Revision v0.54

Functional Blood Chemistry Analyzer

Maximizing Clinical Utility

Patient: SAMPLE SAMPLE, Test Date: 2/6/15
Practitioner: Michael McEvoy

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Section 1: Overview of Results

This section is an overview of all blood testing results that have been analyzed. These include:

1. All individual markers tested and analyzed as being a) within optimal functioning limits listed in **green** and b) individual markers outside of optimal functioning range listed in **red** as either high (H), or low (L).

2. A listing of ONLY the markers outside of optimal range.

3. A listing of the potential physiological imbalances identified. These are categorized as either *primary* or *secondary* .

Patient: SAMPLE SAMPLE, female, age: 43, date of testing: 2/6/15 .

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Section 1.1: All Markers

Click here to make corrections.

Metabolic Panel

Marker	Optimal Range	Result
Glucose	80 - 90 mg/dl	(H) 96
Insulin	1 - 5 mg/dl	—
Hemoglobin A1C	4.8 - 5.8 %	—
Uric Acid	3.5 - 5 mg/dl	4.2
Blood Urea Nitrogen (BUN)	12 - 18 mg/dl	(L) 10
Creatinine	0.65 - 1.18 mg/dL	0.68
Glomerular Filtration Rate (GFR)	60 - 130 mL/min	107
Sodium	137 - 143 mmol/L	139
Potassium	4 - 4.5 mmol/L	4.5
Chloride	100 - 106 mmol/L	(L) 99
Carbon Dioxide	23 - 27 mmol/L	24
Calcium	9.1 - 9.8 mg/dl	(L) 8.8
Phosphorus	3 - 4 mg/dl	3.7
Total Bilirubin	0.2 - 1 mg/dl	0.2
Total Protein	6.7 - 7.4 g/dl	6.7
Albumin	4.1 - 4.8 g/dl	4.3
Globulin	2.3 - 2.8 g/dl	2.4
Alkaline Phosphatase (ALP)	60 - 100 IU/L	61
Alanine Aminotransferase (ALT)	15 - 35 IU/L	(L) 9
Aspartate Aminotransferase (AST)	15 - 35 IU/L	(L) 13
Gamma-Glutamyl Transferase	15 - 35 IU/L	(L) 11
LDH	140 - 200 IU/L	(L) 136
Iron, serum	60 - 110 ug/dl	85

Lipid Panel

Marker	Optimal Range	Result
Triglycerides	60 - 100 mg/dl	(L) 50
HDL Cholesterol	50 - 85 mg/dl	84
LDL Cholesterol	80 - 150 mg/dl	(H) 152
Total Cholesterol	170 - 240 mg/dl	(H) 246

Triglycerides to HDL ratio: 0.60

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CBC (complete blood count)

Marker	Optimal Range	Result
White Blood Cells	5 - 7.5 x10E3/uL	(L) 4.7
Red Blood Cells (RBC)	4 - 5 x10E6/uL	4.38
Hemoglobin	13.5 - 15 g/dl	(L) 12.4
Hematocrit	38 - 48 %	39.6
Mean Corpuscular Volume (MCV)	85 - 93 pg/cell	90
Mean Corpuscular Hemoglobin (MCH)	27 - 32 fL	28.3
Mean Corpuscular Hemoglobin Concentration (MCHC)	32 - 35 g/dL	(L) 31.3
Red Blood Cell Distribution Width (RDW)	0 - 15 %	13.3
Platelets	150 - 380 x10E3/uL	241
Neutrophils (percent of total)	40 - 60 %	56
Lymphocytes (percent of total)	30 - 45 %	35
Eosinophils (percent of total)	0 - 3 %	2
Monocytes (percent of total)	0 - 7 %	6
Basophils (percent of total)	0 - 2 %	1

Thyroid-Related Markers

Marker	Optimal Range	Result
TSH	1.8 - 3 uIU/mL	(H) 9.08
Total Triiodothyronine / T3	100 - 200 ng/dL	—
Total Thyroxine	6 - 12 ug/dL	7.6
Free Triidothyroinine / Free T3	3 - 4.5 pg/mL	(L) 2.5
Free Thyroxine	1 - 1.5 ng/dL	(L) 0.97
Resin T3 Uptake	28 - 38 %	—
Reverse T3	0 - 15 ng/dL	—
Thyroid Peroxidase Anti Body	0 - 10 IU/mL	(H) 1550

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Additional Markers

Marker	Optimal Range	Result
Zinc, serum/plasma	90 - 135 ug/dl	—
Copper, serum	70 - 110 ug/dl	—
Ceruloplasmin	16 - 45 mg/dl	—
Homocysteine	6 - 8 umol/L	—
B-12 serum	500 - 1000 pg/ml	—
Folate, serum	6 - 16 ng/ml	—
Histamine, whole blood	40 - 70 ng/ml	—
Prostate-Specific Antigen (PSA)	0 - 4 ng/ml	—
C-Reactive Protein (hs-CRP)	0 - 2 mg/L	—
Vitamin D (25-hydroxyvitamin D)	30 - 80 ng/mL	—

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Section 1.2: Out of Range Markers

Click here to make corrections.

Metabolic Panel

Marker	Optimal Range	Result
Glucose	80 - 90 mg/dl	(H) 96
Blood Urea Nitrogen (BUN)	12 - 18 mg/dl	(L) 10
Chloride	100 - 106 mmol/L	(L) 99
Calcium	9.1 - 9.8 mg/dl	(L) 8.8
Alanine Aminotransferase (ALT)	15 - 35 IU/L	(L) 9
Aspartate Aminotransferase (AST)	15 - 35 IU/L	(L) 13
Gamma-Glutamyl Transferase	15 - 35 IU/L	(L) 11
LDH	140 - 200 IU/L	(L) 136

Lipid Panel

Marker	Optimal Range	Result
Triglycerides	60 - 100 mg/dl	(L) 50
LDL Cholesterol	80 - 150 mg/dl	(H) 152
Total Cholesterol	170 - 240 mg/dl	(H) 246

CBC (complete blood count)

Marker	Optimal Range	Result
White Blood Cells	5 - 7.5 x10E3/uL	(L) 4.7
Hemoglobin	13.5 - 15 g/dl	(L) 12.4
Mean Corpuscular Hemoglobin Concentration (MCHC)	32 - 35 g/dL	(L) 31.3

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Thyroid-Related Markers

Marker	Optimal Range	Result
TSH	1.8 - 3 uIU/mL	(H) 9.08
Free Triidothyroinine / Free T3	3 - 4.5 pg/mL	(L) 2.5
Free Thyroxine	1 - 1.5 ng/dL	(L) 0.97
Thyroid Peroxidase Anti Body	0 - 10 IU/mL	(H) 1550

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Section 1.3: Patterns Overview

This section provides an overview and description for potential physiological patterns that have been identified.

These potential physiological patterns are based upon the findings of individual blood chemistry markers. These patterns are determined by groups of individual markers that have triggered pre-determined indices.

There are potentially 68 physiological patterns, which can be triggered.

Patterns are classified as either:

- "Primary" (indicated with **this color**)
- "Secondary" (indicated with **this color**)

These analyses are non-diagnostic, but rather represent the potential that certain physiological imbalances are present. Further testing may be warranted to confirm or deny the existence of these potential physiological imbalances.

A "Primary" pattern suggests a stronger likelihood that such a physiological pattern exists. A "Secondary" pattern suggests a physiological pattern may exist, but is less certain than a "Primary pattern.

