 3rd 4th 5th)	Reference Range
Digestion and Absorption			
Pancreatic Elastase 1 †	98 L	100 200	>200 mcg/g
Products of Protein Breakdown (Total*) (Valerate, Isobutyrate, Isovalerate)	2.5		1.8-9.9 micromol/g
Fecal Fat (Total*)	26.7		3.2-38.6 mg/g
Triglycerides	4.6 H		0.3-2.8 mg/g
Long-Chain Fatty Acids	11.8		1.2-29.1 mg/g
Cholesterol	5.8 H		0.4-4.8 mg/g
Phospholipids	4.5		0.2-6.9 mg/g
Inflammation and Immunology			
Calprotectin †	<17	50 120	<=50 mcg/g
Eosinophil Protein X (EPX)†	<DL	1.1 4.6	<=4.6 mcg/g
Fecal secretory IgA	941 H		<=885 mcg/g
Gastrointestinal Microbiome			
Metabolic			
Short-Chain Fatty Acids (SCFA) (Total*) (Acetate, n-Butyrate, Propionate)	28.5		>=23.3 micromol/g
n-Butyrate Concentration	3.1 L		>=3.6 micromol/g
n-Butyrate %	10.9 L		11.8-33.3 %
Acetate %	60.8		48.1-69.2 %
Propionate %	28.3		<=29.3 %
Beta-glucuronidase	15,727 H		368-6,266 U/g

GENOVA DIAGNOSTICS

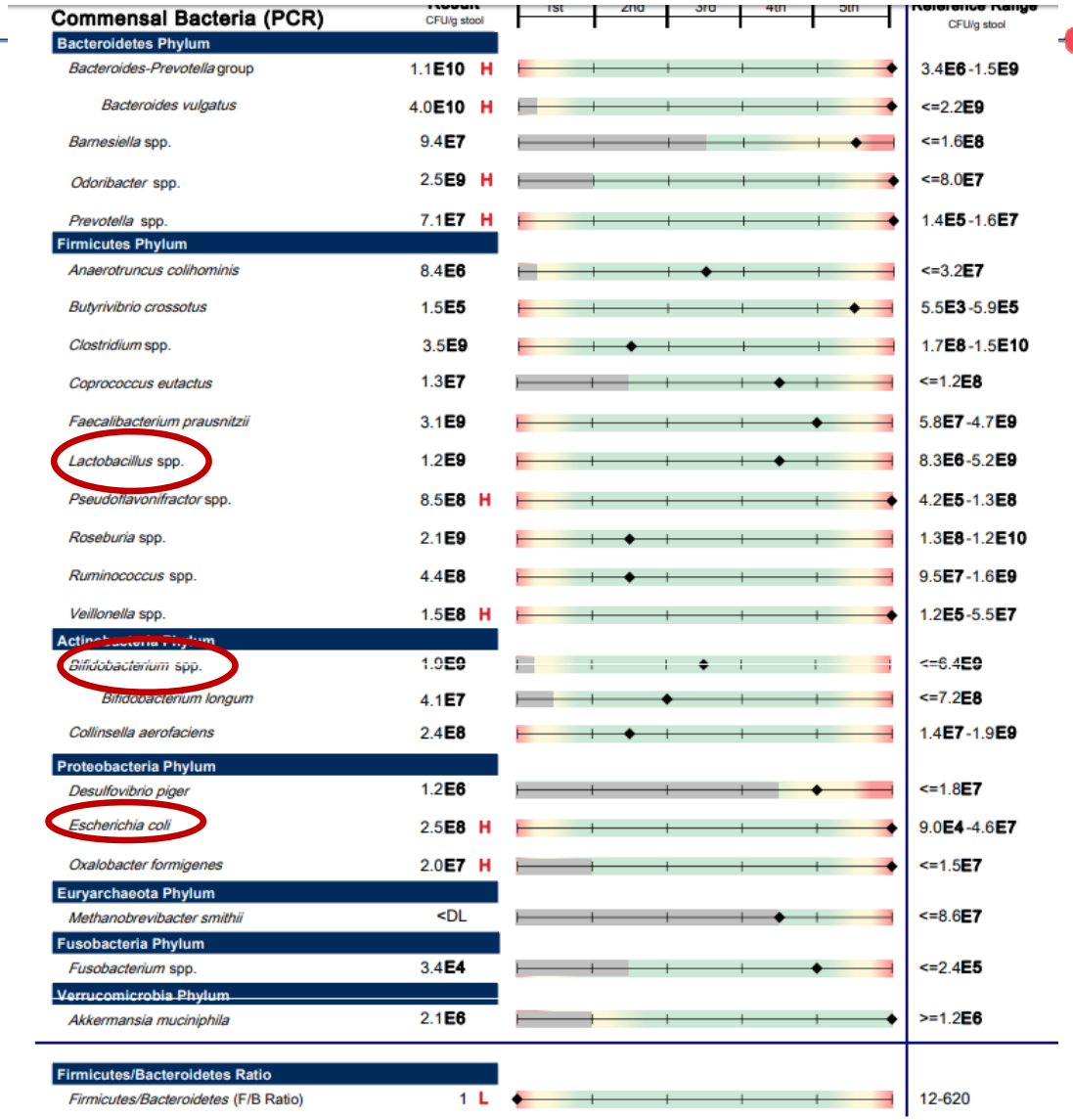
Beta-glucuronidase



- Beta-glucuronidase is an enzyme induced by anaerobic bacteria
  - Many toxins, hormones, and drugs are excreted from the body after conjugation to a glucuronide molecule. Beta-glucuronidase can uncouple these conjugates, freeing these potential carcinogens in the bowel and promoting recirculation of these compounds through enterohepatic pathways
- A moderate level of Beta-glucuronidase activity is preferred as activity appears to be important for normal enterohepatic recirculation of endogenous compounds and vitamins
- Limited human studies show a relationship to colon cancer and hormone-related cancers
  - Calcium D-glucarate inhibits action of enzyme

GENOVA DIAGNOSTICS

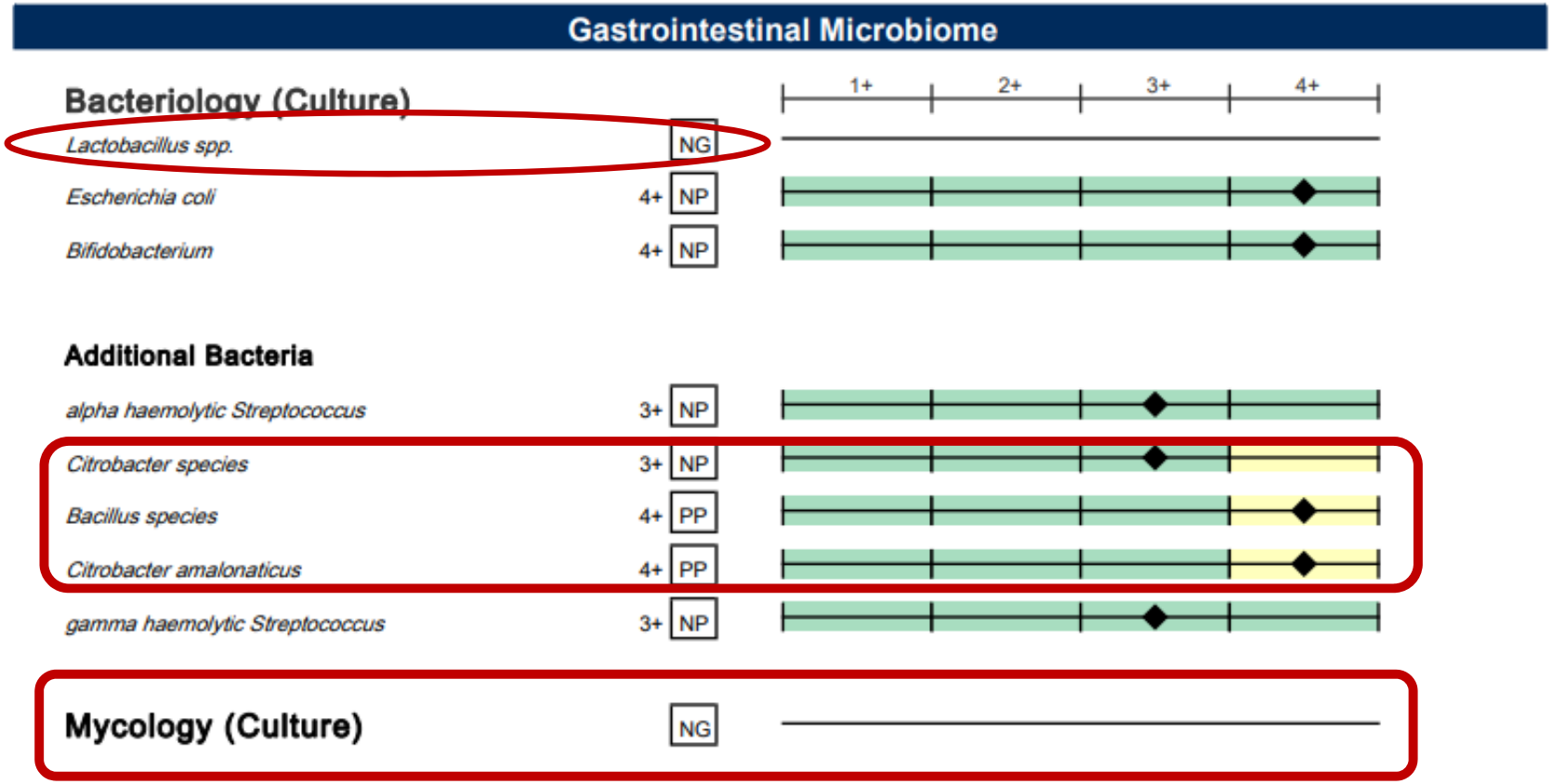
DNA: Quantitative



Commensal Bacteria (PCR)	Result CFU/g stool		Reference Range CFU/g stool
Bacteroidetes Phylum			
Bacteroides-Prevotella group	1.1E10	H	3.4E6-1.5E9
Bacteroides vulgatus	4.0E10	H	<=2.2E9
Barnesiella spp.	9.4E7		<=1.6E8
Odoribacter spp.	2.5E9	H	<=8.0E7
Prevotella spp.	7.1E7	H	1.4E5-1.6E7
Firmicutes Phylum			
Anaerotruncus colihominis	8.4E6		<=3.2E7
Butyrivibrio crossotus	1.5E5		5.5E3-5.9E5
Clostridium spp.	3.5E9		1.7E8-1.5E10
Coprococcus eutactus	1.3E7		<=1.2E8
Faecalibacterium prausnitzii	3.1E9		5.8E7-4.7E9
Lactobacillus spp.	1.2E9		8.3E6-5.2E9
Pseudoflavonifractor spp.	8.5E8	H	4.2E5-1.3E8
Roseburia spp.	2.1E9		1.3E8-1.2E10
Ruminococcus spp.	4.4E8		9.5E7-1.6E9
Veillonella spp.	1.5E8	H	1.2E5-5.5E7
Actinobacteria Phylum			
Bifidobacterium spp.	1.9E9		<=6.4E9
Bifidobacterium longum	4.1E7		<=7.2E8
Collinsella aerofaciens	2.4E8		1.4E7-1.9E9
Proteobacteria Phylum			
Desulfovibrio piger	1.2E6		<=1.8E7
Escherichia coli	2.5E8	H	9.0E4-4.6E7
Oxalobacter formigenes	2.0E7	H	<=1.5E7
Euryarchaeota Phylum			
Methanobrevibacter smithii	<DL		<=8.6E7
Fusobacteria Phylum			
Fusobacterium spp.	3.4E4		<=2.4E5
Verrucomicrobia Phylum			
Akkermansia muciniphila	2.1E6		>=1.2E6
Firmicutes/Bacteroidetes Ratio			
Firmicutes/Bacteroidetes (F/B Ratio)	1	L	12-620

GENOVA DIAGNOSTICS

Culture: Viability



GENOVA DIAGNOSTICS

Parasitology

Parasitology

Microscopic Exam Results**

No Ova or Parasites seen

Parasitology

Parasite Recovery: Literature suggests that >90% of enteric parasitic infections may be detected in a sample from a single stool collection. Increased sensitivity results from the collection of additional specimens on separate days.