Lastly, the "Protocols & Recommended Additional Testing" section is based upon the physiological patterns identified, NOT the individual markers.

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Category	Pattern	Type	Information
Blood Sugar			
	Hypoglycemia	**Primary**	description/symptoms
Cell Hydration			
	Electrolyte Imbalance	**Primary**	description/symptoms
Digestion			
	Hypochlorhydria	**Secondary**	description/symptoms
Liver			
	Diminished Liver Function	**Secondary**	description/symptoms
Inflammation			
	Non-Specific Inflammation	**Secondary**	description/symptoms
Hormones			
	Decreased Thyroid Activity	**Primary**	description/symptoms
	Decreased Pituitary Activity	**Secondary**	description/symptoms
pH			
	Metabolic Alkalosis	**Secondary**	description/symptoms
Immune Response			
	Long-term Immune Response	**Secondary**	description/symptoms

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Nutrients

Dietary Protein Deficiency	**Primary**	description/symptoms
Iron Deficiency	**Secondary**	description/symptoms
B-6 Deficiency	**Primary**	description/symptoms
Glutathione Deficiency	**Primary**	description/symptoms
Magnesium Deficiency	**Secondary**	description/symptoms

Section 1.4: Clinical Objectives

Blood Sugar

Hypoglycemia
- Normalize inefficient glucose utilization
- Investigate endocrine disturbance if present

Cell Hydration

Electrolyte Imbalance
- Maximize hydration
- Maximize fluid/electrolyte balance

Digestion

Hypochlorhydria
- Support digestion & gastric acid synthesis
- Provide raw materials for gastric acid synthesis
- Support nutrient deficiencies induced by hypochlorhydria

Liver

Diminished Liver Function
- Improve/restore functionality of liver
- Support/normalize detoxification phases
- Protect liver cells from damage

Inflammation

Non-Specific Inflammation
- Reduce inflammation
- Support immune defenses
- Investigate deeper

Hormones

Decreased Thyroid Activity
- Support HPT axis
- Support digestion, GI function
- Support T4 >T3 hormone conversion
- Support iron metabolism

Decreased Pituitary Activity
- Support pituitary & HPT/HPA axis
- Support digestion & assimilation
- Identify potential presence of oxidative stress

pH

Metabolic Alkalosis
- Increase concentration & retention of metabolic acids
- Improve/restore cellular hydration
- Support digestion/assimilation if hypochlorhydria accompanies

Immune Response

Long-term Immune Response
- Reduce inflammation
- Support immune defenses

Nutrients

Dietary Protein Deficiency
- Increase dietary protein
- Support digestion & assimilation

Iron Deficiency
- Increase dietary sources of iron
- Support digestion & assimilation
- Support anemia-related symptoms

B-6 Deficiency
- Increase sources of B-6
- Support digestion & assimilation

Glutathione Deficiency
- Support glutathione synthesis & utilization
- Reduce oxidative stress burden
- Investigate causative factors of oxidative stress
- Support digestion & assimilation

Magnesium Deficiency
- Improve magnesium status
- Support digestion and assimilation

Section 2: Markers Descriptions

The following section provides brief descriptions for each individual blood chemistry marker outside of optimal range.

Each blood chemistry marker description also includes a listing of interfering drugs, which are known to affect the status of each blood chemistry marker.

This section also contains other possible factors, which are known to affect blood chemistry.

Metabolic Panel

Glucose (Fasting) – High (Result: **96** ; Range: **80 - 90 mg/dl**)

Glucose is the sugar in the blood serving as a source of fuel to all cells of the body.

Drug interference: antidepressants, beta-adrenergic blocking agents, corticosteroids, dextrothyroxine, statins, diazoxide, diuretics, epinephrine, estrogens, glucagon, isoniazid, lithium, phenothiazines, phenytoin, salicylates, triamterene

BUN – Blood Urea Nitrogen – Low (Result: **10** ; Range: **12 - 18 mg/dl**)

Bun is blood, urea, nitrogen. BUN is a major indicator of dietary protein metabolism. BUN reflects the amount of urea and nitrogenic waste remaining from dietary protein metabolism. Urea is formed in the liver and excreted via the kidneys.

Drug interference: Chloramphenicol, streptomycin

Chloride – Low (Result: **99** ; Range: **100 - 106 mmol/L**)

Chloride is a predominantly extracellular electrolyte. Both chloride and sodium tend to move together on a blood test, i.e. when one is low the other usually is, and vice versa.

Chloride values when viewed in concert with Co2/bicarbonate are largely the most sensitive indirect markers of the acid/base balance of the blood. Therefore, chloride and Co2/ bicarbonate should be viewed in unison.

Drug interference: Steroids, NSAIDs, bicarbonates, diuretics

Calcium – Low (Result: **8.8** ; Range: **9.1 - 9.8 mg/dl**)

Calcium is the most abundant mineral of the body. It is essential for: nerve conduction, skeletal health, cell membrane permeability, muscle contraction, blood clotting, cell membrane voltage, hormone regulation.

The calcium in the blood is directly influenced by parathyroid hormone, as well as the availability of Vitamin D.

Calcium values on a blood test are typically not related to actual dietary calcium intake, in many cases. Rather, calcium values are reflective of the large number of direct and indirect factors influencing calcium metabolism.

Drug interference: Acid-blocking drugs, estrogens, blood thinning drugs, steroids, NSAIDs, contaceptives, albuterol

Alanine Aminotransferase (ALT / SGPT) - Low (Result: **9** ; Range: **15 - 35 IU/L**)

ALT is a metabolic enzyme concentrated in multiple tissues. Its highest

concentrations are found in: liver and biliary duct, heart, kidney and skeletal muscle. ALT acts by converting the amino acid alanine into pyruvate and glutamate.

Additionally, ALT transports nitrogenic waste from skeletal muscle to the liver, where ALT in the liver converts ammonia into urea. The primary cofactor in ALT reactions is Vitamin B-6 (P5P).

Drug interference: Contraceptives, alcohol, aspirin and salicylates

Aspartate aminotransferase (AST / SGOT) – Low (Result: **13** ; Range: **15 - 35 IU/L**)

AST is a metabolic enzyme concentrated in multiple tissues. Its highest

concentrations are found in: liver, biliary duct, cardiac tissue and skeletal tissue.

AST acts during the Kreb's cycle where it converts aspartate and alpha ketoglutarate into glutamate and oxaloacetate. The major cofactor for AST's reactions is

Vitamin B-6 (P5P).

Additionally, AST will increase the deamination of glutamate, increasing levels of ammonia.

Drug interference: Contraceptives, alcohol, aspirin and salicylates

Gamma Glutamyl Transferase (GGT, or GGTP) – Low (Result: **11** ; Range: **15 - 35 IU/L**)

GGTP is a metabolic enzyme concentrated in numerous tissues. Its greatest concentrations are found in the liver, biliary tract and kidneys, and to a lesser extent in the prostate.

GGTP is the primary enzyme that activates the gamma glutamyl cycle, a pathway that involves the transfer of amino acids and peptides across cell membranes. In these regards, the gamma glutamyl cycle is critical for the transport and utilization of the cellular antioxidant glutathione.