Parasitology EIA Tests:

	In Range	Out of Range
Cryptosporidium◆	Negative	
Giardia lamblia◆	Negative	
Entamoeba histolytica◆	Negative	

GENOVA DIAGNOSTICS

Add-On Results

Methodology: EIA, Fecal Immunochemical Testing (FIT)

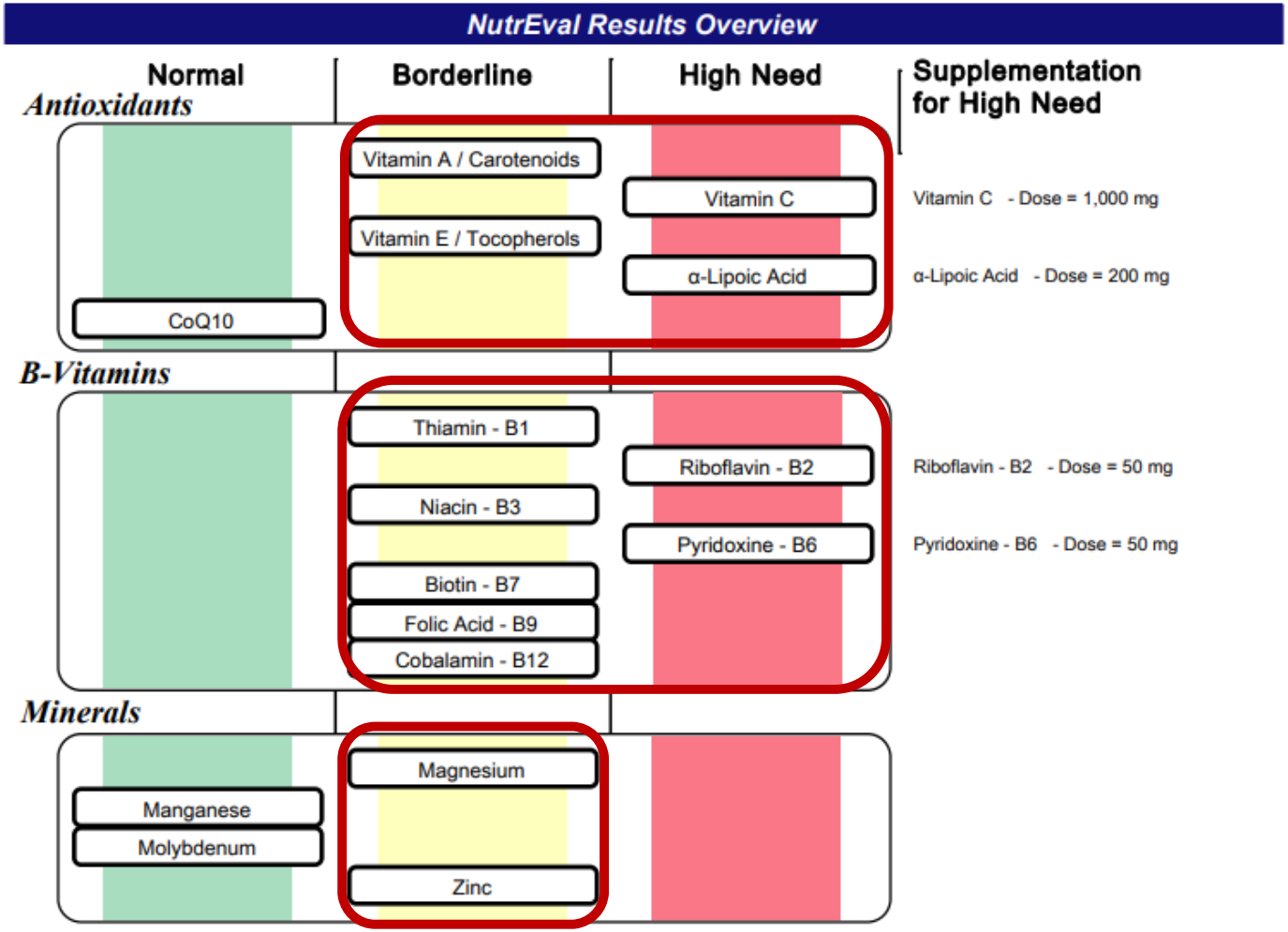
Additional Results

	Result	Expected Value
Fecal Occult Blood◆	Negative	Negative
Color††	Brown	
Consistency††	Formed/Normal	
HpSA - *H. pylori*	Negative	Negative
Campylobacter spp◆	Negative	Negative
Clostridium difficile◆**	Negative	Negative

Lab Comments (if applicable)

GENOVA DIAGNOSTICS

NutrEval



GENOVA DIAGNOSTICS

SUGGESTED SUPPLEMENT SCHEDULE

Supplements	Daily Recommended Intake (DRI)	Patient's Daily Recommendations	Provider Daily Recommendations
Antioxidants			
Vitamin A / Carotenoids	2,333 IU	5,000 IU	
Vitamin C	75 mg	1,000 mg	
Vitamin E / Tocopherols	22 IU	200 IU	
α-Lipoic Acid		200 mg	
CoQ10		30 mg	
B-Vitamins			
Thiamin - B1	1.1 mg	25 mg	
Riboflavin - B2	1.1 mg	50 mg	
Niacin - B3	14 mg	30 mg	
Pyridoxine - B6	1.3 mg	50 mg	
Biotin - B7	30 mcg	200 mcg	
Folic Acid - B9	400 mcg	800 mcg	
Cobalamin - B12	2.4 mcg	500 mcg	
Minerals			
Magnesium	320 mg	600 mg	
Manganese	1.8 mg	3.0 mg	
Molybdenum	45 mcg	75 mcg	
Zinc	8 mg	20 mg	
Essential Fatty Acids			
Omega-3 Oils	500 mg	1,000 mg	
Digestive Support			
Probiotics		50 billion CFU	
Pancreatic Enzymes		10,000 IU	
Other Vitamins			
Vitamin D	600 IU		

Amino Acid	mg/day	Amino Acid	mg/day
Arginine	0	Methionine	0
Asparagine	0	Phenylalanine	0
Cysteine	0	Serine	0
Glutamine	0	Taurine	0
Glycine	0	Threonine	0
Histidine	0	Tryptophan	0
Isoleucine	0	Tyrosine	0
Leucine	0	Valine	0
Lysine	0		

2200 GI Effects™ Comprehensive Profile - Stool

Interpretation At-a-Glance

INFECTION

INFLAMMATION

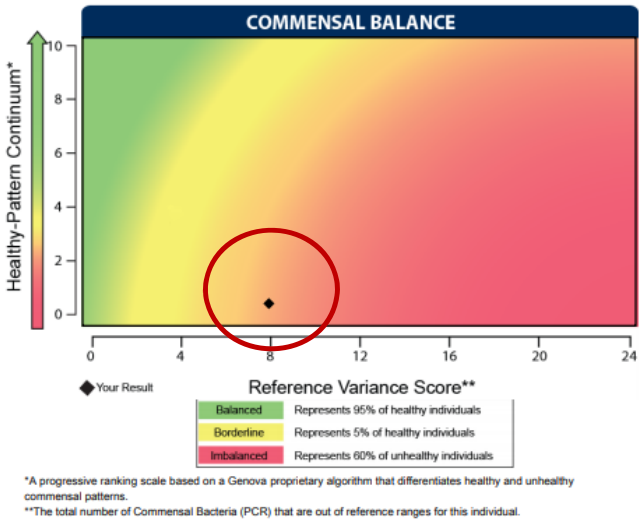
Fecal secretory IgA ▲

INSUFFICIENCY

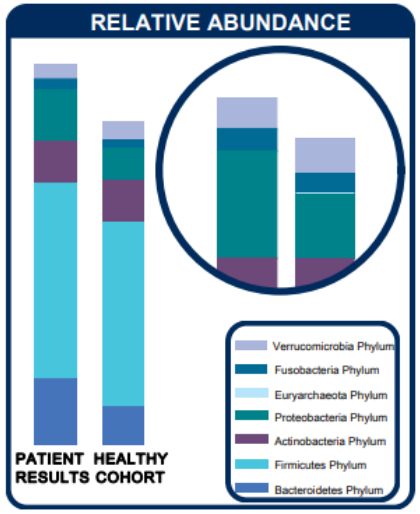
Pancreatic Elastase 1 ▼

IMBALANCE

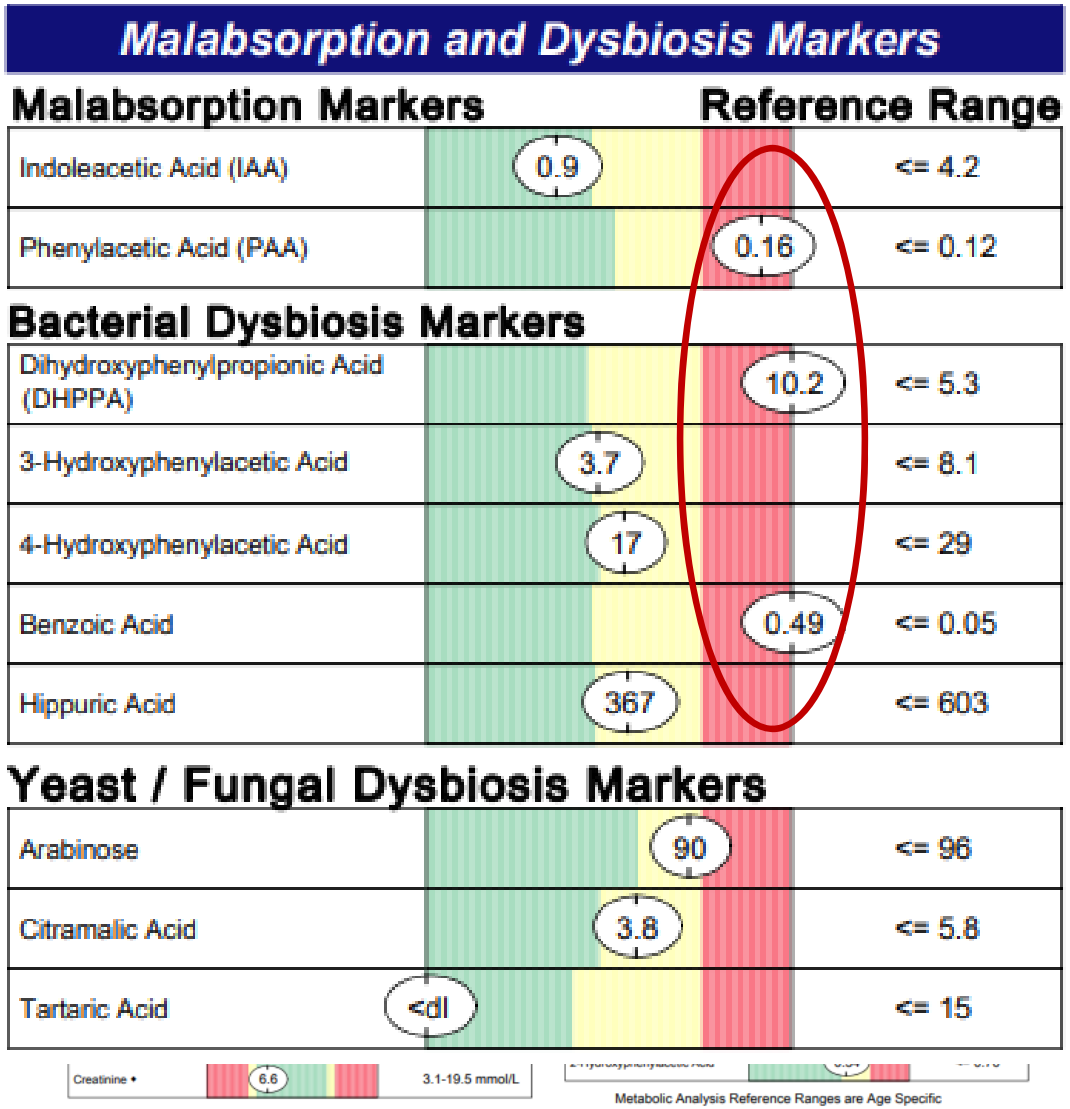
PP Bacteria ▲
n-Butyrate ▼
Beta-glucuronidase ▲
Total SCFA ▼