Drug Interference: Clofibrate, oral contraceptives, drugs that deplete Vitamin B-6: theophylline, loop diuretics, steroids, vasodilators

Lactate dehydrogenase (LDH) – Low (Result: **136** ; Range: **140 - 200 IU/L**)

LDH is a metabolic enzyme concentrated in numerous tissues. Its highest concentrations are found in: heart, liver, lungs, brain, kidney, placenta, pancreas, and skeletal muscle.

LDH converts the reversible reactions of pyruvate to lactate, as well as NADH to NAD. The conversion of pyruvate (from glycolysis) into lactate occurs when oxygen availability is reduced (anaerobic conditions).

LDH on routine blood chemistry represents the “total LDH”. In actuality, there exist 5 LDH isoenzymes. Each isoenzyme originates from a specific tissue. Differentiation of LDH can be determined through electrophoresis.

Drug interference: High doses of Vitamin C

Lipid Panel

Triglycerides – Fasting, 12 hours – Low (Result: **50** ; Range: **60 - 100 mg/dl**)

Triglycerides are fats in the blood, which serve as a source of fuel for all muscles of the body. Triglycerides contain a glycerol and 3 fatty acids.

Triglycerides can be derived from the diet directly, or synthesized endogenously by the liver.

Drug interference: asparaginase, clofibrate, colestipol, Vitamin C,

LDL - High (Result: **152** ; Range: **80 - 150 mg/dl**)

LDL is low density lipo-protein. It is the primary lipo-protein that transports cholesterol, essential fatty acids, and other nutrients from the liver to the peripheral tissues.

Numerous factors can influence LDL values, including: inflammatory processes, infection, chronic disease, thyroid function, fluctuation of endocrine activity, environmental toxins, dietary factors and genetics.

Drug interference: aspirin, oral contraceptives, anti-psychotics, steroids, anti- hypertensives, sulfonamides, androgens, estrogens, progesterone

NOTE: Pregnancy may cause normal elevations in LDL

Total Cholesterol – High (Result: **246** ; Range: **170 - 240 mg/dl**)

The cholesterol on a blood test is actually a sum of 3 lipo-proteins: LDL, HDL and VLDL. Lipo-proteins function as transport mechanisms for cholesterol, as well as for other essential nutrients such as Vitamins A, D, E, K, phospholipids and antioxidants.

Cholesterol is essential for life processes. The primary functions of cholesterol include: primary constituent of all cellular membranes where it controls membrane fluidity, precursor of all steroidal hormones, precursor of bile acids, primary component of myelin and as anti-inflammatory.

Dietary sources of cholesterol have little if any influence on serum cholesterol measurements.

Total cholesterol measurements are not necessarily correlative with cardiovascular disease.

Drug interference: Steroids, ACTH, anabolic steroids, thiazide diuretics, oral contraceptives, cyclosporine, Vitamin D, epinephrine, sulfonamides

NOTE: Pregnancy may cause elevations in serum cholesterol, which is a normal process

CBC (complete blood count)

WBC – Low (Result: **4.7** ; Range: **5 - 7.5 x10E3/uL**)

WBC is the measure of white blood cells. White blood cells are major components of the body's immune defenses.

Decreases in WBCs may suggest a chronic infection of some type, or a prolonged inflammatory response. For greater assessment of WBCs, look to the WBC differential, composed of: neutrophils, lymphocytes, monocytes, eosinophils and basophils.

Drug interference: antibiotics, anticonvulsants, antihistamines, arsenic, chemotherapy, sulfonamides, diuretics, thyroid-suppressing drugs

Hemoglobin (females) – Low (Result: **12.4** ; Range: **13.5 - 15 g/dl**)

Hemoglobin is the iron-carrying protein in red blood cells. Thus, hemoglobin is an essential component of oxygen and carbon dioxide transport.

Decreases in hemoglobin are one indicator of iron deficiency and microcytic anemia.

Drug interference: antibiotics, aspirin, NSAIDs, acid-blocking drugs, indomethacin, rifampin, sulfonamides

NOTE: Hemoglobin values are often low throughout pregnancy.

MCHC (mean corpuscular hemoglobin concentration) – Low (Result: **31.3** ; Range: **32 - 35 g/dL**)

MCHC is a calculation for the average amount of hemoglobin found in red blood cells. MCHC is usually decreased when certain types of anemia are present, primary “microcytosis”.

Drug interference: Drugs that decrease iron: Acid-blocking drugs, ACTH, bile acid sequesterants, chloramphenicol, colchicine, methicilin, testosterone. Drugs that decrease B-6: oral contraceptives, alcohol, aspirin and salicylates

Thyroid-Related Markers

TSH (thyroid stimulating hormone) – High (Result: **9.08** ; Range: **1.8 - 3 uIU/mL**)

TSH is produced by the anterior pituitary gland. It is the hormone that directly signals to the thyroid gland to produce T4 (thyroxine). TSH secretion is stimulated by the hypothalamic hormone TRH (thyroid releasing hormone). Negative feedback mechanisms within the HPT axis (hypothalamic/pituitary/thyroid) further regulate TSH secretions.

An elevation in TSH is one indicator of decreased thyroid activity.

Drug interference: lithium, antithyroid drugs, potassium iodide, injections of TSH

FT3 (Free T3) or Free Triiodothyronine – Low (Result: **2.5** ; Range: **3 - 4.5 pg/mL**)

T3 is also known as triiodothyronine. It is the most active form of thyroid hormone. Free T3 measures are more clinically relevant than Total T3 measures.

Decreased FT3 measures are one indicator of low thyroid activity. A full thyroid panel is recommended in order to understand the nature of imbalance.

Drug interference: Steroids, androgenic hormones, phenytoin, propranolol, resperine, salicylates

FT4 (free T4) – Low (Result: **0.97** ; Range: **1 - 1.5 ng/dL**)

T4 is secreted by the thyroid gland. Free T4 is the metabolically active form of T4 (thyroxine). Free T4 is more clinically relevant than “Total T4”.

A decrease in Free T4 is one indicator of decreased thyroid activity. A full thyroid panel is recommended in order to understand the nature of imbalance.

Drug interference: Furosemide, phenytoins, methadone, rifampicin

TPO Ab (thyroid peroxidase antibody) – High (Result: **1550** ; Range: **0 - 10 IU/mL**)

The thyroid peroxidase enzyme is an enzyme expressed in the thyroid gland. It is central to the formation of T4 and T3.

An elevated thyroid peroxidase antibody (TPO Ab) is indicative of immune system targeting of thyroid tissue for inflammatory attack.

TPO Ab testing is used to differentiate between autoimmune low thyroid and non-autoimmune low thyroid states.

Practitioners implementing functional nutritional therapies consider the difference between autoimmune and non-autoimmune thyroid conditions to be significant, with regards to differing treatment approaches.

Section 3: Pattern Descriptions & Symptoms

This section includes page descriptions for each of the physiological patterns that have been identified. These pages are intended as a reference section for clinicians, in order to better understand each pattern identified.

Additionally, each physiological pattern description includes a listing of related symptomatology, in order to obtain clinical correlations.

Blood Sugar: Hypoglycemia

A “Primary” pattern for hypoglycemia suggests that low blood sugar episodes is a likely occurrence.

Hypoglycemia does not necessarily mean “low blood sugar”, as much as “inefficient glucose utilization”. An individual with hypoglycemic tendencies may exhibit normal and even optimal fasting glucose levels.

In hypoglycemia, cells tend to metabolize glucose very rapidly and inefficiently. In order to improve glucose homeostasis, it is essential to first understand the primary mechanisms influencing blood sugar utilization. These include:

- Diet: Macro-nutrient ratios relative to the individual’s metabolic needs
- Hormones that raise glucose: cortisol, thyroid hormone, ACTH, epinephrine, glucagon, growth hormone

Be sure to review the Recommendations & Protocols for Hypoglycemia.

Hypoglycemia Symptoms
• Hungry all of the time • Need to snack between meals • Energy crash from high carbohydrate meal • High carbohydrate meal produces hunger within 60-90 minutes or less • Loss of cognitive function if meals skipped or delayed

Markers Considered: LDH (**136.00** ; 140 - 200 IU/L)

Cell Hydration: Electrolyte Imbalance

A primary pattern for electrolyte imbalance suggests that electrolyte imbalance is likely a factor.

The electrolytes in the blood serve as the raw materials for the “cell battery”. All cells and tissues require sufficient electrolyte and fluid balance in order to perform fundamental physiological functions.

Among the numerous functions of electrolytes in cell physiology, the following functions are greatly influenced by the balance of electrolytes:

- Cell membrane voltage & action potential
- Cell membrane permeability
- Signal transduction
- ATP synthesis & utilization

The status of serum electrolytes are influenced by:

- Dietary intake of electrolytes
- Hydration & fluid balance
- Intra and extracellular fluid volume
- Blood pressure-regulating mechanisms: water/salt balance, renin, ACE, renal & liver sufficiency
- ADH (anti-diuretic hormone)
- Adrenal hormones: aldosterone & cortisol

Be sure to review the Recommendations & Protocols for Dehydration.

Electrolyte Imbalance Symptoms
• Dry mouth • High or low blood pressure • Orthostatic blood pressure failure • Unquenchable thirst • Lack of saliva • Flaking and/or dry skin • Excess consumption of caffeine, alcohol or diuretics • Increased or decreased urination • Muscle soreness, trigger points or tightness

Markers Considered: Potassium (**4.50** ; 4 - 4.5 mmol/L), Sodium (**139.00** ; 137 - 143 mmol/L), Chloride (**99.00** ; 100 - 106 mmol/L)

Digestion: Hypochlorhydria

A Secondary pattern for Hypochlorhydria indicates the possibility of low gastric acid.

Gastric acid is essential for proper digestion of food, as well as assimilation of nutrients: iron, magnesium, B-12, folate, calcium and numerous trace minerals.

Gastric acid is necessary for:

- Decreasing the pH of the stomach, which triggers the release of pepsinogen by chief cells. Pepsin is the chief digestive enzyme of the stomach
- Sterilization of food

In order for the parietal cells of the stomach to concentrate gastric acid, certain raw materials are required for synthesis. These are primarily:

- Hydrogen (H+)
- Sodium
- Chloride

Inadequate gastric acid is a very common finding, and often is the factor responsible for symptoms of heartburn and acid reflux.

Hypochlorhydria Symptoms
• GERD-related symptoms • Acid reflux, indigestion • Burning or sour stomach • Undigested food in stools • Constipation • Flatulence, abdominal bloating • Halitosis

Markers Considered: Blood Urea Nitrogen (BUN) (**10.00** ; 12 - 18 mg/dl), Chloride (**99.00** ; 100 - 106 mmol/L), Carbon Dioxide (**24.00** ; 23 - 27 mmol/L), Sodium (**139.00** ; 137 - 143 mmol/L), Globulin (**2.40** ; 2.3 - 2.8 g/dl)

Liver: Diminished Liver Function

A secondary pattern for Diminished Liver Function indicates the possibility that some type of decreased liver function is possible.

The liver is a massive organ with countless, essential functions. These include:

- Metabolism of nutrients (amino acids, B-vitamins, minerals, lipids) & drugs
- Biotransformation of substances, especially xenobiotics, chemicals and toxic metals
- Bile synthesis
- Hormone synthesis & degradation
- Blood sugar regulation: stores and releases glycogen & regulates gluconeogenesis
- Synthesis of cholesterol
- Nutrient storage
- Synthesis of blood clotting factors
- Blood pressure regulation: angiotensinogen
- Albumin synthesis, which influences osmotic pressure and nutrient transport

It is important to understand that inadequate liver function has numerous implications related to the overall health of the individual.

Be sure to review the Recommendations & Protocols for Diminished Liver Function.

Diminished Liver Function Symptoms
• Chemical sensitivity • Edema • Caffeine or alcohol sensitivity • Headaches: front lobe • Headaches: base of skull • Pain between shoulder blades • Burning or itching anus

Markers Considered: Iron, serum (**85.00** ; 60 - 110 ug/dl), Total Bilirubin (**0.20** ; 0.2 - 1 mg/dl), Total Cholesterol (**246.00** ; 170 - 240 mg/dl), Blood Urea Nitrogen (BUN) (**10.00** ; 12 - 18 mg/dl), LDH (**136.00** ; 140 - 200 IU/L), Aspartate Aminotransferase (AST) (**13.00** ; 15 - 35 IU/L)

Inflammation: Non-Specific Inflammation

A secondary pattern for non-specific inflammation indicates some type of unspecified inflammation is possible.

This may include:

- Excess skeletal muscle degradation
- Tissue inflammation
- Auto-inflammatory processes

Be sure to review the Recommendations & Protocols for Non-Specific Inflammation.

Non-Specific Inflammation Symptoms
• None • Headaches • Pain, aches • Muscle soreness • Delayed recovery from exercise • GI symptoms • White coated tongue

Markers Considered: Uric Acid (**4.20** ; 3.5 - 5 mg/dl), Platelets (**241.00** ; 150 - 380 x10E3/uL), Triglycerides (**50.00** ; 60 - 100 mg/dl), Total Cholesterol (**246.00** ; 170 - 240 mg/dl), LDL Cholesterol (**152.00** ; 80 - 150 mg/dl), Albumin (**4.30** ; 4.1 - 4.8 g/dl)

Hormones: Decreased Thyroid Activity

A primary pattern for decreased thyroid activity suggests that low thyroid function is likely a factor.

From a clinical perspective, it is fundamentally essential to distinguish between:

- Autoimmune thyroiditis
- Non-autoimmune, functionally decreased thyroid activity

Autoimmune low thyroid activity primarily involves the immune system targeting thyroid tissue. Non-autoimmune, functionally low thyroid activity indicates the primary imbalance exists within the HPT axis, and related physiology. From blood chemistry, autoimmune thyroiditis can be distinguished through the use of TPO Ab testing.

It is important to view decreased thyroid activity in concert with other physiological factors that are related to the thyroid and HPT axis. These may include:

- Liver function - the conversion of T4 to T3 takes place primarily in the liver.
- Oxidative stress - a decrease in glutathione status can impact T3 synthesis
- HPA stress hormone balance - fluctuations in stress hormones can directly affect thyroid function
- Intestinal immune function: microbial balance, food intolerance, leaky gut
- Various nutrient deficiencies: B-12, B-6, zinc, selenium, iodine, glutathione, tyrosine

Be sure to review the Recommendations & Protocols for Decreased Thyroid Activity.