*A progressive ranking scale based on a Genova proprietary algorithm that differentiates healthy and unhealthy commensal patterns.
**The total number of Commensal Bacteria (PCR) that are out of reference ranges for this individual.

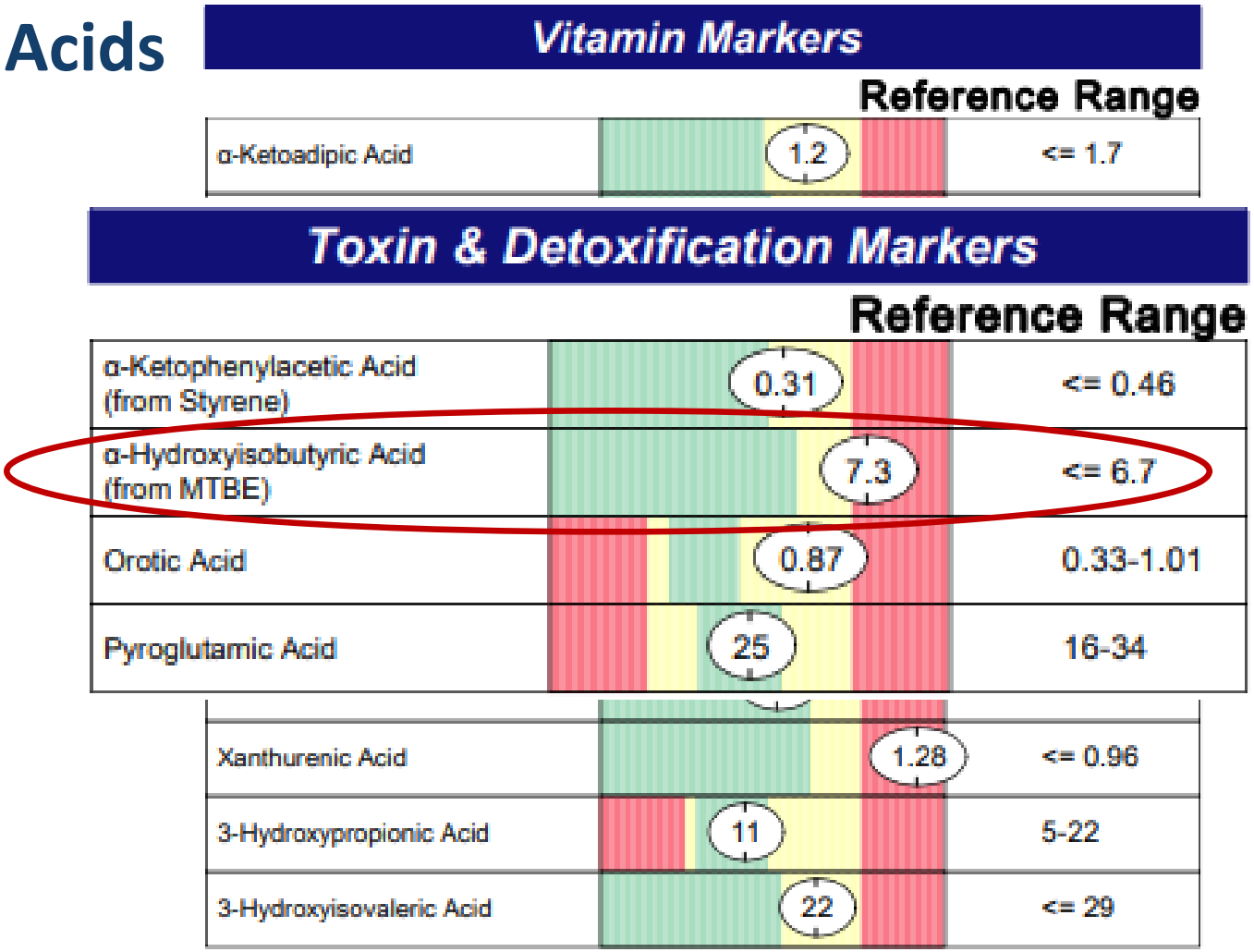


Organic Acids



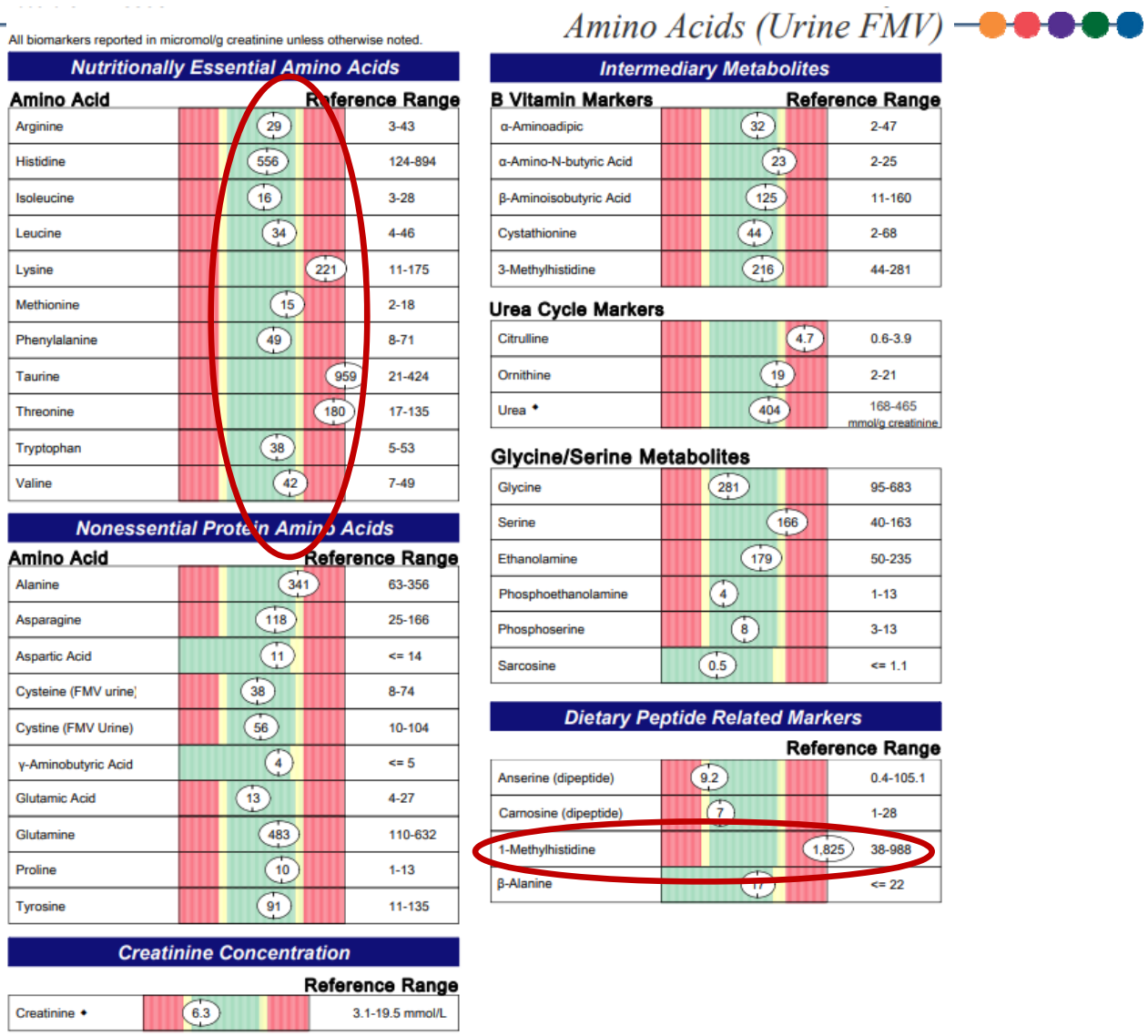
GENOVA DIAGNOSTICS

Organic Acids



GENOVA DIAGNOSTICS

Amino Acids (FMV)



Amino Acids (Urine FMV)

All biomarkers reported in micromol/g creatinine unless otherwise noted.

Nutritionally Essential Amino Acids

Amino Acid	Reference Range
Arginine	3-43
Histidine	124-894
Isoleucine	3-28
Leucine	4-46
Lysine	11-175
Methionine	2-18
Phenylalanine	8-71
Taurine	21-424
Threonine	17-135
Tryptophan	5-53
Valine	7-49

Nonessential Protein Amino Acids

Amino Acid	Reference Range
Alanine	63-356
Asparagine	25-166
Aspartic Acid	<= 14
Cysteine (FMV urine)	8-74
Cystine (FMV Urine)	10-104
γ-Aminobutyric Acid	<= 5
Glutamic Acid	4-27
Glutamine	110-632
Proline	1-13
Tyrosine	11-135

Creatinine Concentration

	Reference Range
Creatinine ◆	3.1-19.5 mmol/L

Intermediary Metabolites

B Vitamin Markers	Reference Range
α-Aminoadipic	2-47
α-Amino-N-butyric Acid	2-25
β-Aminoisobutyric Acid	11-160
Cystathionine	2-68
3-Methylhistidine	44-281

Urea Cycle Markers	
Citrulline	0.6-3.9
Ornithine	2-21
Urea ◆	168-465 mmol/g creatinine

Glycine/Serine Metabolites	
Glycine	95-683
Serine	40-163
Ethanolamine	50-235
Phosphoethanolamine	1-13
Phosphoserine	3-13
Sarcosine	<= 1.1

Dietary Peptide Related Markers

	Reference Range
Anserine (dipeptide)	0.4-105.1
Carnosine (dipeptide)	1-28
1-Methylhistidine	38-988
β-Alanine	<= 22

GENOVA DIAGNOSTICS

Essential and Metabolic Fatty Acids Markers (RBCs)

Omega 3 Fatty Acids

Analyte	(cold water fish, flax, walnut)	Reference Range
α-Linolenic (ALA) 18:3 n3	0.15	>= 0.09 wt %
Eicosapentaenoic (EPA) 20:5 n3	0.33	>= 0.16 wt %
Docosapentaenoic (DPA) 22:5 n3	1.37	>= 1.14 wt %
Docosahexaenoic (DHA) 22:6 n3	3.1	>= 2.1 wt %
% Omega 3s	4.9	>= 3.8

Omega 9 Fatty Acids

Analyte	(olive oil)	Reference Range
Oleic 18:1 n9	12	10-13 wt %
Nervonic 24:1 n9	4.3	2.1-3.5 wt %
% Omega 9s	16.6	13.3-16.6

Saturated Fatty Acids

Analyte	(meat, dairy, coconuts, palm oils)	Reference Range
Palmitic C16:0	19	18-23 wt %
Stearic C18:0	17	14-17 wt %
Arachidic C20:0	0.32	0.22-0.35 wt %
Behenic C22:0	0.98	0.92-1.68 wt %
Tricosanoic C23:0	0.22	0.12-0.18 wt %
Lignoceric C24:0	2.9	2.1-3.8 wt %
Pentadecanoic C15:0	0.06	0.07-0.15 wt %
Margaric C17:0	0.26	0.22-0.37 wt %
% Saturated Fats	40.2	39.8-43.6

Omega 6 Fatty Acids

Analyte	(vegetable oil, grains, most meats, dairy)	Reference Range
Linoleic (LA) 18:2 n6	13.7	10.5-16.9 wt %
γ-Linolenic (GLA) 18:3 n6	0.08	0.03-0.13 wt %
Dihomo-γ-linolenic (DGLA) 20:3 n6	1.28	>= 1.19 wt %
Arachidonic (AA) 20:4 n6	19	15-21 wt %
Docosatetraenoic (DTA) 22:4 n6	2.65	1.50-4.20 wt %
Eicosadienoic 20:2 n6	0.29	<= 0.26 wt %
% Omega 6s	36.9	30.5-39.7

Monounsaturated Fats

Omega 7 Fats		Reference Range
Palmitoleic 16:1 n7	0.16	<= 0.64 wt %
Vaccenic 18:1 n7	1.04	<= 1.13 wt %
Trans Fat		
Elaidic 18:1 n9t	0.20	<= 0.59 wt %

Delta - 6 Desaturase Activity

	Upregulated Functional Impaired	
Linoleic / DGLA 18:2 n6 / 20:3 n6	10.7	6.0-12.3

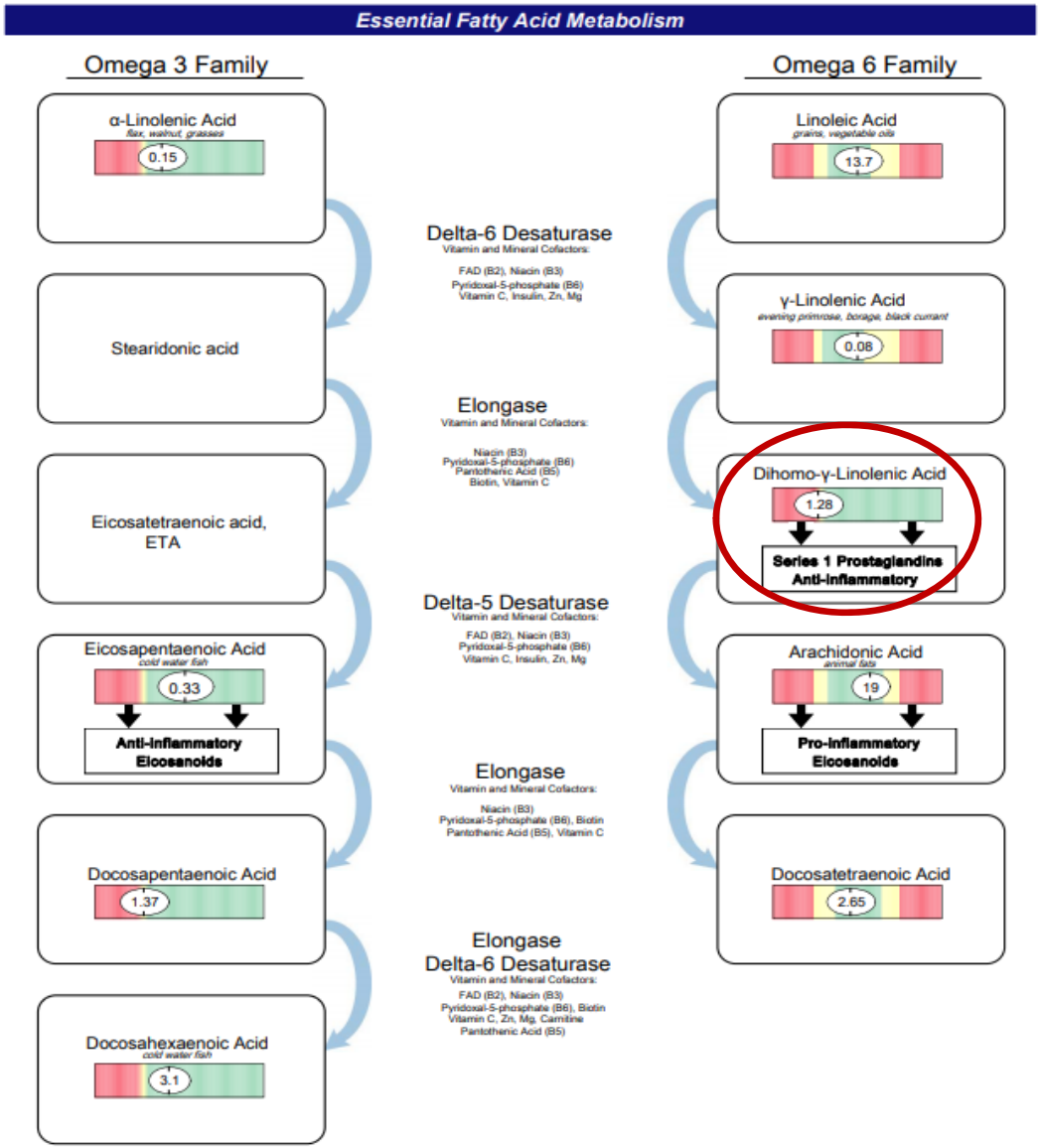
Cardiovascular Risk

Analyte		Reference Range
Omega 6s / Omega 3s	7.5	3.4-10.7
AA / EPA 20:4 n6 / 20:5 n3	57	12-125
Omega 3 Index	3.4	>= 4.0

The Essential Fatty Acid reference ranges are based on an adult population.

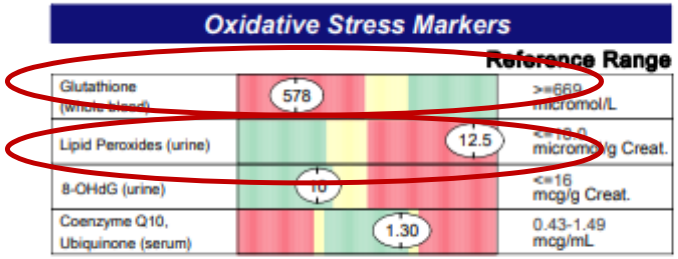
GENOVA DIAGNOSTICS

EMFAs



GENOVA DIAGNOSTICS

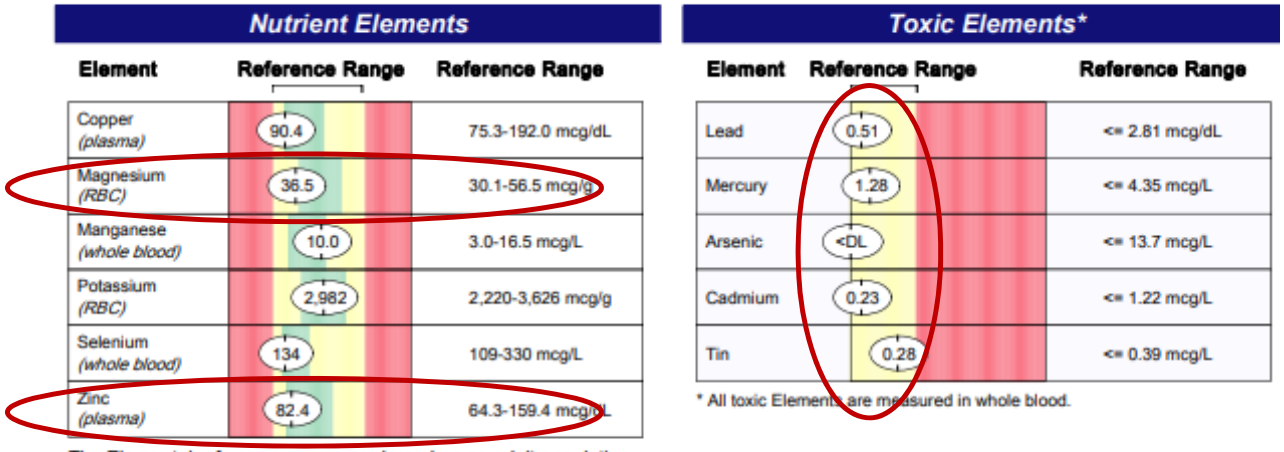
Oxidative Stress Markers



The Oxidative Stress reference ranges are based on an adult population.

The performance characteristics of the Oxidative Stress Markers have been verified by Genova Diagnostics, Inc. They have not been cleared by the U.S. Food and Drug Administration.

Elemental Markers



The Elemental reference ranges are based on an adult population.

The performance characteristics of the Elemental Markers have been verified by Genova Diagnostics, Inc. They have not been cleared by the U.S. Food and Drug Administration.

Elemental testing performed by Genova Diagnostics, Inc. 3425 Corporate Way, Duluth, GA 30096 - Robert M. David, PhD, Lab Director - CLIA Lic. #11D0255349 - Medicare Lic. #34-8475

GENOVA DIAGNOSTICS

Case Example #1

- 42 y/o female
- Loose stools x 18 months
- Endoscopy and colonoscopy were unremarkable
- Rapid transit time
- Dry skin with brittle nails
- Stress is moderate-to-high
- Standard American Diet, craves sweets
- Medications: occasional loperamide for diarrhea