Decreased Thyroid Activity Symptoms
• Fatigue • Inability to lose weight • Anemia • Swollen throat upon palpation • Thinning hair or unnatural hair loss • Low basal body temperature • Achilles tendon reflex failure • Mental sluggishness • Slow digestion/constipation

Markers Considered: TSH (**9.08** ; 1.8 - 3 uIU/mL), Free Triidothyroinine / Free T3 (**2.50** ; 3 - 4.5 pg/mL), Free Thyroxine (**0.97** ; 1 - 1.5 ng/dL)

Hormones: Decreased Pituitary Activity

A secondary pattern for decreased pituitary activity suggests that decreased pituitary activity is possible.

The pituitary gland is divided into the anterior, medial and posterior lobes. In total, the pituitary secretes 9 hormones. The pituitary gland plays an essential, regulatory role in metabolic processes related to:

- Thyroid and stress hormone synthesis - TSH, ACTH
- Water balance - ADH
- Growth, maturation & reproduction - FSH
- Sexual reproduction, bonding & intimacy - oxytocin
- Growth, cell reproduction, fatty acid metabolism - HGH
- Growth, blood clotting, immune activity, milk secretion - prolactin
- Testosterone synthesis (males), ovulation (females) - LH
- Stimulation of HGH - GHRH

A decrease in pituitary function may be related to numerous processes, such as:

- Changes HPT axis hormones
- Changes in HPA axis stress hormones
- Inflammatory cytokine storms
- Disturbances in fluid/electrolyte balance
- Disturbances in lipid metabolism

Be sure to review the Recommendations & Protocols for Decreased Pituitary Activity.

Decreased Pituitary Symptoms
• Elevated stress • Fatigue • Fatigue easily under stress • Fluctuations in sex drive • Possibly abnormal menstrual cycle • Increased urination • Sociopathy • Chronically depleted testosterone • Chronically aberrant menstrual cycle

Markers Considered: TSH (**9.08** ; 1.8 - 3 uIU/mL), Free Thyroxine (**0.97** ; 1 - 1.5 ng/dL)

pH: Metabolic Alkalosis

A secondary pattern for metabolic alkalosis suggests that metabolic alkalosis is possible.

Metabolic alkalosis indicates there is a decreased hydrogen (H+) concentration. In alkalosis, the blood pH is increased.

Alkalosis patterns will involve both the kidneys and respiratory functions, because both of these organ systems are involved in pH regulation of the blood.

Additionally, an alkalosis pattern indicates changes in electrolytes as well, signaling disturbances to cell hydration status.

Be sure to review the Recommendations & Protocols for Metabolic Alkalosis.

Metabolic Alkalosis Symptoms
• Difficulty getting out of bed, fatigue in AM • Histamine reactions • Allergies • Increased breath-holding capacity • Respiration rate at resting: reduced, <13 • Low HCL symptoms

Markers Considered: Chloride (**99.00** ; 100 - 106 mmol/L), Carbon Dioxide (**24.00** ; 23 - 27 mmol/L)

Immune Response: Long-term Immune Response

A secondary pattern for long-term immune response suggests that a long-term immune response is possible.

Chronic immune activation can result in systemic inflammatory processes, which can diminish immune cell activity. In such cases:

- The white blood cell count (WBC) is often decreased
- Neutrophils may be decreased

Be sure to review the Recommendations & Protocols for Long-term Immune Response.

Long-term Immune Response Symptoms
• Persistent flu-like symptoms • Longterm illness • Chronic infections • Frequent and persistent fatigue • Frequent colds, flus

Markers Considered: White Blood Cells (**4.70** ; 5 - 7.5 x10E3/uL), Neutrophils (percent of total) (**56.00** ; 40 - 60 %)

Nutrients: Dietary Protein Deficiency

A primary pattern for dietary protein deficiency suggests that dietary protein deficiency is likely.

Amino acids derived from dietary protein sources are essential components of cellular and metabolic functions. Some of these include:

- Muscle, organ & connective tissue integrity
- Liver detoxification
- Neurotransmitter synthesis
- DNA/RNA synthesis
- Glucose homeostasis
- Synthesis of intracellular antioxidants such as glutathione and metallothionein

Primary patterns for dietary protein deficiency suggest an immediate need to increase dietary protein intake. During prolonged shortages of dietary protein, the body will catabolize tissue protein to make up for the deficit.

Be sure to review the Recommendations & Protocols for Dietary Protein Deficiency.

Dietary Protein Deficiency Symptoms
• Crave meat • Increased appetite • Loss of or lack of muscle mass • Lack of energy • Brain fog, loss of cognition

Markers Considered: Blood Urea Nitrogen (BUN) (**10.00** ; 12 - 18 mg/dl), Albumin (**4.30** ; 4.1 - 4.8 g/dl)

Nutrients: Iron Deficiency

A secondary pattern for iron deficiency suggests that iron deficiency is possible. In Secondary Iron Deficiency, numerous iron or hemoglobin-related markers may be aberrant.

Iron is an essential trace element, needed for numerous biological functions. Some of these include:

- Red blood cell formation
- Mitochondrial ATP synthesis

Decreased iron status can negatively impact oxygen transport to the tissues. Inadequate oxygen transport will result in metabolic inefficiency, and lead to symptoms of iron-deficient anemia.

Iron deficiency is often due to:

- Diet: Inadequate iron-containing foods
- Low gastric acid
- Drugs that deplete iron
- Uterine fibroids

Be sure to review the Recommendations & Protocols for Iron Deficiency.

Iron Deficiency Symptoms
• Anemia • Fatigue • Headaches • Pale complexion • Weakness upon exertion • Uterine fibroids • Acid-blocking drugs • Regular NSAID use

Markers Considered: Iron, serum (**85.00** ; 60 - 110 ug/dl), Mean Corpuscular Volume (MCV) (**90.00** ; 85 - 93 pg/cell), Mean Corpuscular Hemoglobin (MCH) (**28.30** ; 27 - 32 fL), Mean Corpuscular Hemoglobin Concentration (MCHC) (**31.30** ; 32 - 35 g/dL), Red Blood Cells (RBC) (**4.38** ; 4 - 5 x10E6/uL), Hematocrit (**39.60** ; 38 - 48 %)

Nutrients: Vitamin B-6 Deficiency

A primary pattern for B-6 deficiency suggests that Vitamin B-6 deficiency is very likely present.

Vitamin B-6, in its active form is known as P5P (pyridoxal 5 phosphate). B-6 participates in more than 100 chemical reactions in the human body. Some of these include:

- Fatty acid metabolism
- Amino acid synthesis
- Kreb's cycle energy production
- Aminotransferase enzyme synthesis
- Histamine synthesis
- Neurotransmitter synthesis: serotonin, dopamine, GABA & 5-HTP.
- DNA expression
- Hemoglobin synthesis

The most common causes of Vitamin B-6 deficiency include:

- Nutrient requirement increased due to biochemical individuality
- Oxidative stress
- Neurotransmitter imbalances
- Pyrrole disorder

Be sure to review the Recommendations & Protocols for Vitamin B-6 Deficiency.

B-6 Deficiency Symptoms
• Neurological symptoms: tremors, psychosis • Anxiety • Schizophrenia • Mania • Fatigue • Contraceptives • Alcoholism • Seizures

Markers Considered: Alanine Aminotransferase (ALT) (**9.00** ; 15 - 35 IU/L), Aspartate Aminotransferase (AST) (**13.00** ; 15 - 35 IU/L),Gamma-Glutamyl Transferase (**11.00** ; 15 - 35 IU/L), Mean Corpuscular Volume (MCV) (**90.00** ; 85 - 93 pg/cell), Hemoglobin (**12.40** ; 13.5 - 15 g/dl)

Nutrients: Glutathione Deficiency

A primary pattern for glutathione deficiency suggests that glutathione deficiency may be a factor.