GENOVA DIAGNOSTICS

Treatment Considerations

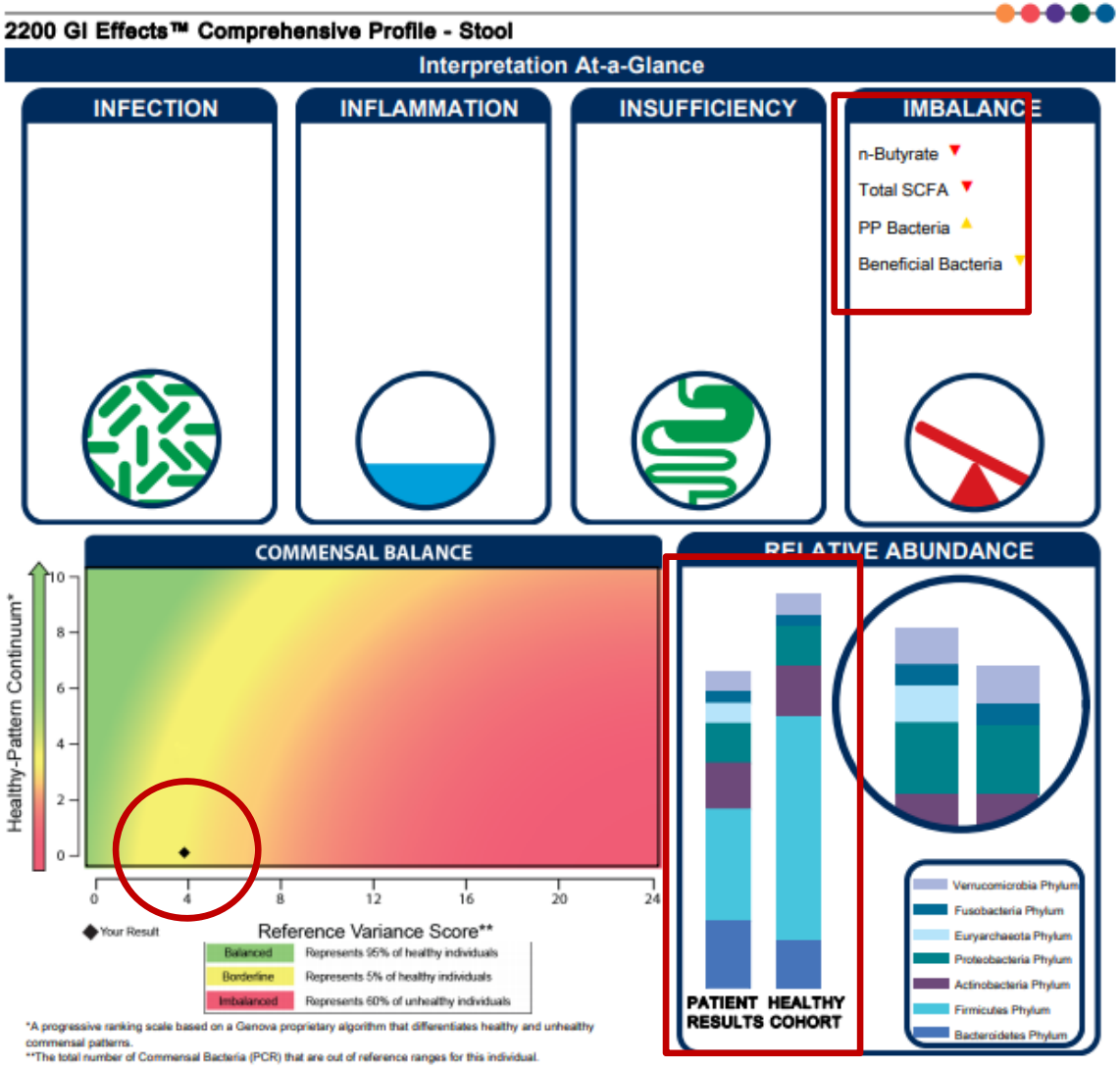
- Continue to monitor thyroid
- Balance gut with pre and probiotic therapy, consider fiber if SIBO dx eliminated
- Pancreatic enzyme support
- Evening primrose, borage for low DGLA
- Omega 3 supplementation
- Consider liver detox protocol
- Anti-oxidant support-Vitamin E, Vitamin C, Lipoic acid
- Follow-up with Adrenocortex Stress Profile with Cortisol Awakening Response
- SIBO testing
- Adjust to a more balanced diet

Case Example #2

- 35 y/o female
- Fatigue x 1 year
- Hashimoto's, treated to optimal TSH, FT4, FT3, etc.
- Occasional non-specific abdominal pain with loose stool
- 32-day cycle, occasionally irregular
- Endoscopy and colonoscopy were unremarkable
- High stress
- Lots of grains in diet (low protein intake)
- Medications: levothyroxine, selenium, omega-3 fish oil, once daily multi-vitamin

GENOVA DIAGNOSTICS

GI Effects


2200 GI Effects™ Comprehensive Profile - Stool
Interpretation At-a-Glance
INFECTION
INFLAMMATION
INSUFFICIENCY
IMBALANCE
n-Butyrate
Total SCFA
PP Bacteria
Beneficial Bacteria
COMMENSAL BALANCE
Healthy-Pattern Continuum*
0
2
4
6
8
10
0
4
8
12
16
20
24
Your Result
Reference Variance Score**
Balanced
Represents 95% of healthy individuals
Borderline
Represents 5% of healthy individuals
Imbalanced
Represents 60% of unhealthy individuals
*A progressive ranking scale based on a Genova proprietary algorithm that differentiates healthy and unhealthy commensal patterns.
**The total number of Commensal Bacteria (PCR) that are out of reference ranges for this individual.
RELATIVE ABUNDANCE
PATIENT RESULTS
HEALTHY COHORT
Verrucomicrobia Phylum
Fusobacteria Phylum
Euryarchaeota Phylum
Proteobacteria Phylum
Actinobacteria Phylum
Firmicutes Phylum
Bacteroidetes Phylum

Interpretation At-a-Glance

Commensal Bacteria	Patient Results Out of Reference Range	Genova Diagnostics Commensal Bacteria Clinical Associations*							
		IBS	IBD	Metabolic Syndrome	Chronic Fatigue	Auto-immune	Type 2 Diabetes	High Blood Pressure	Mood Disorders
Bacteroidetes Phylum									
Bacteroides-Prevotella group		↑	↑	↑	↑	↑	↑	↑	↑
Bacteroides vulgatus		↑			↑	↑		↑	↑
Barnesiella spp.									
Odoribacter spp.									
Prevotella spp.		↑		↑	↑	↑		↑	↑
Firmicutes Phylum									
Anaerotruncus colihominis		↑	↑	↑	↑	↑	↑	↑	↑
Butyrivibrio crossotus	L								
Clostridium spp.	L								
Coprococcus eutactus		↑			↑	↑		↑	↑
Faecalibacterium prausnitzii		↑				↑			↑
Lactobacillus spp.									
Pseudoflavonifractor spp.		↑	↑	↑	↑	↑	↑	↑	↑
Roseburia spp.			↓						
Ruminococcus spp.	L	**↓↑**	↓	↓	↓	**↓↑**	**↓↑**	**↓↑**	**↓↑**
Veillonella spp.	L	↑	↑	↑	↑	↑	↑		↑
Actinobacteria Phylum									
Bifidobacterium spp.									
Bifidobacterium longum									
Collinsella aerofaciens		**↓↑**	**↓↑**	↓	**↓↑**	**↓↑**	**↓↑**	**↓↑**	**↓↑**
Proteobacteria Phylum									
Desulfovibrio piger									↑
Escherichia coli		↑	↑	↑	↑	↑	↑	↑	↑
Oxalobacter formigenes		↑		↑	↑				↑
Euryarchaeota Phylum									
Methanobrevibacter smithii		↑				↑			↑
Fusobacteria Phylum									
Fusobacterium spp.		↑	↑	↑	↑	↑	↑	↑	↑
Verrucomicrobia Phylum									
Akkermansia muciniphila		↓	↓	↓	↓	↓	↓	↓	↓

***Information derived from GDX results data comparing a healthy cohort to various clinical condition cohorts. The chart above showing a comparison of patient results to clinical conditions is meant for informational purposes only; it is not diagnostic, nor does it imply that the patient has a specific clinical diagnosis or condition.**

The arrows indicate Genova's clinical condition cohort test results falling below ↓ or above ↑ the reference range that is greater than that of Genova's healthy cohort.

↓↑ Indicates Genova's clincial condition cohort test results falling below and above the reference range that are greater than that of Genova's healthy cohort.

Cells with bolded arrows indicate Genova's clinical condition cohort had more test results falling above versus below **↓↓** or more below versus above **↑↑** the reference range compared to that of Genova's healthy cohort.

GENOVA DIAGNOSTICS

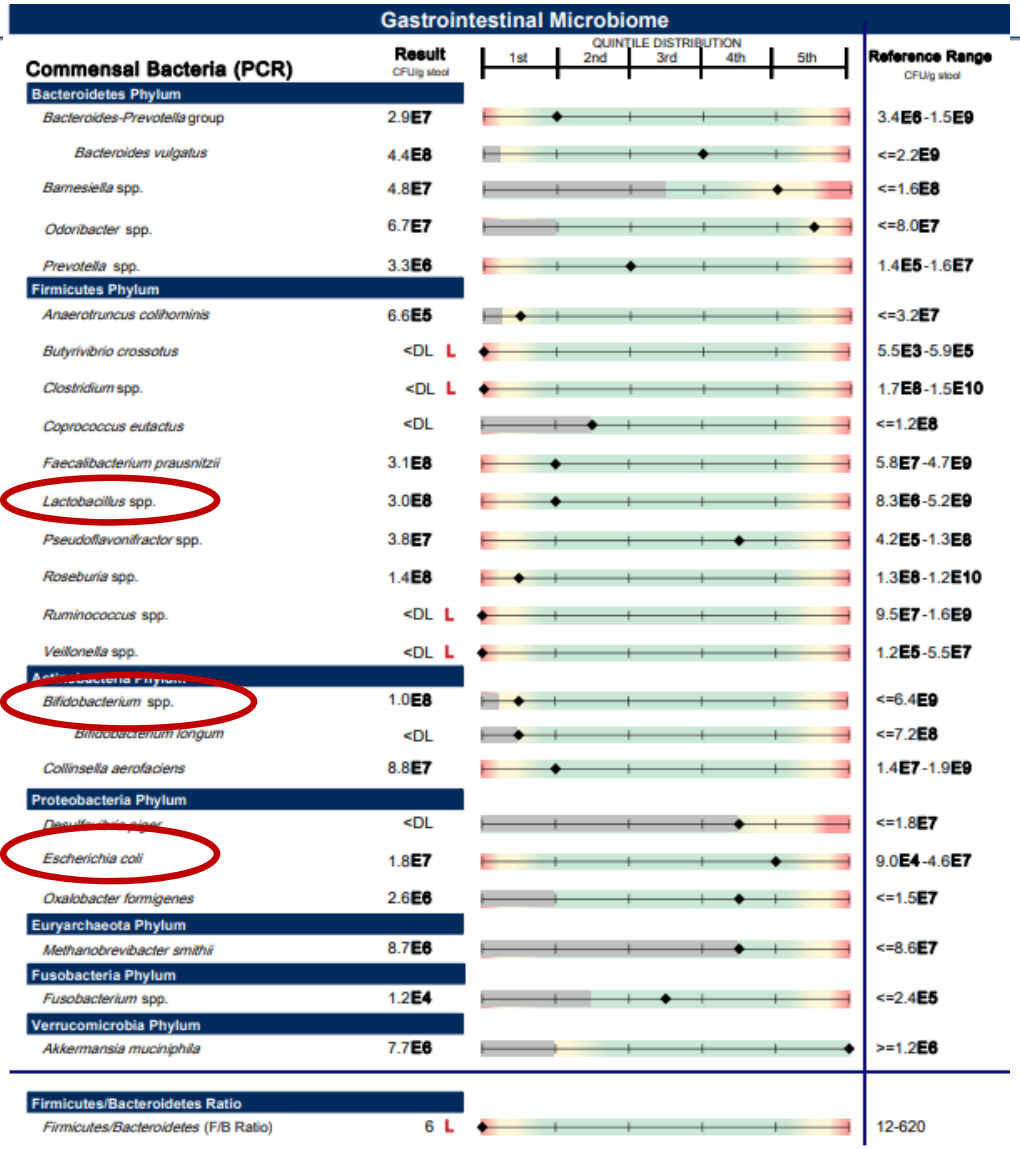
GI Effects™ Comprehensive Profile - Stool

Methodology: GC/MS, Automated Chemistry, EIA

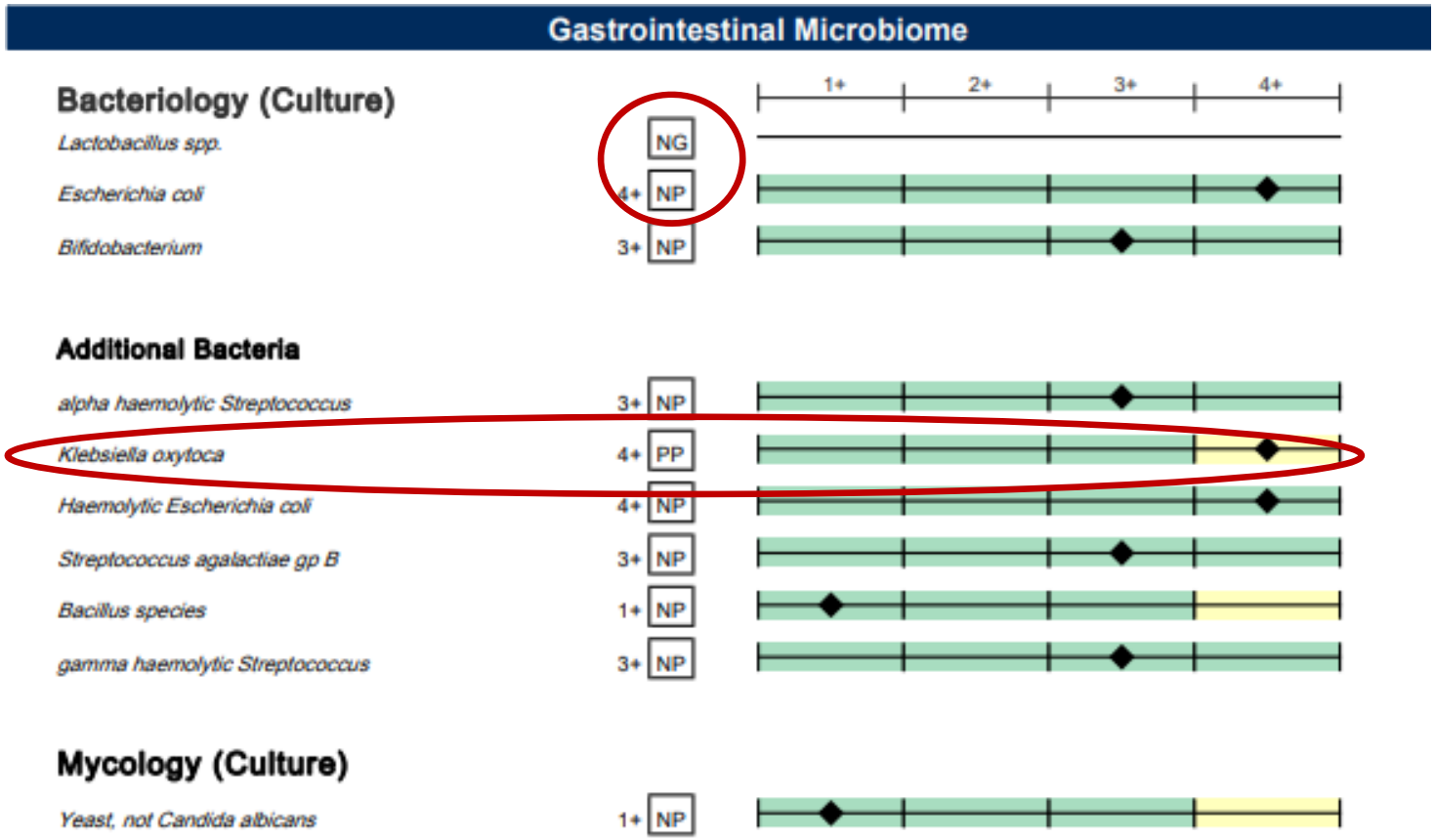
	Results	QUINTILE DISTRIBUTION (1st / 2nd / 3rd / 4th / 5th)	Reference Range
Digestion and Absorption			
Pancreatic Elastase 1 †	227	100 / 200	>200 mcg/g
Products of Protein Breakdown (Total*) (Valerate, Isobutyrate, Isovalerate)	2.8		1.8-9.9 micromol/g
Fecal Fat (Total*)	16.8		3.2-38.6 mg/g
Triglycerides	0.9		0.3-2.8 mg/g
Long-Chain Fatty Acids	10.1		1.2-29.1 mg/g
Cholesterol	0.8		0.4-4.8 mg/g
Phospholipids	5.0		0.2-6.9 mg/g
Inflammation and Immunology			
Calprotectin †	<17	50 / 120	<=50 mcg/g
Eosinophil Protein X (EPX)†	0.4	1.1 / 4.6	<=4.6 mcg/g
Fecal secretory IgA	119		<=885 mcg/g
Gastrointestinal Microbiome			
Metabolic			
Short-Chain Fatty Acids (SCFA) (Total*) (Acetate, n-Butyrate, Propionate)	19.7 L		>=23.3 micromol/g
n-Butyrate Concentration	3.5 L		>=3.6 micromol/g
n-Butyrate %	17.8		11.8-33.3 %
Acetate %	63.6		48.1-69.2 %
Propionate %	18.8		<=29.3 %
Beta-glucuronidase	2,182		368-6,266 U/g

GENOVA DIAGNOSTICS

Commensal Bacteria



GENOVA DIAGNOSTICS



GENOVA DIAGNOSTICS

Parasitology

Microscopic Exam Results**

No Ova or Parasites seen

Parasitology

Parasite Recovery: Literature suggests that >90% of enteric parasitic infections may be detected in a sample from a single stool collection. Increased sensitivity results from the collection of additional specimens on separate days.

Parasitology EIA Tests:

	In Range	Out of Range
Cryptosporidium•	Negative	
Giardia lamblia•	Negative	
Entamoeba histolytica•	Negative	

GENOVA DIAGNOSTICS

Bacteria Sensitivity

Prescriptive Agents

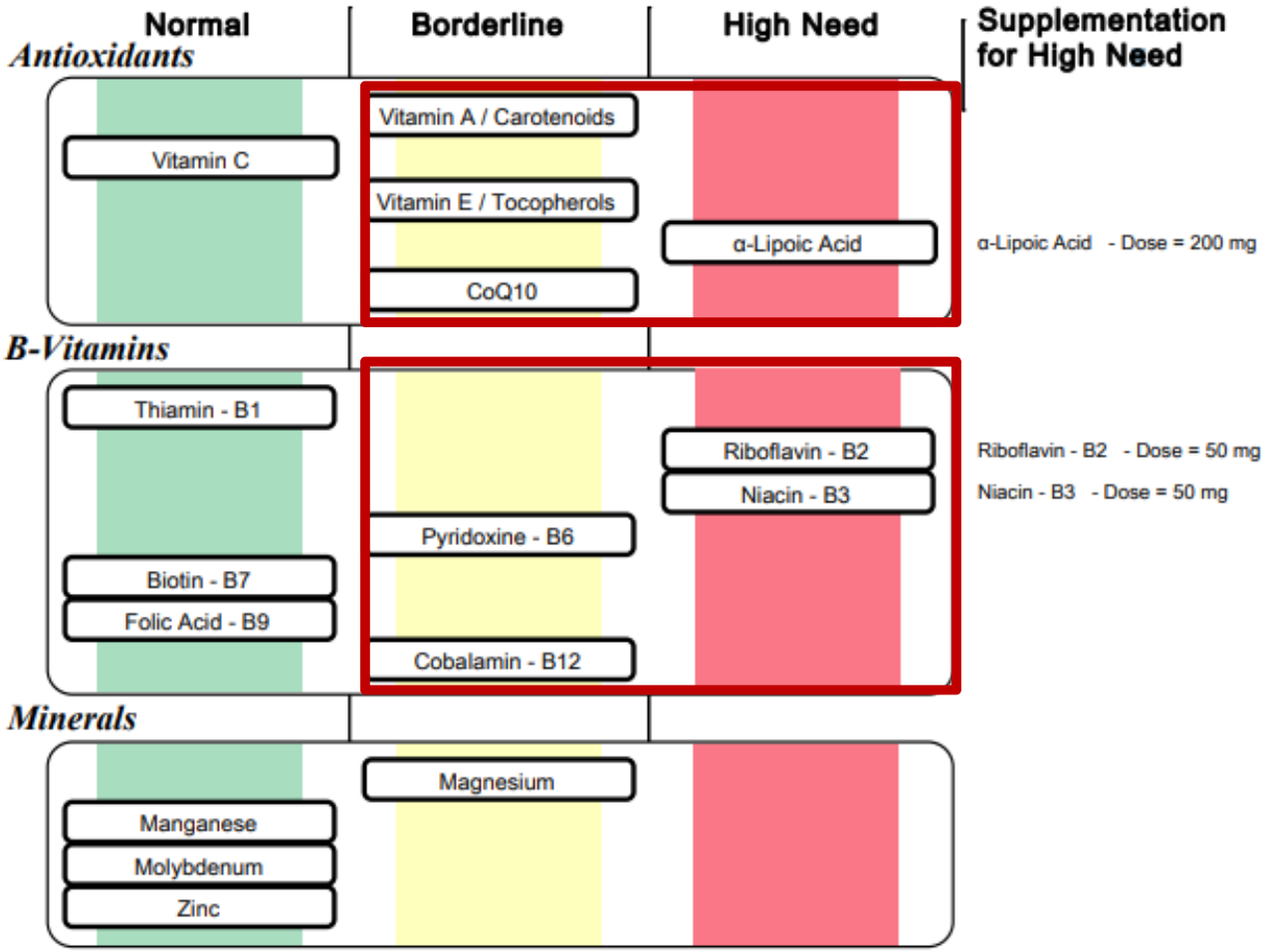
Klebsiella oxytoca	R	I	S-DD	S	NI
Ampicillin	R				
Amox./Clavulanic Acid				S	
Cephalothin				S	
Ciprofloxacin				S	
Tetracycline				S	
Trimethoprim/Sulfa				S	

Natural Agents

Klebsiella oxytoca	LOW INHIBITION	HIGH INHIBITION
Berberine		
Oregano		
Plant Tannins		
Uva-Ursi		