Glutathione is a tripeptide, comprised of: glutamine, glycine and cysteine. Glutathione is a ubiquitous antioxidant system, found in virtually every cell, organ and tissue. Glutathione is capable of scavenging multiple types of free radicals, and is among the only endogenously-produced antioxidants capable of detoxifying mercury.

Glutathione, and the biochemical pathways that lead to its synthesis are under high demand during oxidative stress. In such cases, there may be rising levels of oxidized glutathione (GSSH), and decreased levels of reduced glutathione (GSH).

Numerous factors can influence glutathione deficiency. Some of these include:

- Deficiency of cofactors: P5P, amino acids, zinc, selenium
- Increased use, due to oxidative stress
- Methylation cycle dysfunction
- Genetic predispositions: CBS, GSTM1, GSTM3

Be sure to review the Recommendations & Protocols for Glutathione Deficiency.

Glutathione Deficiency Symptoms
• Chemical sensitivity • Poor detoxification of toxic elements • Chronic fatigue • Headaches • Mercury: toxic burden • Longterm illness

Markers Considered: Gamma-Glutamyl Transferase (**11.00** ; 15 - 35 IU/L)

Nutrients: Magnesium Deficiency

A secondary pattern for magnesium deficiency suggests that magnesium deficiency is possible.

Magnesium is a cofactor in more than 300 enzyme reactions in the body. Some of these functions include:

- ATP synthesis & utilization
- DNA/RNA synthesis
- Skeletal integrity: calcium utilization & bone formation
- Cell signaling
- Cell membrane permeability
- Nervous system balance: activation of parasympathetic ganglia
- Bowel function
- Blood pressure modification
- Methylation reactions & glutathione synthesis
- Sex hormone modulation

Magnesium deficiency is among the most common nutrient deficiencies. The most common causes of magnesium deficiency include:

- Diet: inadequate consumption of magnesium-containing foods
- Low gastric acid: magnesium assimilation is contingent upon gastric acid
- Drugs that deplete or interfere with magnesium metabolism

Be sure to review the Recommendations & Protocols for Magnesium Deficiency.

Magnesium Deficiency Symptoms
• Muscle cramps or spasms • Elevated blood pressure • Bone loss • Constipation • Insomnia • Acid-blocking drugs • Use of diuretics: caffeine, soda, alcohol, drugs

Markers Considered: Gamma-Glutamyl Transferase (**11.00** ; 15 - 35 IU/L), Calcium (**8.80** ; 9.1 - 9.8 mg/dl)

Section 4: Recommendations & Protocols

Section 4.1: Lifestyle

Lifestyle factors are among the most foundational components influencing your client's health.

Various lifestyle factors can complement your dietary and supplemental protocols. Some of these important lifestyle factors can include:

- Clean water & sufficient hydration
- Sleep, rest and relaxation
- Stress management: Regular exercise and/or physical activity
- Improved circulatory function: sauna therapy, sweating, exercise

In many instances, the implementation of lifestyle practices can greatly influence the effectiveness of your protocols. Always encourage your clients to regularly practice the foundations of health, regardless of their age or degree of illness.

Section 4.2: Diet

The following is a list of dietary recommendations based upon the Primary and Secondary physiological patterns identified.

This list serves as a catalyst for understanding how to use food under certain physiological circumstances. Not all recommendations listed may be required. Clinicians are encouraged to pick, choose and implement these recommendations based upon what is needed in each situation.

Blood Sugar

Hypoglycemia

Normalize Inefficient Glucose Utilization: Increase dietary protein & fat, restrict sugar & carbohydrates, Maximize macronutrient ratios, discover Metabolic Type®.

Cell Hydration

Electrolyte Imbalance

Restore Fluid/Electrolyte Balance: Consume potassium and magnesium-rich & water-soluble vegetables, cucumber, cucumber juice, greens, watermelon.

Digestion

Hypochlorhydria

Support Digestion & Gastric Acid Synthesis: Vinegar (diluted to acidity of 5-6%), high quality protein (stimulates gastric acid secretion), apples (source of malic acid), remove protein powders (may elevate BUN).

Provide Raw materials For Gastric Acid Synthesis: High quality protein (stimulates gastric acid secretion).

Liver

Diminished Liver Function

Improve/Restore Functionality of Liver: Increase dietary protein, especially if albumin is decreased, increase intake of beets, beet greens, artichoke (leaf, stem & heart).

Support/Normalize Detoxification Phases: Increase dietary protein, Cruciferous vegetables: broccoli, cauliflower, kale, brussel sprouts, cabbage, Increase intake of beets, beet greens, artichoke (leaf, stem & heart), garlic, radish.

Protect Liver Cells From Damage: Increase dietary protein, Cruciferous vegetables: broccoli, cauliflower, kale, brussel sprouts, cabbage, citrus fruit.

Inflammation

Non-Specific Inflammation

Reduce Inflammation: Eliminate sugar, PUFA, trans fats; include foods rich in antioxidants: vegetables, animal protein (especially liver, heart, kidney); Foods high in omega 3 fatty acids: (raw) fish, flax seeds, turmeric, ginger, garlic.

Support Immune Defenses: Foods rich in Vitamin C (citrus fruit, berries, vegetables), Vitamin A (liver, butter, cream, egg yolks), Vitamin D (liver, egg yolks, whole fat dairy), foods rich in Vitamin E (flax, sunflower, annato, dark green vegetables).

Hormones

Decreased Thyroid Activity

Support Thyroid & HPT/HPA Axis Function: Sufficient dietary protein, fatty acids, discover Metabolic Type® to maximize macro-nutrient ratios, normalize blood sugar with regular eating habits, iodine-containing foods: kelp, nori, wakame.

Support Digestion & Assimilation: Identify & remove antigenic foods, support gut mucosa & bacterial balance: animal protein, bone broth, fermented foods (if tolerant).

Support Iron Uptake (if anemic): Liver, red meat, foods high in Vitamin C.

Decreased Pituitary Activity

Support Pituitary & HPT/HPA Axis Function: Sufficient dietary protein, fatty acids.

Support Digestion & Assimilation: Vinegar (if alkalosis).

Metabolic Alkalosis

Increase Metabolic Acids: Vinegar.

Improve/Restore Cellular Hydration: Consume water-dense vegetables.

Support Digestive Functions (if hypochlorhydria accompanies): vinegar, raw food versus cooked.

Immune Response

Long-term Immune Response

Reduce Inflammation: Eliminate sugar, PUFA, trans fats; include foods rich in antioxidants: vegetables, animal protein (especially liver, heart, kidney); Foods high in omega 3 fatty acids: (raw) fish, flax seeds, turmeric, ginger, garlic.

Support Immune Defenses: Foods rich in Vitamin C (citrus fruit, berries, vegetables), Vitamin A (liver, butter, cream, egg yolks), Vitamin D (liver, egg yolks, whole fat dairy), foods rich in Vitamin E (flax, sunflower, annato, dark green vegetables).

Nutrients

Dietary Protein Deficiency

Increase Dietary Protein: Meat, poultry, fish, seafood, eggs, dairy; consider reducing cooking temperature to 225F (107c) to preserve heat labile amino acids; sources of protein powders are often inadequate and may not be sufficiently digested in some cases.