GENOVA DIAGNOSTICS

NutrEval Results Overview



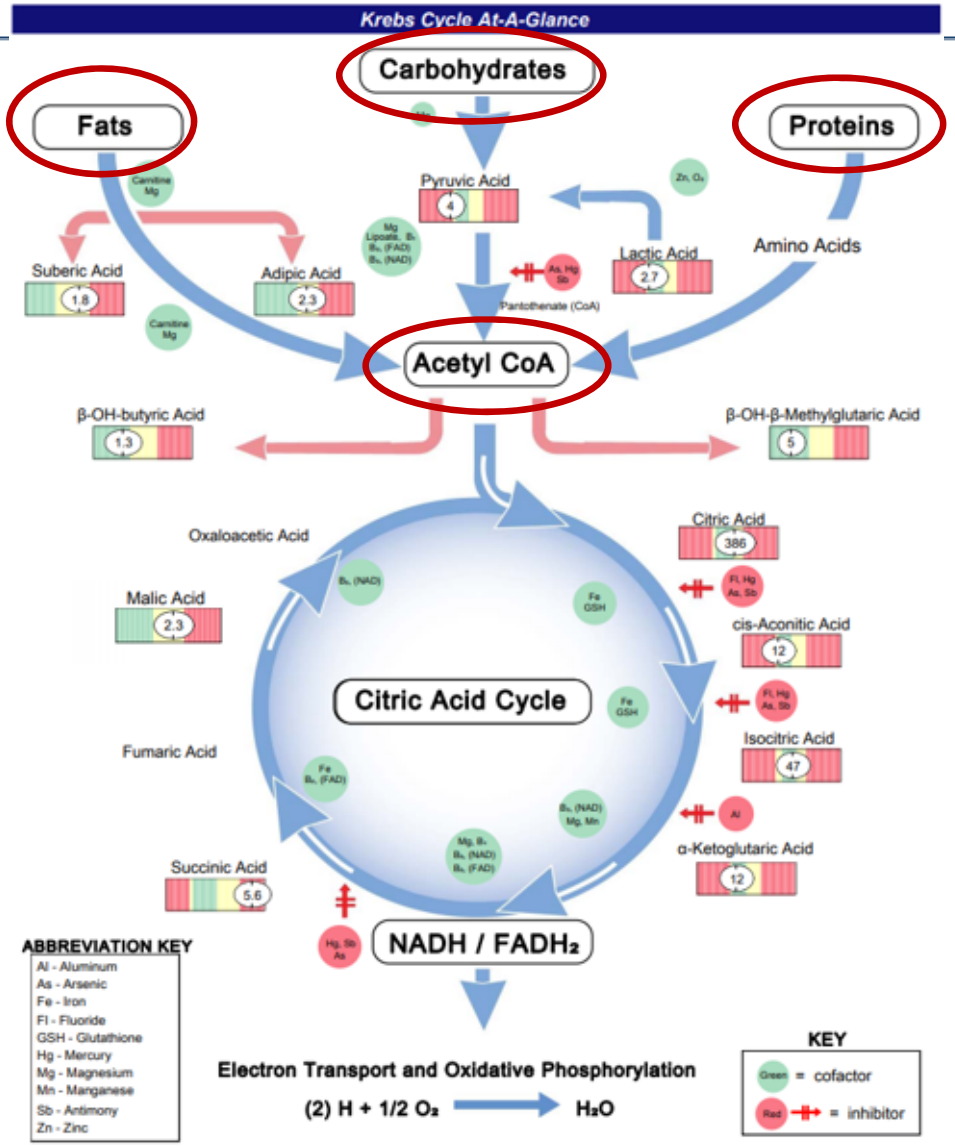
GENOVA DIAGNOSTICS

SUGGESTED SUPPLEMENT SCHEDULE

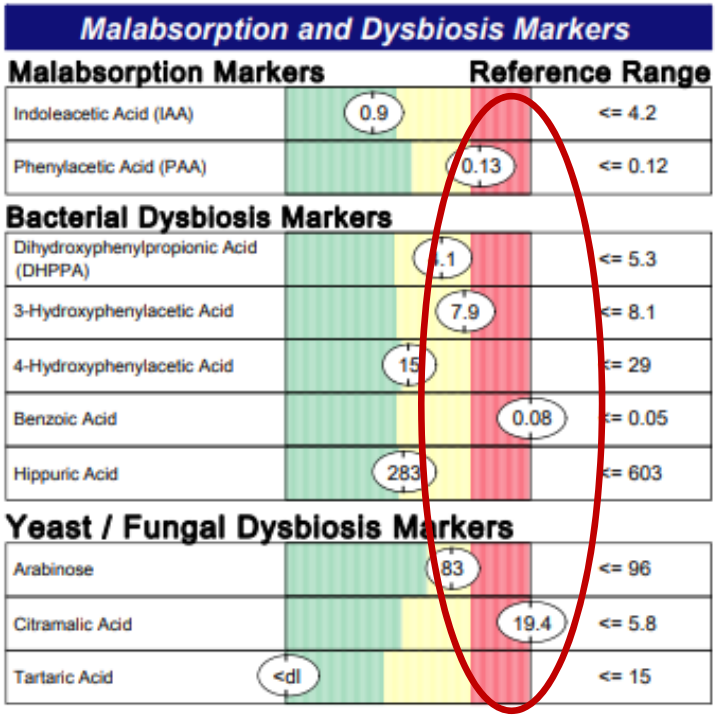
Supplements	Daily Recommended Intake (DRI)	Patient's Daily Recommendations	Provider Daily Recommendations
Antioxidants			
Vitamin A / Carotenoids	2,333 IU	5,000 IU	
Vitamin C	75 mg	250 mg	
Vitamin E / Tocopherols	22 IU	200 IU	
α-Lipoic Acid		200 mg	
CoQ10		60 mg	
B-Vitamins			
Thiamin - B1	1.1 mg	10 mg	
Riboflavin - B2	1.1 mg	50 mg	
Niacin - B3	14 mg	50 mg	
Pyridoxine - B6	1.3 mg	25 mg	
Biotin - B7	30 mcg	100 mcg	
Folic Acid - B9	400 mcg	400 mcg	
Cobalamin - B12	2.4 mcg	500 mcg	
Minerals			
Magnesium	320 mg	600 mg	
Manganese	1.8 mg	3.0 mg	
Molybdenum	45 mcg	75 mcg	
Zinc	8 mg	10 mg	
Essential Fatty Acids			
Omega-3 Oils	500 mg	500 mg	
Digestive Support			
Probiotics		25 billion CFU	
Pancreatic Enzymes		10,000 IU	
Other Vitamins			
Vitamin D	600 IU		

Amino Acid	mg/day	Amino Acid	mg/day
Arginine	195	Methionine	404
Asparagine	287	Phenylalanine	4
Cysteine	0	Serine	0
Glutamine	1,165	Taurine	0
Glycine	2,553	Threonine	292
Histidine	990	Tryptophan	0
Isoleucine	150	Tyrosine	547
Leucine	0	Valine	0
Lysine	14		

GENOVA DIAGNOSTICS



GENOVA DIAGNOSTICS



Metabolic Analysis Markers (Urine)

All biomarkers reported in mmol/mol creatinine unless otherwise noted.

Malabsorption and Dysbiosis Markers

Malabsorption Markers		Reference Range
Indoleacetic Acid (IAA)	0.9	<= 4.2
Phenylacetic Acid (PAA)	0.13	<= 0.12
Bacterial Dysbiosis Markers		
Dihydroxyphenylpropionic Acid (DHPPA)	4.1	<= 5.3
3-Hydroxyphenylacetic Acid	7.9	<= 8.1
4-Hydroxyphenylacetic Acid	15	<= 29
Benzoic Acid	0.08	<= 0.05
Hippuric Acid	283	<= 603
Yeast / Fungal Dysbiosis Markers		
Arabinose	83	<= 96
Citramalic Acid	19.4	<= 5.8
Tartaric Acid	<dl	<= 15

Cellular Energy & Mitochondrial Metabolites

Carbohydrate Metabolism		Reference Range
Lactic Acid	2.7	1.9-19.8
Pyruvic Acid	4	7-32
β-OH-Butyric Acid (BHBA)	1.3	<= 2.8
Energy Metabolism		
Citric Acid	386	40-520
Cis-Aconitic Acid	12	10-36
Isocitric Acid	47	22-65
α-Ketoglutaric Acid (AKG)	12	4-52
Succinic Acid	5.6	0.4-4.6
Malic Acid		
β-OH-β-Methylglutaric Acid (HMG)	5	<= 15
Fatty Acid Metabolism		
Adipic Acid	2.3	<= 2.8
Suberic Acid	1.8	<= 2.1

Creatinine Concentration

		Reference Range
Creatinine •	10.0	3.1-19.5 mmol/L

Neurotransmitter Metabolites

		Reference Range
Vanilmandelic Acid	1.4	0.4-3.6
Homovanillic Acid	4.3	1.2-5.3
5-OH-indoleacetic Acid	8.9	3.8-12.1
3-Methyl-4-OH-phenylglycol	0.04	0.02-0.22
Kynurenic Acid	7.2	<= 7.1
Quinolinic Acid	2.8	<= 9.1
Kynurenic / Quinolinic Ratio	2.57	>= 0.44

Vitamin Markers

		Reference Range
α-Ketoadipic Acid	0.6	<= 1.7
α-Ketoisovaleric Acid	0.13	<= 0.97
α-Ketoisocaproic Acid	0.17	<= 0.89
α-Keto-β-Methylvaleric Acid	0.5	<= 2.1
Formiminoglutamic Acid (FIGlu)	0.6	<= 1.5
Glutaric Acid	0.52	<= 0.51
Isovalerylglycine	1.8	<= 3.7
Methylmalonic Acid	0.9	<= 1.9
Xanthurenic Acid	0.51	<= 0.96
3-Hydroxypropionic Acid	10	5-22
3-Hydroxyisovaleric Acid	15	<= 29

Toxin & Detoxification Markers

		Reference Range
α-Ketophenylacetic Acid (from Styrene)	0.27	<= 0.46
α-Hydroxyisobutyric Acid (from MTBE)	4.7	<= 6.7
Orotic Acid	0.77	0.33-1.01
Pyroglutamic Acid	31	16-34

Tyrosine Metabolism

		Reference Range
Homogentisic Acid	18	<= 19
2-Hydroxyphenylacetic Acid	0.47	<= 0.76

Metabolic Analysis Reference Ranges are Age Specific

GENOVA DIAGNOSTICS

Amino Acids (Urine FMV)

All biomarkers reported in micromol/g creatinine unless otherwise noted.

Nutritionally Essential Amino Acids

Amino Acid	Reference Range
Arginine	3-43
Histidine	124-894
Isoleucine	3-28
Leucine	4-46
Lysine	11-175
Methionine	2-18
Phenylalanine	8-71
Taurine	21-424
Threonine	17-135
Tryptophan	5-53
Valine	7-49

Nonessential Protein Amino Acids

Amino Acid	Reference Range
Alanine	63-356
Asparagine	25-166
Aspartic Acid	<= 14
Cysteine (FMV urine)	8-74
Cystine (FMV Urine)	10-104
γ-Aminobutyric Acid	<= 5
Glutamic Acid	4-27
Glutamine	110-632
Proline	1-13
Tyrosine	11-135

Intermediary Metabolites

B Vitamin Markers	Reference Range
α-Aminoadipic	2-47
α-Amino-N-butyric Acid	2-25
β-Aminoisobutyric Acid	11-160
Cystathionine	2-68
3-Methylhistidine	44-281

Urea Cycle Markers	Reference Range
Citrulline	0.6-3.9
Ornithine	2-21
Urea *	168-465 mmol/g creatinine

Glycine/Serine Metabolites	Reference Range
Glycine	95-683
Serine	40-163
Ethanolamine	50-235
Phosphoethanolamine	1-13
Phosphoserine	3-13
Sarcosine	<= 1.1

Dietary Peptide Related Markers

	Reference Range
Anserine (dipeptide)	0.4-105.1
Carnosine (dipeptide)	1-28
1-Methylhistidine	38-988
β-Alanine	<= 22

GENOVA DIAGNOSTICS

Essential and Metabolic Fatty Acids Markers (RBCs)

Omega 3 Fatty Acids

Analyte	(cold water fish, flax, walnut)	Reference Range
α-Linolenic (ALA) 18:3 n3	0.13	>= 0.09 wt %
Eicosapentaenoic (EPA) 20:5 n3	2.44	>= 0.16 wt %
Docosapentaenoic (DPA) 22:5 n3	2.71	>= 1.14 wt %
Docosahexaenoic (DHA) 22:6 n3	4.9	>= 2.1 wt %
% Omega 3s	10.2	>= 3.8

Omega 9 Fatty Acids

Analyte	(olive oil)	Reference Range
Oleic 18:1 n9	11	10-13 wt %
Nervonic 24:1 n9	3.0	2.1-3.5 wt %
% Omega 9s	14.5	13.3-16.6

Saturated Fatty Acids

Analyte	(meat, dairy, coconuts, palm oils)	Reference Range
Palmitic C16:0	20	18-23 wt %
Stearic C18:0	19	14-17 wt %
Arachidic C20:0	0.35	0.22-0.35 wt %
Behenic C22:0	1.07	0.92-1.68 wt %
Tricosanoic C23:0	0.19	0.12-0.18 wt %
Lignoceric C24:0	2.8	2.1-3.8 wt %
Pentadecanoic C15:0	0.07	0.07-0.15 wt %
Margaric C17:0	0.29	0.22-0.37 wt %
% Saturated Fats	43.6	39.8-43.6

Methodology: GCMS

Omega 6 Fatty Acids

Analyte	(vegetable oil, grains, most meats, dairy)	Reference Range
Linoleic (LA) 18:2 n6	10.5	10.5-16.9 wt %
γ-Linolenic (GLA) 18:3 n6	0.09	0.03-0.13 wt %
Dihomo-γ-linolenic (DGLA) 20:3 n6	1.12	>= 1.19 wt %
Arachidonic (AA) 20:4 n6	17	15-21 wt %
Docosatetraenoic (DTA) 22:4 n6	2.03	1.50-4.20 wt %
Eicosadienoic 20:2 n6	0.26	<= 0.26 wt %
% Omega 6s	30.5	30.5-39.7

Monounsaturated Fats

Omega 7 Fats		Reference Range
Palmitoleic 16:1 n7	0.21	<= 0.64 wt %
Vaccenic 18:1 n7	0.71	<= 1.13 wt %
Trans Fat		
Elaidic 18:1 n9t	0.26	<= 0.59 wt %

Delta - 6 Desaturase Activity

	Upregulated Functional Impaired	
Linoleic / DGLA 18:2 n6 / 20:3 n6	9.3	6.0-12.3

Cardiovascular Risk

Analyte		Reference Range
Omega 6s / Omega 3s	3.0	3.4-10.7
AA / EPA 20:4 n6 / 20:5 n3	7	12-125
Omega 3 Index	7.3	>= 4.0

The Essential Fatty Acid reference ranges are based on an adult population.

GENOVA DIAGNOSTICS

Oxidative Stress Markers

Oxidative Stress Markers

Methodology: Colorimetric, thiobarbituric acid reactive substances (TBARS), Alkaline Picrate, Hexokinase/G-6-PDH, LC/MS/MS, HPLC

	Reference Range
Glutathione (whole blood)	1,141 — >=669 micromol/L
Lipid Peroxides (urine)	10.0 — <=10.0 micromol/g Creat.
8-OHdG (urine)	7 — <=15 mcg/g Creat.
Coenzyme Q10, Ubiquinone (serum)	1.09 — 0.43-1.49 mcg/mL

The Oxidative Stress reference ranges are based on an adult population.

The performance characteristics of the Oxidative Stress Markers have been verified by Genova Diagnostics, Inc. They have not been cleared by the U.S. Food and Drug Administration.

Elemental Markers

Nutrient Elements

Element	Reference Range	Reference Range
Copper *(plasma)*	91.3	75.3-192.0 mcg/dL
Magnesium *(RBC)*	37.7	30.1-56.5 mcg/g
Manganese *(whole blood)*	5.5	3.0-16.5 mcg/L
Potassium *(RBC)*	2,527	2,220-3,626 mcg/g
Selenium *(whole blood)*	341	109-330 mcg/L
Zinc *(plasma)*	122.4	64.3-159.4 mcg/dL

Toxic Elements*

Element	Reference Range	Reference Range
Lead	0.98	<= 2.81 mcg/dL
Mercury	1.69	<= 4.35 mcg/L
Arsenic	1.1	<= 13.7 mcg/L
Cadmium	0.20	<= 1.22 mcg/L
Tin	<DL	<= 0.39 mcg/L

* All toxic Elements are measured in whole blood.

Methodology: ICP-MS

GENOVA DIAGNOSTICS

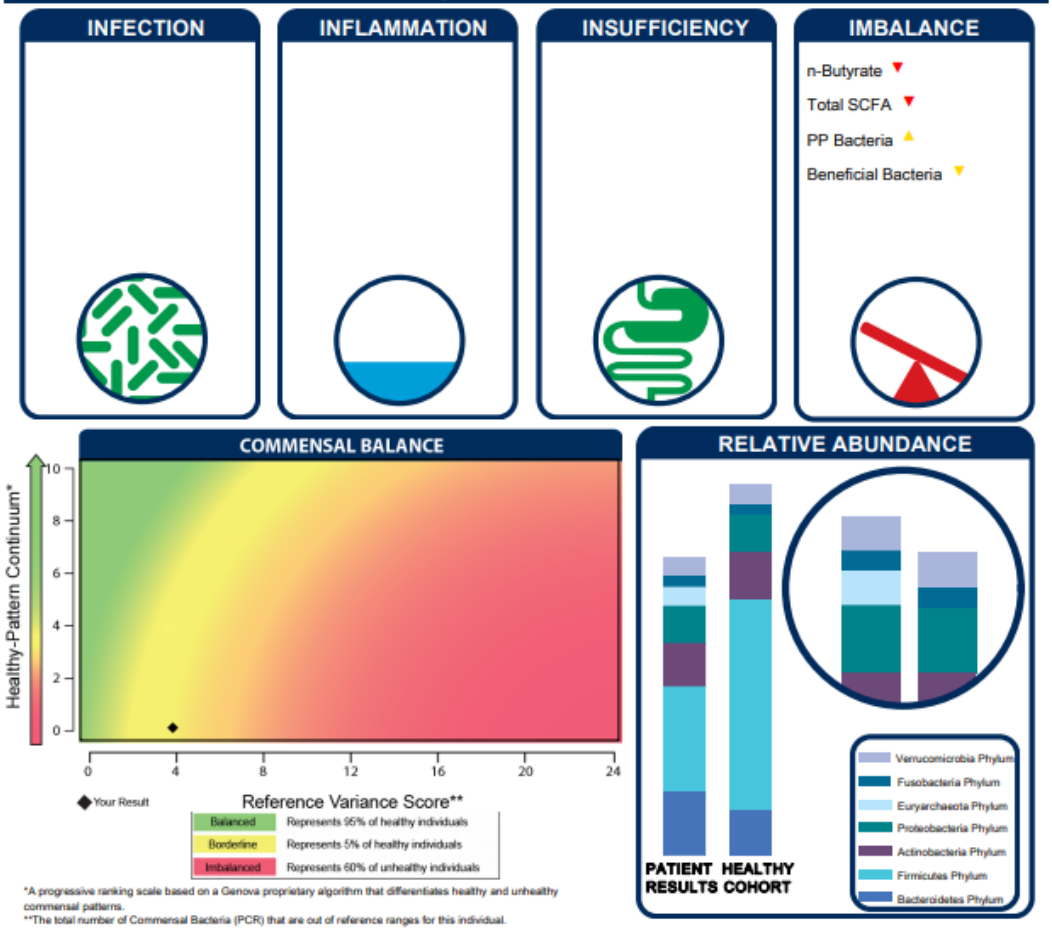
SUGGESTED SUPPLEMENT SCHEDULE

Supplements	Daily Recommended Intake (DRI)	Patient's Daily Recommendations	Provider Daily Recommendations
Antioxidants			
Vitamin A / Carotenoids	2,333 IU	5,000 IU	
Vitamin C	75 mg	250 mg	
Vitamin E / Tocopherols	22 IU	200 IU	
α-Lipoic Acid		200 mg	
CoQ10		60 mg	
B-Vitamins			
Thiamin - B1	1.1 mg	10 mg	
Riboflavin - B2	1.1 mg	50 mg	
Niacin - B3	14 mg	50 mg	
Pyridoxine - B6	1.3 mg	25 mg	
Biotin - B7	30 mcg	100 mcg	
Folic Acid - B9	400 mcg	400 mcg	
Cobalamin - B12	2.4 mcg	500 mcg	
Minerals			
Magnesium	320 mg	600 mg	
Manganese	1.8 mg	3.0 mg	
Molybdenum	45 mcg	75 mcg	
Zinc	8 mg	10 mg	
Essential Fatty Acids			
Omega-3 Oils	500 mg	500 mg	
Digestive Support			
Probiotics		25 billion CFU	
Pancreatic Enzymes		10,000 IU	
Other Vitamins			
Vitamin D	600 IU		

Amino Acid	mg/day	Amino Acid	mg/day
Arginine	195	Methionine	404
Asparagine	287	Phenylalanine	4
Cysteine	0	Serine	0
Glutamine	1,165	Taurine	0
Glycine	2,553	Threonine	292
Histidine	990	Tryptophan	0
Isoleucine	150	Tyrosine	547
Leucine	0	Valine	0
Lysine	14		

2200 GI Effects™ Comprehensive Profile - Stool

Interpretation At-a-Glance



*A progressive ranking scale based on a Genova proprietary algorithm that differentiates healthy and unhealthy commensal patterns.
**The total number of Commensal Bacteria (PCR) that are out of reference ranges for this individual.

Treatment Considerations

- Antimicrobial natural agents, then rebuild with prebiotics, probiotics, and fermented foods
- Diet: increase protein and incorporate more whole, unprocessed foods
  - Emphasize brightly colored veggies and fruits for antioxidant support
- Pancreatic enzymes with protein containing meals
- Continue omega-3 supplementation
- Switch to professional multi-vitamin to one with more magnesium and consider adding a B-complex
- Follow-up with Rhythm Plus profile with Cortisol Awakening Response for insight into cycling hormones and adrenal function

Points to Remember:

- GI Effects stool testing is a more specific indicator of gut issues
- The meaning of a “functional recommendation” in the NutrEval
- DNA as a quantitative measure vs. culture as an insight to viability in the GI Effects profile
- Plasma amino acids vs first morning void urine
- The new Interpretation At-a-Glance and Commensal Balance are not diagnostic -- they allow for pattern analysis based on patients who have run the GI Effects in the past
- Consider the recommendations provided, but always feel free to adjust any recommendations to the clinical presentation

GENOVA DIAGNOSTICS

Objectives for This Presentation

- Identify concepts that connect nutritional assessments and stool testing results
- Provide interpretation and application of laboratory results
- Discuss strategies helpful for treatment plan creation

GENOVA DIAGNOSTICS

Warren Brown, ND
Moderator

Stephen L. Goldman, DC
Presenter

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
Conferences – Schedule of events we attend
Test Menu – Detailed test profile information

MY **GDX –** Order materials and get results

Questions?

GENOVA DIAGNOSTICS

Additional Questions?

US Client Services: 800.522.4762

UK Client Services: 020.8336.7750

Please schedule a complimentary appointment with one of our Medical Education Specialists for questions related to:

- Diagnostic profiles featured in this webinar
- How Genova's profiles might support patients in your clinical practice
- Review a profile that has already been completed on one of your patients

We look forward to hearing from you!

GENOVA DIAGNOSTICS

Upcoming LIVE GDX Webinar Topics

August 22, 2018

NutrEval & ION: Case-Based Interpretation for the Athletic Patient

Warren Brown, ND

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

GENOVA DIAGNOSTICS

The GI Effects & NutrEval: Making Clinical Connections

Stephen L. Goldman, DC
Medical Education Specialist
Genova Diagnostics

July 25, 2018

GENOVA DIAGNOSTICS