Iron Deficiency

Increase Sources of Iron: Richest heme sources: Liver, red meat; Richest non-heme sources: Parsley, spinach, swiss chard, legumes.

Support Anemia-Related Symptoms: blackberry, raspberry, mulberry, lycium berry, bilberry.

B-6 Deficiency

Increase Sources of B-6: Meat, poultry, fish, seafood, eggs, dairy, vegetables, grains, legumes.

Improve Digestion & Assimilation: Vinegar if low gastric acid, consider raw foods vs. cooked.

Glutathione Deficiency

Increase Glutathione Synthesis & Utilization: Sulfur-bearing and glutamine-containing amino acids: Meat, poultry, fish, seafood, eggs, dairy, whey protein.

Support Digestion & Assimilation: Vinegar if low gastric acid, consider raw foods vs. cooked.

Magnesium Deficiency

Increase Sources of Magnesium: Spinach, swiss chard, green beans, vegetables, nuts & seeds, legumes, whole grains .

Section 4.3: Supplements

Blood Sugar

Hypoglycemia

Normalize Inefficient Glucose Utilization: Chromium, zinc, calcium, vitamin B-5, pancreatic glandular, astragalus.

Support Endocrine Disturbance (if present): Adrenal glandular, licorice, eleuthero, siberian or Korean ginseng.

Cell Hydration

Electrolyte Imbalance

Restore Hydration: water with pH >7.0 and 250 ppm, water, mineral salt, magnesium.

Individual Considerations: If sodium <137 consider increasing salt intake; if sodium >143 consider restricting salt intake and increase magnesium. Dilution of minerals salts in water may increase effectiveness of mineral transport.

Digestion

Hypochlorhydria

Support Digestion & Gastric Acid Synthesis: Betaine HCL with pepsin, malic acid, plant-based digestive enzymes, pancreatic enzymes.

Provide Raw materials For Gastric Acid Synthesis: Zinc, mineral salt.

Support Nutrient Deficiencies Induced By Hypochlorhydria: Zinc citrate, magnesium citrate, calcium citrate, copper, selenium, molybdenum, B-12, folate .

Liver

Diminished Liver Function

Improve/Restore Functionality of Liver: If albumin is low then low-molecular weight antioxidants (vitamin C, E, lipoid acid).

B-complex, B-12, glycine, cysteine, taurine, arginine, glutamine, methionine, glutathione, NAC, turmeric, milk thistle, berberrine-containing herbs (Oregon grape, barberry, phellodendron, coptis, goldenseal, celendine), bovine liver glandular/protomorphogen.

Support/Normalize Detoxification Phases: B-complex, B-12, P5P, Betaine HCL, vitamins C, E, choline, inositol, magnesium, molybdenum, sulfur, zinc, dandelion root, berberrine-containing herbs (Oregon grape, barberry, phellodendron, coptis, goldenseal, celendine).

Protect Liver Cells From Damage If Liver Enzymes are Elevated: Vitamins C, E, bioflavanoids, glutathione, lipoic acid, NAC, milk thistle, bupleurum, dandelion, ban zhi lian, cornsilk, licorice, selenium, CoQ10, SOD.

Inflammation

Non-Specific Inflammation

Reduce Inflammation: Vitamins C, E, CoQ10,lipoic acid, molybdenum (if low uric acid), turmeric, ginger, boswellia, garlic, proteolytic enzymes (bromelain, serrapeptase,pancreatin).

Support Immune Defenses: Probiotics, Vitamins A, C, D, E, DHA/EPA/ALA, echinacea, goldenseal, cordyceps & medicinal mushrooms, garlic.

Hormones

Decreased Thyroid Activity

Support Thyroid & HPT/HPA Axis Function: Thyroid glandular/protomorphogen, pituitary glandular/ protomorphogen, zinc, selenium, iodine, glutathione, NAD, tyrosine, emulsified Vitamin D3, Vitamin A, DHA/EPA, ashwagandha, bladderwrack, eleuthero, guggulu, nettle seed.

Support Digestion & Assimilation: HCL, digestive enzymes, bovine bile salts, probiotics.

Support Iron Uptake (if anemic): Vitamin C, food sources of iron are best.

If Low T4 > T3 conversion: Liposomal glutathione, P5P, NAC, NAD, SOD, zinc, selenium, guggulu, lecithin.

Decreased Pituitary Activity

Support Pituitary & HPT/HPA Axis Function: Pituitary glandular/protomorphogen, hypothalamus glandular, manganese, zinc, magnesium, rubidium sulfate, ashwagandha, licorice, eleuthero, schizandra.

Support Digestion & Assimilation: HCL, digestive enzymes, bovine bile salts.

If Low T4 > T3 conversion: Liposomal glutathione, P5P, NAC, NAD, SOD, zinc, selenium, guggulu, lecithin.

pH

Metabolic Alkalosis

Increase Metabolic Acids: Phosphoric acid, HCL, malic acid, ammonium chloride, mineral salt (source of chlorides, phosphates), magnesium chloride, sodium glycerol phosphate.

Support Digestive Functions (if hypochlorhydria accompanies): Mineral salt, HCL with pepsin, malic acid, digestive enzymes.

Immune Response

Long-term Immune Response

Reduce Inflammation: Vitamins C, E, CoQ10, lipoic acid, NAC, turmeric, ginger, boswellia, garlic, proteolytic enzymes (bromelain, serrapeptase, pancreatin), thyme, cat's claw, nettles, licorice, panax ginseng, devil's claw.

Support Immune Defenses: Probiotics, zinc, Vitamins A, C, D, E, DHA/EPA/ALA, take together: echinacea (angustifolia & purpurea) & goldenseal, yarrow & elder flower (take together), cordyceps & medicinal mushrooms, garlic, licorice, colloidal silver, cat's claw, acacia, Oregon grape root, astragalus (consider especially if WBC is decreased), adrenal & thymus glandular/protomorphogen; consider anti-virals: Chinese skullcap, ginger, licorice, elder, isatis, houttuynia, lomatium dissectum, olive leaf extract, pau d'arco, colloidal silver, St. John's wort, cat's claw, oregano oil, lemon balm, honeysuckle, sarsaparilla; herbal antibiotics: usnea, chaparral, isatis, honeysuckle; respiratory support: echinacea (angustifolia & purpurea) & goldenseal, platycodon (expectorant), mullein, wild cherry bark, elecampagne (expectorant).

Nutrients

Dietary Protein Deficiency

Support Digestion & Assimilation: HCL with pepsin, digestive enzymes, pancreatic enzymes, digestive bitters, P5P/Vitamin B-6 (to assist in amino acid metabolism & peptide synthesis).

Iron Deficiency

Increase Sources of Iron: Supplemental iron is not recommended. However, consider the use of Vitamin C to aid in iron assimilation.

Support Anemia-Related Symptoms: Astragalus & dong quai (Angelica sinensis), chyavanprash, ligusticum, codonopsis, blackstrap molasses & yellow dock, rehmannia, mulberry,lycium berry, blackberry, raspberry, bilberry.

Support Digestion & Assimilation: HCL with pepsin, digestive enzymes, pancreatic enzymes.

B-6 Deficiency

Increase Sources of B-6: P5P (pyridoxal-5-phosphate, B-6 pyridoxine .

Improve Digestion & Assimilation: HCL with pepsin, digestive enzymes, pancreatic enzymes, digestive bitters.

Glutathione Deficiency

Support Glutathione Synthesis & Utilization: NAC, L-glycine, L-glutamine, P5P, NAD, lipoic acid, zinc, selenium, Vitamins C & E, B-12 (methylcobalamin, hydroxycobalamin, adenosylcobalamin, cyanocobalamin), folate, liposomal glutathione, 5 herbs in combination: turmeric, green tea, ashwagandha, milk thistle, bacopa monniera.

Support Digestion & Assimilation: HCL with pepsin, digestive enzymes, pancreatic enzymes, digestive bitters.

Magnesium Deficiency

Increase Sources of Magnesium: Magnesium (citratrate, orotate, glycinate, aspartate, chloride) .

Support Digestion & Assimilation: HCL with pepsin, digestive enzymes, pancreatic enzymes.

Section 4.4: Related or Follow-Up Testing

Blood Sugar

Hypoglycemia
- Retest blood chemistry in 30 days
- Thyroid-related Patterns: TSH, FT3, FT4
- Metabolic Type assessment

Cell Hydration

Generally:
- Re-test blood chemistry periodically

Electrolyte Imbalance
- Adrenal hormone assessment

Digestion

Generally:
- Comprehensive GI panel
- Re-test blood chemistry within 30-60 days

Liver

Generally:
- Re-test blood chemistry in 2-4 weeks
- Toxic metals: Hair Tissue Mineral Analysis

Inflammation

Generally:
- Comprehensive GI panel with stool IgA, bacteriology & parasitology
- Follow-up blood test every 4-8 weeks

Hormones

Generally:
- Re-test blood chemistry in 4 weeks

Decreased Thyroid Activity
- Thyroid peroxidase Antibody

pH

Generally:
- Re-test blood chemistry in 4-8 weeks

Immune Response

Generally:
- Re-test blood chemistry in 4-6 weeks
- Comprehensive GI panel with bacteriology and parasitology

Nutrients

Generally:
- Re-test blood chemistry in 30 days
- Intracellular nutrient assessment

B-6 Deficiency
- Urinary Organic acids test (OAT) - Kynurenic acid, Xanthurenate

Glutathione Deficiency
- Re-test blood chemistry in 4 weeks with GGTP
- Urinary organic acids test (OAT): pyroglutamate, alpha hydroxybutyrate, sulfate glucararate

Section 5: Introduction & Support

Section 5.1: Introduction

Blood Chemistry For the 21st Century Clinician

In today's clinical world, there is a seemingly endless bombardment of symptoms, diagnosed and non-diagnosed conditions, and degenerative processes. As research and understanding of these issues evolves, the functional medicine and alternative healthcare marketplace is saturated with biological testing involving: blood, urine, stool, genetics, saliva and hair.

The 21st century clinician has the challenge of keeping up with this sea of functional testing, its relevance, application and importance. Clinical discernment, which evolves from clinical experience is a continual learning process for discovering how and when to use a test, and when not to. Using certain functional lab tests may or may not be useful for the client or patient you are working with. Additionally, functional lab testing can become an expensive expedition, particularly if a clinician cannot properly identify which type of tests to use for each client or patient.

Enter functional blood chemistry analysis. Routine blood chemistry is an inexpensive, minimally invasive test, which when evaluated functionally rather than for pathological assessment, can yield a tremendous amount of physiological data.

In most instances, functional blood chemistry analysis serves as a foundational clinical test to:

- Understand where and what the physiological priorities are: Obtain an understanding of the individual's primary arenas of physiological and biochemical imbalance and dysfunction
- Identify the next level of clinical testing: Lead the clinician towards the best use of various functional tests
- Create an effective, individualized protocol, aimed at supporting and improving biological functions
- Track progress and effectiveness of protocols and health markers over time

Functional blood chemistry analysis can greatly assist the clinician in sorting out a patient or client's clinical presentation, and what to do about it.

Identifying & Working Around Limitations of Blood Chemistry

It is also important for the clinician to understand that, like all types of testing, there may be certain limitations to using blood chemistry solely as a functional test. Some of these limitations may include:

- Understanding that certain factors on a blood test can change frequently due to the body's homeostatic nature.
- Understanding that most blood chemistry factors are under the influence of multiple, physiological factors, making it difficult to discern "what is causing what".
- Understanding that because many blood chemistry factors may be changing more frequently, a single blood test may not effectively identify the physiological patterns over a longer period of time.

Fortunately, there are ways around some of these potential limitations. While we cannot stop the body from its homeostatic fluctuation, we can track a person's blood tests over weeks, months and years. This provides the clinician with a better understanding and appreciation for an individual's inherent tendencies over the long-term. In fact, tracking an individual's blood chemistry over a long-term may actually be more useful than single isolated tests, as it may elucidate the individual's organ, system and physiological patterns more clearly.

Physiological Patterns Indices

Because of the fact that multiple physiological activities may influence a single blood chemistry factor, it is essential to understand correlations and patterns among groups of blood chemistry factors. Viewing individual blood chemistry markers in concert with other markers enables a specific, systematic and more precise analysis of physiological patterns and tendencies. This type of analysis leads the clinician towards identifying more meaningful and effective nutritional therapies.

The analysis of blood chemistry using a physiological patterns assessment is the primary driving mechanism operative in this blood chemistry software system.

Laboratory Reference Ranges

Have you ever been to your doctor or healthcare provider and had them tell you that your blood test results are normal and there is nothing wrong with you? Clearly you don't feel well. You may even be gravely ill, in a state of intense chronic fatigue and have multiple symptoms. But why doesn't your blood or lab test reflect the way you feel? Surely your physician would be able to detect something, right? The problem lies in how the test is being interpreted.

The reality is that there are multiple ways of interpreting a blood test, and what many labs consider to be "normal" or "healthy" values is highly questionable.

The laboratory reference ranges that are the so-called "normal" or "healthy" places to be, are actually statistical averages. Different labs can and do have different reference ranges. It is common to have a test result come back "normal" from one lab and "out of range" from another lab. In truth, if your lab values are within the set reference range, you are within the "average", and not necessarily "normal" or ideal. Standard laboratory reference ranges will continue to get wider and wider as patients get sicker and sicker.

The ranges established in this blood chemistry software system represent the Optimum Functioning ranges for each blood chemistry marker. Blood chemistry markers outside of the Optimal Functioning ranges are not necessarily correlative with disease states. Rather these markers out of optimal range indicate that some physiological imbalance exists, which should be investigated.

”Functional” Approach Versus Pathological

Another important point to consider is that physicians are looking for definable diseases when looking at blood tests. Yet there is a huge percentage of people with no identifiable disease yet with multiple health issues.

Interpreting a blood test functionally rather than pathologically offers a greater scope for knowing where a person's malfunction may lie.

By interpreting a blood test functionally, rather than pathologically, and by assessing a person's biochemical Individuality through other methods of intake and inquiry, there becomes a greater precision for understanding where the problems may exist.

Furthermore, no laboratory data is enough by itself to create an entire nutritional program. Just as important, is the need to understand how a person’s symptoms correlates to their lab test results.

For this reason, recommended is the use of sophisticated questionnaires and intake data, as well as diet logs and food journals. When combined with functional blood chemistry analysis, specifically targeted and effective nutritional therapies can be initiated.

Section 5.2: Technical and Clinical Support

For support regarding display issues, access issues, and other technical problems, visit this page: [Tech Support Page]

For support regarding results, interpretation, and other clinical considerations, visit this page: [Clin Support Page]